A NESTING STUDY OF THE BLACK TERN IN MICHIGAN

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INTRODUCTION

During the summer of 1950, I made a study of Black Terns (*Chlidonias niger surinamensis*) nesting in the Indian River Marsh, 25 miles south of the northern tip of Michigan's Lower Peninsula, in Cheboygan County. Between June 24 and August 14, I visited the marsh 38 times; each visit was of six to nine hours' duration (excepting two one-hour trips). Twenty-seven nests were found, and the majority of these was visited repeatedly. Particular attention was given to two nests.

In 1951, I continued the study making two or three trips each eight or nine days from May 19 to June 15. From June 21 to August 22, trips were made almost every day for a different study, but some observations pertained to general nesting habits of the Black Tern and are included here.

The author wishes to express his deep appreciation of the many valuable suggestions made by Dr. Olin Sewall Pettingill, Jr., during the course of the study and during the writing of the manuscript. Grateful acknowledgment is also due to Mabel Jaques Cuthbert and Knut J. Norstog for their identification of the common plants of the area. This study is a contribution from the University of Michigan Biological Station. It was financed in part by a grant from the Michigan Academy of Science, Arts and Letters.

THE STUDY AREA

The Indian River flows into Mullet Lake from the southwest. Many years ago a dam was placed at the outlet of Mullet Lake, raising the level of the lake and causing the river to overflow. The resulting flooded area, the Indian River Marsh, is about three-quarters of a mile in width and extends for two and one-half miles southwest from the head of the lake; the river channel, 100 to 200 feet in width, meanders through the southeastern side of the marsh. My study area covered approximately one-eighth of the marsh—a strip three-tenths of a mile wide and extending for nine-tenths of a mile along the river channel from a point about one-fourth of a mile above the river mouth.

Large portions of the study area, as well as the rest of the marsh, contained extensive growths of common cat-tail (*Typha latifolia*); next in abundance were two species of bulrush (*Scirpus validus* and

S. acutus). Occasionally in shallow water bordering the river channel and in open areas among the cat-tails and bulrushes, there were patches of sweetflag (*Acorus Calamus*), broad-fruited bur-reed (*Sparganium eurycarpum*), water-lily (*Nymphaea tuberosa*), yellow pond-lily (*Nuphar variegatum*), Canadian waterweed (*Elodea canadensis*), buckbean (*Menyanthes trifoliata*), arrowhead (*Sagittaria latifolia*), spike-rush (*Eleocharis* sp.), hairy-fruited sedge (*Carex lasiocarpa*), pickerelweed (*Pontederia cordata*), and wild rice (*Zizania aquatica*). The alga *Chara* sp. was extremely abundant and blanketed the floor of much of the open shallow water. The river channel supported luxuriant growths of water-milfoil (*Myriophyllum* sp.), mare's-tail (*Hippuris vulgaris*), and four species of pondweed (*Potamogeton*). (Names from Gray's Manual of Botany, Eighth Edition, 1950.)

MATERIALS AND METHODS

For the first two weeks (June 24 to July 7, 1950) I made daily trips through the study area to gather information on nest distribution, hatching-time, and activities of the young. Since the nests were quite close to open water and the water over much of the marsh was one to three feet deep, I approached the nests in a small rowboat.

The period between July 8 and August 14, 1950 was devoted primarily to watching two nests and to following the activities of flying juveniles. The observations on nests were made from a canvas blind, $3\frac{1}{2} \times 3\frac{1}{2} \times 4$ feet in dimensions, mounted in a rowboat placed 6 to 15 feet from the nest. At first the boat was pushed into place near a nest each day and the blind erected anew for each observation. Later, the rowboat with the erected blind in it was left beside a nest. The habits of the flying juveniles were observed through a 20-power telescope on a tripod in an open rowboat, approximately 150 feet from the feeding territories.

In 1951, I visited the marsh on May 19, 20, 29, and 30 and June 7, 8, 9, 14, and 15, gathering data on display flights and courtship, because in 1950 observations began too late in the season to study these activities. Almost daily additional trips from June 21 to August 22 were to study Black Terns under semi-captive conditions as will be reported elsewhere. However, some coincident observations are inserted here.

To aid in identification of individual birds, six adults and 20 young were color-banded. However, most identifications of individual adults at nests were made by noting carefully the progress of the postnuptial molt (described by van Rossem, 1923). The early stages of the whitish winter plumage appeared on the head and neck in very distinctive patterns and (with one exception) made it possible to recognize

individuals in a pair. The progress of the molt is very slow, an individual changing very little from day to day.

DISPLAY FLIGHTS

Palmer (1941) made an extensive report on display flights and courtship behavior in the Common Tern (*Sterna hirundo*). Since it is important to compare the relatively unknown behavior of the marsh-nesting Black Tern with that of the land-nesting Common Tern, I will follow Palmer's terminology and sequence of presentation as closely as possible.

Fish flights.—Palmer (1941: 40–44) pointed out that Common Terns in the process of occupying a ternery frequently exhibited a social activity called the "fish flight." Typically, one bird flew carrying a small fish or other prey and called slowly with head in "bent" position (bill pointed downward), while a partner in "straight" position (bill pointed forward) silently flew ahead. "A Common Tern with a fish may make such flights nearly as frequently as one per minute. Sometimes a new partner is present at each flight." Bent and straight roles were interchangeable and often three birds joined in a flight and the fish was passed from bird to bird. Flights took place only on a few days in mid-May, and Palmer believed that they were primarily a social, pre-courtship activity before sex recognition occurred. Fish flights by Black Terns lasted from 5 to 15 minutes. A fish was sometimes carried, but more often a small insect. Occasionally a dragonfly (Odonata) was carried. Usually the carrier flew in the rear position with head bent and called with short, slow-cadenced cries similar to those used later when flying to young with food. The non-carrier flew silently with beak straight forward. I did not see food passed between partners and believe this difference from the Common Tern is correlated with the fact that the Black Tern (unlike the Common Tern) does not bring food to the incubating mate at the change-over.

There were many variations in the flight. In two cases, the carrier occasionally took the lead. Sometimes two birds flew alone for a while and then were joined by two more. On May 20, 1951, from 12:55 to 1:10 p.m. I watched four birds together flying rapidly around and around in strenuous fish flight. The circles were sometimes large, sometimes small, at times high in the sky or, again, low over the marsh. The flight covered an area approximately one-third of a mile in diameter. The rear bird carried a fish, but I could not determine significant positions of the head. At 1:02 p.m. the carrier dropped the fish, recaught it in the air, and swallowed it; thereafter the flight continued but at a slower rate.

The greatest number of fish flights was seen on my earliest visit to the marsh (May 19 to 20, 1951) when 18 flights were counted in 14 hours. Flights counted were a small fraction of those taking place. As with the Common Tern, the fish-flight phase was brief and, apparently, was a pre-courtship activity, since on my next visit (May 29 to 30) no flights were seen during 17 hours, and on 56 visits (one to ten hours each) through the summer only four flights were seen.

Flock flights.—Palmer (1941: 40–41) mentioned that Common Terns in the process of occupying a ternery may become quiet and suddenly "fly up in a body and return to social life for a time." On May 20, I watched spectacular flock flights of Black Terns which were apparently in the process of pairing. As I sat in a rowboat in one of the main nesting areas, approximately ten "pairs" of birds were visible on rudimentary nest platforms in the surrounding low, dead bulrushes of the previous year. Many others were calling from points out of sight in the vegetation. Suddenly at 3:55 p.m., they all became quiet and then flew up as a flock of at least 100 birds. They resumed calling and climbed noisily into the cloudy sky. Within the flock, many individual pairs occasionally set their wings and swooped downward in long, aerial glides (see below). Suddenly the entire flock became momentarily silent and, on set wings, made a single, swooping aerial glide. The flight then continued with further occasional aerial glides by individual pairs. Twenty minutes after the flight started, birds began dropping back on the rudimentary nest sites, and in a moment the flight was over. A minute later a second flight began and lasted for 14 minutes. In this flight, the whole flock made several long, swooping, silent aerial glides. At 4:54 and 5:18 p.m., two more flock flights began but did not "take." Approximately one-third of the birds flew up for about half a minute, then, probably because the rest did not follow, dropped back on the nesting areas. No further flock flights had taken place by 6:00 p.m.

