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## NESTING OF THE MEXICAN JAY IN THE SANTA RITA MOUNTAINS, ARIZONA

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In the live oak woods of the Santa Rita Mountains in southeastern Arizona, the Mexican Jay (*Aphelocoma ultramarina*) is one of the most striking and abundant species of birds. Here it is represented by a race well known as the Arizona Jay (*A. u. arizonae*). Opportunity to observe the nesting activities of this jay came to the author when he was camped in Madera Canyon, at 5000 feet altitude, in the period from April 2 to June 15, 1948.

Bands of boisterous, noisy jays were among the first birds to attract our attention when we arrived in the canyon. The next day they were quick to discover the feeding shelves which we erected near camp and they continued to be our constant companions throughout our stay. Their daily visits gave us an excellent opportunity to become well acquainted with them. They never came alone but always as garrulous bands of four or five to a dozen or fifteen individuals. Long before they were seen, their presence was well announced by their loud *wheat wheat* calls. Regardless of other birds that might be peacefully feeding on the shelves, they would land with a loud flutter of their wings, causing juncos, towhees, grosbeaks and others usually present to scatter in all directions and take cover in the nearby trees and shrubs. Only the White-winged Dove ever braved their onslaughts, holding them at bay to keep possession of the tray for itself. This dove always exhibited a defensive and sometimes an aggressive attitude, not only toward jays, but also toward other birds.

Mexican Jays are omnivorous in their feeding habits. They ate freely of seeds, acorns, cracked corn, fruit, meat, suet, insects and anything that was available, but they seemed especially fond of bread. Large chunks of moist bread were gulped down, and before leaving the shelf they would snatch up not one, but two or three large pieces in their beaks and fly away to give place to their fellows. Such food, taken from the shelf, was hidden in crotches or cavities of trees, and I saw one jay take a large piece of crust, fly to the ground, and deliberately cover it over with fallen live oak leaves. This bread was subsequently retrieved, presumably by the same individual. Later in the season they were seen carrying pieces of bread to feed their equally voracious young. In that extremely dry climate they exhibited an insatiable thirst and like most of the other birds drank freely of the water which was kept in cans and jars on the feeding shelf.

### NESTS AND NEST-BUILDING

Among the live oak trees about our camp I examined no less than twenty old nests of jays, within a radius of a half mile, that had been used during previous nesting seasons. It was obvious that at an altitude of 5000 feet we were within the area where this species is especially abundant in the Santa Ritas. The birds were by no means restricted to this altitude, for even in the nesting season, as late as April 17, several Mexican Jays were seen with a band of Steller Jays (*Cyanocitta stelleri*) near the top of Mount Baldy at an elevation of over 9000 feet. Their nomadic bands were also seen

in the forest margins at the edge of the desert, but no nest was discovered at these extremes of altitude.

The first occupied nest of the Mexican Jay was found on April 10, 1948, and contained four eggs. A fifth egg was laid the following day. This nest was situated 21 feet above the ground in a live oak tree eight inches in diameter at the base and approximately 35 feet tall. The nest was built firmly against the trunk of the tree and was supported by three lateral branches and several small, living twigs. The nest was made of crooked twigs, chiefly of the live oak, many being 10 to 12 inches in length and the larger ones a quarter of an inch in diameter. The mass of twigs measured 15 inches from side to side and ten inches in total depth. The well-formed nesting cavity measured  $3\frac{1}{4} \times 3\frac{3}{4}$  inches in diameter and  $2\frac{3}{4}$  inches in depth. Lining the mass of larger sticks was a layer of smaller twigs mixed with grass and weed stems. Inside of this was a layer of fine tendrils and hair-like rootlets which were intricately interwoven to make a smooth interior. The nest was collected soon after the young left and is now before me. The sticks are so well interlocked and bound together that the entire structure was easily moved intact from the tree. After having been used by the birds for a period of 18 days of incubation and then 25 days more by the young, it is still clean and in excellent condition. The nesting cavity is now much flattened, as compared to its condition when it was first completed, having been pressed down by the adults and later by the young standing on the brim. The depth of the cup is now scarcely  $1\frac{1}{2}$  inches instead of the original  $2\frac{3}{4}$  inches.

