

the writer (Tarshis, 1953). If the large holding cage is in an open area it is essential that some shade and protection from rain be provided the birds. For this purpose a large tarpaulin was often stretched over the cage. Leafy boughs were placed in the cage for the birds to rest upon. Food and water were also provided.

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#### SUMMARY

Four traps for trapping California quail (*Lophortyx californica californica* and *L. cal. brunnescens*) are described. Methods and procedures for trapping California quail are discussed.

#### REFERENCE

TARSHIS, I. BARRY

1953 The transmission of *Haemoproteus lophortyx* O'Roke of the valley California quail by hippoboscid flies of the species *Stilbometopa impressa* (Bigot) and *Lynchia hirsuta* Ferris and the elucidation of the biology of these ectoparasites. Manuscript of Ph.D. Thesis, Deposited in Library, University of California, Berkeley, California.

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## FURTHER BANDING AND NESTING STUDIES OF THE EASTERN NIGHTHAWK

BY RALPH W. DEXTER

An earlier report (Dexter, 1952a) summarized observations made on the nesting behavior of the Eastern Nighthawk (*Cordeiles minor minor*) on the roof tops at Kent State University during 1948-1951. Since that time the study has been continued. The same female parent has been recaptured and additional juveniles have been banded. Observations have also been made on the roof of the Akron City Hospital and at Kelley's Island in Lake Erie. In addition, a report is given on two hand-raised Nighthawks.

### 1. Nesting at Kent State University, Kent, Ohio, 1952-55.

The Nighthawks returned to the campus on May 11, 1952. From that time on they were heard each evening while on feeding flights over the campus grounds. A search of the roof tops, made June 1, disclosed the nesting site on the roof of Rockwell Library. At that time the female was incubating two eggs in the southeast corner where a pair of Nighthawks had been raised the year before. On June 16 she was still incubating the eggs when observed at 11:00 a.m. Two days later, however, the eggs were found unattended at noontime; henceforth, the female was not again found at her nest although the birds were seen and heard frequently on the campus during the remainder of the summer season. A heavy rainstorm broke the eggs to pieces. No development of the eggs was apparent, even though they had been incubated for nearly the full 18 days required for hatching. Without much doubt the female was the same one banded earlier since she laid her eggs in the identical place where they had been laid the year before, and the banded female was again recaptured in later years while nesting on the campus.

In 1953 they returned to the campus on May 10. On June 9 the female was found in the northeast corner of the University School where she was incubating two eggs. At the time of discovery, 10:30 a.m., she was facing outward away from the corner. At 3:30 p.m., however, she was facing into the corner away from the direct rays of the sun. While this orientation shaded her eyes, it prevented a rapid take-off when disturbed. At 10:30 p.m. the cries of the chicks, still in the egg shells, could be plainly heard. They seemed to call to each other in alternation. The next day the newly-hatched nestlings were observed. They were sitting side by side on the sloping tarpaper at the base of the wall encircling the roof. On June 12 the female was captured and she proved to be No. 42-232611 banded at McGilvrey Hall, June 7, 1950, recaptured on Rockwell Library, June 26, 1951, and with little question had returned to Rockwell Library the following year. When she was captured in 1953 by means of a drop trap, one flight feather and several contour feathers dropped out while she was handled. A blood stain was found on her breast, but since it was not fresh it could not have resulted from the trapping operation. Possibly a predator or the accidental striking against some object during night flight may have caused the injury. The two nestlings were banded with numbers 512-45915 and 512-45916 on June 18. At that time (noon) they were running about over the roof and were attended by the female. As the female took off in flight she dropped a large scat, which seems to be a common behavior trait of this species when disturbed. While the nestlings were being banded, she put on the broken-wing act and her familiar attempt to frighten away intruders as described in the previous report. A photograph of this behavior was subsequently published (Dexter, 1952b). At 3:00 p.m. the female was brooding No. -16 in bright sunlight in the northeast corner while No. -15 was sitting in the shade of the west wall. At noon the next day all three were sitting in the shade of a soil pipe in the middle of the roof. At 3:00 p.m. the female was again brooding No. -16 in the

northeast corner, while No. -15 was nearby in the shade. When disturbed, No. -16 ran with the wings held vertically over the back.