I believe these flock flights were transitional steps from a flocking phase to the nesting phase, since nine and ten days later (May 29 and 30), when egg-laying had begun, I watched the marsh for 17 hours and saw only very minor flock flights. In all, there were seven flights lasting from 40 seconds to four minutes on those two days. Thereafter, no more were seen through the summer.

Trautman (1939: 44–45) saw "twilight flights" of the Black Tern, in which large flocks variously circled, swooped, and ascended in spirals. These flights started shortly after sunset and lasted, on some nights, until 10:00 o'clock. They took place from early June to

August. I watched for this flight on 19 evenings in 1950 and 1951 but did not see it.

COURTSHIP

For the Common Tern, Palmer (1941: 44–49) divided courtship into four activities: (1) Posturing. This included a *bent position* with head down, wings drooped, and tail tilted, followed by an *erect position* with head raised, bill pointed upward, tail tilted, and wings drooped. (2) The parade. "A bird, frequently in the bent position, walks in a circle, or arc of one, about the other tern." (3) Incipient nest-building. This included *scrape-making* (digging a hollow in sand as for a nest), and *twig-tossing* (picking up bits of "nest material" only to drop them again). (4) Aerial gliding. In this "A pair of birds may fly close together and high in the air. All of a sudden, one partly folds its wings and starts to glide quite leisurely earthward. The other keeps pace with it [gliding] . . ."

Posturing in the Black Tern usually began with one bird (the male?) standing upon a floating mat of vegetation on which a few plant stems were drawn together as a potential nest platform. Sometimes the bird stood on a post in the river or on a bare log floating near the river's edge. When a second bird flew overhead, the standing bird dipped its head down, tipped its tail up, and emitted low "chortling" sounds for about five seconds. This apparently corresponded to the "bent position," but no significant drooping of the wings was noted. The second bird alighted an inch or two from the first, whereupon both immediately craned their necks straight up for about ten seconds, pointing their beaks upward (erect position). Both then relaxed and stood preening quietly.

I did not see the "parade" in the Black Tern and doubt if it occurred. The scrape-making phase of incipient nest-building was lacking because of the nature of the Black Tern nesting habitat. Twig-tossing was also lacking, but the birds did frequently drag together small piles of plant material to form scant nest platforms on which they postured.

During aerial gliding, the Black Tern was silent and did not carry fish. Typically, two birds flew high and fast, then set wings and swept down rapidly toward the marsh, keeping a constant distance between each other as if the rear bird were on a tow-line. They often dropped two or three hundred feet, then swooped upward approximately 50 feet. In contrast, Witherby *et al.* (1941: 3), wrote that the European subspecies of the Black Tern "sometimes performs a gliding display flight, comparable to Common Tern's, but only from a small height . . ."

Seventeen aerial glides were seen on the earliest visit to the marsh (May 19, 1951); approximately eight on May 20. These counts were of aerial glides by individual pairs and did not include the hundreds of glides seen within flock flights, nor the social glides when a whole flock swooped down at once. According to Palmer (1941: 49–51), the aerial glide of the Common Tern maintained the sexual bond between mated pairs through the nesting season. In the Black Tern the aerial glide was rare after the eggs were laid. In fact, successfully nesting pairs could not do aerial glides until the young were at least five days of age, because one mate or the other was on the eggs almost 100 per cent of the time, and for the first five days after hatching one or the other was continuously feeding or brooding the young. From May 29, when laying had begun, to July 5 only seven aerial glides were seen on 21 daily observation periods of approximately five hours in length. After July 5, when young at many nests were quite well developed, aerial gliding of mild intensity took place and four, four, zero, approximately ten, and four glides were seen on July 5, 6, 8, 9, and 11, respectively.

NESTS

From my observations and from previous descriptions by various authors, I believe that Black Terns should be considered as only partly colonial. On a 1000-acre area in northwestern Iowa, Provost (1947: 500) found "many well-scattered groups of 10 to 20 nests, interspersed with isolated nests," and "isolated nests on small ponds were frequent." Pittman (1927: 140–141) described Black Terns nesting in Saskatchewan in a colonial manner, but with the nests "dotted here and there . . ." Witherby *et al.* (1941: 3), writing about the European subspecies (*C. n. niger*), stated that it usually nests in colonies but sometimes in scattered pairs. In contrast, Hoffman (1926: 86) described a Wisconsin marsh where it was "not unusual to find a half dozen nests in . . . twenty-five square yards."

Of the 27 nests I found at Indian River in 1950, 17 were in a loose colony in a 20-acre tract and ten were scattered in five sets of two each at various distances from the colony. In the colony, each nest was within 100 feet or less of at least one other nest; the three most closely associated nests were, respectively, 30, 36, and 37 feet apart. In the case of the five scattered pairs of nests, the distances separating the two members of each set were respectively: 31, 25, 40, 121, and (approximately) 50 feet; the distance between the pairs of nests varied from 100 yards to one-eighth mile.

Nest sites.—The nests were located in various vegetation types as follows: 18 in bulrushes, two in bulrush and cat-tail mixtures, three in cat-tails, two in cat-tail and yellow pond-lily mixtures, and two in bur-reeds. The birds had a definite preference for areas where the vegetation was low and thin. Most commonly this was afforded by thinly scattered bulrushes within a few feet of open water. However, two nests were in dense cat-tails through which a small rowboat could be poled only with considerable effort. But even these nests were only 15 and 20 feet from open water and were placed in a local clearing in the vegetation made by muskrats (*Ondatra*).

All save four of the nests were on floating platforms in water at least two feet deep; as waves from the river channel swept through the marsh, the nests rose and fell gently. In Iowa, Provost (1947: 499) found few nests in water less than two feet deep, which seems to be the usual situation in America; Witherby *et al.* (1941: 3) wrote that the nests of the European subspecies are also generally floating. Bisseling (1930: 60) observed this subspecies in the province of South Holland and found that "nests . . . consist of a fairly substantial structure of decaying plants and weeds which can rise and fall with the water." However, Turner (1920: 125–126) also studied the Black Tern in The Netherlands and wrote "I saw no floating nests anywhere." He found nests on "narrow strips of rough herbage lying between the dykes." Likewise, de Morsier (1947: 142) found nests in Dombes, France, "sur terre ferme." In the last two cases, clear photographs show the nests in coarse, low vegetation. No water is evident in the pictures.

Of the floating nests at Indian River, 11 were built upon very thin mats of dead plant material which had drifted and lodged against the stems of the surrounding vegetation; five nests were on floating logs or boards; five on bulrushes cut by muskrats; and two on stems of broken-down bulrushes. The muskrat-constructed platforms (similar to those described by Cahalane, 1947: 533) consisted of freshly-cut bulrush stems arranged in a radiating pattern. Of the four platforms which were not floating, one was an extensive pile of old bulrushes and three were extremely flattened old muskrat houses. Provost (1947: 499) found platforms of similar material and also nests on algal mats. He found one nest built in a recently-used nest of an American Coot (*Fulica americana*).

A nest was wet or dry, depending upon the weather and upon how well the platform held the nest above the water. Occasionally extreme wave action washed away parts of a nest and left mere fragments, the eggs resting precariously near the water's edge. In such a case, the nests usually were built up again by the following day.

