A NESTING STUDY OF THE LITTLE BLUE HERON IN EASTERN ARKANSAS

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THE nesting of the Little Blue Heron (*Florida caerulea*) has been observed in its coastal and inland habitats on many occasions, as cited by Bent (1926), Howell (1932), Sprunt and Chamberlain (1949), and others. Most of the heronries discussed in these publications were located on coastal marsh islands or about lakes in the interior. Such heronries, usually isolated from human activity, often are difficult to keep under observation.

The following observations were made during 1952, 1953, and 1954 (mostly in the latter year) at a heronry located within 200 yards of the village of Swan Lake, Jefferson County, Arkansas. The Swan Lake heronry was described briefly in a recent paper by the writer (1954).

It has been reported reliably that this heronry has been in continuous use at least since 1938, the year that the informant moved within sight of it. In spite of its proximity to civilization, the site obviously was chosen because an extensive growth of buttonbushes (*Cephalanthus occidentalis*) at one end of the lake furnished ideal nesting habitat, and because areas of ready access provided an abundance of food.

The location of this heronry was similar to one found by M. G. Vaiden at Benoit, Mississippi. Both heronries were situated on the outskirts of a small village, were surrounded by delta cotton fields, and were about two miles from a river, in sight of the river levee.

METHODS

It was possible to drive to within about 40 yards of the Swan Lake heronry along a well-used farm road and to make observations from the car window; or to sit on the front porch of one of two tenant houses nearby and watch nest building, feeding of young, and other activities.

The use of a blind was unnecessary until after hatching, as it was possible for an observer to approach to within 20 to 30 feet of the nests and to watch the herons with or without binoculars as they went unconcernedly about their ways. When first disturbed the herons would simply fly a few yards away, returning to their nests soon after the intruder stopped moving. The birds became less tame after the eggs hatched.

The role of the sexes in most of the early phases of nesting behavior was revealed by the activities of individuals immediately following copulation.

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Nesting Habitat

The old riverbed lake in which the heronry was located is known as Old Crow Lake. The lake is fringed on the north and northwest sides by willow (*Salix nigra*) and on the south, southwest and southeast sides by buttonbush, swamp privet (*Forestiera acuminata*), and willow, in order of abundance as named. The buttonbushes actually extend en masse more than 100 feet out into the lake, occupying several acres at the south end.

Fig. 1. Adult Little Blue Herons near nests in buttonbushes at Swan Lake, Arkansas, May 20, 1954.

The Little Blue Heron nesting colony was located mostly along the southeastern side of the lake, while most of the nesting associates, discussed elsewhere by the writer (1954), occupied the south and southwest sides. Although there was some mixing of the species, Little Blue Herons selected the sites closest to land, American Egrets (*Casmerodius albus*) ranged in an intermediate section, and Snowy Egrets (*Egretta thula*) built in the outermost bushes near the open water, and at a lower level than the other species. At least three-fourths of the Little Blue Heron nests were in buttonbushes; the remainder in swamp privet (Fig. 1).

The water beneath most nests averaged two feet in depth during the early part of the nesting season. Since there usually is less precipitation in June and July the water level fell in mid-summer, exposing the lake bottom beneath the nests.

Arrival of Migrants

The spring arrival of Little Blue Herons at Swan Lake usually is timed with the blooming of the swamp privet. The earliest spring arrival recorded was March 13, 1954, when four birds were observed. In two previous years Little Blues began arriving about the middle of March or shortly thereafter. In 1953 several pairs were feeding small young by April 21, which indicates they must have been at Swan Lake by mid-March; and on March 23, 1952, 400 birds were estimated at the heronry.

