# LIGHT INTENSITY AND THE ROOSTING FLIGHT OF HERONS IN NEW JERSEY

BY HENRI C. SEIBERT

ON August 25, 1948, the writer located a heron roost situated at the south end of Ocean City, Cape May County, New Jersey. The birds were noted returning from the marshes to the west and settling down for the night in a small growth of cherry trees. The tallest tree in the area was a cedar, scarcely over 25 feet tall. The majority of the cherry trees were less than 15 feet, but formed a dense, almost impenetrable growth. A rough count of the birds gave a total of 359 and included the following species: Little Blue Heron, *Florida caerulea;* American Egret, *Casmerodius albus;* Green Heron, *Butorides virescens;* and Black-crowned Night Heron, *Nycticorax nycticorax.* Several birds were already on the roost when the count was begun and as a result the total evening's count was far too low.

The following evening observations were started at 5:53 p. m. and no bird was detected on the roost. From then on the herons were counted and timed at five-minute intervals as they entered. The Night Herons, having spent the daylight hours on the roost, were similarly counted and timed as they left. Observations were made on August 26, 27, 30, 31, and on September 2 and 6.

The same roost was studied again the following year and counts made as before on August 17, 19, 24, and on September 1, 8, and 13. In addition, the morning flight was observed on August 25, and on September 2 and 9. A calibrated Weston illumination meter was used to measure the light intensity directly overhead at five-minute intervals. Each day's count for both years is given in Table I.

From this information an attempt was made to determine the size and composition of the colony, the relationship of roosting flight to such factors as light, temperature, and tide, and to relate differences in roosting behavior with the migratory status of the species concerned.

## THE COLONY IN 1948

If the data of August 25 are excluded, since they are obviously incomplete, the average size of the 1948 colony was about 536 birds. Little Blue Herons comprised by far the largest percentage of birds in the roost, being 71.3 per cent of the total observed. The members of this species were tabulated as those with the adult blue plumage and those with the immature white. From two to four birds with a mixed plumage were observed, but since the feathers were predominantly

blue, and since the species is known to breed in this pied plumage, they were classed with the adults.

Snowy Egrets, *Leucophoyx thula*, would seem to have arrived at the roost on August 27, as indicated by the single specimen noted in Table 1, and then to have increased in numbers on succeeding days of observation. Actually, the writer was not expecting to find Snowy Egrets and only by chance happened to note the yellow feet on the one bird.

TABLE 1

POPULATIONS OF HERONS COUNTED IN 1948 AND 1949. SEE TEXT FOR DISCUSSION OF COUNT OF SNOWY EGRETS

| | *August* | | | *September* | | | | |
|---|---|---|---|---|---|---|---|---|
| *1948* | *26* | *27* | *30* | *31* | *2* | *6* | *Average* | *Per cent* |
| American Egret | 37 | 41 | 37 | 44 | 48 | 31 | 39.7 | 7.4 |
| Little Blue (adult) | 42 | 46 | 25 | 22 | 21 | 18 | 29.0 | 5.4 |
| Little Blue (immature) | 332 | 384 | 315 | 265 | 305 | 324 | | |
| | | | | | | | 353.3 | 65.9 |
| Snowy Egret | | 1 | 56 | 86 | 40 | 12 | | |
| Green Heron | 49 | 68 | 98 | 60 | 87 | 76 | 73.0 | 13.6 |
| Black-crowned Night Heron | 34 | 27 | 42 | 50 | 53 | 38 | 40.7 | 7.6 |
| Louisiana Heron | 1 | 1 | 1 | | 1 | | 0.7 | 0.1 |
| TOTALS | 495 | 568 | 574 | 527 | 555 | 499 | 536.3 | 100.0 |

| | *August* | | | *September* | | | | |
|---|---|---|---|---|---|---|---|---|
| *1949* | *17* | *19* | *24* | *1* | *8* | *13* | | |
| American Egret | 101 | 109 | 130 | 127 | 109 | 105 | 113.5 | 14.4 |
| Little Blue (adult) | 151 | 146 | 129 | 131 | 79 | 85 | 120.2 | 15.3 |
| Little Blue (immature) | 605 | 367 | 495 | 225 | 323 | 335 | | |
| | | | | | | | 453.8 | 57.8 |
| Snowy Egret | 4 | 121 | 42 | 115 | 57 | 34 | | |
| Green Heron | 87 | 72 | 100 | 45 | 39 | 18 | 60.2 | 7.6 |
| Black-crowned Night Heron | 47 | 40 | 41 | 30 | 30 | 41 | 38.2 | 4.9 |
| TOTALS | 995 | 855 | 937 | 673 | 637 | 618 | 785.8 | 100.0 |

