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## THE TEXAS NIGHTHAWK IN ITS SUMMER HOME

WITH FOURTEEN ILLUSTRATIONS

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### INTRODUCTION

A spur of the Santa Cruz Mountains extends toward the Mount Hamilton Mountains ten miles south of the city of San Jose, California, to restrict the level portion of the Santa Clara Valley to a trough less than a mile wide. Through this restricted area, the Lower Gorge, the Coyote River has its channel. Through most of the year the Coyote channels are dry and surfaced with stream gravel. On these gravel surfaces, Texas Nighthawks (*Chordeiles acutipennis texensis*) were seen by the writers for the first time on May 22, 1929, and on this date the first nest was found. This was the initiation of an intensive study of this striking bird, a study that extended over several years.

Within the past few years this area has been utilized as a percolation basin as a part of the water conservation program of the Santa Clara Valley. This necessarily has made untenable for the nighthawks much of the area covered by these studies.

The area wherein the nighthawks bred was called to the attention of the writers by Dr. Charles Piper Smith of San Jose. He accompanied us on our first journey and was present at the finding of our first nest. Many other individuals have served as companions or assistants in searching for nests or young. One of these was Dr. Alton Alderman, now of Eugene, Oregon. Miss Mary Morgan Smith accompanied Miss Emily Smith on some of her visits in the evening and very early morning. Miss Yvonne Champreux was a companion to Miss Smith during the observations that lasted through the night. Mr. Tom Rodgers frequently accompanied Pickwell; also he made the map (fig. 46) which accompanies this article.

In furtherance of the study of the Texas Nighthawk, 51 visits were made to the territory in 1929, 12 in 1930, 8 in 1931, 4 in 1932, 4 in 1933, and 3 in 1936, a total of 83 visits. On some of these occasions both of the writers were present, but usually they were working independently and this paper is a combination of the work and study of both.

### THE BIRD

*The Foraging Nighthawk.*—The Texas Nighthawk, a typical goatsucker, seems to live exclusively on insects, for which it forages in the air. Nighthawks were observed foraging on one of our evening visits to the nesting territory. The following record taken from the notes of July 8, 1930, will be indicative of the general behavior. The first nighthawk was seen at 7:16 p.m., apparently a female. The sun had not yet set. Four nighthawks were observed in the air at 7:25. Swallows were still in voice. The sun set at 7:31. These foraging nighthawks were flying rather high, at a maximum height of about 100 feet. At 7:37 a male came to the vicinity of the young, apparently supplied with food.

*Migration.*—We do not have enough records to give extensive data on migration. However, we have a record of a Texas Nighthawk on the breeding grounds on April 10, 1931, and a late record on September 13, 1929, when an adult and juvenile were noted.

*Molt.*—On July 9, 1929, a male was noted with some central primaries missing, and the female of this pair had ragged tail and wings. The nighthawks in general were at this time still in breeding activity and this pair was still feeding young.

*Eyeshine*.—On one or two occasions our records show that red eyeshine was noted in both male and female birds. For instance, on July 18, 1929, at 8:25 p.m. at nest 4, both the sexes showed this eyeshine when a flashlight was directed upon them. This character of eyeshine becomes of some interest when it is noted that van Rossem (1927, p. 28) describes the eyeshine of these birds in their winter home in January and February, in El Salvador, as a pale green. He also recounts in this publication that Mr. Laurence Huey had told him of the red eyeshine of these birds in spring and summer months. Van Rossem then suggests that the change of eye color may be related to sexual activity.

#### THE BREEDING AREA

The Santa Clara Valley has been known as a breeding area of the Texas Nighthawk for some time, for English (1929, p. 223) records the presence of eight or ten pairs of

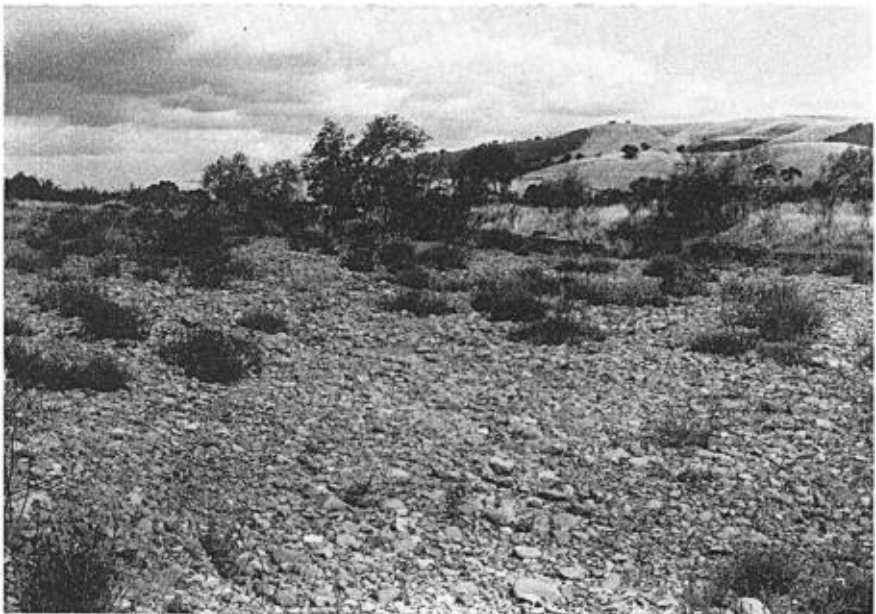


Fig. 45. Breeding ground of Texas Nighthawk. Gravel bed of Coyote River in region of Lower Gorge, near San Jose, California.

nighthawks on Uvas Creek in the vicinity of Gilroy in 1894 and reports eggs taken in 1922, 1923, and 1929; he also reports eggs taken on the Coyote River near Coyote (the location of this study) in 1925.

As figure 46 shows, the breeding area covered by this study was restricted to the gravel beds of the Coyote River, and extended northward from the narrowest portion of the Lower Gorge for a distance of not over half a mile along the course of the river. Careful study was not made of other regions of the valley where the Texas Nighthawk might also nest, but the region under consideration was worked very carefully.

*Flora and Life-zone*.—Grinnell (1915, p. 85) says of this bird, "Common summer visitant to Lower Sonoran practically wherever this zone occurs." Hall and Grinnell (1919, p. 49) list the Texas Nighthawk as an indicator of the Lower Sonoran Life-zone and the A. O. U. Check-list (1931, p. 177) also states that this bird occurs in the Lower Austral Zone. However, it is to be noted that the Santa Clara Valley, where this study was made, is in the Upper Sonoran Zone (see Grinnell, 1935). A careful study of the

flora of the gravel beds was made and it was found that *Lepidospartum squamatum* occurred there. Hall and Grinnell listed this as a Lower Sonoran indicator, noting that it is closely restricted to this zone and particularly characteristic of it. This would seem to show that the region occupied by the Texas Nighthawk represents a Lower Sonoran island surrounded by typical Upper Sonoran conditions.