By March 27, 1954, due to an unusually prolonged cool period with daily minimum temperatures between 40° F. and 50° F., only a small segment of the nesting population had arrived at the colony, and there were no signs of mating. Wintering or migrant waterfowl using the lake at that time included Mallards (*Anas platyrhynchos*), Blue-winged Teal (*Anas discors*), Lesser Scaup (*Aythya affinis*), and Coots (*Fulica americana*). Approximately 20,000 "blackbirds" (*Agelaius phoeniceus* and *Quiscalus quiscula versicolor*) were roosting in the buttonbushes and swamp privet.

Snowy and American egrets normally arrived during the third or last week in March with "snowies" usually putting in an appearance first. Water-turkeys (*Anhinga anhinga*), the last to arrive, were first seen on April 5, 1952, April 19, 1953, and April 14, 1954.

Several authors have reported all three color phases in a Little Blue Heron breeding colony. At Wilmot, Arkansas, in June, 1910, Arthur H. Howell (1911:26) wrote of finding the three phases about equally represented. Only the adult, blue phase birds were found nesting at Swan Lake. White and intermediate phase birds roosted at the heronry during the early part of the nesting season, but later they roosted near the rice fields in which most of them fed during the day.

Courtship Display

Data concerning courtship behavior were obtained between April 11 and 14, 1954. At this time some pairs already were mated and had started building nests.

Being unwilling to risk possible loss of later observations by collecting a displaying bird within the heronry itself, the writer did not determine the sex of any of the displaying birds.

Courtship display apparently takes place on the nesting territory and near the nest site eventually used, because in nearly every case observed nest construction was started subsequently near the courtship perch. Usually the same

perch was used for repetition of the display, although there was some shifting about to nearby perches in the same bush, and occasionally to nearby bushes.

On the morning of April 11 a displaying bird under observation performed in a buttonbush about eight feet above the water, the average nest height for this section of the colony. Most of the herons nearby were building nests. Perched about two and one-half feet above the displaying bird was the prospective mate. The displaying bird moved twice in a sort of pumping motion from an upright position to a crouch. As it assumed the crouching position the bird opened its bill slightly, but the observer could not be certain whether or not the heron was emitting a sound. During the act the bill was pointed upwards, the back and neck plumes were extended and spread, and the wings were either drooped or spread, or both. Upon resuming a normal standing position the bird twice swayed from side to side.

One Little Blue Heron repeated its performance seven times in 12 minutes, and, at another period during the same day, 17 times in 30 minutes. The prospective mate made threatening gestures at other herons that alighted near it on the same bush, but occasionally stretched its neck in the direction of the displaying bird, looked down, and clapped its mandibles with a rattling sound. The displaying bird then usually followed suit. The prospective mate sometimes attempted to work its way toward the displaying bird, which seemed to discourage it with scolding and a darting bill. However, the former eventually reached a perch near the displaying bird and pecked at its plumes. Both birds then crossed their outstretched necks and kept up a continuous rattling chatter for several minutes, biting at each other's plumes at the posterior part of the body. Once the displaying bird flew from the perch, circled about 30 yards over the lake and returned. The other heron left several times, but always returned within two or three minutes.

At least 20 males were observed in the act of courtship display and all followed a similar pattern; but in most cases there was no indication that a prospective mate was nearby. One individual displayed within three feet of an incubating bird. Courtship continued from sunrise until sunset.

Copulatory Behavior

Copulation commenced during the initial stages of nest building, and, as a rule, took place on the nest platform. During the egg-laying period it frequently followed closely the change-over at the nest (both male and female incubate, feed, and otherwise care for the young).

During copulation, the female assumed a partial or complete crouching position and the male grasped the female with his feet close to her body underneath the wings, just beneath the shoulders. In one case the male was seen to grasp the female on the outside of the bend of the wing or shoulders. The

male usually extended his wings to help maintain balance. When copulation was completed, the male stood up on the back of the female and stepped off to the side.

