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NESTING OF THE ALLEN HUMMINGBIRD

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For several years my observations in the field were concerned largely with hummingbirds. In 1937 and 1938, attention was directed primarily to the natural history of the Allen Hummingbird (*Selasphorus sasin*). Observations were made through the spring and summer months in the San Francisco Bay region of California and especially in the hills of Oakland and Berkeley. The observations reported here were taken from a report dealing with the natural history of the species which was prepared at the Museum of Vertebrate Zoology, University of California, under the direction of the late Professor Joseph Grinnell. Dr. Jean M. Linsdale has assisted generously in the preparation of the manuscript for publication.

The content of this paper represents only a segment of the results of my field studies of the Allen Hummingbird. An effort has been made to bring together here data on the nest and on the behavior of the female during nest-building and incubation. Information on courtship and other aspects of behavior as well as development of nestlings has not yet been prepared for publication.

The processes of nest-building, incubation and rearing the young are carried out solely by the females apart from, and not necessarily near, the stations of the males. The males may form "bachelor societies" centered about choice feeding areas.

NESTING SITES

Allen Hummingbird nesting sites usually are places which provide many separate supports for the first nesting materials that are to be laid down. This species tends to build where part of the supporting structure can be incorporated into the sides of the nest rather than on a solid support as the Anna Hummingbird (*Calypte anna*) tends to do. The latter species sometimes places a nest on a limb three or four inches in diameter. Dense tangles are favorite sites for the Allen, though I have never found nests of the Anna in them. The Allen Hummingbird may build within a few inches of the ground, but I have never found an Anna nest lower than four feet from the ground. The Allen nests in less open situations than does the Anna and it is less often found close to the homes of people. Only one out of about 50 nests of the Allen Hummer was on a man-made structure, a bridge. Mailliard (Condor, 15, 1913:205), however, reported a nest on a pulley, one on a rope, and one on a wire. Anna nests are commonly found on trellises, hanging ropes, wires, porch eaves, and other artificial sites. The Allen Hummingbird nests in a variety of habitats and in many kinds of location in each habitat, but it is more restricted in selection of sites than is the Anna.

In eucalyptus trees nests are from one to fifty feet above the ground, usually near the tips of drooping, incurved branches. The nest is saddled between two fruits or on the petioles of leaves. Sometimes one petiole is incorporated into the side of the nest. The nests I have seen have been on limbs less than one inch in diameter. The normal flexibility of the support, then, causes the nests to be moved violently in the wind. At these

times the parent stays on the nest to keep the eggs or small young in it. When the small square stems of a young eucalyptus are used, they give a sturdier base for the nest and a rougher surface for attachment of the binding spider webs and other supporting materials. Occasionally a nest is placed on a horizontal leaf attached to a vertical stem which, by being incorporated into the side structure of the nest, prevents tilting. Sometimes a nest is placed between pieces of loose bark on the main trunk. The rough edges of the bark provide good anchorage for the supporting spider webs. Rarely a nest is on a curled dry leaf still attached to a drooping branch. Nests have been found on dry, rigid branches broken from the top of a tree and lodged farther down. None of the many nests found in eucalyptus trees has been within branches blooming profusely. This may be because the female avoids the multitude of hummingbirds foraging in these branches. Usually, uneasiness is displayed by the brooding female when other birds are near.

When cypress trees are near eucalyptus, the former are used for nesting. I studied two cypress groves in Oakland. In one, which was adjacent to a blossoming eucalyptus grove which provided favorable hummingbird forage, I found ten nests within a radius of fifteen yards, all in use at the same time and some within five yards of a neighboring one. The other grove was far from any eucalyptus, and I could find no hummingbird nest in it. The rough scale-like branchlets of cypress offer good attachments for the nests and often are incorporated into them. Nests in cypress trees usually are on the flat branches four to thirty feet above the ground and on one of the lower limbs which may be approached from below. At such a site there is another branch about a foot above it, which, like an awning, shades and protects the contents of the nest. Nests may be on limbs up to an inch in diameter or attached to scaly twigs only a millimeter thick. On the large limbs the nest often is saddled between two laterally attached cones. Scales of the cones afford attachments. These trees also supply much of the nesting material. Extraneous things like pappus of thistles, drifting spider webs, and bits of plant fibers collect in them. Numerous spiders spread webs in the cracks of the bark. The birds hover beside the trunks gathering these materials.