Nest materials.—Knox (1899: 132) watched a Black Tern building part of a nest and observed that "the materials which could have been had directly at hand, were brought from a distance." He watched the bird fly in with nest material (weed stems) in its beak 14 times in half an hour.

I did not see nest-building in preparation for egg-laying. The material of each nest observed was dead vegetation similar to that scattered about in the immediate vicinity. Nests in cat-tails were constructed principally of pieces of old cat-tail leaves, whereas nests in bulrushes were made of short, broken bulrush stems from the previous year. I did not observe a single case of a Black Tern flying and carrying nest material. I observed in detail the building of an "auxiliary" nest (see below) and, as in nest reinforcement during incubation, all material was gathered from the water within a few feet of the nest site.

EGGS AND INCUBATION

Provost (1947: 499) stated that the first nest of the season was found on May 26, and by June 4 "black tern nesting was well under way" (Iowa). Hoffman (1927: 79) found a nest containing three eggs on June 6 (Wisconsin). Turner (1920: 122) observed incubating birds on May 21 (The Netherlands). In 1950 at Indian River, I found large numbers of newly-hatched young from June 26 to June 29. Allowing 21 days for incubation, egg-laying must have begun between June 6 and June 9. However, in 1951, I found 14 nests containing one to three eggs on May 29. The latest laying date which I recorded was June 30 or July 1, 1950.

The incubation period was given as 17 days by Seton and Chapman (1904: 1) and subsequent authors have cited this figure although it was based on observations on a single nest. Mr. Robert Goodman checked the incubation period of six marked eggs at a marsh near Pulaski, New York, in 1952 and has written me that "the average of the six was 21 days and 2 hours." In 1951, at Indian River, I observed six nests containing a total of 16 marked eggs. All eggs were still unhatched when I checked them at 19 or 20 days of incubation. I was unable to check them again until six days later by which time all had hatched.

Clutch size at Indian River varied from one to three. Of 20 nests found with eggs in 1950, each of ten contained three eggs, five contained two, and five contained one, a mean of 2.25 eggs per nest. The clutches were found at various stages of incubation, and some nests had perhaps already lost an egg or eggs. According to Bent (1921:

293) the "full set is almost always three eggs, occasionally two, and very rarely four or even five."

Black Terns at Indian River were very close sitters and, unless molested, rarely left their eggs uncovered for more than a minute or two at a time. Day after day as I went from nest to nest, a bird was always on the eggs and usually remained until I was within 30 or 40 feet of the nest. During this period (June 24–July 21, 1950) the temperature was usually rather low. (At the University of Michigan Biological Station nine miles from the marsh, the maximum temperature rose to above 80° F. on only 13 of the 28 days, and the highest temperature reached was 89° F.—recordings made by Dr. F. C. Gates.) It was variously "windy and cold" or "slightly overcast" or "cold and foggy," except for five days (July 8 to 11 and July 20) of hot and sunny weather. It is possible that the parents would have been less attentive if the weather had been warmer; Roberts (1877: 36) in Minnesota found that "during the day the parent birds sit on the nest very little, leaving the incubation of the eggs greatly to the heat from the sun and the warmth arising from the damp decaying vegetable matter upon which they rest."

In addition, I watched Nest 22 from a blind for a total of 666 minutes, July 17 to 19, the last three days of incubation; the eggs were covered 97.3 per cent of the time, being left untended for a total of only 15 minutes (20 very brief flights from the nest). The temperature on these days was quite low, the maxima at the Biological Station being respectively 80, 74, and 60° F.

During my observations on July 17 and 18, one bird alone incubated. On July 18, this bird (designated Adult Y and distinguished from its mate by the pattern of white winter-plumage feathers appearing on its head) remained on the eggs, except for 14 absences totalling nine minutes, from 2:16 to 9:00 p.m. (404 minutes). I did not see the mate (Adult X) in the vicinity during this entire interval. The following morning, however, Adult X incubated for 87 minutes of the 165 minutes observed, or nine minutes longer than Adult Y. Turner's (1920: 125) observations on the European subspecies were quite different: the "male" stayed on the eggs only once (for about ten minutes) during four days of observation, and he "spent all his time flying to and fro over his [incubating] mate, driving away Redshanks (*T. totanus*), Ruffs (*P. pugnax*), and other intruders." Palmer (1941: 79), working with the Common Tern, noted "that females did approximately three-quarters of the incubating" and that the "times between changing over varied from less than five minutes to over four hours."

The change-over at Indian River was very rapid. The returning bird flew over the nest and called. The sitting bird replied, then usually arose, and the other dropped down and quickly covered the eggs. Unlike the Common Tern, which sometimes brings a fish for its mate at the change-over (Palmer, 1941: 79), the incoming bird always flew in with empty beak. Sometimes the sitting bird did not leave the eggs, whereupon the returning bird alighted and pushed against it gently with its breast and caused it to arise. (Palmer described the same action in the Common Tern.) In either case, in the Black Tern, the outgoing bird either flew away immediately or remained for approximately one minute on or near the nest platform and gathered bits of vegetation which it piled about the mate on the nest. In gathering these, the bird often waded out about six inches into the surrounding water, where it was supported by various pieces of underwater vegetation projecting from the nest platform. Here it stood and, with great flapping of wings, stretched outward and grasped pieces of broken-off plant stems. It pulled these in one at a time and, with a quick jerk of the head, tossed them about the incubating mate. In a few moments it would pull in four or five of these thick, short stems. Again, a bird would wade out a foot or two from the nest, flapping its wings and dragging its belly and tail in the water as it worked. At times one momentarily submerged its entire head to grasp the stems. Palmer (*loc. cit.*) wrote of the Common Tern: "Sometimes at the approach of the mate, the incubating bird may pick up twigs or bits of grass and toss or slide them backward over its back . . . . This seems to be the result of a heightened emotional state caused by the return of the mate and sometimes the returning bird is the one exhibiting it." Possibly the formalized twig-tossing of the Common Tern is an evolutionary remnant of the more elaborate and useful nest-reinforcement activity of the Black Tern.

A failure of the change-over routines occurred occasionally when the incubating bird did not fly off but made low, chortling sounds and twitched its body when the mate called overhead. Turner's descriptions (1920: 125) for the European subspecies were similar to this: "When he swooped low over the nest, she would look up and reply to his call with soft, low notes; these were accompanied by a little vibrating movement of her whole body."

Within four to ten minutes after I entered the blind (at three nests in 1950, two in 1951), an adult returned and covered the eggs. Usually the bird was quiet and inactive and occasionally inserted its beak under its scapulars and slept lightly. At other times it preened or reached out and pulled bits of the nest up about itself. During one

observation period, a rather heavy rain fell and the incubating bird merely sat quietly for 31 minutes while the rain ran off its back. A Redwing (*Agelaius phoeniceus*) family frequently flew near one of the nests, and when one of these birds came within three to eight feet of the nest, the tern scolded, sometimes standing in the nest, occasionally flying off to chase the intruder. Unseen turtles, fishes, or other animals under the water at times caused the bulrush stems by the nest to sway; the incubating bird then became very excited, raised its wings, and scolded vigorously while reaching out with its head toward the moving plants.

None of the nests under observation on June 24 and 25, 1950, contained young. The peak period of hatching followed immediately (June 26 to 29), and scattered hatchings took place up to July 20. The number of nests in which the first young bird had recently hatched and the dates of these hatchings were: June 26—4 nests, June 28—2 nests, June 29—3 nests, June 30—1 nest, July 1—1 nest, July 2—1 nest, July 4—2 nests, July 5—3 nests, July 6—1 nest, July 19—1 nest, and July 20—1 nest.