A nest containing three eggs, found on May 20, 1948, was placed in the main fork of a small live oak at a height of eight feet from the ground. The tree was  $3\frac{1}{2}$  inches in diameter at the base and about 15 feet tall. It stood on the side of a hill in a dense growth of larger oaks. This nest had an over-all diameter of 13 inches and a total depth of ten inches. The nesting cavity was  $3 \times 3\frac{1}{4}$  inches in diameter, with a depth of  $3\frac{1}{2}$  inches. The foundation material was similar to that of the first nest described. The longest oak twigs were 12 inches but the majority ranged from 5 to 10 inches in length and less than a quarter of an inch in diameter. The lining of this nest was very different, being made up entirely of long horse hair and masses of short hair, no rootlets or other material having been used. The hair composing the lining was also carefully and intricately interwoven, producing a very neat and smooth interior. These two examples are typical of the nest architecture as I found it in the Santa Ritas.

Twelve occupied nests were found in Madera Canyon during the time spent there. All these nests were in live oak trees and they varied in height from one only six feet above the ground to one that was saddled in a fork near the end of a horizontal branch of a large oak, 54 feet from the ground. The average height of the twelve nests was 19 feet.

On April 9, a nest was found in the first stages of construction. At that time there were not more than a dozen sticks that were lodged against the trunk of a small tree and supported by four lateral branches at a height of 16 feet above the ground. This nest was being built not by a single pair of birds, but at times by as many as seven or eight. This well-known communal habit is one of the interesting and peculiar characteristics of the Mexican Jay. The birds always appeared at the nesting site with a great deal of ceremony, uttering loud *wheat wheat* calls and with intermittent curious fluttering of their wings. Usually only one, rarely two, but at one time three of the jays were carrying sticks as they arrived. The other members of the band alighted in the branches of the nesting tree and exhibited a great deal of interest in the entire procedure. One bird would carefully manipulate a stick into the desired position after repeated trials and then would give place to a second bird carrying a stick. At times the other members of the

band would fly down and rearrange the materials previously added. When the sticks had been arranged, they flew away well out of sight of my blind, calling noisily. In ten minutes four of the jays reappeared with only one carrying a stick, which was added to the growing structure. The other three perched in the tree only a few feet from the nest. Two of them inspected the nest and then all flew away. After fifteen minutes a band of eight jays appeared, two of them probably year-old birds, their age being revealed by the yellow or horn-colored basal portion of their mandibles. The younger birds were not seen to add nesting material at this time, but they succeeded in making a general nuisance of themselves in the procedure of nest building. Regular visits were made to the



Fig. 47. Mexican Jay arriving at the nest. Madera Canyon, Santa Rita Mountains, Arizona, June 5, 1948.

nest throughout the morning on the average of five visits each hour. Work was halted in the early afternoon, but the group was again active at 4 p.m. The jays were never seen to collect sticks from the ground although sticks were present there in abundance.

One morning while looking for other birds in the canyon I chanced to see a Mexican Jay tugging at a twig near the top of a live oak tree. The bird grasped the twig with its beak and pulled it from side to side. Not succeeding, it leaped and flew to grasp the outer end and with much fluttering attempted to free it. Another jay joined in and both took turns in a determined effort. After several minutes they succeeded in breaking it near the point of attachment. One of the jays then easily pulled it free from a strand of bark which still loosely held it and flew away with it. Later I saw a jay grasp a smaller dead twig which it broke with ease at the first attempt. After seeing these performances, I made a more critical examination of the foundation twigs of several nests. I was surprised to find that practically every stick had a freshly broken end which was not at all discolored by weathering. It was convincing evidence that the majority of the twigs forming the nest foundation had been broken off the trees by the jays and were not old sticks that had been gathered on the ground as one might suppose.