On July 26 all three were still living on the roof. The female and No. -16 flew off when approached, but No. -15 remained. It was discovered that this one had no primaries on the right wing and consequently could not fly. Attempts were repeatedly made to take off in flight and the tip of the right wing was bloody from beating against the roof in vain. At 10:00 p.m. that evening the cripple was alone on the roof. The following day at 1:00 p.m. the female was attending the cripple in the shade while the other juvenile was in the northeast corner. The two juveniles remained together until the end of July, after which the cripple was found alone, still trying unsuccessfully to fly. At that time the primaries began to appear and in a few days some progress was made in taking flight. While at first it had flopped around completely out of balance, it could now rise some three feet in the air and fly about one-third the distance across the roof by making very vigorous and loud wing beats. Apparently the cripple had been fed by the female since it appeared in good health and maintained its strength, although the parent bird was not again observed on the roof. On August 6 the cripple was found on the ground not far from the building by a passing student. Possibly the bird had been molested by a dog or a cat. Most of the tail feathers and some of the body feathers were gone. The left wing was injured and bleeding. The primaries on the right wing were still lengthening. Apparently the bird had gained enough altitude to get over the roof wall and glided to the ground where it became helpless. It was kept in captivity and hand-raised by Mrs. Ira Machamer, who fed it scraps of raw meat and vegetable oils. The primaries continued to grow slowly, but no replacement of the tail feathers was observed. The bird died on September 2. The other Nighthawks did not return to the roof of the nesting site so far as known. However, while setting chimney swift traps on the roof of Kent Hall at dusk on August 7, the writer observed a Nighthawk settle onto the roof of that building. Possibly this was the surviving juvenile.

In 1954 Nighthawks returned to the campus on May 16 and were observed nightly thereafter although a search of available roof tops failed to disclose the nesting site. In the absence of the writer, Mr. William Clapp of the Maintenance Department located a banded Nighthawk with one nestling about half-grown on the roof of Lowry Hall on June 24. The band was observed on the right leg but the bird was not captured. Without doubt it was the same female which nests each year on the campus. Two weeks later they left the roof. When the writer returned on July 26, one unhatched egg was found with broken shells of the other in the southeast corner of the building. The egg contained a partly developed embryo.

In 1955 the Nighthawks returned on May 14. The female, incubating two eggs, was discovered on June 15 in the southwest corner of Wills Gymnasium. She was captured with a drop trap and proved to be the same female (42-232611) as found in previous years. About a dozen body feathers became loose during the brief period of handling and fell out when she was released. The next day one egg was found

in its original position, but the other had been moved about one foot away and broken open. The embryo was in an early stage of development. The female was sitting in the shade some three feet away from the undisturbed egg, but was not again observed to incubate it. The following morning the remaining egg was found with a small hole pipped by the egg tooth of the chick which perished in the shell before it could extricate itself. Apparently the female ignored the ready-to-hatch egg after her capture. Nevertheless, the Nighthawks remained on the campus and were frequently observed in the evenings. During the last week of June and the first week of July, science students at the University School observed a Nighthawk on the roof of that building in the same corner where No. 42-232611 had nested in 1953. One morning the male was seen some 20 feet away from the female. No eggs were laid on that roof, however. In middle July Mr. William Clapp found a Nighthawk, presumably the same female, roosting in the early morning on McGilvrey not far from the nesting site of 1950. Here again, no eggs were found, and apparently a replacement clutch was never laid. The adults remained on the campus, however, for the duration of the season.

## II. Nesting at Akron City Hospital, Akron, Ohio, 1953 (In collaboration with Robert M. Bensinger).

A student of the writer, Robert M. Bensinger, engaged as a laboratory technician at the Akron City Hospital, reported the following observations of a nesting Nighthawk on the roof of that building. The nesting female was discovered on July 14, 1953. She was found near the southeast corner incubating two eggs on the limestone slag in the shade of the south wall. When approached too closely she exhibited the broken-wing act or tried to frighten away the intruder with violent beating of the outstretched wings and with loud hissing sounds. During a heavy rainstorm it was noticed that she faced in the direction of the rain. On July 23 the newly-hatched chicks were found in the morning in a position some eight inches away from the site of incubation. By middle afternoon they had been moved some 10 feet farther away and were resting in the shade. Three days later they were moved into the northeast corner, and subsequently were moved around the roof to keep in the shade for the most part. One week after hatching, pin feathers were observed. On August 1 the writer banded the two juveniles with Nos. 512-45917 and 512-45918. The former weighed 32.1 gm. while the latter weighed 34.1 gm. The female could not be captured at that time. That night, however, she was captured by Mr. Bensinger who banded her with No. 512-45919. In the dusk of early morning he observed another Nighthawk, without doubt the male, some 40 feet away from the female who was brooding the nestlings. On August 3 No. -17 weighed 42.3 gm. and No. -18 weighed 40.0 gm. At that time the body feathers were liberally mixed with the down, but the primaries were still in their sheaths some 1.5 inches long. The following day No. -17 disappeared. That evening No. -18 disappeared, but one of the parents was still present on the roof. Possibly a predator had discovered the nestlings before they could fly.