In 1951, hatching began earlier. Five nests contained at least one recently hatched bird on June 14. Thereafter, because of other activities, I did not check nests for hatching as intensively as in 1950. However, the following dates were obtained for nests with one or more young just hatched: June 14—5 nests, June 25—1 nest, June 27—2 nests, June 29—1 nest, June 30—1 nest, and July 16—1 nest.

Hatching was observed from the blind at Nest 22 (which contained two eggs). Approximately 25 to 26 hours elapsed between the hatching of the two eggs. At 9:34 a.m. on July 20, 1950, I first noticed that one of the eggs was pipped. Presumably it had been pipped for some time, for it hatched between 11:37 and 11:47 a.m. the same day. An adult flew away with one piece of shell from this egg at 11:56 a.m. and with the other piece at 12:48 p.m. (A third adult alighted on the nest and briefly attempted to copulate with the sitting bird shortly after the first egg hatched. See below.) The following day, I first noticed at 8:47 a.m. that the other egg was pipped, and it hatched between 12:53 and 1:37 o'clock that afternoon.

Beginning approximately one-half hour before the hatching of the first egg, the adults became quite excited, as evidenced by frequent preening, turning about in the nest, and picking at the nest materials. This excitement continued until about half an hour after the egg hatched and was accompanied by a large amount of vigorous nest-reinforcement activity.

ACTIVITIES OF YOUNG BIRDS IN THE NEST

On July 20, 1950, a clear, hot day, one newly-hatched bird in Nest 22 was observed from the blind within ten minutes after hatching. This wet bird, with eyes open, was able to raise its head in a wobbly manner. Twenty-nine minutes later it called feebly with a *'chirr'*-like sound, raised its head upward, and gaped. Shortly thereafter, the adults made several attempts to feed it mayflies (Ephemeridae) but without success. Finally two hours and two minutes after hatching, the young bird accepted a damsel fly (Odonata) but swallowed it only after a considerable amount of gulping and swaying its head about. Half an hour later another damsel fly was taken, and four minutes later still another; 15 minutes later the first fish, a one-inch shiner (*Notropis* sp.), was accepted. The young bird remained continuously under a parent except when the mate flew in calling and carrying food; then the young bird pushed its head out from under the brooding parent and *'chirred'* in response. Two hours and 48 minutes after hatching, its down was dry and fluffy except for a few small patches. The young bird remained in the nest as I rowed away from the blind.

Day-old birds were observed on two hot, bright days—July 7 (Nest 1) and July 21 (Nest 22). During the first few hours after dawn, they remained continuously under the parent except while being fed. However, as the day progressed, approximately one hour was spent under the parent, then one hour in the open, lying beside the parent or wandering about the nest, then another hour back under the parent, etc.

Defecation probably occurred earlier, but the earliest I observed it was at one day of age. The young bird climbed to the edge of the nest, turned, placed its abdomen in the water and defecated. The nests remained completely clean.

Reactions of one-day-old downy young varied when I approached to enter a blind. In one case (Nest 22, July 21), the single young bird remained quietly on the nest. At Nest 1 (July 6) one of the two one-day-old birds remained in the nest (with a newly-hatched sibling) while the other swam out a few feet into the surrounding vegetation. This young returned immediately when the parent alighted in the nest and called to it with low, throaty notes after I had settled in the blind. Hoffman (1936) described the notes used to recall the young as "a soft, low cooing." In a third case (Nest 1, July 7), the single one-day-old bird swam a few feet from the nest as I approached, but it quickly climbed back, while I was settling in the blind and before the parent alighted.

Birds at two days of age were left alone in the nest approximately 25 per cent of the daylight time during 572 minutes observation and were more active than one-day-olds. They stood and walked ably. When the adults left the nesting area, the young birds peacefully wandered about the nest or stood quietly. At times they preened, scratched the head with a foot, *'chirred'*, and picked at the nest and at stems hanging near by. Frequently they merely squatted and slept. During the heat of the day, they alternately spent approximately one hour under the parent and one hour by the parent on the nest (or alone in the otherwise empty nest). During an observation at Nest 22, which ran until 9:00 on a clear, very warm evening (July 22), the lone two-day-old downy young remained under the parent almost continuously after 5:30 p.m. except for feedings. At this age, young at Nests 1 and 22 swam as far as eight inches from the nest before turning about and defecating in the water. Drinking was first observed at this age and occurred frequently. It usually followed ingestion of some large item of food or a series of small feedings. The young birds walked to the edge of the nest, dipped the beak in the water, raised the head, and swallowed.

The two-day-old birds were more responsive than younger birds to the alarm notes of the parents. If a parent became nervous and flew off the nest calling with shrill, short cries in slow cadence, the young birds "froze" on the nest. If, on the other hand, the cries had a rapid cadence the young birds dashed off the nest in a fraction of a second; when the parent's calls dropped to a slow cadence again, they returned to the nest even before the parent alighted.

The activities of birds of three and four days of age were essentially the same as those of two-day-olds, except that they swam farther out from the nest when disturbed. However, in one case, at Nest 1, I approached and entered the blind at 4:30 a.m.—before dawn—and the three young birds remained stationary in the nest, packed side-by-side like three slanted dominoes, although a parent was calling overhead in the darkness. From 4:55 until 6:03 a.m. these three birds spent most of their time under the brooding parent but, as the day (July 9) became warm and bright, a parent was on the nest for only 43 minutes during 341 minutes of observation, and the young birds only infrequently burrowed under it.

I watched some four- and five-day-old birds at Nest 1 on a slightly cloudy, but hot, afternoon (July 10), and they were left alone in the nest most of the time. Between 2:00 and 8:12 p.m. one parent or the other was on the nest 14 times for a total of 85 minutes, but brooded

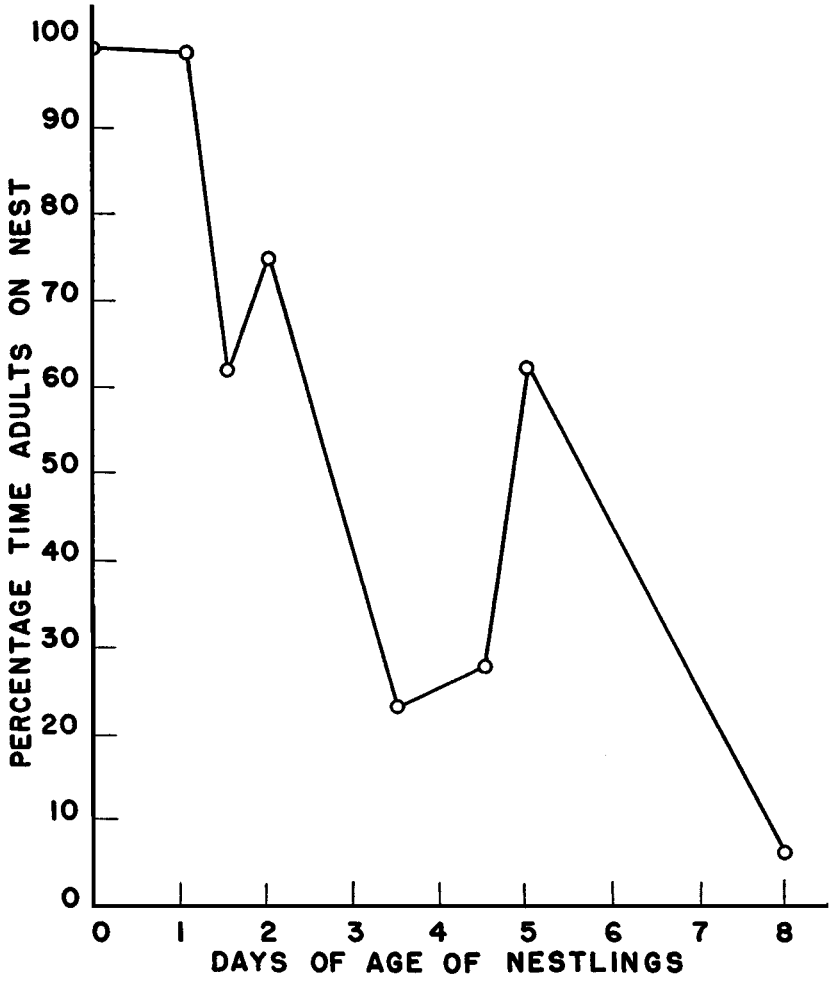

FIGURE 1. Black Tern. Percentage of daylight time spent by adults on nest. Young birds 0 to 8 days of age.

the young for only 19 minutes. After 8:12 p.m., however, brooding continued until I frightened the adult from the nest when I left the blind at 8:40 p.m.