Wild blackberry and bracken fern provide sites for most of the nests that are placed in tangles and thickets. Other plants which add to the density of the tangle are oso berry, poison oak, baccharis, hazelnut, and elderberry. The tangle generally is mixed with live oaks which provide patchy shade. On blackberry vines nests usually are beneath the canopy of leaves on a solid base at the intersection of several leafless stems. On a sloping bank the nest may be on one stem only, usually on top of a leaf and its petiole and anchored on one side to the main stem. Nests attached to the ferns have attachments to the leaves as well as to the stem. Frequently the turned-up edges of fronds serve as side supports. In these tangles nests are placed from six inches to four feet above the ground, but they may be at a greater height as, for example, when held by a live oak.

On the more open bushy hillsides where coffee berry, small live oak, small elderberry, baccharis, and sticky monkey flower are characteristic plants, the last named kind is most often used. Its low growth and the sticky surfaces of the leaves make it especially suitable. The plant is not always adequate, for in one example the nest slipped around its attachment on the stem so far that one of the young birds fell out. Nests are found in this bush at open sites only where shade is present.

Allen Hummingbird nests are easily found in streamside thickets, especially where a steep bank has an abundant growth of plants like wild blackberry, nine-bark and oso berry (fig. 22). Nests are far out on overhanging branches or on exposed roots close to the bank. Nesting materials are particularly abundant, mainly the webs of spiders and

the down from willows, which constitutes the lining of most of the nests. Suitable locations are present on low banks as well as high ones. Food is generally abundant in the habitat. Road banks resemble stream banks as regards hummingbirds' needs except for the absence of streams and moisture, and this makes them less suitable. The necessary shade sometimes is furnished by the bank itself.

Fig. 22. Allen Hummingbird nest bound to petiole and branch of wild blackberry vine in a dense tangle on a steep streamside bank. The nest contained two young about six days old.

Old, weathered nests of a previous year come to form a compact pad with a secure attachment to the supporting stem. This resembles the platform built by the hummingbird at the start of each new nest and it is often used as the base for a new nest. Suitability of the site thus made available may be more important in the selection than continuity of ownership.

The observations here reported show that shade is an important element in the suitability of a nest site. Solid shadow, as that provided by a bank or a bridge, is not necessary. When shade comes from trees or tall plants projecting above a tangle, the nests in the lower bushes are in exposed situations. Twelve nests in tangles were studied. Four of these were in tangles with no shade overhead, and the nests were far within the bushes so that prolonged search was needed to find them. The eight nests under trees were in open growths of bushes, and they could be seen easily from a standing position. Equal amounts of time were spent in searching the shaded and unshaded tangles.

It is evident that a loose tangle shaded by trees is preferred over a dense, unshaded one. The reason apparently is that the bird can approach the nest easier in a loose tangle. Several times I watched a female approach its nest in a dense blackberry thicket. Always the approach was difficult because of the intervening thorny leaves and stems. The wings frequently hit the obstructions and some side-slipping and backward flying

was necessary as well as a change of course before the nest was reached. Every approach appeared as difficult as the first. This contrasted with the faster and easier approaches to a nest in a loose tangle.

Oak trees provide a patchy shade, and the movement of the sun, with alternation of light and shade, gives intermittent warmth. The eggs and young of the Allen Hummingbird are hardy and they appear not so readily injured by the hot sun as the nestlings of some passerine birds. Nevertheless, much uneasiness is shown by the young or the brooding female when cover is removed from above the nest. This presents difficulty in photography, for the young birds wiggle violently when the desired amount of light is obtained by removing the branches from overhead.