#### FLORA OF GRAVELLY FLOOD BEDS

##### Abundant plants

*Baccharis viminea*  
*Chrysopsis oregana*  
*Senecio douglasii*  
*Mentzelia laevicaulis*  
*Brickellia californica*  
*Brassica adpressa*

##### Scattered plants

*Lepidospartum squamatum*  
*Datura stramonium*  
*Heliotropium curassavicum*

*Verbascum thapsus*  
*Xanthium canadense*  
*Amaranthus blitoides*  
*Chenopodium botrys*  
*Centaurea melitensis*  
*Artemisia vulgaris* var. *heterophylla*  
*Eremocarpus setigerus*  
*Antirrhinum glandulosum*  
*Antirrhinum vagans*  
*Salix melanopsis*  
*Salix laevigata*

*Bird Associates.*—Careful records of other birds were maintained on many of the visits to the home of the Texas Nighthawk. A table follows, but one or two items of more than passing interest will be mentioned here.

On two or three occasions while experimenting with the Texas Nighthawk, the flushing bird created considerable excitement among Cliff Swallows which were foraging over the region, for they flew back and forth crying in alarm upon the appearance of the female nighthawk. Also, an Arkansas Kingbird, watching for insects on a nearby clump of *Baccharis viminea*, became excited and remained so for several minutes, flying back and forth over a point where the nighthawk had disappeared.

This reaction of these passerine birds to the nighthawk, so similar to the reaction of these same birds to an owl, came about perhaps because of the similarity in plumage. In another part of this paper it is suggested that the intimidation display of the nighthawks, which resembles that of a raptorial bird, may have some relationship to the reaction of other birds to them.

#### BIRD ASSOCIATES OF THE NIGHTHAWK AREA

##### Breeding birds

Sparrow Hawk  
 California Quail  
 Killdeer  
 Western Mourning Dove  
 Lewis Woodpecker  
 Arkansas Kingbird  
 Ash-throated Flycatcher  
 Barn Swallow  
 Western Meadowlark  
 Bullock Oriole

##### Breeding birds of neighboring hill (voice records)

California Horned Lark  
 Rock Wren

##### Birds using region merely for foraging

Turkey Vulture  
 Western Red-tailed Hawk  
 Barn Owl  
 Cliff Swallow

##### Casual birds

Black-crowned Night Heron  
 Golden Eagle  
 Ring-necked Pheasant

Hudsonian Curlew  
 Anna Hummingbird  
 Allen Hummingbird  
 California Woodpecker  
 Red-shafted Flicker  
 Black Phoebe  
 Violet-green Swallow  
 Rough-winged Swallow  
 California Jay  
 Plain Titmouse  
 Bewick Wren  
 California Shrike  
 Yellow-throat  
 Red-wing  
 Brewer Blackbird  
 English Sparrow  
 House Finch  
 Willow Goldfinch  
 Green-backed Goldfinch  
 Brown Towhee  
 Spotted Towhee  
 Song Sparrow  
 Lark Sparrow  
 Gambel White-crowned Sparrow

*Nesting Territories.*—Smith (1910, p. 103) and Bailey (1928, p. 348) report the Texas Nighthawk nesting on adobe roofs at Brownsville, Texas; Sharp (1907, p. 88) and Tyler (1913, p. 57) in vineyards at Escondido and near Fresno, California; Sumner (1931, p. 89) on alkali barrens in Merced County; Eifrig (1930, p. 514) on smooth, hard beach sand at Velasco, Texas; Davie (1889, p. 229) on bare ground; Taylor (1912, p. 22) in rocky country; Bendire (1895, p. 174) on parched gravelly mesas of southern Arizona; and Mailliard (1901, p. 123), Dawson (1923, p. 1068), Grinnell and Storer (1924, p. 348), Woods (1924, p. 3), and Unglish (1929, p. 223) on the gravel of stream beds. The nests reported in this paper were placed on the gravel of the Coyote River bed or its adjoining gravel flood plain, without any indication whatsoever that any effort had been made by the parent bird to form a nest structure. Their protection, it seems, rested in the fact that the two eggs (in all cases there were two eggs), with their dark markings, resembled closely the pebbles among which they lay. The eggs were light clay-color, speckled, lined, and delicately blotched with olive brown and faint violet. At times there was enough difference between the eggs of a pair that they could be individually identified.

A table has been made of the twelve known nests found in the years 1929, 1930, 1932, and 1933, with data regarding the relationship to other nesting sites of the same season, and remarks concerning their specific environment. The locations of these nests are shown in the map (fig. 46). Reference to the map will show that contemporaneous nests were never closer to each other than 700 to 800 feet, this indicating the extent of territory allotted to the nest site by the Texas Nighthawk.

Without exception the nest locations or the eggs were found by tramping the gravel beds of the wash, carefully observing flushing birds. If females left with distress simulation at a distance of ten feet or less, they thus disclosed the nest or prospective position of the nest.

#### NESTS OF THE TEXAS NIGHTHAWK

Nest	Date found	Immediate environment
1	May 22, 1929	3 feet above channel bottom. Bench sparsely covered with <i>Chrysoopsis oregana</i> and <i>Brassica adpressa</i> . Low shrub, <i>Chrysoopsis oregana</i> within 2 feet. Too low to offer shade.
2	June 7, 1929	Same pebbly bench as nest 1, same shrubs. Thin green shrub, <i>Senecio douglasii</i> , in flower 2 feet to southwest. No shade.
3	June 23, 1929	Gravelly bench. A grass-covered alluvial plain about 4 yards to the west. Bench well covered with <i>Chrysoopsis oregana</i> , <i>Senecio douglasii</i> , and <i>Mentzelia laevicaulis</i> . No shade all day long.
4	July 12, 1929	Same as nest 1. Nest 9 inches northeast from base of <i>Baccharis viminea</i> . Shaded in afternoon.
5	May 3, 1930	Sloping terrace of dry east channel. No protecting shrubs nearby.
6	May 3, 1930	West side of <i>Baccharis viminea</i> fringing channel.
7	June 23, 1930	Sloping terrace of main channel. Base of <i>Senecio douglasii</i> 9 inches to the south offering shade.
8	June 27, 1930	Same as nest 4 of 1929.
9	May 19, 1932	Lower end of channel. Side fringe of <i>Baccharis viminea</i> .
10	May 21, 1932	Near fringe of <i>Baccharis viminea</i> .
11	April 22, 1933	
12	July 8, 1933	Nest under drift-covered limb of <i>Baccharis viminea</i> .