One five-day-old bird at Nest 22 was observed from 5:30 a.m. until 1:45 p.m. on July 25. From 5:30 until 7:17 a.m. an adult was on the nest two-thirds of the time and kept the young bird covered. Toward the middle of the morning the day grew warmer and during the periods that an adult was on the nest, the young bird spent much of its time

standing or squatting by the parent. During the late morning and early afternoon, however, the sun became quite bright; most of the time a parent stood in the nest, and the young bird pushed under it for shade. When a parent was not on the nest, the young bird

TABLE 1

DAYLIGHT TIME NESTS COVERED OR NOT COVERED BY BLACK TERNS

				Periods nest covered				*Periods nest not covered*		
Nest	*Date (1950)*	*Age of young birds*	*Time*	*Total time in minutes*	*Number*	*Mean in minutes*	*Per cent of total*	*Number*	*Mean in minutes*	*Per cent of total*
22	July 20	(1 egg) 0-day*	9:34 a. m.–2:50 p. m.	316	3	104.7	99.4	2	1.0	0.6
22	21	(1 egg) 1-day	4:52 a. m.–2:00 p. m.	548	2	270.5	98.7	1	7.0	1.3
1	7	1- and 2-day	10:30 a. m.–1:17 p. m.	167	12	8.6	62.3	11	5.7	37.3
22	22	2-day	2:15 p. m.–9:00 p. m.	405	21	14.5	75.0	20	5.0	25.0
1 and 1**	9	3- and 4-day	4:55 a. m.–7:43 a. m. and 9:29 a. m.–1:30 p. m.	409	17	5.6	23.1	17	18.4	76.9
1**	10	4- and 5-day	2:00 p. m.–8:40 p. m.	400	15	7.5	28.1	14	20.4	71.9
22	25	5-day	5:30 a. m.–1:45 p. m.	495	36	8.5	62.5	35	5.3	37.5
1	13	8-day	5:15 a. m.–2:00 p. m.	525	4	8.0	6.1	5	98.6	93.9

* Hatched 193 minutes before end of observation period.
** Auxiliary Nest 1.

slept a great deal and usually raised its head only to be fed. Much of the feeding was done from the air, the adult hovering momentarily above the nest. The five-day-old was much more wary than younger birds and swam out about 20 feet from the nest as I entered the blind. The parent called a full 15 minutes before the five-day-old returned to the nest.

I watched a lone eight-day-old bird in Nest 1 from 5:15 a.m. until 2:00 p.m. on July 13. The day was cloudy and rainy and the parents stayed on the nest very little. Again, approximately 15 minutes elapsed after I settled in the blind before the young bird returned to the nest. Once, when the parents were away from the nesting area,

something frightened the young bird. It swam out two feet from the nest, remained there for ten minutes, and then returned voluntarily to the nest before the parents came back. In another case, after I had made a particularly prolonged disturbance near a nest, I found an eight-day-old color-banded young bird from the nest swimming vigorously through an open area 40 feet away.

Young of 9 to 25 days of age were not observed from a blind because of various difficulties. However, many birds of this age were caught, handled, and measured. As I approached a nest they swam away rapidly, and I recovered color-banded birds at distances of from 3 to 75 feet from their nest. They usually squalled loudly when picked up. The 19-and 20-day-old birds still were unable to fly when tossed into the air.

PARENTAL CARE OF YOUNG BIRDS IN THE NEST

Parental care of young birds of zero up to eight days of age was observed from the blind. Thereafter (and until the young were approximately 25 or 30 days of age), notes on parental care were gathered only as I rowed about the general nesting area.

Covering the nest.—Until the young were at least 8 days old, the parents shared in covering the nest (*i.e.* brooding or sheltering the young, or standing by them in the nest). For two days (at Nest 22) incubation and brooding overlapped, since eggs and young were in the nest simultaneously. During these two days, the period when one parent covered the nest was usually continuous with that of the other and the combined parental daylight time covering the nest (table 1) was 99.0 per cent of the 14 hours and 24 minutes of observation. It was thus very similar to the percentage (97.3) for the last three days of incubation. Thereafter, time spent covering the nest decreased rather regularly (with some fluctuations apparently due to variations in the weather) to 6.1 per cent at eight days of age. After the two hatching days, the change-over system broke down rapidly, and varying lengths of time elapsed during which both parents were off the nest. By two days of age, the mean length of the combined periods covering the nest had dropped very abruptly (table 1 and figure 1).

The data on length of time parents covered nests containing young are tabulated separately under the individual parents for Nest 22 (table 2) and Nest 1 (table 3). In these arrangements, the day-by-day decrease in time covering the nest recognizable in the combined parental analysis is masked greatly by individual variations. At Nest

TABLE 2

DAYLIGHT PERIODS NEST 22 COVERED OR NOT COVERED BY INDIVIDUAL ADULT BLACK TERNS*

Age of young birds	Total minutes observed	Adult X: Periods nest covered: Number	Adult X: Periods nest covered: Mean length (minutes)	Adult X: Periods nest covered: Per cent of total	Adult X: Periods nest not covered: Number	Adult X: Periods nest not covered: Mean length (minutes)	Adult X: Periods nest not covered: Per cent of total	Adult Y: Periods nest covered: Number	Adult Y: Periods nest covered: Mean length (minutes)	Adult Y: Periods nest covered: Per cent of total	Adult Y: Periods nest not covered: Number	Adult Y: Periods nest not covered: Mean length (minutes)	Adult Y: Periods nest not covered: Per cent of total
(1 egg) 0-day**	316	8	19.7	49.7	8	19.8	50.3	9	17.4	49.7	9	17.7	50.3
(1 egg) 1-day	548	10	36.8	67.1	11	16.3	32.9	10	17.3	31.6	10	37.5	68.4
2-day	405	8	10.9	21.5	8	39.7	78.5	16	13.6	53.5	16	11.7	46.5
5-day	495	22	7.4	32.4	23	14.4	67.6	17	8.7	30.1	18	19.3	69.9

* From same data as material on Nest 22 in table 1.
** Hatched 193 minutes before end of this record.

TABLE 3

DAYLIGHT PERIODS NEST 1 COVERED OR NOT COVERED BY INDIVIDUAL ADULT BLACK TERNS*

Age of young birds	Total minutes observed	Adult A: Periods nest covered: Number	Adult A: Periods nest covered: Mean length (minutes)	Adult A: Periods nest covered: Per cent of total	Adult A: Periods nest not covered: Number	Adult A: Periods nest not covered: Mean length (minutes)	Adult A: Periods nest not covered: Per cent of total	Adult B: Periods nest covered: Number	Adult B: Periods nest covered: Mean length (minutes)	Adult B: Periods nest covered: Per cent of total	Adult B: Periods nest not covered: Number	Adult B: Periods nest not covered: Mean length (minutes)	Adult B: Periods nest not covered: Per cent of total
1- and 2-day	167	3	5.0	9.0	4	38.0	91.0	10	8.9	53.3	9	8.7	46.7
3- and 4-day	409	12	4.7	13.9	13	27.1	86.1	6	6.3	9.2	7	53.0	90.8
4- and 5-day	400	5	6.2	7.8	6	61.2	92.2	11	7.4	20.3	10	31.7	79.7
8-day	525	3	6.7	3.8	4	126.0	96.2	1	12.0	2.3	2	256.0	97.7

* From same data as material on Nest 1 in table 1.

