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## THE NEST LIFE OF THE TURKEY VULTURE

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For several years we have been interested in the nesting of the Turkey Vulture (*Cathartes aura*). Opportunity to study a nest in detail came in the spring of 1940 when we discovered a site in southwestern Alameda County, California. The senior author was employed during the summer and consequently several of our visits to the nest in June and July were at night after working hours. Time and expense limited our observations.

The following is a summary of some of our observations. We wish to express special appreciation to Dr. W. H. Rich of the Stanford Natural History Museum for his help, encouragement, and enthusiasm for the work we were doing. Others who have aided greatly are: J. R. Fassett, R. F. Connett, W. Wool, D. Grant, and Harvey I. Fisher.

In the spring of 1939 we flushed a Turkey Vulture from a hollow-log nest in Buzard's Canyon, about 26 miles northeast of Paso Robles, San Luis Obispo County, California. The log, which had been hollowed out by fire, was in a horizontal position in a growth of sage brush which camouflaged it. The stump end was buried in the south-facing slope of the hill; the other end was open. Entrance to the nest was possible through this open end and through an aperture on the top of the log about four feet from the end. With the aid of a flashlight we could see two downy vultures in the end of the hollow which was filled to a depth of 14 inches with odoriferous and white-washed debris. The young birds, about six days old, were hobbing up and down and occasionally emitting a weak, muffled hiss. This nest was not used in 1940.

A nesting site in the steep wall of Arroyo Hondo, several miles southeast of Calaveras Dam, in Santa Clara County, was found in early June of 1937. The "nest" was in a large dark cave and contained a single young vulture. The site was more exposed to the light and weather than the one described below.

The nest with which this study is chiefly concerned was found on April 16, 1940, in a sandstone cliff approximately 15 miles northeast of San Jose, California. The cliff is one-fourth mile long and has a maximum height of 130 feet, but the height near its south end where the nest was situated is 100 feet. On a clear day one can see open country for several miles to the west and south. The slopes surrounding the cliff are covered with wild oats and sage brush (fig. 51). Occasional clumps of live oak, toyon and poison oak are found on the slopes, and these plants are abundant in near-by shallow ravines. Black-tailed deer are abundant; on our daylight trips we never saw fewer than a dozen.

The entrance to the nest cave is twenty feet from the base of the precipitous cliff. The opening is only two feet wide and a little higher; inside it opens out into a large chamber eight feet in diameter. In the ceiling of the chamber is an opening to the outside, and six feet from the entrance, in the rear of the chamber, is a pit nine feet deep and three and one-half feet wide. This pit gradually narrows to a diameter of two feet at the bottom. The floor of the chamber is irregular and is strewn with rocks of various sizes. On the other hand, the floor of the pit is sandy and has a slight