#### BREEDING BEHAVIOR

*Cock Roosts.*—As the map (fig. 46) shows, the contemporary nests of the Texas Nighthawks were quite widely separated, indicating that breeding territories were well established and distinct. In some cases, such as with nest 2, the male was frequently flushed from a position about 25 yards from the nest. In other words, this male had a location within the nesting territory. This he persistently occupied and when flushed

he would rise and circle with alarm notes. This was not true of all the males, however, for frequently in the east channel, at a time when no known nests were present there, from two to three males would be flushed near one another from this region. This was so characteristic that we named it the "cock roost." What relationship these males had with the incubating or brooding females could not be definitely determined.

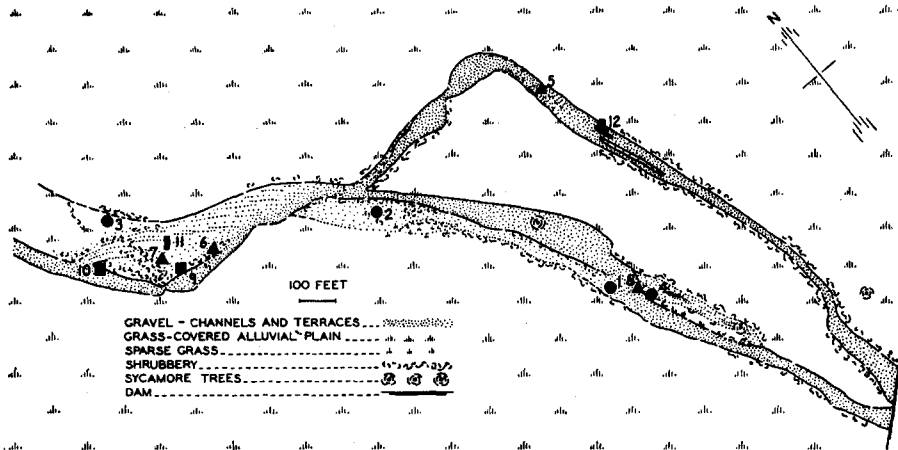


Fig. 46. Map of Coyote River channels, showing locations of nests of Texas Nighthawks. Nests of 1929 marked by dots; 1930, triangles; 1932, squares; 1933, oblong figures.

That this cock roost was regularly frequented was proven by the large number of droppings at this place, a characteristic spiral dropping readily identified. Attention has been called to this type of dropping by Grinnell and Storer (1924, p. 348).

Incidentally, the white bars in the wings of males readily served to distinguish them from the females, which had buffy bars. This difference also has been described by Oberholser (1914, p. 87).

*Courtship Behavior.*—The pursuit of the female by the male has been described by Lincoln (1917, p. 69) and Miller (1937, p. 42). Our observations confirm these reports, but in some respects are a bit more detailed. At nest 3, the male and female had been seen in the territory several days before the first egg was laid. On June 23, 1929, at 7:25 p.m., with the sun almost set, both birds rose and flew high, with the male in pursuit and frequently sailing close above the female for a few seconds with wings flexed sharply down over her. They circled and sailed off, lost to sight.

Two years later in the territory formerly occupied by nest 1, on May 11, 1931, just before 8:00 p.m., both male and female came into the territory, both flying, the male in pursuit and purring. Two days later in the same territory at 6:40 p.m. the male pursued the female actively, giving nasal notes. Several times, poised with down-flexed wings just above her, he uttered a vigorous *whää*. Soon the male dropped to the ground and purred there, while the female circled over the territory where a second male rose to pursue her with no less ardor, although briefly. Then the female, hawking this way and that, came back and settled near the first male who was still purring. The purring went on almost continuously for 15 minutes, 6½ minutes without a stop. At 7:10 the female rose and left, soon followed by the male who circled about. A second male appeared and then a third male came. All three hawked over the territory paying no apparent attention to each other. They flew with easy flight, a few beats of the wings

and then sailing, tilting, suddenly rising, sinking, turning; but passage through the air was rapid in spite of the seeming leisureliness. At 7:20 the three birds left. Similar courtship antics have been recorded by Swarth (1920, p. 38), Grinnell and Storer (1924, pp. 347-348), and Miller (1937, p. 42).

*Voice.*—Records of the courtship voice of the male are incomplete, though a great many records of his voice are in our notes. The following records in connection with the foraging male are of some value, however. On July 8, 1930, when the male returned from foraging, he gave two or three nasal *whää*, *whää* notes, a note that can be imitated if said well to the back of the throat to add the nasal effect. Milder variants of this note were occasionally heard. They might be written *hrunk* or *whoo* or *choo*. The characteristic and frequent trilling or purring of the nighthawk seems to be a *chuck* note, very rapidly uttered, not less than five to six times per second, the rate of utterance being related to the interest of the occasion. When very rapid, it can be imitated by saying *chut-r-r-r-r-r-r* and placing the tongue against the roof of the mouth. At a distance this note sounds like the explosion of an outboard motor. When faintly heard, it sounds like a Screech Owl or like the singing of *Bufo americana*. This note occasionally ended with an incisive, somewhat guttural *wahugh*. All notes were given in a very low pitch and had remarkable carrying quality.

One behavior characteristic of the males in addition to voice should be noted here. When on the ground and approached by an observer they frequently go through a bobbing maneuver, lowering and raising the head. This is accompanied by a *thunk-unk*.

Many observers have given us records of their impressions of the voice of the Texas Nighthawk, Bendire (1895, p. 173), quoting Dr. J. C. Merrill, F. M. Bailey (1902, p. 229), quoting Vernon Bailey, Hollister (1908, p. 459), Tyler (1913, p. 57),



Fig. 47. Nest 11 of Texas Nighthawk, Coyote River bed, April 22, 1933.

Oberholser (1914, p. 93), Swarth (1920, p. 38), Dawson (1923, pp. 1065-1067), Grinnell and Storer (1924, pp. 347-348), Woods (1924, p. 6), Hoffmann (1927, p. 174), and Miller (1937, p. 42).

NESTS AND YOUNG

*Incubation Period.*—On June 7, 1929, nest 2 was found with a single egg. When the nest was visited on June 8, it had two eggs. This nest was visited on June 11, 12, 18, 20, 21, 22, 23, 24. On each of these occasions the female was incubating. On June 25, at 8:00 a.m., the nest contained 1 young and 1 egg. The second egg hatched at 11:12 a.m. on the following day, June 26. Presuming these eggs to have hatched in the order in which they were laid, an incubation period for each of 18 days is indicated.