NEST CONSTRUCTION

Nests of the Allen Hummingbird in early stages of construction are seldom found. Also, it is difficult to determine when a nest is completed, for materials are added throughout the nesting. A nest found on March 9 by Howard Twining was seen when

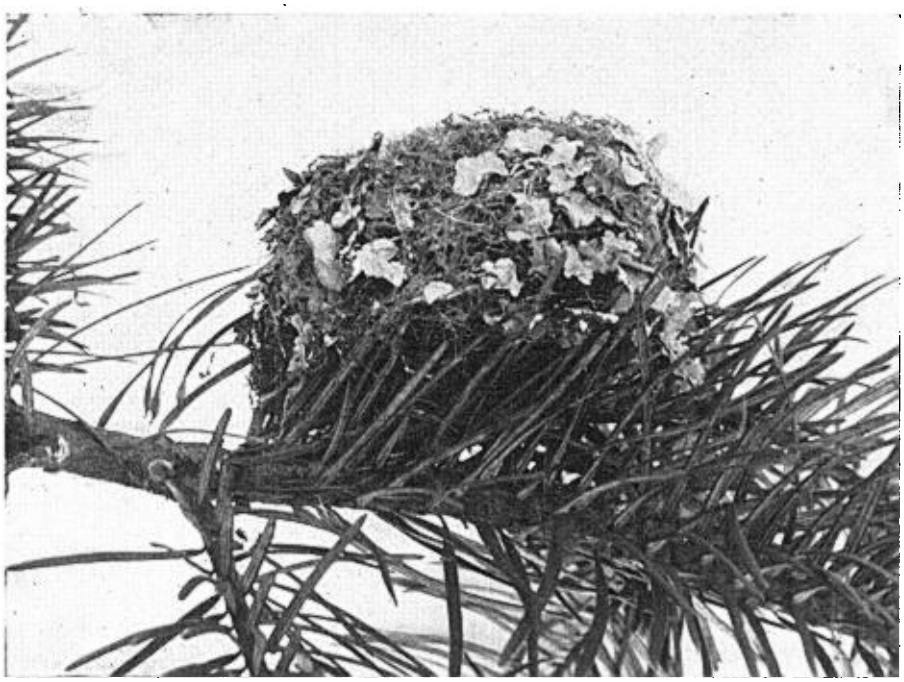

Fig. 23. Nest placed on branch of Douglas fir, six feet above ground, and shaded by a branch above. Well incubated eggs were present.

the female deposited the first material, some pappus of baccharis. The site seemed to be a poor one, and at first it was thought that the bird was gathering, rather than placing material. Thirteen days later a nest containing two eggs was found on the site. Examination of the eggs indicated that they had been laid at least two days earlier. It was thought then that this nest contained eggs eleven day after construction began.

Nests placed on old nests require shorter time to build than ones placed on a new base. On March 7, 1937, I saw a female place first material of a new nest on an old

structure of a previous year. Eight days later, on March 15, the first egg was laid. Early stages of nest building involve the making of a base from which the rest of the building is done. Apparently old nests are much sought, because in them the pad is already provided.

Trips for nesting material may extend as far as 300 yards, but my observations show that about 90 per cent of the material is obtained within 25 yards of the nest. As a rule the bird goes only as far as is necessary. On occasion trips for food and nesting material may be combined, and then items may be brought from a distance that are available close by.

In a grove of cypress trees close to blooming eucalyptus trees nests were close together and no long trips for food or nesting were observed. Long periods of watching at one nest showed that nearly all the material came from within 25 yards of the site. Occasional trips were made to a pigeon pen 40 yards away to get down feathers for the lining. Many times the bird flew 100 yards or farther to a eucalyptus, presumably to feed, but on these long trips it rarely brought back nesting material. All the nests in this area contained pappus or down from plants which I suspect was taken from spider webs that had tethered it, for none was available on plants. Females were seen to take spider webs, lichens, and mosses from a large rock 15 yards from the nests.

This cypress nesting area where materials were readily available contrasted with a location high in a canyon which necessitated long trips for food as well as materials. The nest was at the edge of a small, young, dense grove of eucalyptus surrounded by open fields and containing no flowers. The hummingbird flew repeatedly to the bottom of the canyon 300 yards away, presumably to get down from willow catkins. Various other types of material were brought up by direct flight from the streamside below. Another nest high on the side of a gulch contained willow down. The nearest willows were at least 350 yards away. Possibly the down was obtained from the air or from spider webs.