Promiscuity existed throughout the nesting colony, and many females were serviced more by foreign males than by their own mates. A male perched within a few inches of his incubating mate often moved over to a nearby nest, copulated with the incubating female there, and returned to his perch. This frequently was immediately preceded or immediately followed by copulation with his own mate. Females approached by foreign males sometimes stood up in their nests and fought off the males, but usually they submitted under protest; occasionally they made no effort whatsoever to ward off the promiscuous male, merely scolding it a bit after the act. Sometimes the mate of the female about to be attacked was able to prevent the intrusion; however, in at least one case I observed, the male was unable to do so. Intruding males usually approach the incubating females rapidly, whereas a female's own mate is usually much slower and more deliberate.

Promiscuous copulation was noted in 16 cases in a section of the colony during seven hours of continuous observation. Three foreign males were seen to copulate with the same female within a 45-minute period. One male attempted to copulate with five different females and was successful with four of them. In one case a foreign male attempted to copulate with an incubating male, remaining on the incubating bird during the normal period of coitus. This fact was confirmed when the latter bird's mate returned and was in turn mounted by the male, which had been incubating.

Nest Building

Nest building usually began during the last week in March or the first week in April. In 1951, Robert E. Stewart and the writer found eggs in some nests on April 10; in 1952 many pairs were building on April 5; in 1953 adults were feeding young in several nests by April 21, and therefore had constructed their nests during the third week in March; and in 1954 a few nests contained eggs by April 11, but most pairs were just beginning to build.

There seemed to be no inclination on the part of herons to use the previous year's nests, many of which were almost completely intact; nor were these herons seen to remove sticks from the old nests for use in new construction. When the opportunity availed itself they would remove sticks from other newly-built heron nests as well as from the nest of egrets and Anhingas. On the other hand American Egrets and Anhingas sometimes appropriated Little Blue Heron nests, adding material to them and otherwise fashioning them for their own use.

One American Egret made four trips in 30 minutes to a Little Blue Heron's nest to obtain sticks for use in the construction of its own nest. It removed

only the larger sticks, tossing the smaller ones aside. Several times while it was tugging at the larger sticks the heron's eggs almost rolled out of the nest. On another occasion, American Egrets, fighting over sticks from a Little Blue Heron's nest, shook the nest bush and all of the Little Blue's eggs fell into the water. One Little Blue Heron's nest, left unguarded, was raided by a Snowy Egret which picked up the eggs and dropped them into the water.

In the nest-building operation the male gathers most of the sticks, carrying them to the nest one by one and presenting them to the female, who works them into place. Julian S. Huxley (Bent, 1926:169), in his study of the Louisiana Heron (*Hydranassa tricolor*) at Avery Island, Louisiana, observed the same behavior. However, when the male is away from the vicinity of the nest the female sometimes gathers sticks. The male when alone at the nest, particularly during the egg-laying and incubation periods, frequently rearranges some of the sticks. One member of the pair nearly always remains at the nest during construction as well as the egg laying period, apparently to prevent removal of sticks by other birds.

Most of the sticks were gathered from the shallow water beneath the nest, but some were picked up from the dry land along the edge of the lake and occasionally they were brought in from a great distance. Frequently a bird which had been feeding brought in nesting material on the return trip. Herons often perched about six inches above the water, reaching out to pick up sticks floating by. Sometimes they waded out into the water to pick up a stick, and occasionally a heron would scoop up a stick from the water's surface while on the wing. Only occasionally were sticks broken from branches of the buttonbushes in which most of the herons were nesting.

Buttonbush twigs were used to make most nests (Fig. 2). A few weed stalks and stems were noted in many nests and one nest was constructed entirely of them. Other herbaceous material used in part for nest construction included stems and pods of a mallow (*Hibiscus* sp.) and those of a milkweed (*Asclepias* sp.). Green leaves were rarely found in nests.

A pair of herons was watched for several hours on April 14 while building a nest which at that time was in the initial stage of construction. Between 10:00 a.m. and 12:12 p.m. only one stick was brought to the nest. However, from 12:13 until 12:34 the male made six trips for sticks, never remaining at the nest for more than two or three minutes at a time. Another bird was observed to make seven trips for sticks in 12 minutes.