At nest 3 the female bird was flushed from the same location on June 22, 23, 26, and 27. On June 27, the location was visited at 12:30 p.m. and between that hour and 7:25 p.m. an egg was laid. The nest site was not visited again until June 29, when 2 eggs were present. The second egg was narrower than the first. The incubating female was observed on July 1, 5, 10, 12, 13, 15, and 16. On July 17 at 2:00 p.m. one egg had hatched; the peep of the chick had been heard within the egg at 8:00 p.m. the previous evening. One egg, the narrower, had not yet hatched. On the evening of July 18, the second egg had apparently hatched and the halves of the two eggs were found scattered about within four feet of the nest. Though the young were not seen at this time, the empty shells proved that they had hatched. In this case the incubation period of the first egg, the broader, definitely was 19 days, and of the other egg perhaps 19 days.

Thus our observations agree with Bendire (1895, p. 174) who believed that "the two eggs are deposited on alternate days, and incubation begins with the first egg laid."

DURATION OF INCUBATION			
Nest	Eggs laid	Eggs hatched	Number of days incubation
2	June 7	June 25	18
	June 8	June 26	18
3	June 27	July 16	19
	June 28(?)	July 17	19(?)

*Brooding.*—During the daylight hours the female was noted brooding the young regularly at all ages. The male was seen to brood for brief periods only in connection with his feeding visits. Notes concerning this brooding are taken up later in connection with feedings.

*Feedings.*—Feeding observations were made at nests 1, 2, 3, and 4, between the dates of June 11 and July 27, 1929.

The first feeding noted was at nest 1 on June 11, when the nest was under observation from 7:50 p.m. until 8:50 p.m. At 8:25 p.m. the male dropped down in front of the young, followed in less than a minute by the female. The flashlight was turned on them and the female flew away. The male had his bill thrust into the opened mouth of one of the young, and peristaltic motion was observed in the male's throat. He seemed undisturbed by the flashlight. After a moment the heads of the adult and the young were jerked back and forth (slightly up and down) and the male withdrew his bill and uttered soft notes. Both young birds, the fed and the unfed, reached up with wide-open mouths, uttering soft notes. Then the male's bill went down into the second mouth, followed by regurgitation without motion, and then rather violent jerking again. The same process was repeated with the first bird, then the second, longer each time with the first than with the second. The male departed. The feeding had taken about five minutes.

The second feeding noted was at nest 2, on June 27, when the nighthawks were under observation from 7:15 p.m. until 8:15 p.m. This time the male was again seen to feed both the young at 8:05 p.m. The jerking heads could be dimly seen.

On June 29, the nighthawks in nest 2 were observed from 7:14 p.m. until 8:40 and a third and fourth feeding record made. On this occasion, with the observers 15 feet removed from the young birds, the male came in, circled about with calls, and alighted about 2 feet from the young. After a few notes, he waddled over to them, squatted as both young reached up with uplifted wings and wide-open mouths. He fed the older and larger for at least a minute, with an up and down jerking motion at the end of the feeding, then for a shorter time fed the younger. While the male fed the younger, the older crept under him, then the younger followed. The male brooded them for about five minutes, then he rose, apparently not startled, circled, uttering calls, and flew away.

The male came in again at 8:15 p.m. and fed one of the young. A flashlight was used for necessary light. Though the female was in the vicinity and calling at the same time, she was not observed to feed; she flushed when the light flashed. The male departed again at 8:25 p.m.

The fifth feeding was again at nest 2 at 4:30 a.m. on July 1, when the nest was under observation from 4:15 a.m. until 5:45 a.m. Again it was the male that came in, dropped a foot from the young, waddled up to them and fed them both. During this feeding the female had dropped 18 inches in front of the male and watched with her head turned so that an eye was on her observers, but she remained motionless. Again the male brooded the young until he was disturbed at 4:55 a.m. by the raising of the heads of the observers who were about 15 feet away. He left with distress simulation. The female did not flush, but remained. About 30 minutes later the young birds uttered notes and the female crept nearer the young. One of them responded to her calling and crept under her feathers. This young bird soon emerged from the feathers and implored the female for food, but received nothing.

The sixth feeding recorded was made at nest 2 on July 4 when the nest was under observation from 7:30 p.m. to 9:30 p.m. This time the male came in at 8:10 p.m. and fed the young briefly. He left without brooding them. Though the female came in 20 minutes later and dropped about 20 feet from the young and called them, they did not go to her and she was not seen to feed them, but shortly went away.

The seventh feeding was at nest 4 on July 18, at 7:30 p.m. On that date the nest was under observation from 7:30 p.m. to 9:30 p.m. At this time the female brooding the young was approached by the observer to a point within 6 feet of her. The bird did not flush. She was seen to thrust her bill into the open mouth of one young in front of her, for a few seconds, and give three slight jerks. Upon the withdrawal of her bill, the young bird moved its bill as if it had been fed.

At 8:25 p.m. the male alighted near the female who then moved behind a neighboring shrub. One of the young went to her and the other stayed with the male and was fed briefly (eighth feeding). Subsequent to the feeding the young crept beneath the feathers of the male.

Again on July 20, nest 4 was under observation from 7:10 p.m. until 9:30 p.m. and a ninth feeding by the male at 8:00 p.m. was noted. The male had come into the territory a few minutes before this time and had brooded first one of the young and then the other which was separated from the first slightly. The male fed the second young bird. The female came in at 8:15 and the male departed. After various maneuvers of the female, jerking heads were noted in the bright moonlight. Perhaps this indicated feeding actions of the female.

On July 23, nest 4 was observed from 6:55 p.m. until 10:00 p.m. and the tenth definite feeding was recorded. With two observers prone about six feet removed from the young birds, the male arrived at 8:00 and dropped about one foot from the young



bird. He called, but without waiting, walked over to it and fed it. There was only one young on this occasion. After the feeding the male brooded the young.

The female arrived in the vicinity, flying about, and the male responded while continuing to brood the young. The male shortly arose and flew toward the calling female. The uncovered young walked between the two recumbent humans who were lying with not more than a foot space between them. The male then came up and brooded the young very briefly in this location. In a few seconds the male turned and walked away, the young following. He brooded it again at a distance of 3 feet from the observers. Again the male arose, and walked farther with the young trailing. Once again he brooded the young, but this was shortly terminated by a movement on the part of one of the observers, which sent the male away with striking distress display.

The next feedings recorded were in the course of an entire night's vigil extending from 7:00 p.m. until 7:00 a.m. on July 27 and 28, at nest 3. During this period the two observers were under blankets at a distance of ten feet from the young. The first feeding of the evening was at 7:50 p.m., again by the male, at which time he fed both young briefly. He had come into the vicinity in voice, dropped to the ground and continued calling, then finally moved to the young. He left without brooding them.