Spider webs are essential in the construction of an Allen Hummingbird nest. They are gathered from trees, faces of rocks, out of the air, or any place visible to the bird. At one place most of the webbing was obtained from up-turned cypress stumps among standing trees. Females gathering webbing were pugnacious at times and they chased one another from the coveted materials. Webs usually are taken while the hummingbird is on the wing and hovering. They are grasped between the tips of the bill and the fibers are tangled irregularly over all of the bill and sometimes on the forehead and throat. Quick backward movements pull the webs from their moorings. Sometimes a female clings woodpecker fashion and with outspread wings to the face of a rock, picking off spider webs, moss, and other materials for a nest. Both green and dry mosses are obtained, pulled while the bird is in flight.

Bits of shredded leaves and grass are used, the bird weaving in and out of a bush to pull grass fibers apart. Considerable tugging may be necessary to tear off a piece of leaf or fine bark. The pulling backward enables the bird to obtain the fiber and to shred the material. Most of the shreds thus obtained are less than a millimeter in width and they become curled so as to be more easily woven into the nest.

Down from willow and pappus from composite plants such as baccharis and small thistles are used abundantly in the nests. The birds in gathering down from willows make intermittent stabs and short, backward flights until they have a loose ball about half an inch in diameter in the terminal third of the bill. Usually a direct flight takes this to the nest. Downy feathers are taken from the ground, from spider webs, or from the air. Birds in areas where little undergrowth is present appear to get their down as

it floats by in the air. Females perch at the edge of a clearing and sally out for nesting material as well as for insects.

Hairs from horses and dogs are present in many nests, and several nests contained hairs from a California ground squirrel. Padding from the top of an old automobile supplied hairs for many females building in a cypress grove. A man told me that a hummingbird once tugged at hair of his head as he sat beneath a tree.

Lichens are invariably used on the outside of nests of Allen Hummingbirds. The pieces are pulled one at a time in the manner used in gathering moss. Nests close to a supply of lichens are especially well decorated with them. A nest far from a lichen supply had only three pieces on its outer wall. Possibly the cover of lichens should not be called a decoration. To the human eye it breaks up the pattern and causes the nest to blend with the surrounding foliage. It is difficult to see the nests in tangles because of the lichens scattered over the exterior. Even without lichens the nest simulates its surroundings because of its concealingly green outer layer.

In about nine-tenths of the nests moss makes up the largest part of the outer layer, thus giving the outside of the nest a greenish color which is characteristic of this species. Nests without moss are far from moist places where moss occurs. When moss is not used, as in some nests in eucalyptus groves, the outer layer is usually composed of bits of shredded bark and dried small blades of grass, thus giving the nest a dull grayish appearance, rather than the mossy-green color. Occasionally, however, a nest near a mossy stream has little moss in it.

The inner layer of a nest of an Allen Hummingbird comprises the greater bulk and is always made of white downy material. This was true of the 65 nests I have examined from localities from Humboldt County to Ventura County, California. In all of these the down was from willow or from some composite plants. The outer layer is thin and composed of stiffer material than that in the inner layer. It and the whole nest is held in place by spider web.

The first material deposited at a nest site is usually some form of down. Immediately trips are made to obtain spider webs and the bit of down is securely bound. Unless there is a convenient perching place at the site, the first materials are deposited while the bird is hovering. Spider webs are used abundantly in early stages, and they provide a sticky surface on which to place the materials. They are scraped off the bill of the hovering bird by short forward and backward flights and they are adjusted with the tip of the bill. Sometimes coarser materials such as grass, moss, and bits of leaves are incorporated into the basal structure of the nest. If the site is on fine twigs, as in a cypress, the twigs are bound together and the network furnishes a base. After a small pad is made, nearly all the building is done from a sitting position. As the rim rises from the edges, the two layers become distinct. After that few spider webs are used in the interior, but they are used to bind the outer layer. The tuft of downy material brought in may be half an inch in diameter, and if placed on the floor it is tamped with an almost vibratory motion of the feet. The developing cavity is rounded and made a suitable size by the compacting action of the pivoting female accompanied by the foot motion and outward thrusts of the depressed bends of the wings. The rim is made solid by using the bill in a forceps-like manner to force bits of grass or leaves through the wall and into the base of the nest. The protruding ends of materials are pushed into the sides and rim by frequent probing. Most of the elongated material of the outer layer is placed so that it follows the curvature of the nest. Preparation of the material, such as shredding of the fibers or breaking off their unwanted ends, is done away from the nest when they are collected.