On May 1, 1954, Nighthawks were seen flying over the hospital, but they did not nest on that roof again.

### III. Nesting on Kelley's Island, Lake Erie, 1954.

In settled regions, especially in large metropolitan areas, the Nighthawk usually nests on the roof of flat-topped buildings. Lynds Jones (1903) stated in his book *The Birds of Ohio*, "I have yet to learn of a nest that has been found in the woods within thirty miles of Cleveland." In the summer of 1954 the writer with a group of students at the Stone Institute of Hydrobiology discovered a nest of the Nighthawk on the ground in an abandoned limestone quarry on Kelley's Island. (See figs. 1 and 2.) It was first found on July 1 at which time the two eggs were seen among small rocks when the female was flushed. The eggs were still being incubated on July 7. The writer returned on July 19 with bands hoping to band at least the nestlings and, if possible, the female parent as well. Unfortunately, the eggs had been abandoned and were dried out. While the female did not remain nearby, a search disclosed a Nighthawk on the ground at the extreme opposite end of the quarry but no eggs could be found. Possibly she had laid another clutch of eggs since she continually tried to draw the writer's attention away from the area from which she had been flushed. In the summer of 1955 a search was made of this quarry on June 27 and again on July 11, but nesting Nighthawks were not found again in that locality.



Fig. 1. Abandoned limestone quarry on Kelley's Island in Lake Erie where a Nighthawk was found nesting on the ground near middle of picture. Photo by R. W. Dexter.



Fig. 2. Nest of the Nighthawk consisting of two eggs among rocks in quarry on Kelley's Island. Photo by N. W. Britt.

#### IV. Two Hand-Raised Nighthawks.

As previously mentioned in Part I, a juvenile Nighthawk, unable to fly because of undeveloped primaries on the right wing, was hand-raised by Mrs. Ira Machamer from August 7 until September 2, 1953. Recently, a most remarkable case of hand-raising a Nighthawk came to the attention of the writer. Mr. and Mrs. Harvey E. Thompson found a Nighthawk in a lettuce patch at their residence, 1947 East 79th Street, Cleveland, Ohio, after a heavy wind and rain storm on July 2, 1953. It was fully feathered at the time and probably was a juvenile bird. It was a female with a wing spread of 16 inches, but for some reason could not fly well. Possibly it was injured during the storm. Seldom is it practical for one to hand-raise an insectivorous bird. The Thompsons, however, undertook to rear the bird in captivity. For about six weeks insects were fed to this bird. Earthworms were not accepted. Bits of raw beef were then used as food and cooked vegetables were added to the diet. Peas and corn were acceptable, but carrots were rejected. The cooked vegetables were mixed with raw, ground beef. Corn meal, oat meal, and Wheatina were also tried with success. These cereals were mixed with cream or canned milk. Later, wheat germ was added. The eventual diet consisted of a mixture of ground, raw beef, cooked vegetables and cereals with wheat germ rolled into pellets with cream or canned milk. The pellets were thrust into the mouth as the bird approached with wide open mouth. Water was supplied from a medicine dropper. After three or four months, the wing and tail feathers began to drop out one or two at a time. Replacements gradually developed but did not last long. They were

also shed one or two at a time before fully developed. Suspecting a diet deficiency, cod liver oil was given by medicine dropper every third day. In spite of an apparent balanced diet, the wing and tail feathers were never fully replaced. It is known that feathers of this species may readily be dropped after the bird is handled as noted earlier in this paper. Also, G. Hapgood Parks (1946; 1948; and personal communication) has reported extensive shedding of feathers by Nighthawks which he captured. It may be that such an occurrence is a common behavior pattern with this species while in captivity.