Again at 8:15 p.m. the male fed both young and left without brooding. Though the female had preceded the male, she seemed to spend her time attempting to induce the young to come to her. In the meantime the male dropped down in front of the young and fed them. The male returned at 9:00 p.m. but it could not be determined that he fed the young. Though the male was heard flying in the vicinity at 12:30 a.m., nothing further was noted of male or female until 5:00 a.m. when both were seen coming into the nesting vicinity and alighting some distance away. The observers at this time were in a sitting position.

At 5:25 a.m. the male was seen again and at 6:30 the female was flushed from the young and it was discovered at this time that they had moved 85 feet from the position where they had started the night.

The feeding is by means of regurgitation, which is the behavior one would expect with birds of the anatomical structure and feeding habits of the Texas Nighthawk. In spite of the relatively large number of observations, however, it will be noted that not more than one or two definite feedings by the female were recorded, the male being the chief carrier of food for the young. It may well be, since the observers of necessity were very near, that the greater solicitude of the female for the young prevented her from feeding a normal number of times, whereas the male, with less solicitude and therefore less fear, fed them more frequently while the observers were present.

One other item can be deduced from these observations and that is that the activity of the Texas Nighthawk in feeding seems to be strikingly crepuscular. The observed feedings were in the early evening and again in the early morning. If feedings extended throughout the night on the occasion of the night vigil of the observers, they were not seen, and the lack of notes from the parents would indicate that no such feedings took place during the hours from 9:00 p.m. until dawn.

Observations in support of this have been made by Wood (1924, p. 6), though one or two records in the literature (Grinnell and Storer, 1924, p. 347) indicate that these birds are, at times at least, active through the night.

Several attempts were made to photograph the parent bird in the act of feeding the young. On one occasion the young were tethered with a string in order to keep them within the range of the camera, and at another time a pen of rocks was built about a pair of young birds. In neither case would the parent bird come to the young.



Fig. 48. Young nighthawks of nest 1, less than 2 days old, in crouch-concealment; May 27, 1929.



Fig. 49. Young nighthawk of nest 1, approximately 5 days old, in crouch-concealment following flushing of female who left with distress simulation.

*Growth and Development.*—Our records of young nighthawks begin with the birds at hatching. At nest 2 a young nighthawk was able to toddle when less than 24 hours of age. The young of nest 1 when first visited on May 27 were heavily covered with down,

light tan in color, almost faint salmon (fig. 48). They were then less than 2 days of age and able to crawl to the calling mother.

Two days later no great change was observed in them except that their eyes were widely open and they were able to run rapidly 2 or 3 feet to their mother, with wings up. They were then approximately 3 days of age. On May 31, the young were able to walk with very little fluttering of the wings (fig. 49).

On June 2, with the young approximately a week old, the sheaths of the wing coverts were opening and the primaries were nearly an inch long. On June 7, with the young at approximately 12 days, one was appreciably smaller than the other, but both were well feathered. The color was reddish-tan with black spots (fig. 50). On June 12, the primaries were well unsheathed. On June 16, the larger bird, 21 days old, could make flights of 50 to 100 feet and the smaller bird made shorter flights. In this juvenal plumage they showed no bar in the wing (fig. 51). On June 18, they both were able to fly easily, and on the morning of June 20, the female and one young were flushed, this young bird flying and circling easily. The second young was not observed on this date.

The color of the young nighthawks varied in several of the other nests and one of the pair could be distinguished from the other by being more rufous or more buffy.

At nest 2, where only one young survived the nestling period, the young bird made its first flight of short distances on July 15, approximately 21 days after hatching. The birds at nest 3 were not under observation during the time they would have started flight; at nest 4, the one remaining young was observed on August 8 and was able to fly high in easy flight. It was then 22 or 23 days old. In nest 3 the egg tooth was still present on the older bird (about 12 days), but not on the younger. Incidentally, at nests 2, 3, and 4 only one bird reached flying age.



Fig. 50. Young nighthawks of nest 1, approximately 12 days old, showing juvenal plumage with only fragments of natal plumage remaining; June 7, 1929.

## PROTECTIVE BEHAVIOR OF ADULTS AND YOUNG

*Protective Behavior of Adult Female Nighthawk with Eggs or with Young.*—At nest 1 extensive experiments were performed in an attempt to reduce the egg- and young-protective behavior of the bird to a definite pattern with respect to the character of the stimulus presented. To this end, following its discovery, May 22, 1929, visits were made to nest 1 and its resulting young, on May 24, 25, 27, 29, 30, 31 and June 2, 7, 12, and 16. Eggs were present on May 22, 24, and 25. The eggs hatched between May 25 and 27, so that all experiments made subsequent to May 25 were concerned with the behavior of the adult in connection with young or the experiments concerned the young themselves.



Fig. 51. Flashlight photo of young of nest 1, showing fully developed juvenal plumage; June 16, 1929; age about three weeks.

Nest 1 was found through the distress simulation of the incubating female flushing from the eggs. As we were scouting the gravel bed of the Coyote wash, a Mexican laborer came into the stream bed just in front of our party. The bird got up not more than two or three feet in front of him and went fluttering over the ground for a distance of 50 feet, flicking the pebbles with her wing tips. She made no audible sound other than that caused by the wings. This behavior, in response to the approach of a standing human, proved typical not only for this bird but for all incubating or brooding Texas Nighthawks.

The first extensive experiments dealing with the incubating bird were made on May 24 between the hours of 8:30 and 11:00 a.m. The bird was approached by the experimenter on hands and knees pushing a large camera on a tripod. Photographs were taken from time to time with attendant changing of plates and lenses, beginning at 15 feet and continuing until the camera was within 4 feet. The bird did not flush from the eggs in this period.

In the beginning of the hand-and-knee approach, the incubating bird remained mo-

tionless with eyes nearly closed (fig. 52). We shall call this close sitting of the strikingly colored bird a "concealment by self." This reaction is related to the "freeze" or crouch-concealment presented by all strikingly protectively colored birds, young or old, but differs here in that the eggs were also involved and the reaction was more marked



Fig. 52. Brooding female Texas Nighthawk in "concealment by self."

because of them. To human eyes, this protection through concealment by self was amazingly impressive; and to enemies not aware of the position of the bird or not accidentally wandering within a foot or two of her, the method would have afforded complete protection for the nest contents. Bendire (1895, p. 173) quotes Dr. J. C. Merrill as follows: "I have ridden up to within five feet of a female on her eggs, dismounted, tied my horse, and put my hand on the bird before she would move." In this case the Texas Nighthawk described by Merrill undoubtedly presented the concealment-by-self reaction.