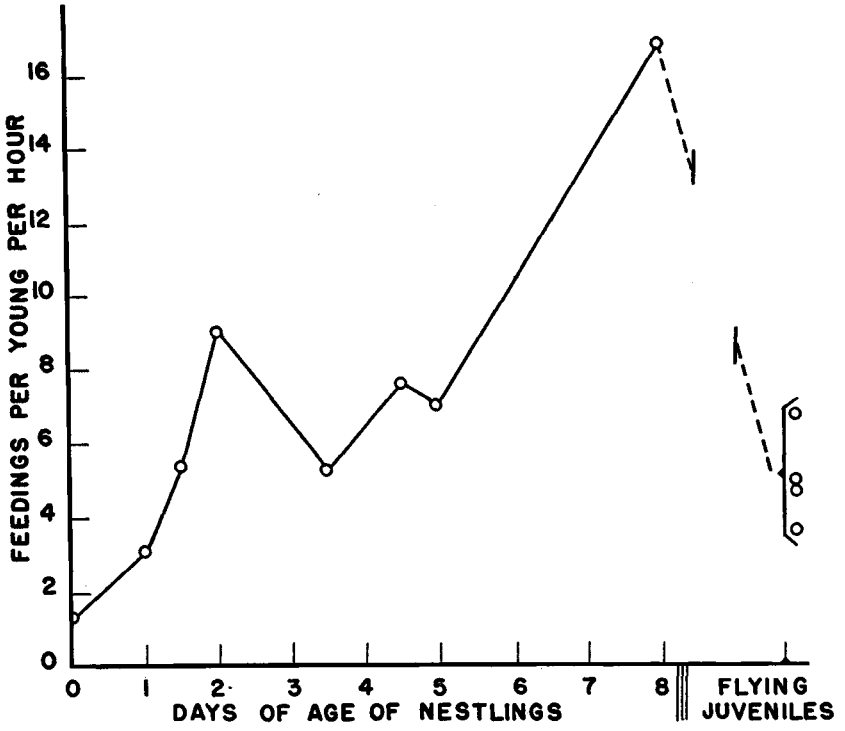

FIGURE 2. Black Tern. Number of feedings per young per hour. Young birds 0 to 8 days of age and flying juveniles.

22, from zero to five days, the adults shared fairly equally in covering the nest. Adult X covered the nest 776 minutes or 43.9 per cent of the time observed, Adult Y 695 minutes or 39.4 per cent. At Nest 1, from one to eight days, parental sharing of this duty was not equal. Adult A covered the nest 122 minutes (8.1 per cent), Adult B, 220 minutes (14.6 per cent).

Feeding.—The greatest part of the food for the young birds was gathered within a radius of a few hundred feet from the nest. The hunting parent flew about above the vegetation, hovered occasionally, and then dropped downward quickly to pick an insect from a stem or leaf. The bird then rose and flew directly to the nest, crying as it went. It dropped to the nest momentarily, or merely hovered above the nest for a fraction of a second to feed one chick, and then flew away to repeat the performance. A few insects were caught from the surface of the water or on the wing, and at times I saw an adult vigorously chasing a zigzagging dragon-fly. Pittman (1927: 140) watched Black

Terns in Saskatchewan which gathered most of their food from plowed ground and, later, from among the growing grain. Bent (1921: 295–297) has given excellent descriptions of food gathering and feeding of young. At Indian River, fish were usually obtained at some distance from the nest and were caught by the typical weak plunge of the Black Tern. Of interest is Murphy's (1938: 177) observation that Black Terns in gray winter plumage wintering in great flocks off

TABLE 4

SUMMARY OF FEEDING RECORDS OF YOUNG IN NESTS AND OF FLYING JUVENILE BLACK TERNS

Nest	*Date (1950)*	*Age of young birds*	*Number of young*	*Minutes watched*	*Number of feedings*	*Feedings per hour per young*
22	July 20	(1 egg) 0-day*	1	316	4	1.24
22	21	(1 egg) 1-day	1	548	28	3.07
1	7	1- and 2-day	3	167	45	5.39
22	22	2-day	1	405	61	9.03
1 and 1†	9	3- and 4-day	3	409	108	5.28
1†	10	4- and 5-day	3	400	152	7.61
22	25	5-day	1	495	57	6.91
1	13	8-day	1	525	147	16.80
	29	flying juvenile	2	240	55	6.35
	30	flying juvenile	2	540	85	4.72
	31	flying juvenile	2	390	59	4.53
	Aug. 8	34-day	1	455	26	3.43

* Hatched 193 minutes before end of this record.
† Auxiliary Nest 1.

the Pacific coast of Colombia fed "by stooping to the surface over areas in which schools of predacious fishes are engaged in carnage." He adds "Never did I see one plunge in the traditional tern manner."

Insects comprised 93.6 per cent of the feedings brought to the nest. Of 602 feedings observed between zero and eight days of age, 78.1 per cent were unidentified insects, 10.3 per cent damsel flies, 2.68 per cent dragon-flies, 2.5 per cent mayflies, 0.02 per cent cicadas (Homoptera), 4.9 per cent fish, and 1.5 per cent unidentified. Because of the hurried, split-second feedings on the wing, it is possible that a small percentage of the food items might have been misidentified as insects when they were crustaceans, arachnids, etc.

I observed a total of 602 feedings of young between zero and eight days of age. On frequent occasions many feedings occurred in a series of one-minute or half-minute intervals. On July 13 at Nest 1, one adult made 53 feedings in 86 minutes (7:44 to 9:10 a.m.) to a single eight-day-old bird. The number of parental feedings per nest, and the mean number of feedings per young per hour are listed accord-

ing to age of young in table 4. A graph (figure 2) drawn from these data illustrates the increase from 1.24 feedings per young per hour for the first 193 minutes after hatching to 16.8 feedings per hour at eight days of age. Between two and five days of age, the feedings fluctuated around a mean of 7.2 per hour and suggest a temporary plateau in the number of feedings for that period. The extremes of the numbers of feedings per young per hour during single observation periods varied as much as four to seven, zero to 27, and two to 37. Often, however, the hours of least feeding on one day were the hours of greatest feeding on another, so that no consistent, clear-cut daily pattern of feedings could be recognized.

Of 150 observed feedings of young between zero and five days of age at Nest 22, Adult X made 67 (44.7 per cent) and Adult Y made 83 (55.3 per cent). Of 452 observed feedings of young between one and eight days at Nest 1, Adult A made 313 (69.3 per cent), Adult B made 100 (22.1 per cent), and 39 (8.6 per cent) were made by an unidentified parent.

Parental care of young between nine and approximately 25 days of age apparently continued as with young from zero to eight days of age, but with much less time spent in covering the nest. I often observed the feeding activities and nest-protecting activities of the adults during this period, but made no detailed records from a blind.

Activities of Flying Juveniles

Young Black Terns take wing during July. Tinker (1914: 74) observed the first flying juveniles of the year (Palo Alto County, Iowa) on July 3; Willett (1919: 197) in Harney County, Oregon, saw some flying juveniles on July 20; and Du Bois (1931) watched Black Terns feeding their flying juvenile offspring in Minneapolis during the latter half of July. July 6 was the earliest flying date at Indian River in 1950. Counts of the number of flying juveniles seen at Indian River during daily observations for six to nine hours were as follows: July 6—1, July 8—1, July 11—7, July 16—12, July 18—14, July 19—19, July 20—12, July 26—4, August 4—4, August 8—5, and August 10—3.