From the sitting position the bird removes cobwebs from the bill by pointing it downward over the outside of the nest and scraping them off with an upward motion of the head and neck. This motion also aids in compacting the nest. Sometimes the bird removes the webbing while pivoting. Often the female moves her bill back and forth along the rim and outer surface of the nest, possibly to adjust spiderwebs too small for the observer to see. Hair is placed in the lining along with the downy material and around the rim. Feathers may be added after the nest is nearly completed. These are placed almost invariably on the inner border of the rim where they come into contact with the body of the bird. I found no nest containing more than three feathers.

Lichens are placed with the light green side out and are bound to the outside of the nest with spider webs. Although the birds might be thought to recognize the protective advantage in having the green side out, they more likely place the lichens in this fashion because the rougher surface on the underside makes them more easily secured to the nest.

Nest building continues until the young leave. Some females laid eggs when the nest was a mere platform and the eggs could be easily rolled out. Others laid eggs after the

Fig. 24. Nest precariously attached to curled tips of bracken fern. A heavy rain caused the nest to stretch. Later both young fell from the nest.

nests were almost completed and were decorated with lichens. In many instances lichens were added after the eggs had been laid and the nest had reached final proportions. The birds bring additional downy lining and spider webs throughout incubation. During incubation the lining becomes matted, and this, coupled with stretching of the entire nest, makes room for the developing young. They further stretch the nest. In one instance feathers, spider webs, and lichens were added after one young had left the nest.

The female is alert to keep the nest in order, and if the wind is blowing, she may struggle for a good part of a day to keep a feather securely attached. Rain tends to keep the mosses and lichens green and fresh, but sometimes it causes a nest to sag badly

(fig. 24). The female then adds to the lower side and makes further attachments of supporting spider webs. Sometimes she does not succeed and the young fall out.

EGGS

This species, like other hummingbirds, almost invariably lays two eggs in each nest. I have seen nests containing one egg, but in each instance it was known that one egg had been broken. A set of two eggs (Mus. Vert. Zool. no. 1408) collected by L. P. Bolander in Santa Cruz County, is accompanied by the notation, "Set of 3, one egg missing." The eggs usually are laid on alternate rather than on successive days, although Orr (Condor, 41, 1939:17) has reported one example when laying was on successive days. I found one instance where the layings were separated by two days.

The eggs are large in comparison to the size of the bird. Two fresh eggs weighed 5 and 6 grains, or .323 and .388 grams. They appeared noticeably different in size. The first-laid egg of a set weighed 7.5 grains when fresh. An egg advanced in incubation weighed 6.7 grains. Weights indicated on tags of specimens of adult females averaged about three grams or 46.29 grains. This is about eight times the weight of an egg.

Eggs of hummingbirds are elliptical-ovate and appear nearly the same shape at both ends. Some nests of the Allen Hummingbird contain eggs that are relatively larger than others. According to Dawson (Birds of California, 1924:924) the average dimensions of 24 eggs from Santa Barbara were 11.9 and 7.9 mm.; average of 16 eggs from Humboldt County, 12.2 and 7.9 mm.

Egg color in the Allen Hummer is pure white without gloss. Because of the opaqueness of the shell, there is little of the pinkish tinge that might be expected. This may be detected in a fresh egg by holding it to the light. When incubation is advanced, the eggs become discolored and more opaque, then appearing dirty white.

ACTIVITIES DURING INCUBATION

The incubation period at nests of Allen Hummingbirds I watched varied from 17 to 22 days. The higher figure is greater than any record for a hummingbird that I have found. Variability in the published records may result from differences in opinion as to when incubation begins. I observed that in the Allen Hummingbird it begins with laying of the first egg. Variability also may result because some females do not attend the nest as closely as others. According to Dawson (*op. cit.*:938), counting from deposition of the second egg, incubation lasts 12 days.

For two or three days prior to laying of the first egg the female is busy building, but she may brood for periods nearly as long as during incubation. Incubation begins some time after laying of the first egg. Until the second egg is laid, incubation is less intense than afterwards. Although the interval between layings is nearly two days, the interval between hatchings is nearly a day shorter. Incubation reaches its greatest intensity about three days after the second egg is laid, and remains constant until hatching. Length of periods on the nest is highly variable. Periods off the nest, however, are fairly constant. Only occasionally does a female stay away for a period exceeding seven minutes.