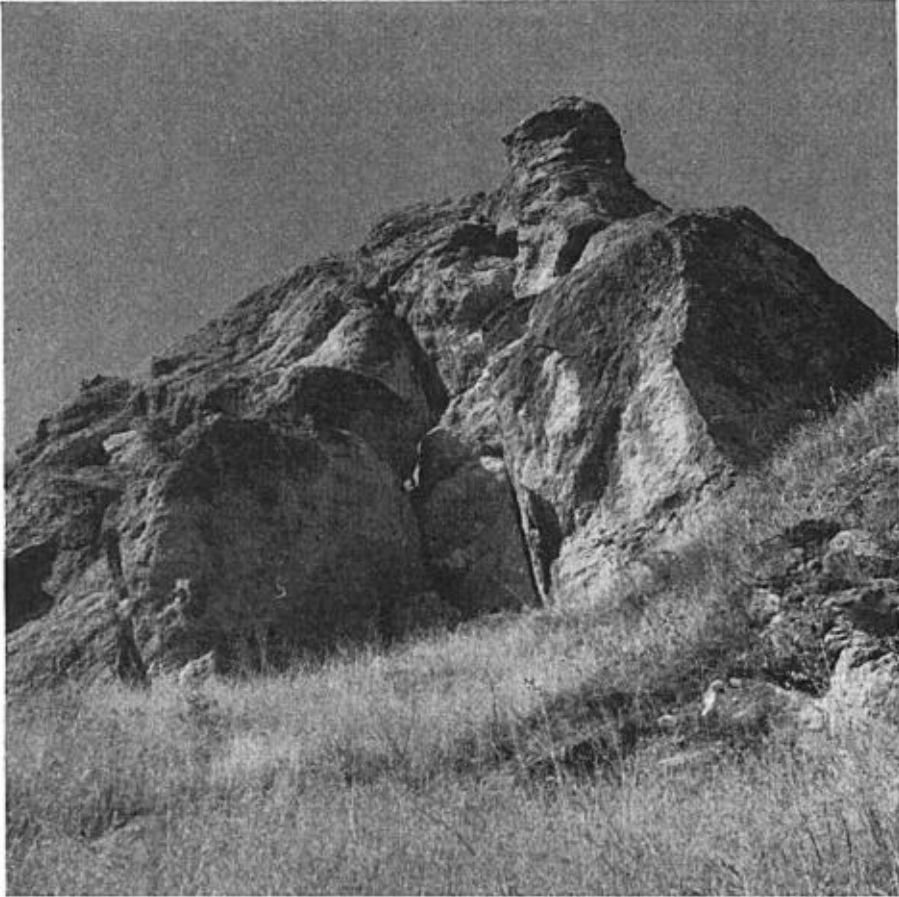


Fig. 51. Nest cliff used by Turkey Vultures in 1940; 15 miles northeast of San Jose, California.

covering of twigs, stones and fossil shells which have been deposited there by water coursing through the cave in the rainy season. There was no "imported" material used in the nest in the pit. At the bottom are two small passageways which lead off opposite sides of the pit. These escape-ways furnished opportunity for some interesting observations which we made later in our study of the young birds.

Within the pit it was impossible to see more than the boundaries of the cavern even after one's eyes became accustomed to the darkness. Our observations on this nest and others, as well as published accounts, lead us to think that the Turkey Vulture prefers dark, secluded places in which to rear its young.

At right angles to the small entrance is a larger opening which leads to a ledge on the cliff. The ledge is also the entrance to another funnel-like cave which extends far back into the cliff. At its deep end this cave becomes very small before enlarging to form a chamber. The smallness of this inner entrance shuts out almost all light in the chamber. Two eggs of the Turkey Vulture were found here in 1937. Nests found on this sandstone cliff were never situated in the same place in successive years except once, but the eggs or remains of eggs found there in 1936, 1937, 1939 and 1940 may have been laid by the same bird.

The single exception occurred in 1941 at the same nest that was observed in 1940. On April 20, 1941, Wilbur Wool and Telford Work returned to the cliff to examine this nest. On entering the cave, a strong vulture odor was evident and further examination of the pit showed the form of a vulture on the nest. After taking several photo-flash pictures, the bird failed to move. Work crawled down and brought the vulture to the upper chamber. It was dead and in such a state of decomposition that it was impossible to identify it as the same bird that nested the year before. One fresh egg was found in the nest. There was no evidence that the bird died of egg-binding. It had probably been dead for two weeks.

The first indication we had of a Turkey Vulture nest in the cliff in 1940 was the sight of a bird emerging from the opening in the top of the nest chamber. Examination of the cave revealed two eggs which were "stone cold," and candling of the eggs with a flashlight showed that they were fresh. We left immediately in order that the parent might return. Knowing that birds are less likely to desert a nest after incubation has started, we decided to return later for photographs.

On the afternoon of April 19 we again flushed the old bird from the nest and climbed to the cave. Just inside the entrance was a mass of dark-colored, partly digested meat which evidently had just been regurgitated by the parent we had frightened from the nest. The eggs had been moved back toward the wall of the pit. While we were near the cave the old bird soared high in the air, but it always remained within half a mile of the cliff.