As a result, at the next observation period, the colony was approached at closer range and all apparent immature Blue Herons were examined as carefully as possible. The total of Snowy Egrets thereby greatly increased, reaching a high of 86. Unfortunately on the days following this high total count, partly cloudy weather made observation difficult around sunset and many Snowy Egrets were undoubtedly classed as immature blues. Once the birds had perched it was impossible to follow them in the trees and still keep count of other birds coming in; thus the Snowy Egrets had to be identified in flight before reaching the roost. A total of immature Blue Herons and Snowy Egrets together gave a fairly constant count, from 332 to 385 birds, indicating that some Snowy Egrets were missed on the cloudy days. In view of the inaccuracy of the Snowy Egret count they have been lumped

with the immature Blue Herons in the following data unless specifically stated otherwise.

One Louisiana Heron, *Hydranassa tricolor*, was observed on four different days as indicated in Table I.

## THE COLONY IN 1949

The colony in 1949 averaged about 786 birds, an average increase of 250 birds over the 1948 colony. Again the Little Blue Heron was the predominant species, being 73 per cent of the total birds counted (including all Snowy Egrets). The ratio of Little Blue Herons to the total colony was, therefore, approximately the same for both seasons. In the 1949 total the adult Little Blues were nearly one-fourth (26.1%) as many as the immatures, whereas in 1948 they were only 8.2 per cent. On August 29, 1929, Stone (1937: 140) found that one-quarter of the Little Blues he tabulated at one roost near Bennett, Cape May County, were adult; two days later a more accurate count gave 124 to 400.

American Egrets increased in number and constituted a greater part of the colony in 1949; both the Black-crowned Night Heron and the Green Heron showed a slight decrease. What little evidence was obtained indicated that the Snowy Egret increased slightly, although the error in the counts may have been as great as 100 per cent.

The colony did not maintain stable numbers during the periods of observation. The 1948 count showed an increase leading to a peak on August 30 followed by a progressive decline. The relatively low count of August 31 was undoubtedly due to the fact that the birds were frightened out of the colony and in their short flight before settling down again new arrivals were overlooked in the confusion. The 1949 colony showed a similar, but more striking, decrease after August 24, occasioned by the disappearance of 200 immature Little Blue Herons (and Snowy Egrets?) and a reduction by half in the population of Green Herons. The count of August 17 was described as not being a good one because of two incoming flocks too large for accurate count, and because the roosting birds were flushed out twice. Under such circumstances an error of 100 birds could easily have been made. The counts of August 19 and 24 were described as good and the peak in numbers, therefore, occurred between August 24 and September 1, in agreement with the observations in 1948. Urner (1929–1930) counted the maximum number of Little Blue Herons at Newark Meadows on August 30, but the peak for American Egrets was much earlier, August 16.

The 1948 data indicate that among the Little Blue Herons, the adults left the area earlier than did the immatures. In the first two counts the ratio of adults to immatures was 12.7 and 12.0 per cent,

and by September this had dropped to 6.1 and 5.4 per cent. The 1949 data, having been accumulated earlier, show first an increase in the proportion of adults and then a decrease, there being 25 per cent on August 17, 38.5 per cent on September 1, and 21 and 23 per cent on September 8 and 13, respectively. It must be remembered that these ratios include the Snowy Egret and are only valid with the assumption that the latter species maintained a constant ratio in numbers with the immature Little Blue Herons.

In both years the American Egret maintained a relatively constant number of individuals as did the Black-crowned Night Heron. The greater fluctuation in numbers showed by the latter species can be attributed to the daytime roosting habits and the probable disturbances by persons walking through the area.

Whereas the decrease in the number of Little Blue Herons can be explained by their tendency to migrate southward earlier than either the American Egret or the Black-crowned Night Heron, the sudden decrease in numbers of Green Herons between August 24 and September 1 in 1949 is rather puzzling. There is the possibility that they may have selected another roosting site.

Although some Great Blue Herons, *Ardea herodias*, were seen on the marshes, none ever attempted to join the other species at the roost.