The bird rescued by the Thompsons readily became tame and was easily handled. It was fed five or six times a day and handled frequently. The bird became an attached pet which was allowed freedom in the house and which was carried on visits to other places in a cigar box. The Thompsons recognized four distinct calls, one for food, one for water, one for clean-up, and one for attention. Each call was distinct and used for the single purpose only. The bird stood on its feet much of the time and walked frequently which is unusual for this species. On February 5, 1955, it lost its balance, fell, and struck its head. This injury led to its death. This Nighthawk had lived in captivity for one year and seven months with hand-feeding under artificial conditions.

## V. Summary

1. The same female Nighthawk (No. 42-232611) which nested in former years on the buildings of Kent State University and was banded in 1950 returned over a period of four additional years. She was recaptured in 1953 on the roof of the University School and again in 1955, on the roof of Wills Gymnasium. Without much doubt she was the female who nested during the intervening years on Rockwell Library in 1952 and on Lowry Hall in 1954, but was not captured those years.

2. Two eggs were laid each year, always in a corner of a slag-covered roof. The eggs laid in 1952 were apparently not fertile but were incubated for at least sixteen of the eighteen days required for hatching before they were abandoned. Those laid in 1953 hatched successfully, but only one normal juvenile (512-45916) was produced. The other (512-45915) was unable to fly because of undeveloped feathers on the right wing and finally died in captivity after being hand-raised for nearly four weeks. Only one of the eggs laid in 1954 hatched. The two eggs laid in 1955 were abandoned at the time the female was recaptured. One embryo was only partly developed while the other was just ready to hatch, but perished in the egg.

3. Nighthawks nested on the roof of the Akron City Hospital in July, 1953. The female parent was banded with No. 512-45919 and the two nestlings with band Nos. 512-45917 and 512-45918. Both nestlings disappeared before they could fly, probably victims of a predator.

4. A Nighthawk's nest was discovered on the ground in an abandoned limestone quarry on Kelley's Island in July, 1954. Seldom are Nighthawks found nesting on the ground in settled regions.

5. In addition to the hand-raised juvenile mentioned above, another Nighthawk was reared in captivity for one year and seven months by Mr. and Mrs. Harvey E. Thompson who kept it as a pet. The bird lived successfully under constant care and became accustomed to handling, but its wing and tail feathers were shed after several months and were never fully replaced. Replacement feathers were also shed, a few at a time, before they were completely developed. Nighthawks seem to drop feathers readily.

## LITERATURE CITED

- DEXTER, R. W., 1952a. Banding and nesting studies of the Eastern Nighthawk. *Bird-Banding*, **23**(3): 109-114.  
 ————1952b. Dwellers of the roof tops. *Inland Bird-Banding News*, **25**(9): 21-22.  
 JONES, LYNDS. 1903. The Birds of Ohio. Ohio State Acad. Sci. Special Papers No. 6. 241 pp.  
 PARKS, G. H. 1946. Notes on the behavior of a nesting Nighthawk. *Bird-Banding*, **17**(2): 55-60.  
 ————1948. A loose-feathered Nighthawk. *Auk*, **65**(2): 300-301.  
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## WEIGHT CHANGES IN BIRDS

BY CHARLES H. BLAKE

Weights of birds have been quite often recorded. Usually these have been raw weights, that is, weights at the moment of weighing with little attempt to determine the condition of the bird. A few authors, notably Stewart (1937), have recorded something of the history of the individual for a short period before weighing, whether it had fed in the trap or been held without food before weighing. I have had the opportunity in Lincoln and Lexington, Mass. to make a few, more detailed observations.

The Slate-colored Juncos and Eastern Tree Sparrows were removed from traps after dark and released the next morning about sunrise. The Eastern Purple Finches were held on an experimental basis by Mr. and Mrs. Parker C. Reed. Since the object of the weighings was to determine weight losses the birds were not supplied with food and water and were kept in the dark.

It is clear that there is at first a rapid but declining rate of weight loss if the bird has been feeding up to nearly the time of first weighing. In one Purple Finch (55-02653) the initial rate of loss was 1.8 g/hr for a half hour but the rate fell to 0.6 g/hr for the next half hour. In general, after two hours or so the rate has fallen to about twice the average rate for the next 10 to 15 hours. Changes have not yet been followed later in the period of fasting.

It will be immediately apparent from Table I that the minimum rate of loss, although varying from one individual to another, is of the same general size throughout. Some of the variation may be caused by differences in the relative time of the evening weighings. Junco 22-98651 would probably have shown a lower rate if it had been weighed again about 7:30 pm. The average minimum rate for Junco