By the morning of April 12 the jays had a substantial mass of sticks in place although from below one could see the bright light of the sky coming through the narrow spaces between the twigs. At 8 a.m. six jays arrived at the nest, and one of them held a large compact mass of horse hair in its beak. It was made up of long hairs from the tail or mane twisted about and mixed with shorter hairs. Some of the individual hairs which I measured later were more than two feet in length. The bird sat in the center of the nest for four minutes while it carefully arranged each strand of hair. It frequently shifted its body to press and shape the lining of hair against the rough interior. During this time the other jays remained in the tree calling loudly and seeming to challenge any intruder that might enter their territory. At one time a Red-shafted Flicker (*Colaptes cafer*) alighted on the trunk of the tree above the nest and immediately it was chased away. However, the jays did not react to a Painted Redstart (*Setophaga picta*) and several Ruby-crowned Kinglets (*Regulus calendula*) that were flitting about in a nearby tree. After the bird in the nest had completed arranging the mass of hair in the lining, two of the other three jays took over; one of them sat in the bowl turning its body and shaping the interior and changing the position of some of the hair while the other jay perched on the edge of the nest, intently observing the whole procedure. It took its turn in the nest when the second bird was through.

I saw jays removing hair from the interiors of deserted jays' nests, and this proved to be the source of the major portion of the lining of this nest under construction. Hair is evidently used again and again, as every nest that has been deserted for any length of time is without a horsehair lining. Near the nests which were under observation was a horse corral. On the trees, fence posts and other places strands of hair could be seen, and this undoubtedly was the source of some of the hair; but although I watched these places many times, I never saw a jay collecting hair at the corral. On one occasion I saw several jays on the ground along a road, and one of them was pulling at some fine rootlets in a place where the surface soil had been removed by a road scraper. The jay pulled at one rootlet about eight inches in length, and after it was freed, it was left on the ground. After detaching two others, the jay gathered up the first and all were carried away, presumably to be used in a lining of some nest.

On the morning of April 13, the jays were again busily engaged with adding more lining material to the nest, coming at intervals of twenty or thirty minutes. The group varied from five to eight individuals and they always announced their arrival with loud *wheat, wheat* calls and the curious ruffled flutter sounds produced by manipulating their wing feathers in a manner I could not determine. From this time on the birds made many visits to the nest without nesting material, but at almost every visit two or more of them would take turns sitting in the nest, working the materials with their beaks and turning and fitting their bodies to shape the nesting cavity. Sometimes this procedure would require five to six minutes. At times one or more of the waiting birds would fly down and alight on the ground. They poked their bills among the fallen leaves and twigs as if searching for food or nesting materials, but I did not see that they obtained anything before the whole group left on another foraging trip.

On April 15, the jays were again working on the nest which now had a very thick lining of horse hair and some fine rootlets. A one-year old bird was seen with a small bit of nesting material.

On April 16, the nest appeared to be completed. No birds were seen at the nest during the morning, but at 2:45 p.m. a jay was seen to go on the nest and sit in the completed bowl. After this bird left the nest, a second jay took its place and remained for several minutes. During this time another jay arrived and presented the bird on the nest with some food which was readily accepted and eaten. There were five visits to the nest in

the afternoon. No nesting material was added, but the materials in place were given minor adjustments and were moulded, as previously described. On the following day the procedure of April 16 was repeated. At 11:40 a.m., five jays appeared. One went on the nest, but, unlike previous occasions, it uttered a continuous series of calls in concert with the others perched in the tree. After fifteen minutes all left the vicinity, flew up the mountain side, and were not seen again that day.

During the next few days I observed no visits to the nest, and as no eggs were laid it seemed that this might be a dummy nest which was not to be used further. A nest of



Fig. 48. Nest and eggs of the Mexican Jay. Photograph taken April 19, 1948.

this kind was observed later in the season. On May 3 a group started building a nest in an oak in the upper part of the canyon. The birds worked industriously, and by May 12 the structure was complete with a lining of horse hair. This nest was never used, but a second nest was constructed in another oak about fifty feet from the first. Presence of two peculiar birds in this clan, one a partial albino and the other a one-legged individual, made it reasonably certain that the same group had built the two nests in succession. All the lining and a few of the twigs of the first were carried to the second nest. Four eggs were laid in the latter, and the young were successfully reared.