## TIME AND SEQUENCE OF ARRIVAL AT ROOST

Since the herons were tabulated at five-minute intervals, a frequency distribution was set up wherein the interval containing sunset was regarded as the origin and the others as plus or minus departures from it. The calculated mean, therefore, expresses arrival time in minutes before or after sunset. For deriving the mean of all observations the frequencies were shifted so that the intervals containing sunset coincided. The mean arrival time for all observations in minutes before or after sunset is given in Table 2, together with data calculated from Urner's (1929–1930) report. For the Black-crowned Night Heron the data represent mean departure time.

The peak of arrival during the entire observation period for the Little Blue Herons varied between 17 and 15 minutes before sunset and for the American Egret, between 15 and 10 minutes (Table 2). Green Herons arrived much later, from seven to 14 minutes after sunset. About four to nine minutes later, the outbound movement of the Night Herons was at its peak. In all cases there was considerable spread in time as indicated by rather large standard deviations. In spite of this, the mean times for Green, Night, and white Herons (the term white heron is used collectively for the American and Snowy

Egrets, adult and immature Little Blue Herons) differed significantly. Although decreasing light caused a corresponding decrease in the ability to differentiate Snowy Egrets from immature Little Blue Herons, some observations seemed to indicate that the former were actually the earliest of arrivals. On August 30, 1948, 55 Snowy Egrets arrived at the roost before any Little Blues appeared; on August 31, 38 Snowy Egrets were observed before the first Little Blue; on September 2, 22 Snowy Egrets were already on the roost when the observations started.

TABLE 2

MEAN ARRIVAL TIME OF HERONS AT THE ROOST (DEPARTURE TIME FOR THE BLACK-CROWNED NIGHT HERONS) IN MINUTES BEFORE SUNSET

| | | *1948* | *1949* | *Urner* |
|---|---|---|---|---|
| Little Blue Heron | $M=$ | 16.6±0.27 | 15.1±0.26 | 17.5±0.45 |
| | $\sigma=$ | 12.8±0.19 | 14.2±0.18 | 21.2±0.31 |
| American Egret | $M=$ | 9.6±1.04 | 14.5±0.59 | 17.6±1.23 |
| | $\sigma=$ | 16.1±0.74 | 15.3±0.42 | 17.1±0.87 |
| Green Heron | $M=$ | −7.2±0.71 | −14.4±0.77 | |
| | $\sigma=$ | 14.9±0.48 | 12.4±0.47 | |
| Black-crowned Night Heron | $M=$ | −16.0±1.00 | −18.5±0.73 | |
| | $\sigma=$ | 14.7±0.71 | 11.0±0.52 | |

Little Blue Herons arrived in small groups of three to ten, then in ever increasing flocks of 20 to 40. Flying about 100 feet up, they approached the roost rather closely, then made sudden twisting dives at sharp angles into the trees. Snowy Egrets behaved in a similar fashion. American Egrets, on the other hand, usually glided in at less than 50 feet, very often approaching the roost at tree-top level. They arrived in groups of two to five, seldom more, and frequently in company with Little Blues. The white herons normally landed on the top of the trees where they were rather conspicuous, then gradually and, at times almost imperceptibly, "melted" into the vegetation and out of sight.

Green Herons approached at an intermediate height, very seldom more than 50 feet, and flew directly to the roost. This species had a tendency to segregate from the larger herons and selected a spot to the side of, but still adjacent to, the main roost. The Green Herons arrived for the most part singly or in pairs, never in flocks. Occasionally a bird would fly off the roost soon after arriving. The larger herons flew off a short distance and returned, but Green Herons usually disappeared from sight. In all cases, birds leaving the roost were tabulated as such and were corrected for in all totals so that no bird was counted twice.

Night Herons began leaving the roost in ever increasing numbers around sunset. Often a few individuals were observed coming from

their hiding places and perching near the outer edge of the bushes and trees, waiting for the proper time to fly off. The majority of these birds departed from the bushy vegetation that surrounded the trees of the roost.

The lone Louisiana Heron that was observed on four fifferent days was an early arrival, being clocked between 52 and 34 minutes before sunset for an average arrival time of 40 minutes. On the last day it arrived earliest, hesitated briefly on the perch, then flew off and was never seen again.