On our next visit, on May 1, we crept silently along the base of the cliff to a position where we could photograph the bird as it left the nest. When the equipment was set up, we made a commotion to frighten the bird out of the cave, but no bird appeared. We climbed to the cave. The eggs were not stone cold but neither did they feel as though they had been incubated recently. Candling revealed that they had been incubated, but the development seemed slight for the fourteenth day of incubation. A dark red embryo could be seen through the shell, but it was only one-tenth the volume of the egg. Large blood vessels were formed next to the shell, and everything was still quite fluid within the egg. This early stage of the incubation, the temperature of the egg, and the absence of the parent caused us to wonder if the nest was deserted. On leaving the cave in the late afternoon we noticed two Turkey Vultures soaring over the canyon at the level of the cliff.

Albert and Wilbur Wool returned to the nest on the afternoon of May 12. Albert Wool's field notes read: "As we started to climb to the narrow opening, we heard the old vulture struggle against the steep walls of the funnel as she abandoned her eggs. A moment later, with wings awkwardly scraping the sides of the upper opening, she pitched out and soared across the valley, only to return and circle about nearby."

Since the round trip from Stanford University to the nest is an 85-mile, 8-hour affair, we planned to delay the next visit until the eggs had hatched. Published estimates of the incubation period for Turkey Vultures range from 30 to 40 days. By comparison with birds of comparable size we calculated that 31 days would be about the correct period. We returned on May 17. Wool climbed to the nest while Work remained below to photograph any ensuing action. The old bird did not flush and we were afraid the eggs had been deserted.

The parent had remained on the nest! Looking down into the pit with the aid of a flashlight, we saw the old bird flattened out on the sandy floor with its head turned sideways to watch us. Under its neck and chin was an unhatched egg, and near the egg was a recently hatched chick which was entirely white except for its black head and feet (fig. 52). The chick's eyes were not opened, and its neck was too weak to



Fig. 52. Adult Turkey Vulture crouched over egg and newly hatched chick.

support the head which was lying sideways on the ground. We expected the parent to make a move at any moment, but we took pictures (one at 16 inches) and stroked its feathers without causing it to move. The old bird crouched lower when we set off the flash bulbs and from time to time it blinked its eye and emitted a few guttural hisses. The chick moved only once or twice and tried to raise its head. It hissed almost inaudibly two or three times. The remaining egg was pipped, and the bill of a chick was protruding from a hole in the under side of the egg. As we left the cave, another Turkey Vulture flew past the entrance.

On the afternoon of May 19 the white fluffy chicks were somewhat apart from the adult when we first peered into the pit. Almost immediately the parent moved a few paces up the escape passage to the left and regurgitated an odoriferous piece of meat eight inches long and about an inch thick. The old bird, which we knew to be the same one observed previously because of a dark red blotch behind the right eye, remained hunched over the meat until we forced it out into the pit for a photograph with the young. In the pit it again assumed the flattened position, hugging the ground with the head turned to one side. The hisses were more forceful and drawn out on this visit.



Fig. 53. Adult vulture with downy young on May 19, 1940.

The most obvious change in the young birds, aside from a 100 per cent increase in their size, was the longer, more attenuated bill. Two days previously the bill had been short, and the head had been relatively wide between the eyes. The white down covering the young was long, the skin was black, and the feet were large as compared with the rest of the body. Figure 54 shows the black skin on the bare ventrum. As in subsequent visits we noticed that one chick was much smaller and weaker. Both tired easily. Early in the visit they hissed occasionally, but later they were quiet and the smaller bird could not hold up its head.

We returned for our third observation of the young on May 29, when they were 13 days old. They were approximately four times as large as they were on the last visit and were much stronger. They hissed continually, but alternately. If we turned the lights off, they stopped, but they resumed immediately when the lights flashed on. As we descended into the pit, their hisses became more frequent. At a distance of three feet they hissed simultaneously and awkwardly spread their wings. When we stopped moving, they stopped hissing, but the least disturbance caused them to start again. This spreading of the wings for defense and balance was the first sign of coordinated use of the wings. One chick backed up into a corner and used its right wing

as a brace to maintain an upright position. In moving about the floor of the cavity the chicks rested on the entire length of the tarsus as well as on the foot. In a resting position they sat on their haunches with the legs extending forward.