On April 25 a jay was seen sitting on the nest the construction of which was described above and near which my blind was located. It remained there for more than an hour. I fully expected that it might be a female laying her first egg, but a subsequent visit to the nest revealed that only another try-out of the nest had occurred. Similar visits were made by the birds to the nest in the next three days, but no eggs were laid. Finally on April 29 the first egg was laid, a second on April 30, a third on May 1 and the fourth

and final egg on May 2. Twenty-three days had elapsed from the time the platform of a few sticks was discovered to the time the set of four eggs was laid.

#### INCUBATION

Incubation at this nest was started after the first egg was laid; in fact, long periods of time were spent at the nest before any eggs were present, presumably by the individual which laid them. The group of jays, probably the same individuals which took part in the building of the nest, did not loose interest in the structure but continued their visits often to the serious annoyance of the incubating bird. They would even alight on the edge of the nest, nudge its body, push it aside, and peer at the eggs intently and then fly away. On several occasions when the incubating bird resisted, it was vigorously attacked, and one time I saw one of the birds grasp the incubating bird by the beak, completely dislodge it from the nest, greatly ruffling its feathers, and then proceed to chase it from the vicinity of the nesting tree. Such violent behavior is difficult to interpret. Was the attacking bird a member of another clan or was it the mate, over-zealous in taking over its turn at incubating the eggs? I doubt the latter, for ordinarily the exchange of birds at the nest was not accompanied by such violence. In striking contrast I saw one of the jays deliver food to the bird on the nest without any indication of conflict. It is possible, in this complicated interrelationship where so many individuals are involved, that polygamy may be practiced, but of this I have no evidence. Neither could I be sure of the sexes of the birds which exchanged places at the nest. Perhaps banding the birds with colored celluloid bands so that each individual could be easily identified would throw light on this problem. All the birds observed incubating or feeding young were black-billed.

For the first several days these visits by several jays were continued, but as incubation progressed the other jays seemed to exhibit less interest in the nest and its contents. After ten days only two birds, presumably a male and female, were regularly seen at the nest. However, when the incubating bird was disturbed, as when I climbed the tree to examine the nest, her cries on leaving would summon a group of three or four and sometimes as many as six or seven individuals which would join in angry protests at the intrusion. Their cries and curious wing flutterings would continue until I retreated and the incubating bird returned to her nest.

The eggs were closely incubated, and almost every time I visited the nest, which was many times daily, an incubating bird would be present. When it was excessively hot, the bird would elevate its body well above the eggs and at times would rest on the brim of the nest shading the eggs from the direct rays of the sun. At such times its beak would be held widely open. At night as well as during the early morning and late afternoon the incubating bird was snuggled deep in the nest and only its long tail and the tip of its beak which extended over the edge of the nest could be seen when I stood on the ground beneath the tree.

The incubation period of the Mexican Jay is 18 days. A marked egg which was laid on April 11 hatched on April 29. In another nest the eggs were laid on May 2, 3, 4 and 5, respectively. Two of the eggs hatched on May 20, one on May 21 and the fourth on the morning of May 22.

The color of fresh unblown eggs is pale sulphate green (Ridgway, 1912, 39'd), entirely free of markings of any kind. This is a brighter and a more vivid color than glaucous green (Ridgway, 37'd) determined by Bendire (1895) and Niagara green (Ridgway, 41'b) by Bent (1946). Colors of dried blown eggs, obtained from various sources, which I have examined more nearly approach the colors determined by Bendire and Bent.

The numbers of eggs for complete sets found in Madera Canyon varied from three

to five. Contents of nests located were as follows: April 11, 5 eggs; May 2, 4 eggs; May 4, 4 eggs; May 5, 3 eggs; May 9, 5 eggs; May 14, 4 eggs; May 20, 3 eggs; May 24, 4 eggs; June 3, 3 eggs; June 3, 4 eggs; June 6, 4 eggs; June 9, 4 young.