The protective reaction, through concealment by self, changed as the experimenter and camera moved forward in that when pulling away a stem within 6 inches of the female, she opened her eyes more widely, spread her tail, raised wings, lifted her throat feathers, and gave a deep, throaty, rasping hiss. The hiss was not loud but very decisive. This was the initial step in her second protective reaction, that of intimidation display (figs. 53, 54, 55). The fingers of the experimenter were frequently thenceforth within an inch or so of the incubating bird, and though she withdrew an inch or so from the eggs, she did not flush.

Withdrawal of the experimenter from the vicinity of the nest was made by a backward hand-and-knee crawl without flushing the bird. After an interval of 30 minutes the nest was reapproached, this time with the experimenter upright. The incubating bird flushed at a distance of 5 yards, flicking the ground with her wings as she flew a distance of 75 to 80 feet. Thus she presented a third protective reaction, that of distress simulation. In their order of presentation to the animal on hand and knee, these reactions were: (1) concealment by self, and (2) protection by intimidation display. To the bipedal enemy they were: (1) protection through concealment by self, and (2) distress simulation.

On May 25, while visiting the region very briefly, the incubating bird gave reactions as of May 24, this time while a class of nearly thirty students observed.

The region was visited on May 27 at 9 a.m. The parent bird was 6 inches removed from her previous position over the eggs and was found to be brooding two downy



Fig. 53. Initial step in intimidation display of brooding female.

young. She was approached on hands and knees with camera as before, the lowered position beginning at a distance of 20 feet. Her initial reaction was the same as that of the incubating bird, namely, protection through concealment by self. Though the slit-eye was opened slightly, shortly it was closed again.

A hand was extended to her. Her reaction was that of intimidation display. This time fingers were actually put into her breast feathers. Her intimidation display became exaggerated as follows: she opened her mouth as the hand came near and at a



Fig. 54. Female in intimidation display, allowing herself to be touched while on the young.

too vigorous move on the part of the hand she flipped it with her wings and remained for a moment with wings and tail spread. Though this pose resembled later distress-simulation attitudes, it seemed to be rather a part of the intimidation display. This reaction had carried her a short distance from the young in the direction of her tormentor, but shortly she waddled back to cover them. Later she moved some 6 to 8



Fig. 55. Brooding female at peak of intimidation display.

inches away from the young and away from the experimenter. On these occasions she uttered a low note, not unlike a hen calling her brood. The note was *whunk, whunk, whunk*, now slower, now faster. Her *whunk* notes were made with closed mouth. Her throat feathers pulsed out each time. When she was greatly excited, the notes became *hrunk*, which was more pronounced than the others. The young responded by orienting toward the sound (fig. 57). On their movement, the female repeated her note more rapidly and spread her breast feathers sympathetically. The young crawled to her, one after the other, until both had crossed the 6 to 8 inches. The parent then cuddled them under her feathers with *whunks* of solicitude. All this time her human intruder was within 3 to 4 feet fully exposed and with a large camera.

The experimenter withdrew on hands and knees and reapproached in the upright position. The bird flushed at 10 feet with distress simulation, alighted within 30 feet partly spread and swaying, then flew again, flipping the ground with her wings. When approached this time, she flew again, flipping the ground. This distress simulation has been noted and described by Taylor (1912, p. 222), Tyler (1913, p. 57), Dawson (1923, p. 1069), Grinnell and Storer (1924, p. 348), Woods (1924, p. 4), and E. L. Sumner (1931, pp. 90-91).

The nighthawk was left at 10:10 a.m. She was back over the young at 10:25 a.m. When approached by the upright intruder this time, she flew directly at him, dropped to the gravel 30 feet away, widely spread. Here she remained quietly. When approached within 20 feet, she flew away with no further distress.

The experiments were continued this date to watch the variants of behavior if any. The bird was approached while crawling on hands and knees and also in an upright

position. On one occasion while crawling to her, she made no effort to fly but ran as much as 6 to 8 inches toward the hand of the experimenter as it moved toward her. Fingers were run into her feathers and her wing lifted. She moved over a few inches, called, and the young waddled to her. At this time both young and adult were very warm. The young came forth from the feathers, panted a moment and crawled back again. One last time the bird was flushed from her young by the experimenter in upright position. She was in "concealment-by-self" position and flushed at 20 feet, flying directly at the experimenter; she then swung to one side and alighted with wings spread in distress simulation. When flushed from this position, she flicked the pebbles for 30 feet and alighted as before. She was left at 11:15 a.m. At this time the female and young were about 18 inches from the place where they had been first seen.

Experiments with the brooding female during the forenoon and early afternoon were continued on May 29 and 31 and on June 2 and 7. The behavior, in spite of the marked growth of the young, was not greatly different from that noted on May 27, except perhaps a bit more exaggerated. The bird was approached in an upright position from different angles, with or without the camera, on many different occasions. Always the female presented a "concealment by self" upon these approaches. She then flushed from the young at distances varying from 2 to 10 feet, with tail adroop, wings striking down and forward, flipping pebbles and vegetation, and rocking from side to side, but with no vocal note, alighting at distances varying from 30 to 75 feet, usually with wings spread in a distress-simulation posture (fig. 56). This behavior was also presented subsequently by the female of nest 4. As noted later, this may have been the same individual.



Fig. 56. Female nighthawk at termination of distress simulation flight.

When the experimenter approached the bird in a crawling position, she again flushed with distress simulation unless she was covering the young. In most cases, however, when actually brooding, she allowed the experimenter to approach very near and would permit herself to be touched, would exhibit marked intimidation display with tail spread, wings lifted, and mouth widely agape. She would move several inches from the young toward an outstretched finger. The proof of the intimidation display in this experiment lies in the fact that she would not close the mouth upon the intruding finger.



The female in returning to the vicinity of her young subsequent to her flushing would attract the young to her by a mild *chunk, chunk, chunk*. She expressed a mild distress, when the experimenter was near her young, by a *whunk*. A deep distress, such as occasioned by the picking up of her young when she was near, was registered by a very throaty, guttural note, *whō-ōwk*.

For a period of two hours, from 8:00 to 10:00 p.m. on June 12, the young were observed. The female came in and alighted in various positions near the young but never actually came to them. She maintained a constant call that varied from *cwa, cwu* or *cwut* to a most frequently uttered *hrunk, hrunk, hrunk*. The young had been tethered in an attempt to get flashlight photographs of the feeding, and though they struggled they could not reach the calling female. It is interesting to note that the female at these hours gave no reactions comparable to those of the daylight period.

Thus the protective behavior of the brooding female Texas Nighthawk was strikingly similar to the behavior of the incubating bird, though more pronounced. This consisted of: (1) concealment by self, whether the enemy approached her in an upright or crawling position; (2) distress simulation presented to the upright enemy; (3) intimidation display of marked character, presented, however, only to the crawling enemy.