Handling preparatory to weighing excited them and they regurgitated. The process of regurgitation started with an undulating movement that began at the feet, passed through the entire body and was climaxed by a forward projection of the neck and head. As the meat passed from the bill, the eyes were closed. On most occasions regurgi-



Fig. 54. Young vultures at age of thirteen days.

tated meat was not eaten again; the cave was splotted with such material. However, larger pieces of such meat may be eaten. Several times we tried without success to find pieces that had been regurgitated previously.

We realized that weights of the young birds would be affected greatly by this regurgitation and, consequently, we forced them to regurgitate completely before weighing on this and other visits to the nest. On this date, May 29, the larger chick weighed 380 grams and the smaller 340 grams. It was possible to differentiate the chicks in these early visits because the larger had a thick, heavy covering of down on the head; the smaller one's head was only sparsely covered.

Upon our entrance into the pit on May 29 the parent which had been with the young moved into the left escape passage and remained there until we brought it out into the pit. Once in the pit the bird covered the chicks, one under each wing, and settled down into the flattened position. When the adult was stroked, nothing hap-

pened; ruffling of the feathers produced no reaction. After several minutes the chicks crawled out from beneath the old vulture (fig. 54). We removed them to the upper chamber for weighing. While we had them there, we brought the parent up and set it free near the entrance to the cavern. Instead of escaping to the outside the bird scrambled back into the pit. It neither struggled nor hissed when handled, and the crop was empty.

An attempt at what we thought was feeding occurred on this visit. The parent regurgitated food into the open mouths of the young.

On the afternoon of June 1 the parent was not observed. The two young birds were squatted down on the nest in the pit. Lengthening of the head was again apparent, even though the elapsed time was only three days. The nostrils were beginning to assume the adult shape, and along the posterior edge of the wing the quills of the primaries were about one-fourth inch long. In the three-day interval the chicks (now 15 days old) had increased their weight more than one-third. The larger weighed 550 grams, the smaller 485 grams. Part of this increased weight may have been due to the retention of food. The young birds seemed more accustomed to us, and only one piece of meat was regurgitated. They did not retreat as often or as far from us as on previous visits. However, it may have been that they were bolder and more antagonistic. Co-ordination of wing and leg action was much improved. The young birds showed a noticeable desire to be next to something. When they were up against a wall, they did not try to move farther although a way of escape was possible. The large chick once squatted, seemingly content, next to Wool's knee, and when we put them in a leatherette equipment case to move them for weighing, they did not want to be removed.

We had noticed feathers of Turkey Vultures and whitewashed areas on ledges near the cave and thought the other parent might roost there at night. Although our approach at 9:00 p.m. on June 6 was cautious, we saw no vulture outside the cave. The same (?) parent walked into one of the escape ways off the pit and disappeared from sight. Now, at the age of 20 days, the larger chick weighed 1010 grams and the smaller 820 grams. In five days they had increased their weight by more than 40 per cent. The primary quills were one-half inch long, and the down was beginning to curl. The bills had assumed adult proportions and had a well shaped hook on the tip of the upper mandible. The skin was still black, but the feet and legs were lighter in color than on former occasions.

A much bolder attitude was exhibited by the young birds. They hissed continually and squatted on their haunches in a threatening manner with wings partly extended and trailing on the ground. When a hand came near, they attempted to nip it, and twice the smaller bird succeeded. An increased ability to balance the body was shown by the vultures when they were placed on the scales or were held high on a hand.

Early in the afternoon of June 11 we visited the nest site again. No Turkey Vultures were observed in the vicinity of the cliff. The young birds were alone in the bottom of the pit. The larger weighed 1030 grams, a gain of 20 grams in five days; the smaller chick had gained 39 grams and weighed 859 grams. The longer quills of the primaries were one and one-half inches in length and barbs were beginning to appear at the tips. Quills for tail feathers and some body feathers were first noticed at this time. The downy covering of the body had become coarse, long and very curly. The shape of the head was that of the adult.

Although they exhibited no particular antagonism toward us, the young vultures were extremely antagonistic toward each other. When forced into close quarters, they lunged at one another and hissed loudly. In a series of these actions they occasionally came in contact. Then one or both would suddenly be repelled backward, as if by some explosive force. As a rule the larger bird dominated the smaller. The smaller was finally

forced back into the right passage leading from the pit. This passage had never been used by the adult or the chicks to our knowledge. When we attempted to extricate it, the bird worked back out of sight.