The accompanying table shows typical incubation activities. It represents the 7 hours and 32 minutes from 10:08 a.m. to 5:40 p.m. on one day. The female was on the nest 6 hours and 14 minutes, or 82.8 per cent of the time. Periods on the nest are longer late in the day than in the morning. In normal daylight hours longer periods are spent on the nest when the temperature is low. Shortest periods come between 11 a.m. and 1:30 p.m. when temperatures are highest. Departures of incubating females usually

ceased when the light reflected from a green background and measured by a Western Exposure Meter, Model 650, fell below two foot candles. This was not influenced by temperature.

Attentiveness of an incubating female

Light in foot candles	Left nest	Returned to nest	Minutes on	Minutes off
		10:08		
	10:12	10:17	4	5
	10:46	10:51	29	5
	11:02	11:06	11	4
	11:21	11:23	19	2
	11:36½	11:37	13½	½
	11:38	11:40	1	2
	11:51½	11:54	11½	2½
	12:06	12:08	12	2
	12:11	12:12	3	1
	12:39	12:43	27	4
	12:54	1:01	11	7
	1:04	1:05	3	1
	1:19	1:22	14	3
	1:44½	1:46	22½	1½
14	2:28	2:31	42	3
13	3:10	3:17	39¼	6¾
10	3:30	3:56	13	26
5	4:35	4:36¾	39	1¾
2.5	5:06¼	5:11	30¼	4½

Females with nests in open situations make rapid approaches to the nest, possible because there are few obstructions. At nests situated at the edge of a tangle, the females usually approach through the tangle and they always do this if a person is near the nest. The return is unobstrusive as the bird weaves through the underbrush, and sometimes perches for a minute or two several times before lighting on the nest. Nests in open eucalyptus or cypress trees are approached more directly than those in dense brush. The bird usually perches ten or twenty feet away and then occupies several perches, each one closer, before the final flight is made to the nest. These nests also are approached by the bird flying to a point below the nest, then hesitating, and rising almost vertically and slipping onto it. The *tick* note may be given repeatedly in the short perching periods near the nest.

The female usually alights directly on the eggs without standing on the nest rim. Contact with the eggs is made by gradually lowering the body into the cup with the tail partly spread over the rim. This takes only a part of a second. Occasionally the bird alights on the rim and adjusts eggs or nest. The bird is more likely to stand on the rim on warm days than on cold ones. Sometimes a bird approaches a nest, hovers beside it, and makes adjustments of nest or eggs.

One bird I watched landed on its nest and breathed for three minutes at a rate of 234 times a minute or greater than twice the normal rate. Breathing then was reduced to the normal. After alighting on a nest the female may hold its bill open about an eighth of an inch to facilitate breathing.

Manner of leaving the nest is fairly constant at all stages of incubation or from any type of site. Usually restlessness is shown by pivoting in the nest or moving the head. Departure is so rapid as to be difficult to observe. The bird usually leaves in the direction it is facing and then may circle on a radius of about five feet about the nest before heading straight away. She rises only enough to clear the edge of the nest. Sometimes a brooding bird snaps at a passing insect or rises a few feet from the nest to catch one.

The nest cavity is too small to allow the wings below the rim, and they may be spread easily in departure.

One nest, within a few inches of a bank and in a dense tangle, had but one avenue for departure. The bird usually pivoted on the nest after alighting so as to be in position to leave readily. If she left before pivoting, she would rise vertically about an inch off the eggs, fly backwards about six inches to reach the open, then about-face and fly away.

When a person is conspicuously present, actions of a nesting hummingbird are altered considerably. She does not readily approach the nest and may not return until the intruder leaves. This wariness seems to increase as incubation progresses. Continual ob-