One heron continued to bring sticks three to four feet in length to its mate at a nest in the early stages of construction. The female dropped one 4-foot stick three times after spending several futile minutes attempting to place it in the crotch of the bush. The male continued to drop down into the water

after the stick, returning it to the female. That nest was never completed and all of the sticks eventually disappeared.

Nest building at the heron colony continued throughout the day, from early morning until dusk. However, at certain nests in various stages of construction, many hours went by when not one stick was added.

Most nests were nearly complete by egg-laying time, usually requiring from three to five days to reach this stage. However, in several nests there were barely enough sticks in the platform to keep the first egg from falling through. At two nests under close observation there was a lapse of six or seven days between the beginning of construction and the laying of the first egg.

FIG. 2. Nest and eggs of the Little Blue Heron, Swan Lake, Arkansas, May 20, 1954.

Following the change-over during egg-laying or incubation periods the male nearly always made several trips to the water beneath the nest to gather sticks. This is apparently a part of the greeting ceremony.

In one section of the colony, 58 nests were on the average eight feet above the water with a maximum of 15 feet and a minimum of three feet. Several nests in swamp privet were 25 feet above the water. As many as nine nests have been counted in a single buttonbush, and most bushes had at least five.

THE EGG LAYING PERIOD

Five to eight days are required for a Little Blue Heron to lay a complete clutch of eggs, depending upon whether the clutch contained three, four, or

five eggs. Thus a single egg is deposited on an average of one nearly every other day (see Table 1).

Typical behavior during the egg-laying period is illustrated by the following record of the activities of one pair on April 17. The male was found standing over the single egg in the nest, which posture it alternated with an incubating one for the ensuing 35 minutes. When the female returned the male stood up in the nest. The female sidled in under the male, gently pushing him aside and began moving the egg about in the nest, then rearranging several sticks. Meanwhile the male walked out on a limb about two feet from the nest, where he remained for seven minutes. He returned to the nest and copulation took place. The female left the nest, returning after 25 minutes to move in under the standing male as before. Once again she moved the egg about and tugged at a few sticks before settling down upon the egg. A few minutes later a second egg was deposited and the female stood up in the nest where the male joined her. The two stood together some 15 minutes before the female left and the male settled down upon the eggs.

Each time one bird returned to the nest after being away for a time, elaborate greetings were exchanged. The pair would repeatedly call "*quip-a-quee, quip-a-quee*" to each other, peck at one another's plumes and cross outstretched necks. Although the latter displays gradually diminished and, at later stages, were discontinued, the vocal greetings were regularly exchanged between the members of the pair throughout nearly all phases of the nesting period.

Clutch Size

Bent (1926:179) says that, "The little blue heron usually lays four or five eggs, sometimes only three, and occasionally six." Clutch size in 50 nests at Swan Lake ranged from three to five eggs with an average of 4.04 per nest. Nine nests contained five eggs, 34 contained four eggs each, and seven contained three eggs. Additional eggs may have been laid in any of these nests, but could have been knocked out or removed.

Incubation

At virtually all nests under observation, incubation began after the laying of the second egg. This was evident not only from observations of incubating birds at nests containing only two eggs, but was confirmed in several nests at hatching time. Nests Nos. 7 and 12 (Table 1) contained four eggs on April 24 at 5:00 p.m. On May 10, at 5:00 p.m., there were two newly hatched young and two eggs in each nest. The following day at 12:00 noon there were still two eggs and two young in the nests.

Sprunt and Chamberlain (1949) list the incubation period of the Little Blue Heron as 21 to 23 days. The incubation period for the Swan Lake birds was 22 to 24 days; however 22 or 23 days was the rule (see Table I).