Very probably many more young birds were on the wing than these figures show, for there was considerable evidence that some families were feeding in areas hidden by vegetation and thus went unobserved. This was especially true from July 11 to July 20. Many adults and juveniles left the marsh at the same time. On July 26 the marsh was very quiet, and it was then I first realized that large numbers of birds had departed. On that date, I saw only eight adults and five juveniles;

on August 4, ten adults and four juveniles; and on the last trip to the marsh, August 14, only one adult and no juveniles.

In 1951, the earliest flying date was July 5 (one bird). Three flying juveniles were seen the next day. Thereafter, counts were not made until mid-August when it was found that flying juveniles were at the marsh much later than in 1950. Young in flight during daily observation periods for two to five hours were as follows: August 10—2, August 11—8, August 12—5, August 13—10, August 14—8, August 15—5, August 16—7, August 17—5, and August 21—5.

My general observations place the flying age at approximately 25 days. Of the many flying juveniles seen in 1950, only one was recognized as a color-banded individual of known age. This was the single bird from Nest 1. Last observed at the nest on July 14, this bird was flying almost a mile from the nest on August 4, at 30 days of age.

Palmer (1941: 92) wrote that the young Common Terns which he studied in Maine flew from their nests on islands to the nearby beach of the mainland. "Upon arrival, the young separate and each alights on the sand, usually very close to a given spot, where they stand, sometimes for hours, while their parents bring food to them." They were fed thus for four or five days or even longer. At Indian River the young Black Terns flew to some other part of the general nesting area, where a feeding territory containing a few perching stations was established. For the juvenile from Nest 1, there were three perches, two of which were the ends of small logs projecting an inch above the water in a small, shallow bay on the edge of the river channel; the third was a channel-marker post extending six feet above the water. These perches were approximately 100 feet apart. Young birds were seen in many feeding areas along the edge of the river, but only one other area was watched intensively. Two juveniles used the second area, and here there were four perches. One was a small log floating in the bulrushes on the edge of the channel, two were channel posts, and the fourth was a group of water-lily leaves covering an area approximately five feet in diameter. Distances between the perches varied from 25 to 100 feet.

The juveniles spent much of their time standing quietly on one of the perches in a feeding territory, but cried loudly when a calling parent approached with food. The juveniles were strong fliers and at times flew about locally, demonstrating considerable skill in dipping, turning, and hovering. Often they flew low over water, dipping their beaks in the water. Occasionally one picked up a bit of plant material and carried it for a few feet before dropping it back in the water. At times they made the half-hearted plunge typical of adult Black Terns,

a plunge which amounts to little more than dropping to the water and dipping the head beneath the surface. The juveniles sometimes flew away from the feeding areas (alone or with a parent) and out of my field of vision; usually they would be gone for 5 to 15 minutes—once for an hour. I believe that such departures were for trial flights, not for feeding. Juveniles from other areas often flew by, but I never observed them feeding. Indeed, even within their own territories, I saw flying juveniles gathering food only three times: once one caught a small fish and ate it, and once a juvenile on a log reached out and picked small midge-like insects from the water as they floated past. Finally, on August 21, 1951, I watched two color-marked juveniles more advanced than any studied in 1950, having made their initial flight 13 days before, and for 114 minutes they fed continuously on the wing by hovering and picking small insects from bulrush stems. They were still attended by a single parent, which fed them occasionally. Du Bois (1931) described young Black Terns being fed by adults near a boat dock on a lake in Minnesota at a place far from any breeding area. When dead minnows were thrown into the lake by the boat keeper, "Black Terns, young and old, flocked to the spit. The young swooped down upon the floating minnows in the same manner as the old birds, and usually secured a minnow quite dexterously." Palmer (1941: 93) reported an observation (made by A. H. Norton) of juvenile Common Terns fishing as early as August 29.

The young Black Terns were aggressive in defending the feeding area and often joined the parent in chasing strange birds. In one case, two juveniles chased away a Ring-billed Gull (*Larus delawarensis*) when no parent was present.

PARENTAL CARE OF FLYING JUVENILES

As I rowed about the nesting area, I observed many groups of flying juveniles in feeding territories. One feeding area was occupied for at least five days. In each case only one parent was seen with the young at any one time, and I believe that the other parent had left the young entirely. This was substantiated by intensive observations of two broods. In 455 minutes of feeding of a juvenile from Nest 1, only one adult appeared, and it was consistently identified by the very distinctive development of the winter plumage. During 19 hours and 48 minutes of observation of a second feeding territory with two young, only one parent was present at any one time. However, in this case the postnuptial molt had just begun, and it is possible—although highly improbable—that there were two adults in the same stage of the molt visiting the feeding area at different times.

The number of feedings per hour was less for a flying juvenile than for an eight-day-old bird. The mean number of feedings per bird per hour was 5.02 during three observations of two juveniles, and 3.43 per hour for one observation of one juvenile (table 4 and figure 2). Of the 225 feedings, at least 12.9 per cent were of small fish. The remainder of the foods were not identified, but presumably they were largely insect material, since the parents exhibited typical insect-gathering activity near by.

AUXILIARY NESTS

Auxiliary nest building was observed at Nest 1 on July 9, 1950, when three birds of three and four days of age were in the nest. From 4:55 until 7:43 a.m., activity at this nest had been normal and 57 feedings had been made. At 7:43 a.m., the young were sleeping while Adult A flew about calling occasionally. At 8:01 a.m., two of the three young suddenly appeared frightened. They left the nest and, by swimming and scrambling over broken bulrushes, progressed three feet to the edge of a 50-foot strip of open water separating the bulrushes from some cat-tails. Here they paused briefly and *'chirred'* noisily; then in response to parental calls, they swam across the open water and five feet back into the thin cat-tails. Both parents hovered above their heads calling, then dropped to a thin log on which the young had climbed and *immediately* began to reach out into the surrounding water and vigorously pull in old, wet plant stems, piling them about the young. At 8:18 a.m., the third young bird left the original nest and, in a few minutes, joined the others at the new nest. From 8:20 to 9:29 a.m., one or the other of the parents occasionally brooded the young or, more frequently, with great fluttering of wings to keep its balance reached out in the water and hurriedly pulled vegetation up around itself and the young. As I watched with a binocular, the parents periodically flew in with food to the *'chirring'* young standing in the new nest. From 9:29 a.m. until 1:30 p.m. the same day, normal feeding followed (52 feedings in 241 minutes), broken at times by brief periods of nest construction.

The next day (July 10) I watched this auxiliary nest from 1:30 until 8:40 p.m.; there was no unusual activity (152 feedings); as darkness fell, Adult B was carefully brooding the three young—rumps out.

On July 13, at 4:30 a.m., I pushed the boat and blind into place at the auxiliary nest, but no young birds or adults came in. I moved the blind to the original nesting site; at 5:15 a.m. one young bird came to the nest, and 147 feedings took place between 5:21 a.m. and 2:00 p.m. the same day. The other two young did not appear, and I did not see them again.

On July 14 I returned to the original nesting site and pushed the boat and blind into place at 2:00 p.m. The young bird (now nine days of age) could be heard *'chirring'* in the bulrushes about 15 feet from the original nest. The adults dropped down in some cat-tails about 30 or 40 feet away (in the opposite direction from the auxiliary nest) and emitted the low, throaty "young-calling" notes. The young bird moved to this point, and the parents then flew an additional 60 feet over the cat-tails and dropped down. During the next half-hour the adults spent most of the time (out of sight) at this spot. Possibly the young bird had moved over to them, and they were building a second auxiliary nest. I did not row in to observe them, as I feared further disturbance would cause them to move again.