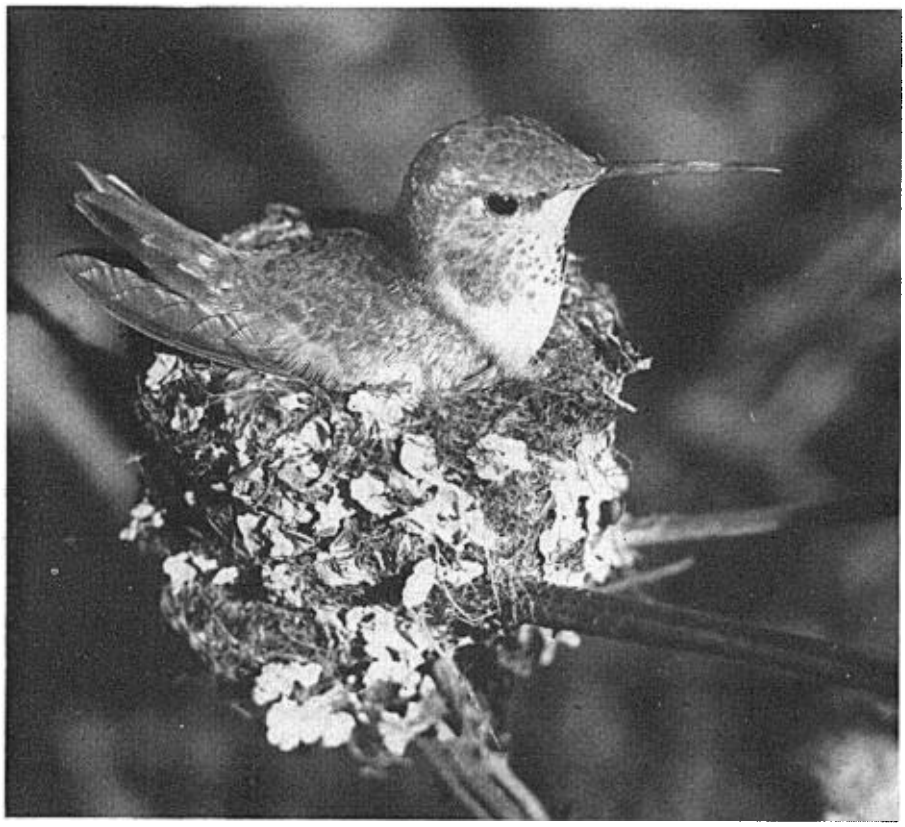

Fig. 25. Female Allen Hummingbird in normal incubation position when temperature not excessive.

servation at a nest seems to make the bird more wary. At nests beside well-used trails, birds flushed from eggs more readily than at more secluded sites. When driven from a nest, the bird usually does not fly far, but makes jerky flights for perhaps 20 feet, and pauses to hover many times. There is then much vocal noise, the *tick* notes being rapid and loud. The bird may retire to a perch and utter the notes in rapid succession, accompanying them with jerks of the tail. Often a female will perch behind an observer at a nest, possibly to attract him away from it.

. Nesting Allen Hummingbirds are more wary than Anna Hummingbirds, and I have never been able to touch one on the nest as I have frequently done with other kinds. In one instance I approached to within six inches of an incubating bird before it flushed. A returning, frightened but anxious female may do much weaving about in the shrubbery, then light on the nest, only to leave and repeat the weaving flight. When finally settled, it is wary, and will flush again at the slightest movement of the observer.

Usually an incubating Allen Hummingbird will tolerate the close presence of other birds near the nest. Once a female chased away another female of the same species. It flew toward the intruder, hovered six inches in front of it, and chased it for about five feet.

Turning of the eggs usually is by movement of the feet while the bird is sitting. After alighting on the nest, the female pivots and seems to move the feet rapidly up and down. Several eggs, marked with ink, were turned in the pivoting so as to be side by side and