TABLE 1

EGG-LAYING AND HATCHING DATES AT 10 NESTS OF LITTLE BLUE HERONS, SWAN LAKE, JEFFERSON COUNTY, ARKANSAS, IN 1954.
(Number of eggs and/or young in individual nest)*

Date	Nest No. 1	Nest No. 2	Nest No. 3	Nest No. 4	Nest No. 5	Nest No. 6	Nest No. 7	Nest No. 8	Nest No. 9	Nest No. 10
Apr. 17	1 egg	1 egg	0 eggs	1 egg	2 eggs	2 eggs	1 egg	1 egg	2 eggs	2 eggs
Apr. 18	2 eggs	1 egg	1 egg	2 eggs	2 eggs	3 eggs	2 eggs	1 egg	3 eggs	3 eggs
Apr. 19	empty	2 eggs	1 egg	3 eggs	3 eggs	3 eggs	2 eggs	2 eggs	3 eggs	3 eggs
Apr. 20	—	3 eggs	2 eggs	3 eggs	3 eggs	4 eggs	3 eggs	2 eggs	4 eggs	4 eggs
Apr. 21	—	3 eggs	2 eggs	4 eggs	4 eggs	4 eggs	4 eggs	3 eggs	4 eggs	—
Apr. 22	—	4 eggs	3 eggs	4 eggs	—	5 eggs	—	4 eggs	5 eggs	—
Apr. 23	—	—	4 eggs	5 eggs	—	—	—	—	—	—
May 10	—	—	—	—	2 eggs 2 young	3 eggs 2 young	—	—	4 eggs 1 young	2 eggs 2 young
May 11	—	—	—	—	—	2 eggs 3 young	—	—	3 eggs 2 young	—
May 12	—	—	—	2 eggs 2 young	1 egg 3 young	1 egg 4 young	1 egg 3 young	2 eggs 2 young	2 eggs 3 young	4 young
May 13	—	2 eggs 1 young	—	—	—	—	—	1 egg 3 young	1 egg 4 young	—
May 14	—	—	2 eggs 2 young	—	—	—	—	—	—	—
May 15	—	2 young	1 egg 3 young	empty	4 young	4 young	3 young	4 young	empty	4 young

*Nests inspected for contents at 5:00 p. m.

The members of a pair seldom are together for any length of time during the incubation period. One bird was incubating at nest No. 7 when observations began at 10:58 a.m., April 24. At 12:31 p.m., the mate returned and the bird that was relieved left the scene immediately. On this same date at nest No. 6, after the change-over, the bird that had been incubating gathered sticks and presented them to the incubating bird for about 15 minutes, then left the scene. At another nest the mate flew in for the change-over at 11:45 a.m. It stopped about two feet short of the nest. The incubating bird then stood up, moved to the nearest nest (three feet away) and copulated with the bird on that nest, then climbed about three feet above its own nest and preened as its mate moved in and settled on the eggs. In about a minute it left the area.

The typical routine of the incubating bird was recorded during an hour's watch on April 24: At 11:20 a.m. (temperature 85° F.) bird at nest standing over five eggs, shading with drooped wings, bill open and apparently panting; at 11:24 bird settled on eggs with bill open and panting; between 11:28 and 12:20 p.m. it stood up in nest six times, twice to chase off intruding Little Blues, once when a tractor passed by 40 yards away, and three times to preen or rearrange sticks in nest.

In 1954 hatched young were noted in nests during the first week in May, but the peak of the hatching period was toward the latter part of the second week in May. In three previous nesting seasons the first young were found in nests during the third or fourth week in April.

Within a few minutes after hatching, the egg shell is tossed out of the nest by the adult in attendance.

Care and Behavior of Young

Incubation and brooding overlap at hatching time because it takes from three to five days for the entire clutch to hatch. The young therefore are brooded much of the time during their first week of life. At one nest, newly hatched young were covered by an adult approximately 80 per cent of the time from 12:00 noon until 5:30 p.m. Both parents shared in brooding the young with the change-over essentially the same as during incubation.