It should be noted at this point that the intimidation display as described here was not secured from the incubating or brooding nighthawks at nests 2 or 3, though experiments identical with those used in connection with nest 1 were employed. But at nest 4, the location (fig. 46) and dates of which would indicate that it was a second nesting of pair 1, the female displayed reactions identical to those reported for number 1. This behavior constituted a strong confirmation of the opinion that the female at nest 4 was the same as the female at nest 1.

*Protective Behavior of the Adult Male.*—The male of nest 1 was not observed until the evening of June 11 when he came into the vicinity at 7:30 p.m., flying here and there and uttering notes. He alighted near the young at 8:00 p.m. and, incidentally, located them for us. We flushed him at 8:00 p.m., and though he was near the young, he went without distress simulation, and continued to fly in the vicinity with notes of solicitude but without protective behavior.

In no case was the male observed to incubate, and only after sunset and in connection with the feeding of the young was he observed to brood. On several of these occasions when the male was brooding, he left the young with distress simulation upon being flushed. The male was not observed near nest 1 during daylight hours, but at nest 2, the male was always near at hand and became vociferous upon the approach of the intruder. This may have constituted a form of nest-protective behavior.

*Protective Behavior of the Young.*—The young of nest 1, the experimental nest, hatched between May 25 and 27. When they were first visited on May 27, they were about 6 inches removed from the former position of the eggs. This apparent mystery was soon solved, when the birds later on this date, were noted to move 6 or 8 inches to the calling female while the experimenter was very near. These young were certainly not over 48 hours old, perhaps much less, and were able to crawl, however haltingly, at this time. Several times during the experiments of this date this was repeated.

The young of the nighthawk are precocial in that they are born with a heavy coat of down (fig. 48) and have some sense of vision and are able to move shortly after hatching, but of course because of their highly specialized food requirements, they must be fed by the parents until they are able to fly skillfully. They differ, therefore, from the precocial young of gallinaceous birds and such charadriiform birds as plovers or sandpipers, but resemble such charadriiform young as those of terns or gulls which must be fed by the parents.

The literature has one or two observations in this connection. For instance, Taylor (1912, p. 223) and Woods (1924, p. 3) noted that the young were in a different position each day and could move over the ground at a fair rate of speed. E. L. Sumner (1931, p. 90) makes the observation that the young of this bird were noted to have moved and he suggested that the parents must have done it. Our observations show in many cases that the young were able to move themselves, though slowly, shortly after hatching.

On May 29 the young were 8 feet from the position noted two days previously. They were four days or less in age and they ran two or three feet with wings uplifted to the calling mother; their note was a weak *chēē-uk*. The young at times, in spite of a cool wind, came out from beneath the feathers of the mother and panted, very shortly returning. In addition to the protection afforded by the mother to whom they ran when she called, the young presented a crouch-concealment or "freeze." This they would maintain for a short period only, for the female was usually in the vicinity and calling them, with the result that they broke the crouch-concealment and moved in her direc-



Fig. 57. Young nighthawks, about 5 days old, breaking crouch-concealment and orienting toward voice of calling female.

tion. Our records do not show when the crouch-concealment reaction first appeared, though at nest 2 young less than 24 hours old did not exhibit this behavior.

On May 31, when the young of nest 1 were 20 yards from the nest site and 18 yards from where last seen on May 29, they presented a picture of crouch-concealment when the female was flushed from them (age 6 days or less, see fig. 49). On this date it was possible to induce crouch-concealment with the hand or with a sudden noise or movement, and the young seemed to hold it as long as the mother was quiet. But as she remained, under these conditions, within a few feet and called almost constantly, they soon responded and oriented to the direction from which came her call. When the female left with distress and the experimenter approached upright, the young held crouch-concealment until her return (5 to 15 minutes).

On June 2, the young were 28 yards from where they were left May 31 and 56 yards from the original nest site. They were found after about 25 minutes of systematic tramping, starting at the point where the young had last been seen and criss-crossing downstream. When the female flushed from the young, they were discovered in crouch-concealment. Though a sudden move would cause them to twitch (in the sun they also panted), or open their eyes wider (unlike Killdeer in this respect), they made no notes until touched. Then, before moving, they uttered their low, plaintive *whee-ur* or *chee-urr*. They ran when prodded a little with the finger, but shortly stopped and crouched. Any slight manipulation would induce crouch-concealment: (1) placing a jacket over them; (2) placing hand over them and gently removing; (3) laying on and off of dark cloth; (4) a sudden noise, scramble or commotion on the part of the experimenter when they were running. During this period no notes were to be heard from the parent bird. The young were then 8 days old or less.

On June 7, the young were discovered in the usual way by criss-crossing and subsequent flushing of the female, and they were found this date as before in crouch-concealment after the female had flown (fig. 50). At this time their developing feathers were reddish-tan with black spots. On the reddish brown stones they were very effectively concealed. They were in crouch-concealment always, except when there was motion near them such as that caused by removing stones or pulling grass. This caused them to breathe faster, open their eyes wider and move, though almost imperceptibly. On this date they were teased by the experimenter and would run, lifting their wings only when most excited. Additional teasing caused the larger of the two to give an intimidation display (fig. 58) by opening its mouth and spreading its wings without running. Still further teasing caused it to run.



Fig. 58. Young nighthawk, about 12 days old, responding to experimenter with intimidation display.

This was a striking reaction to secure from the infant bird. At this time it was approximately 12 days old. It is a reaction one secures from the advanced young of rap-

torial birds. The intimidation display of both adult and young was peculiarly like that of raptorial birds in spite of the lack of close relationship to those groups. It has been noted that the reaction of other birds to nighthawks resembles that to raptorial birds. It is suggested that if there is any relationship here it lies in the fact that the plumage of the nighthawks is owl-like, and it would seem that they have developed in their protective behavior some of the reactions of that group. In this connection, 8 or 10 English Sparrows and 6 robins were noted mobbing an Eastern Nighthawk (*Chordeiles minor*) as it sat lengthwise on an elm tree at Ithaca, New York, on May 12, 1927.

During the above experiments on intimidation display with the young, the female was not heard to utter any notes. The notes of the young when teased were a quavering, low *chēē-ēē-ēē-ēē*.

On June 12 the nighthawks were visited in the evening after sunset. The young were found this time by flushing the male. They were not over 15 feet from the spot where they had been found on June 7 and near the place where they had been left on June 11. This was a total of 72 yards from the original nest site.