## FACTORS INFLUENCING ROOSTING TIME

An attempt was made to determine the primary factors controlling the herons' movement to and from the roosting site. The most obvious influence was the time of sunset. In Figure 1 the mean arrival time of herons at the colony (departure for the Black-crowned Night Herons) is shown relative to sunset. In 1949, the results showed a remarkably close relationship between sunset and arrival time of Little Blue Herons, varying between 12 and 20 minutes. This curve is closely paralleled by that of the American Egrets, except for an unusually late arrival on August 24. Even the Green Herons, whose major arrival occurred after sunset, showed good agreement although the fluctuation was more than in the case of either the egrets or the Little Blue Herons.

In 1948 the relationship of flight to sunset time was less rigid, although the species arrived at the roost in the same order as in 1949. The American Egrets particularly showed a wide variation in mean arrival time, from 15 to 0 minutes before sunset. Also, the American Egrets arrived at a significantly later time in 1948 than did the Little Blue Herons, whereas in 1949 the two species arrived at about the same time as also did Urner's birds. On the other hand, the Little Blue Herons and the Green Herons came to the roost at significantly earlier times. No obvious explanation is forthcoming for these disparities. The 1948 season had more rain and the evenings were often cloudy while 1949 was dry throughout August. The greater extent of wet marsh with the possibility of an increased and more easily obtainable food supply along with a seemingly earlier sunset occasioned by gathering clouds may have caused the birds to return earlier.

The Night Herons left the roost 2.5 minutes earlier in 1948 than in 1949. This difference was in large part the result of the early departure of August 26. As this was the first time that I had approached the roost at close quarters, these herons may have been made nervous by my presence, especially since I moved around to some extent locat-

ing a favorable spot from which to observe the incoming white herons. On August 27, the roosting Night Herons were frightened away by a passerby, and their departure time (10.3 minutes before sunset) was not included in the graph or in the calculations used to determine mean departure time in Table 2.

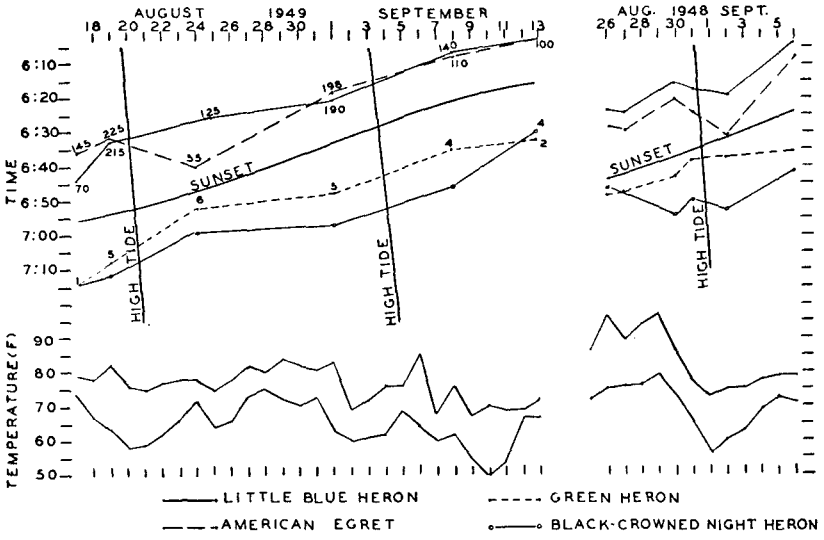


FIGURE 1. Mean arrival time of herons at the roost (mean departure time for Black-crowned Night Herons). Numbers on 1949 curves represent light intensity in foot-candles. Lower curves are maximum and minimum temperatures.

Urner pointed out the irregularities in roosting time and attributed these in part to the condition of the sky, noting that on dark cloudy evenings the birds roosted earlier. He described a thundercloud darkening the sky at 4:30 p. m. (= 3:30 E. S. T.) at which time 20 birds arrived to roost and all left when the sky cleared soon after. On a dark, cloudy evening, Stone (1937: 140) observed an entire colony of 522 birds arriving within a 45-minute period. A similar observation was made in the present study on August 18, a dark and rainy day. At 70 minutes before sunset, with the light in the sky equal to only 55 foot-candles, the roost was found to contain many birds and many others were coming in. Again on September 7, a cloudy day, a large number of herons was already roosting 65 minutes before sunset. These were frightened off; within the next 15 minutes, 368 herons had flown in. In both this and the previous example above, the birds were restless, "bickering" with each other more than was customary. The majority of the flock would suddenly fly off, wheel in a long semi-