Fig. 49. Mexican Jay incubating. Another jay is about to inspect the nest; June 5, 1948.

#### THE YOUNG

After the eggs hatched, only two adult birds were seen about the nest. Bands of jays were seen roving about the neighborhood but as far as I could determine no individuals other than the parents fed the young. There were four nests within close range, two not more than seventy-five feet distant, but each pair seemed independent of the others. However, in the event the birds were disturbed, the neighbors were quick to respond and to add their protests.

The young were brooded during the first week and were left alone only for short intervals when both adults might be away foraging for food, often in company with their neighbors. Both male and female shared equally in the tasks of feeding the young and were frequently seen at the nest together. Some of the food first delivered to the young was insect larvae, but as they grew older a great variety of food was offered. When the adults approached the nest with food, their calls brought an immediate response from the young. The rasping calls of the young were given continuously until the adult alighted on the brim of the nest to feed them. The calls of the young increased in intensity and changed in quality as they grew older.

The nest was kept perfectly clean, the excrement of the young being eaten or, when the young were older, carried away by the adults. After the young were two weeks old, they were not brooded during the day when normal temperatures prevailed. At night an adult was usually at the nest even when the young were in advanced stages of growth.

The growth of the young for the period spent in the nest is shown in the table of measurements taken of representative ages of 1, 3, 6, 10, 16, 20 and 24 days. Most of

the measurements are standard and need no explanation. The measurement toe-toe is taken from the tip of the toe nail of the hind toe (number one) to the tip of the nail of toe (number 3). The length of the tarsus is derived by subtracting the length of toe number 3 from the tarsus-toe measurement. These measurements, in centimeters, and the following brief descriptions will serve as an aid in determining the approximate age of any nestling of the race *Aphelocoma ultramarina arizonae*.

Age in days	1	3	6	10	16	20	24
Length	5.8	6.9	10.2	11.1	13.9	16.5	18.8
Tail	....	....	....	.7	1.3	2.3	3.1
Unsheathed portion of middle tail feather	....	....	....	....	.1	.9	1.2
Extent	5.2	5.9	9.1	14.7	20.3	29.5	33.3
Wing	.9	1.1	1.9	3.1	6.1	7.8	8.6
Fifth primary	....	....	.1	.9	3.1	5.1	6.2
Unsheathed portion of fifth primary	....	....	....	....	.2	1.5	2.8
Culmen	.7	.9	1.2	1.3	1.5	1.5	1.6
Bill from nostril	.3	.4	.7	.8	.9	1.1	1.2
Toe-toe	1.4	1.7	2.9	3.2	4.9	4.9	4.9
First toe	.6	.8	1.1	1.6	2.0	2.2	2.2
Third toe	.7	.9	2.0	2.1	2.2	2.4	2.4
Tarsus-toe	1.9	2.2	3.8	5.5	6.8	7.2	7.2

*One day.*—The young are naked without any natal down at the time of hatching. There is no external evidence of feather tracts, but along the manus there are raised spots of the integument marking the positions of the underlying papillae of the primaries and secondaries. The eyes are closed.

*Six days.*—The naked skin of the six-day old chick as well as that of younger stages varies from vinaceous tawny (Ridgway, 11"a) to pinkish vinaceous (Ridgway, 5"d). Some of the feather tracts are faintly indicated by papillae, but very few have as yet pierced the integument except those of the primaries and secondaries which are about  $\frac{1}{2}$  to 1 mm. in length. The fifth primary is 1 mm. in length.

*Ten days.*—The feather tracts of the body are well defined but the tracts of the head are only faintly suggested so that the head still appears naked. The tips of the papillae of the scapulars, spinal, femoral and ventral tracts are unsheathed. These tips are downy. Feather growth on the leg tracts is scant with little unsheathing at this stage. The papillae of the primaries and secondaries are 8 to 9 mm. in length but with sheaths intact. Eyes are open.