During the first three or four days the young were fed upon regurgitated food dropped into the nest by the attending parent. The mass of food, if round in shape, was sometimes the size of a golf ball. The young lost no time in attacking the food, even appearing to choke on some oversized morsels.

On May 8, from 12:00 p.m. until 5:30 p.m., observations were made at nest No. 60 which at that time contained three young from two to three days old and two unhatched eggs. One parent bird remained at the nest until 3:14 p.m., occupying its time with brooding the young, shifting position, chasing off intruders, regurgitating food into the nest for the young on five different occasions, and nibbling at some of its regurgitated food. At 3:14 the mate re-

turned and resumed brooding. Two hours later it regurgitated food in the nest for the first time since its return.

By the end of the first week the method of feeding changed and the young were taking food from the parent's bill. This was done by grasping the parent's bill crosswise near the base and tugging at it until the regurgitated food was forthcoming. This procedure is well narrated by Dr. A. H. Cordier (cited in Bent, 1926:180), and similar behavior on the part of an American Egret is described by Bent (*op. cit.*:138).

When a foreign adult alighted near the nest the young poked their heads at the intruder and moved over toward it to be fed, but the adult bird only threatened them with poking bill and backed away or flew off. Sometimes the young attempted to move over to a nearby nest to be fed by the adult in that nest, but they were fast discouraged by the darting bill of that parent.

During the second week the young began to stand in their nests and to walk out short distances on nearby branches. However, most of the time was still spent in the nest where the parents brooded less, usually by merely standing over the young with wings drooped. Sometimes when a parent was perched several feet from the nest the young attempted to climb to it and grasp its bill for food.

Observations at nest No. 60 were continued for a short period of time on the afternoon of May 16. The young at this time were in their second week. Adults exchanged places at the nest at 2:55 p.m. During the next four minutes the parent at the nest fed the young, one four times, another three times, and a third twice, while the smallest or fourth received nothing. The adult standing on the edge of the nest with its back to the sun began brooding by bending its knees slightly, spreading its wings forward and parting its breast feathers. During a 20-minute siesta one of the young remained completely outside the canopy formed by the parent and slept with its bill tucked beneath its wing. The adult, again beset with demands for food, fed only one nestling at that time; then, after preening on a nearby perch for about 15 minutes, it returned to the nest and began to brood once again, pushing the young downward in the nest with its feet. The smallest young tried to get the parent to feed it, but there was no response. Seventeen minutes later the parent again moved out on a branch where it preened and rested approximately 24 minutes before returning. It left the nest when its mate returned at 4:33 p.m. The three older young were fed almost immediately by the returning parent. When they had obtained their fill the fourth and smallest was fed. Sometimes the smallest bird in the clutch picked up a scrap that was accidentally dropped by one of the older nestlings.

By the third week the young were spending more time out on the branches than in the nest, climbing awkwardly about branches, sometimes to the top-

most part of the bush to exercise their wings (Fig. 3). Occasionally a young bird lost its balance and fell part way off a branch, but by maintaining its grip it eventually regained its balance on the perch by the use of its neck, bill, feet and wings. The parents were never seen to offer any help in such a situation. During their third week three young birds which were placed in the water were able to maneuver well enough to return to the nest.

FIG. 3. Juvenile Little Blue Herons approximately one month old. Swan Lake, Arkansas, June, 1953.

The young generally remained closer to their own nests than to others, seldom wandering near other nests unless frightened. Straying young were chased away from other nests or nest bushes by the parent bird or the young of that nest. Juveniles out on branches near their nest returned to defend it. I have seen a young Little Blue Heron in its nest inflict painful blows at the neck of an intruding juvenile, sending it away as hurriedly as the itinerant could move; and I have seen this happen to the same stray bird three times in succession.

When a parent returned to its nest, young out on the branches usually hurried back to be fed. Occasionally one or two of the young failed to return and then the parent flew or walked to the branch to feed the young there. However, it was evident that parent birds preferred to feed the young in the nest.