TABLE 3

COMPARISON OF THE MORNING AND THE PREVIOUS EVENING'S COUNT

| | *August 24 and 25* | | *September 1 and 2* | | *September 8 and 9* | |
|---|---|---|---|---|---|---|
| | *p.m.* | *a.m.* | *p.m.* | *a.m.* | *p.m.* | *a.m.* |
| White Herons | 796 | 823 | 598 | 669 | 568 | 620 |
| Green Herons | | | 45 | 64 | 39 | 39 |
| Night Herons | | | 30 | 27 | 30 | 26 |

circle, and return. These excursions rendered any count impossible. There was no indication in either year that roosting occurred at an earlier time in relation to sunset as the season advanced, as Urner observed.

According to Urner, factors other than light must have influenced the heron flights that he observed, since he found that on clear days the birds arrived, on the average, at 25 minutes before sunset, but on dark days, at 18 minutes. Photoelectric readings of the sky directly overhead were taken during the 1949 census. In Figure 1 are given the foot-candles of illumination at which the mean flight occurred for the three groups of herons. Night Herons are not included as their flight occurred principally below the sensitivity of the instrument. There existed no close correlation between variations in mean arrival time relative to sunset and light intensity. Since the light intensity changes very rapidly during this part of the day it is not surprising that the birds should arrive over a wide range of values. One can say that the white herons arrived in major numbers when the intensity was between 100 and 200 foot-candles, but that individuals or small flocks would come to roost in a range between 1800 and 0 foot-candles.

The same can be said for the Green Heron except that its main flight occurred below 6 foot-candles of intensity. Its range was from 100 to well below one foot-candle. If any bird arrived when the light was greater than 100 foot-candles, it would stay for only a short time before flying out into the marshes again. If the flight of Night Herons is compared to the light intensity that occurred at sunset (Table 5), using this value as an indicator of the condition of the sky, there existed a closer relationship between their departure from the roost and the light intensity than existed between the light intensity and the arrival of the other herons.

Maximum and minimum daily temperatures are shown on Figure 1. In 1948, one might surmise that the late average arrival of herons on August 31 and September 2 may have been related to the sharp drops in temperature that began on August 30. Unfortunately the 1949 data are so uniform that no marked change in arrival time can be

TABLE 4

MEAN DEPARTURE TIME (MEAN ARRIVAL FOR NIGHT HERONS) IN MINUTES BEFORE SUNRISE

| | *August 25* | *September 2* | *September 9* |
|---|---|---|---|
| White Herons | $M=6.6\pm0.11$ | $11.1\pm0.12$ | $12.5\pm0.10$ |
| | $\sigma=3.1\pm0.08$ | $3.1\pm0.08$ | $2.5\pm0.07$ |
| Green Herons | $M=$ | $29.7\pm0.55$ | $27.6\pm1.05$ |
| | $\sigma=$ | $4.4\pm0.39$ | $6.5\pm0.74$ |
| Night Herons | $M=$ | $32.3\pm1.91$ | $30.9\pm1.90$ |
| | $\sigma=$ | $9.9\pm1.35$ | $9.7\pm1.34$ |

associated with any change in temperature. One might further postulate that the late arrival of American Egrets on August 24 was related to the cooler temperatures on the preceding night, and that the American Egret, being a larger bird, would take longer to restore its energy equilibrium than the smaller herons. However, the cool period of September 10 was not reflected in any later arrival of Egrets.

The period of high tides is also shown in Figure 1. In 1949, its influence, if any, was not evident. In 1948, it may have had some delaying action on the white heron flight.

## THE MORNING FLIGHT

Three morning flights were observed; each was on a morning following one of the evening counts. This provided a rough check on the accuracy of the evening's count and on the tabulating technique in general. Unfortunately on the first morning, the writer arrived too late to tally all of the Night and Green Herons, but did arrive before the white herons had begun to leave. A comparison of the counts is given in Table 3. Except for the Green Herons tabulated on September 1 and 2, the agreement in totals runs close to 10 per cent. The mean departure time for the white and Green Herons and the mean arrival time for the Night Herons are given in Table 4. The Night Herons' peak of arrival occurred about one-half hour before sunrise when the light intensity was still below one foot-candle. Green Herons began leaving soon after, before there was sufficient light to register on the photometer. Between six and 12 minutes before sunrise occurred the mass movement of the white herons, the light intensity measuring 20, 12, and 18 foot-candles on each of the three mornings. The smaller standard deviations, indicated in the morning counts, especially that of the white herons, compared to that of the evening flights should be noted. It took only 20 to 25 minutes to empty the colony of herons, whereas their arrival was spread out over an hour or more. In the morning, a few individuals left first, followed shortly after by large mass-movements. Thus, in the three observations made, 530, 412,