While weighing the vultures near the entrance, we noticed seven Turkey Vultures soaring past. Oftentimes they came within twenty feet of the opening, and as they did



Fig. 55. Young twenty-five days old.

they turned their heads toward the cave entrance. When Work went outside, they paid no particular attention to him and continued to soar near the cliff.

It was 1:30 in the morning of June 29 that we next visited the nest. We were greeted by the familiar chorus of hissing as we approached the cave. Although the young vultures were approaching adult size, they were still quite downy. The tail feathers were long, and the flight feathers were well developed all along the wing. On the shoulder the feathers seemed to have grown more rapidly than on the rest of the body; they were as long as some of the primaries. The black feathers of the wing, shoulder and tail contrasted markedly with the white down covering the rest of the body (fig. 56).

The two young birds were at first frightened by our presence. The smaller one escaped up the right passageway, as it had done on the last visit. When we brought it back into the pit, it continued its efforts to escape by attempting to climb the steep walls of the pit. Once it performed what we have termed a "scare rush." This action starts with a slow hiss accompanied by a rapid forward projection of the head. When the neck is extended part way, it is jerked back and a violent concluding hiss is emitted.



Simultaneously the wings are thrown forward. This creates a startling flash and a rush of air. On this occasion the whole performance was bluff, for the bird never followed through with an actual attempt at contact. The larger chick became quiet later in our visit and moved up next to us as it had done several times on other visits. We examined the cliff surrounding the cave but could find no trace of the adults.



Fig. 56. Young at age of six weeks.

Our last trip to observe and photograph the young Turkey Vultures was made on July 18. When we arrived at 12:30 p.m., no vultures were in the cave, but with the aid of a flashlight we found the young vultures in the adjoining funnel-like cave described earlier. They were perched on the rocks; at the moment the wings were almost fully extended (fig. 57). Although they still retained the downy white head covering, the down on the neck and breast was interspersed with black feathers. The skin was still black, but the feet were light in color. The wingspread was four and one-half feet.

As we approached, the small bird retreated, but the large vulture stood its ground and regurgitated. We placed the large bird in a hollow near the mouth of the cave and went back to recover the other bird which had continued to retreat, walking backward and watching us constantly. When we placed the two birds together in the depression in the floor, an "explosion" resulted. The small bird scrambled over the edge of



Fig. 57. Young ready to leave nest cliff.

the cliff and fell to a ledge three feet below. Meanwhile, without using its wings, the larger vulture had climbed a twelve foot perpendicular wall of rock to another ledge. We know of no explanation for this abrupt reaction when the two young birds came together, but we had seen it several times before. Each time it was the smaller bird that was routed unceremoniously.

Attempts to recover the smaller vulture failed. When Wool approached the ledge on which the larger bird was resting, it started backing away. This bird had never retreated before, but this time it continued moving away and stepped off the ledge backward. It fell for some distance before making any visible effort to fly. Then the right wing was flapped once, then the left, but the bird continued to fall until the wings started flapping in unison. It flapped for a short distance and then soared to a landing in the valley below, about one-half mile away. This was undoubtedly its first flight.

Three days later Wool visited the cliff; the smaller vulture was gone.

#### SUMMARY

Thirteen visits were made to a Turkey Vulture nest in Alameda County, California, in the spring and summer of 1940. The nest was situated in a dark cave in a sandstone cliff facing the southwest. Two fresh eggs were found on April 16; hatching occurred

on May 17, an elapsed time of 31 days. When an adult was in the cave, it was always the same individual. When sitting on the eggs the vulture was easily flushed, but for two weeks after the eggs hatched it would not leave the young even when we were in the cave and handled it.

The first primary quills were observed at 15 days of age; the first development of rectrices was observed at 25 days. Lengthening of the bill to adult proportions was a striking feature of development. In the last month that the young birds were in the nest, they were antagonistic toward one another, and the small bird was dominated by its larger nest mate. At 62 days the larger bird was forced to fly; the other flew before 65 days. Maximum increase in weight occurred between the fifteenth and twentieth days.

*Stanford University, California, March 15, 1942.*