The parents of young in the third week stayed away from nests for increasingly longer periods of time. I observed feeding of young by incoming parents at nests Nos. 90 and 8 at which there were periods of 2 hours, 8 minutes and 2 hours, 46 minutes respectively, during which no parent was in attendance.

By the time the young were a month old they were able to make short flights to nearby bushes or limbs. On August 1, 1953, I observed for some time the feeding of the juvenile birds some distance from the nest. A great many of the younger juveniles, about one month old, remained for the most part within a given area and the adult bird returned to that area to feed them. However, the older juveniles often followed the adult bird about the colony; sometimes two or three juveniles could be seen flying behind the adult bird as it circled far out over the lake. Some such flights lasted at least five minutes. When the adult finally came to a resting place the young were usually but not always fed. Generally when the adult returned with food it did not go directly to the young, but was pursued persistently from bush to bush until overtaken by them.

Since some of the juveniles move about so much it is entirely possible that they are fed by many different adult birds.

Nesting Success

Fifty nests were tagged so that nesting success could be appraised. Later, when young about two weeks of age began to wander widely and even join young from other nests, observations were concentrated on 30 of the 50 nests originally selected. The 124 eggs laid in 30 nests produced a total of 92 young reared to two weeks of age. Of 30 nests, 28 produced one or more 2-week-old young. In ten randomly-selected nests 32 young were hatched, and at two weeks, 26 had survived.

The principal cause of egg losses during the laying and incubation periods appeared to be nest robbing (for sticks) by other herons and egrets. Some eggs were infertile. Eggs laid in partially-completed nests may have rolled out or fallen through the meager platform during periods of high winds. Fish Crows (*Corvus ossifragus*) were seen stealing eggs on several occasions, and a Baltimore Oriole (*Icterus galbula*) was seen to puncture the eggs at one Little Blue Heron nest. Very small young were occasionally pushed out of the nest by the older siblings, or perhaps fell out.

The ponds or lakes over which many of the heronries in the lower Mississippi Valley are located dry up in June or July, thus exposing the young to attack by mammalian predators. At several nests, herons two or three weeks old apparently were killed and partially eaten by raccoons (*Procyon lotor*), since the tracks of this predator led to the nest bush in which the dead young were found. A domestic cat (*Felis domesticus*) was observed

jumping from one nest to another. It is possible that the several thousand Black Vultures (*Coragyps atratus*), roosting at the Benoit, Mississippi, heronry may have preyed upon young herons, particularly those young that fell out of their nests onto the dry lake bed.

Food of Young

Food for the young was obtained mostly from "borrow pits" along the Arkansas River levee, bayous, and rice fields. Little Blue Herons, along with American and Snowy egrets, came into rice fields as soon as the fields were flooded, at a time when the rice was six inches to one foot high. This flooding was begun in May and the herons appeared promptly and continued to feed

Table 2

Foods Items of young Little Blue Herons, Listed in Order of the Number of Pellets in which Each was found.

Dytiscidae larvae (predaceous diving beetles)	20
Libellulidae nymphs (dragonflies)	17
Belostomatidae (giant water-bugs)	14
Rana pipiens (leopard frog)	13
Cambarus sp. (crayfish)	12
Arachnida (spiders)	11
Hydrophilidae larvae (water-scavenger beetles)	9
Gryllidae (crickets)	8
Lissorhoptrus simplex (rice water weevils)	8
Lepomis sp. (sunfish)	7
Tabanidae larvae (horseflies)	7
Noctuidae larvae (cutworms)	7
Notonectidae (back swimmers)	6
Undetermined fish	6
Carabidae (ground beetles)	5
Acrididae (short-horned grasshoppers)	4
Other land Coleoptera	4
Hyla cinerea (green tree frog)	4
Tettigoniidae (long-horned grasshoppers)	3
Solubea pugnax (rice stink-bug)	3
Scarabaeidae (scarab beetles)	2
Stratiomyidae (soldier flies)	2
Hydrophilidae (water-scavenger beetles)	2
Esox sp. (pike)	2
Undetermined insects	2
Elateridae (click beetles)	1
Gyrinidae? (whirligig beetles)	1
Copiphorinae (cone-headed grasshoppers)	1
Oryza sativa hull (rice)	1
Echinochloa sp. (barnyard grass)	1