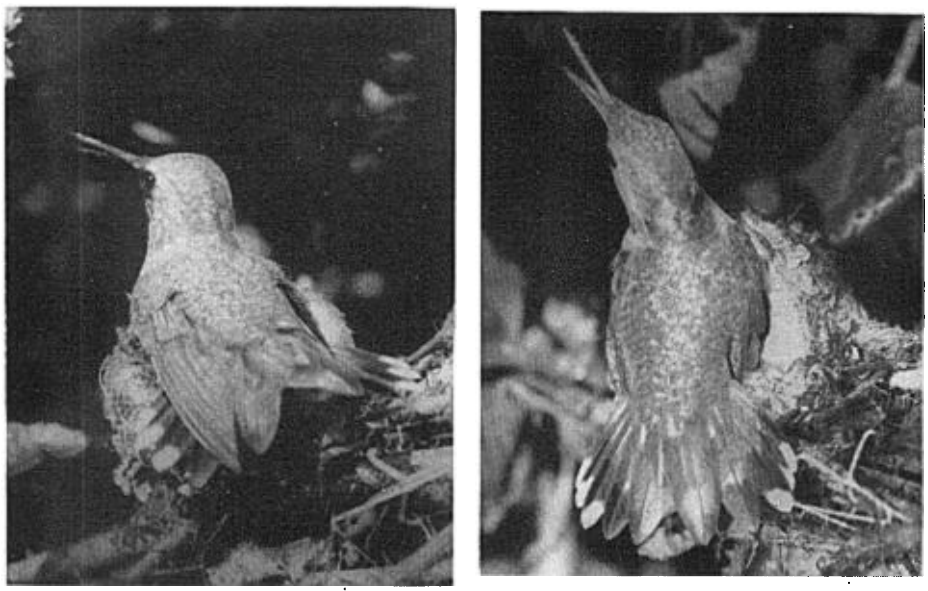

Fig. 26. Two views of an incubating female reacting to bright mirror-reflected sunlight.

parallel with the body of the bird. The eggs are also turned by foot movement without pivoting. The sitting female often turns the eggs with the bill. The body is raised to a nearly vertical position by pressing the feet on the nest wall, the neck is doubled, and the eggs are shifted by probing with the bill. After this the bird usually settles on the eggs. Females were seen to turn eggs for several seconds from a standing position and then sit on them, using their wings for the change of position. Only occasionally did a a female turn eggs while on the wing. Then the bird hovered beside the nest in nearly horizontal position and rolled the eggs over by probing under them with the bill.

Position of the hummingbird on a nest is modified by temperature and light (fig. 25). On cold days the bird sits close with the bend of the wing in the nest and most of the exposed feathers ruffled. The head is brought close to the body, making the neck appear short. On warm days the tail is spread and held vertically. On hot days the bird lifts its body partly off the eggs by standing on the floor of the nest and leaning against the

tail base on the rim. The bill opens as the rate of breathing increases. In extreme heat the bird spreads the outer tail feathers to make a right angle with the main axis of the tail. The wings are lowered and the tail spread over them.

Responses of an incubating bird to light were tested with a mirror (fig. 26). Light was directed at a bird on a nest in shade. No matter what the direction of the light shaft, the bird turned so its back would be toward it. The tail would be opened gradually to make an angle of about 100 degrees. This required about five seconds, but when the light persisted for half a minute the angle would increase to 180 degrees. The central rectrices were separated from the others, but they spread very little.

During incubation the female becomes less responsive to courtship of the males. The *zeet* note is given less often in response to notes or dives of a male. On several occasions a male performed arcs and a power dive over an incubating female. Once the female left the nest unnoticed by the male and the performance continued. Females nesting in open situations are more likely thus to be "preyed upon" by males. Some nests in open situations are not disturbed by males because of scarcity of food for them. Females with nests close to an abundant food supply are bothered considerably by males. Those in dense tangles in oak groves are bothered least. Females have been seen to fly 75 yards or farther from a nest and there feed with males, but usually they stay low under cover and feed within 25 yards of the nest.

SUMMARY

Nests of the Allen Hummingbird are commonly built in dense, at least partially shaded tangles where several separate supports are available and lend themselves to incorporation in the nest structure.

In the San Francisco Bay region, eucalyptus and cypress trees, oaks, and shrubs and vines of streamside thickets provide suitable nesting sites. Nests may be placed one to 50 feet above the ground.

In about nine-tenths of all the nests, moss makes up most of the outer layer. Willow down and pappus from composite seeds are common lining materials. Spider webs are essential in nest construction, holding the layers as well as the whole nest in place. Other nest materials used are lichens, feathers, shredded leaves, grass fibers, and hair. About 90 per cent of the material is obtained within 25 yards of the nest.

Nest-building may occupy eight to eleven days before the eggs are laid. It continues until the young leave. Eggs may be laid when the nest is a mere platform.

Two eggs constitute a clutch almost invariably. Eggs are usually laid on alternate days. Incubation begins with the laying of the first egg and lasts from 17 to 22 days.

Position of the incubating female on the nest is modified by temperature. The bird's back is directed toward the source of light.

Museum of Vertebrate Zoology, Berkeley, California, February 1, 1945.