The male continued to fly near for some minutes and the young responded to his call by an almost inaudible note, a high-pitched, wheezy, mild *chee-ee-ee-ee*. Shortly the female, who had not been in evidence any of the preceding time, came in. Her *chunk* or *whunk* was somewhat different and much softer than that of the male, and the young immediately responded with a much more pronounced squeal. In the dusk the young would not remain in crouch-concealment but wanted to run shortly after the experimenter began working near them, though they had not been touched.

On June 16, again after sundown, the nighthawks were visited. The parent birds were not near and the young were found this time by carefully working over the gravel. They had moved nearer the original nest site and were only 35 yards removed from it. On this date and at this time of the day, the young, well advanced, were alert, moving with each abrupt move on the part of the intruders, but holding their original position. The young began to move at 8:00 p.m. when they were worked with in an endeavor to photograph them. One bird got up and ran, the other followed and then began to fly. The larger could make flights of from 50 to 100 feet, flying easily, like a bat. The smaller bird made shorter flights.

To these observations, all applying to nest 1, should be added a few observations of the young of other nests. Thus, at nest 2, one of the young when 5 days old, opened its mouth as if begging for food when a hand was placed near it; and a food-begging response was also secured by touching its bill. All this was shortly after it had been fed in the early evening. This reaction also was presented by the young in nest 3 at 6 days of age, when talking and tapping on the ground with the finger caused the smaller to peep and run to the finger with open bill and an attempt on its part to swallow the finger. Three days later, noises on the part of the experimenter caused the young to peep, and one of them came halfway toward the experimenter.

At nest 4, a young nestling, then 24 hours old, stumbled toward the experimenter in response to a tapping on the ground and calls in imitation of its mother. When it had come a little more than 3 feet, it opened its mouth in response to a finger put on its bill. It showed no evidence of fear. The following day at this nest, one of two young (probably the older) responded when touched and the other did not.

On July 20, at 7:10 p.m., as the observers established themselves on the ground near the young, these same young (nest 4), then 3 and 4 days old, again came 4 feet to the observer importuning for food. On July 27, when the young were 10 and 11 days old, the smaller still responded with a food-begging pose during an imitation of the parental

feeding call. The larger did not. This would indicate that a distinct fear instinct came to the nighthawks at about the age of 11 days. Three days later, July 30, no such response could be obtained, but instead the young responded with a weak intimidation display.

It is suggested that this behavior resulted from one of two causes. Either the young at these early ages had not yet developed the instinct of fear, or they were coming to the experimenter as a result of sounds or tappings, as if in response to the calls made by the parent.

The protective behavior of the young had the following elements: (1) as long as the young were brooded, concealment by the parent bird sufficed as protection for them; (2) the flushing the parent would leave the young in crouch-concealment wherein they supplied their own self-concealment through coloration, which became strikingly protective as their feathers advanced; (3) almost from the beginning these precocial young were able to run to cover, however haltingly, though this cover consisted of the female bird who caused them to run by her calling; (4) not until they were about three weeks old were they able to substitute flying for running; (5) the astonishing method of protective behavior presented by the nighthawks was their intimidation display which was first presented when they were approximately 12 days old.

#### SUMMARY

1. A total of 81 visits were made in study of the Texas Nighthawks nesting in the Coyote River bottom near Coyote, 10 miles south of San Jose, Santa Clara County, California.

2. It is noted that though the Texas Nighthawk is listed for the Lower Sonoran Life-zone, the region under observation is Upper Sonoran, but certain species of plants indicate that it was, in part at least, a Lower Sonoran "island."

3. All nesting territories studied were on the gravel of the Coyote River or on the immediate flood plain and in no case was there any evidence that any action was taken by the parent birds to modify the nest site, unless the saucer-like depression in hard sand that contained the eggs of nest 4 represented such a modification.

4. A total of 12 nests was found in the years 1929, 1930, 1932, and 1933, four nests being the maximum for any one year. Without exception each nest had two eggs.

5. Contemporaneous nests were never nearer to one another than 700 to 800 feet.

6. In only one case was the male observed to have established a roosting place near his incubating female. Two to three males were frequently flushed from a region to which the name "cock roost" was given.

7. At nest 3, a male and female Texas Nighthawk were flushed from the same territory on several days before eggs were deposited there.

8. Courtship behavior consisted of the male flying with down-flexed wings above the female. In some instances two and again three males were noted pursuing a single female.

9. The incubation period was 18 days in one case and 19 days in another.

10. During daylight hours only the female brooded. The male brooded briefly in connection with feeding visits.

11. Most of the 10 observed feedings were by the male, though it is suggested that the presence of the observer may have been a restraining factor in the case of the feeding behavior of the female.

12. All feedings were by means of regurgitation, wherein the bill of the parent was thrust into the open mouth of the young, the food brought forth by peristalsis in the regurgitation. Each feeding was terminated by a violent agitation of the heads of both the bird supplying the food and the one being fed.

13. Usually both of the young were supplied with food by the attending parent on the feeding visits.
14. Feedings noted were all crepuscular, at 9 p.m. or earlier, or again at 4:30 a.m. or later.
15. The young are able to walk, though haltingly, shortly after hatching. When only one or two days of age, they would crawl to the importuning female.
16. Primaries were nearly an inch long and the wing coverts unsheathing when the young were approximately a week old. The young at 12 days had lost most of the natal down and were well feathered.
17. The first ability to fly was noted at the age of 3 weeks. Easy and consistent flight was performed at 23 days.
18. The young hatched at 24-hour intervals (as proven definitely by observations of nests 2 and 3), and the resultant difference in size of the pair could be noted throughout the growing period.
19. The protective reactions of the incubating female nighthawk to a quadrupedal animal were in the order of presentation as follows: (a) "concealment by self," and (b) protection by intimidation display.
20. To a bipedal enemy the protective methods of an incubating female were: (a) protection through "concealment by self," and (b) distress simulation.
21. "Protection by self" and distress simulation were devices presented by all incubating Texas Nighthawks, but protection through intimidation display was presented by the female of nest 1 and by the female of nest 4 only. Nest 4 was probably a second nest of the female of nest 1.
22. The protective behavior of brooding female Texas Nighthawks was similar to that of the incubating bird except that it was more pronounced.
23. The male did not incubate. He frequently uttered notes in the vicinity of eggs or young upon the approach of an intruder. These may have indicated solicitude.
24. The male, when flushed while brooding, left the young with typical distress simulation.
25. The young were protected first by the concealment of the brooding female.
26. Under certain conditions the young presented a crouch-concealment protective reaction at an early age, and such reactions were used until they were able to fly.
27. The crouch-concealment reaction could be induced by the experimenter through several manipulative devices.
28. The young ran to the cover presented by the calling female almost from the first.
29. At approximately 12 days of age, the young of nest 1 presented intimidation display in self protection when they were annoyed by the experimenters.

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