Another example of auxiliary nest building occurred at Nest 22. This new nest was built when I was not present and was placed 30 feet from the original nest on an extensive mat of bulrush stems formed when a rowboat had been poled into the area a few days before. The single color-banded young bird had moved to the new nest when it was three to five days of age. This nest, too, was used for brooding, feeding, etc. just as the original nest had been used. In 495 minutes of observation on July 25 when the young bird was five days old, it received 57 feedings.

The final case of auxiliary nest building was that of Nest 24. This new nest was 103 feet from the original one and contained two color-banded young approximately three days of age.

AGGRESSIVENESS OF BLACK TERNS

The Black Tern is noted for its aggressiveness toward human intruders. A great clamor arose from the parents and other birds near by whenever I visited a nest, but birds varied considerably in belligerence. At some nests the parents flew 20 or more feet above my head calling vigorously; at other nests they circled overhead and repeatedly struck my head or hat, each swoop accompanied by a raucous cry. A few of the birds soon learned to recognize me as an intruder in contrast to local fishermen, and would pass by the fishermen, coming as far as 200 feet from a nest to attack me. This habit proved helpful in capturing birds to band for identification. By means of an insect net with a 33-inch handle, 12-inch hoop, and 21-inch-deep net, it was possible to capture some of the birds as they swooped low at my head. At the height of the nesting season, six particularly pugnacious adults were caught in this manner. One of the six was thus captured three days in succession; when released, it merely shook itself for a few minutes and returned to the attack.

Later in the season the birds could not be caught, with the exception of one which was netted on August 10 while it was feeding some month-old juveniles.

At times, in company with a few Redwings, 10 to 20 Black Terns joined in a flock to mob an animal encroaching on the area. Fluttering overhead, they would follow it noisily across the marsh. At one time the animal being followed came out of the vegetation and into view in the river and proved to be an otter (*Lutra canadensis*). Judging from the great speed with which the flocks moved across the marsh, I suspect that an otter (or otters) was usually the cause of the mobbing. Once a small flock of terns was seen chasing a mink (*Mustela vison*) near the edge of the river, but they stopped as soon as the mink ran into the dense cat-tails. Dr. O. S. Pettingill, Jr., has sent me the following statement: "In the area where you worked I witnessed a group of Black Terns mobbing a water snake (*Natrix sipedon*) and a big snapping turtle (*Chelydra serpentina*) in the same manner you describe."

Areas where juveniles were fed were defended against other birds. During 19 hours and 48 minutes of observation in one feeding area, the one adult made 12 defensive actions: eight against Black Terns, one against some Common Terns, and three against Ring-billed Gulls.

NEST VISITING

Visits of strange Black Terns to nests were observed twice. At Nest 1, when the construction work on the first auxiliary nest was nearing completion, a strange adult—distinguishable as a stranger by the condition of the postnuptial molt—alighted on the nest. A moment later it departed and a second stranger alighted briefly and very gently pecked at the heads of the young birds. The parents were standing on the nest but made no protest. I believe that the visiting birds were from Nest 16 which was 31 feet away.

The second visit of a strange adult to a nest took place during the excitement following the hatching of the first egg at Nest 22. At 12:33 a.m., Adult X alighted and settled on the egg and young bird. Adult Y departed. In a few moments, a *third adult* flew in. The two birds "talked" quietly, then the visiting bird climbed on X's back in copulatory position. Adult X protested mildly and tried to throw it off although continuing to cover the young bird and egg. X stood partly erect; the third bird kept sliding backwards and then walking forward treadmill-like to hold its position. Finally the third bird lowered its belly feathers and under tail coverts in a very brief copulatory gesture and then flew away. Adult X was apparently

only slightly perturbed by this whole sequence, which required two or three minutes.

Dr. O. S. Pettingill, Jr., has told me he saw a strange Black Tern alight briefly on a nest containing three young approximately three days old and attempt to copulate with two of them. First one, then the other squalling young bird was pushed flat on the nest as the bird stood on it. The young were unharmed.

SUMMARY

Nesting habits of Black Terns were studied at the Indian River Marsh in Cheboygan County, Michigan, from June 24 to August 14, 1950, and supplementary observations were made from May 19 to August 22, 1951.

The greatest number of observed fish flights was on May 19 and 20, 1951. Spectacular flock flights of at least 100 birds preparing to nest took place on May 20.

Courtship included posturing and aerial gliding, and both were generally similar to these activities in the Common Tern. However, through the summer, aerial gliding was apparently less frequent than in the Common Tern.

Of 27 nests found in 1950, 17 were in a loose colony; ten were scattered in pairs. All but four of the nests were built on floating platforms and were in water at least two feet deep. Dead vegetation floating about immediately adjacent to the nest platforms was apparently the source of nest material.

In 1950, eggs were laid between June 6 (estimated) and July 1. In 1951, one to three eggs were found in each of 14 nests on May 29. The clutch number was one to three (mean, 2.25, in 1950). Data of Mr. Robert Goodman are reported placing the incubation period at 21 days.

During observations at one nest on the last three days of incubation, the eggs were covered 97.3 per cent of the time. At this nest, one bird (Adult Y) did all of the afternoon and evening incubating (once Y remained on the eggs for 404 minutes except for 14 absences totalling nine minutes). Both parents shared the morning incubation.

Change-overs occurred very quickly although the outgoing bird often pulled in a few stems and piled them about its incubating mate before departing.

The peak period of hatching in 1950 was June 26 to 29, but newly-hatched young were found occasionally until July 20. In 1951, five nests were found with recently hatched young on June 14.

One nest was observed during hatching. Both parents were obviously excited and took part in vigorous nest-reinforcement activity at this time. Once a strange adult attempted to copulate with the brooding parent. An adult flew away with the egg shells.

One young bird accepted food 122 minutes after hatching. Young almost always left the nest as I approached, but returned after I had settled in the blind. As they matured, such frightened birds swam farther out, and it became progressively more difficult for the parents to call them back to the nest. Young birds always defecated in the water.

Parents shared in covering young in the nest. At hatching, one nest was covered 99.0 per cent of the time. Thereafter, time covering the nest decreased rather regularly to 6.1 per cent at eight days of age.

From zero to eight days of age, the combined feedings from two nests were 93.6 per cent insect, 4.9 per cent fish, and 1.5 per cent unidentified. Most insect food was gathered from the stems and leaves of marsh vegetation near the nest. The number of feedings per young per hour during this time increased from 1.2 to 16.8. At one nest, one parent made 44.7 per cent of the feedings, the other 55.3 per cent. At the second nest, one parent made 69.3 per cent of the feedings, the other 22.1 per cent, and 8.6 per cent were made by an unidentified adult.

Juveniles took flight at approximately 25 to 30 days of age. First flying dates were July 6, 1950 and July 5, 1951. The largest numbers were seen in flight in 1950 from July 16 to 20, and by August 14 all had apparently left the area. In 1951, five juveniles still remained on August 21.

As juveniles first took flight, each brood (one to three birds) became established in large, defended feeding territories with three or four perches. Here a parent fed them. Once, two young were still being fed in such a territory 13 days after taking flight, although also catching food themselves. Food brought to flying juveniles was at least 12.9 per cent fish. Other food was unidentified but probably consisted of insects. Feedings numbered 5.0 per juvenile per hour in one case, 3.4 in another.

In three cases, parents built new ("auxiliary") nests at 30, 53, and 103 feet, respectively, from the original nest. The new nests were used as the original nests had been.

The adults were extremely aggressive toward intruders on the nesting area.

Strange adults visited nests in two instances.

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