in the rice fields throughout the summer. A field in which the rice had attained a height of several feet usually was deserted in favor of a field where the rice was shorter. Little Blues were seen feeding all over the rice field but usually preferred the "borrow" along the contour or levee. By feeding on crayfish (*Cambarus* sp.), a favorite food, the herons were perhaps performing a service to the farmer since crayfish are known to make holes in the levees.

Determination of food items fed to the young Little Blue Herons was revealed by examination of 50 regurgitated pellets collected beneath nests containing young from one to four weeks of age. Most of the pellets were obtained on July 11, 1953, after the section of the lake over which the herons were nesting had dried up. The young in question readily regurgitated the material when alarmed by my presence (see Table 2).

Late Summer Activity

On August 1, 1953, there were still at least 300 adult and juvenile Little Blue Herons at Swan Lake. All of the young observed were out of their nests, although several evidently had not been out more than a few days. The youngest birds observed could not fly. Most of the herons, egret, and Anhingas left the heronry by the last week in August.

Little Blues remained in the general area until about October 1, many of them feeding in the nearby rice fields. American Egrets, with which they had been feeding in the rice fields all summer and early fall, were still plentiful during the last week in October, thus remaining about a month later than the Little Blue Herons.

Summary

A nesting study of the Little Blue Heron was made at Swan Lake, near Pine Bluff, Arkansas, in 1952, 1953, and 1954. This heronry, like many in the lower Mississippi Valley, was located in an old riverbed lake surrounded by cotton fields. Only adult (blue phase) birds nested at Swan Lake. Nesting associates were the American Egret, Snowy Egret and Anhinga. Most of the birds nested in buttonbushes. The earliest recorded spring arrival date was March 13, 1954. In the courtship display the performing bird moved from an upright position to crouch twice in a sort of pumping motion. At the conclusion of the pumping it assumed a normal standing position and swayed from side to side twice. Copulation took place at the nest. All males under observation engaged in promiscuous copulation. Nest building began in late March and early April. The male gathered most of the sticks, presenting them to the female at the nest. There was much stick robbing from nests by other Little Blues, Egrets and Anhingas. Five to eight days were required for completion of a clutch, depending upon the number of eggs laid. Clutch size in 50

nests averaged 4.04 eggs. During the egg-laying period, the male remained at the nest most of the time. Incubation usually began after the laying of the second egg. The incubation period was 22 or 23 days. Both parents shared in incubation and in brooding and feeding the young. At one nest, newly-hatched young were brooded 80 per cent of the time. During the first three or four days nestlings were fed upon regurgitated food dropped into the nest by the parent. By the end of the first week the young were taking food from the parent's bill. During the second week young stood up in the nest. Parents preparing to brood sometimes used their feet to push young downward in the nest. By the third week the young were spending most of their time on branches near the nest, and at about one month were making short flights. In 30 nests, 124 eggs laid produced a total of 92 young herons two weeks of age. One or more young, two weeks of age, were produced in 28 of those 30 nests. Principal cause of egg losses appeared to be nest robbing (for sticks) by other herons, egrets, and anhingas. Tracks leading to certain nests containing dead young indicated that the raccoon probably was an important predator when the lake bottom was dry. Analysis of pellets regurgitated by young Little Blue Herons revealed at least 30 different food items, among which aquatic beetles and their larvae, dragonfly nymphs, giant water-bugs, frogs and crayfish were important.

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