*Fourteen days.*—All tracts of feathers including those of the crown are well advanced and unsheathing is progressing rapidly. The tips of primaries and secondaries are unsheathed.

*Sixteen days.*—The growth and unsheathing of the feathers has advanced to a stage where there is a substantial covering of feathers. The unsheathed portions of the ventral tracts are a tawny white in color. Although the feathers of these tracts average 8 mm. in length, the ventral apterium is conspicuous when the bird is viewed from below. The sides of the head are naked, but a few feather papillae have appeared in the auricular region. The ear openings are still well exposed to view. Rictal feathers are prominent. Young at this age are able to support their heads in a sustained upright position.

*Twenty days.*—A nestling at the age of twenty days, when viewed from above, reveals no naked areas or apteria; these are well concealed by the grayish brown contour feathers. The ventral tracts are buffy white in color, but as yet the feathers have not grown sufficiently to conceal the large ventral apterium. The auricular region is feathered, and only a small area on the side of the head remains naked. The unsheathed portions of the remiges are bluish gray but some parts display a distinct blue color. The unsheathed tips of the rectrices are now 9 mm. in length. These tips are brown in color without any tint of blue. The tip of the bill is horn color but a dark area is present near the outer one-third of the maxilla. The base of the maxilla is of a flesh color and the posterior lateral extensions of the gape are pale yellow. The iris is dark slate in color. The bird of this age clings tenaciously with its claws to a twig or to one's finger.

*Twenty-four days.*—The juvenal plumage at this stage is well advanced and many of the tracts of feathers have completed their growth and unsheathing. The upper parts are grayish-brown or grayish slate in color. The outer vanes of the primaries are tinted distinctly with blue; the inner vanes are



fuscous. The under parts, including the under tail coverts, are white; the sides and flanks are tinged with buff. The throat is white, the upper breast, dusky. Tarsus and toes are light olive, the nails being darker. The mandibles are vinaceous horn color, the entire lower mandible having a reddish tint. The dark area present in the bill of a twenty-day old young has increased in extent and in degree of pigmentation. (The bill of the adults is entirely black, a condition usually not acquired until the bird is more than a year old. Most one-year-old birds have the basal portions a light horn color. See Pitelka, 1945:256).

The young at 24 or 25 days of age are able to leave the nest. At one nest the young left at the end of 24 days and at two nests they were 25 days of age at the time of leaving. At that age they can make short flights from limb to limb, but another week is required before they are capable of strong, sustained flights.

#### RELATIONS WITH OTHER BIRDS

Mention has already been made of the relation of the Mexican Jays to other birds at the feeding station at our camp. Their gregarious habits, so conspicuous during the winter months, are continued throughout the nesting season. Noisy garrulous bands of four or five to as many as a dozen or fifteen can be seen on any walk through the live oak belt of Madera Canyon.

A Mexican Jay when alone is extremely wary and suspicious, but when a member of a group, it becomes aggressive and ready to exploit any situation that may net it food or satisfy its tendency toward plunder. Often I have met with such groups in the lower part of Madera Canyon where other birds were under observation. On May 22, when I was in a blind observing a nest of a Solitary Vireo, a group of five jays appeared, one of them alighting on the oak branch on which the nest was placed. The disturbed vireo flew from the nest and called alarmedly. The cries of the bird brought the male vireo to the scene. The first jay had retreated, but the other four came in as a gang, resulting in a losing battle for the vireos until I left the blind to take sides in the contest. The next day when I visited the nest the eggs were gone. I suspected that the jays had made another visit in my absence and made off with the eggs.

Later in the season I saw one of a group of jays with a bird's egg in its beak. At another time a group of jays was seen causing a great commotion in a tree where there was a nest of half-grown Black-headed Grosbeaks which had been examined an hour or so before. After the jay's visit I again climbed the tree and found only one young present, circumstantial evidence that the jays were responsible. Jays may also have been responsible for the disappearance of eggs or young at several other nests kept under observation.

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