TABLE 5

COMPARISON OF MAXIMUM TEMPERATURES, LIGHT INTENSITY AT SUNSET, AND MEAN DEPARTURE TIME IN MINUTES AFTER SUNSET FOR BLACK-CROWNED NIGHT HERONS

| | *Degrees Fahrenheit* | *Minutes* | *Foot-candles* |
|---|---|---|---|
| August 17 | 79 | 19.3 | 30 |
| August 19 | 82 | 22.0 | 55 |
| August 24 | 78 | 14.0 | 22 |
| September 1 | 83 | 22.0 | 45 |
| September 8 | 76 | 25.8 | 35 |
| September 13 | 72 | 9.9 | 20 |

and 510 white herons left within a five-minute period. These large flocks prevented any attempt to differentiate American Egrets, immature and adult Little Blue Herons, much less any Snowy Egrets. As a consequence they are all lumped together.

## DISCUSSION

A comparison of mean and median values showed the latter to be shifted to the right, indicating a left skewed distribution. In other words, the birds arrived at the roost at an increasing tempo, reached a maximum in traffic volume, then declined rather abruptly. This pattern seems reasonable enough, but the curious fact is that the Night Herons left their roost in the same manner and not the reverse.

The curves of the morning flights are skewed to the right, indicating a rapid increase in movement from the colony followed by a gradual slackening, terminating in a few stragglers that left in small groups. Night Herons responded in the same fashion even though they were coming in. Between 10 and 20 foot-candles of light apparently stimulated the white herons, whereas in the evening by the time the light was down to 20 foot-candles, well over 90 per cent of these birds had settled in the roost. This indicates a lower threshold stimulus or release from the inhibiting influence of darkness for the morning flight, especially since in the evenings the herons were stimulated, at their feeding grounds, to return to the roost at a period earlier than they actually arrived. The distances traveled by these birds is not known. During the day large numbers were found feeding within a mile of the roost, but since these birds were also found commonly scattered all the way from Atlantic City to Cape May it was not possible to learn to which roost each belonged. The behavior of the Green Heron was the same. In the evening, the mean arrival time of this species occurred between six and one foot-candles, but in the morning the mean flight was under way between five and ten minutes before one foot-candle was registered. Night Herons left the roost in the evening when the intensity of light was down close to one, or

slightly less, foot-candle. In the morning they returned at 11 or 12 minutes before the instrument registered one foot-candle. In the case of these birds the threshold was higher in the evening than in the morning. Thus the departure of all night-roosting herons from the roost occurred at a lower light threshold than the return flight, whereas the departure of day-roosting herons occurred at a higher threshold. The conclusion is that superimposed on the light stimulus may be an urge to satisfy the hunger drive. The day-feeding herons may be considered to leave the roost in the morning at a lower light intensity threshold because of empty digestive tracts, but with full stomachs they respond to a higher threshold of light by returning to the roost earlier. The Night Herons, having fed during the night, return earlier (at a lower light intensity) in the morning, but in the evening their hunger causes an earlier (at a higher light intensity) departure.

The progressively earlier morning departure of the white herons (Table 4) is significant mathematically; what its biological significance may be is not apparent. Whereas September 9 was a slightly brighter morning than the others, August 25 was brighter than September 2. The minimum temperatures for the nights in question were 72, 63, and 62° F. The cooler nights, together with their increasingly longer duration, may have caused the birds to expend sufficiently more energy to keep up their normal metabolism. Their greater hunger in the morning would then cause them to leave the roost at an earlier time. It is admitted that these data are too meager to prove the point. On the other hand, since Night Herons spend the day at the roost, their departure time may be compared with the maximum temperatures during the day. These data are given in Table 5. With due allowances, it can be seen that the lower the daytime maximum temperature, the earlier the birds left the roost. The sum of the mean hourly temperatures would obviously be a better basis for comparisons. At such time when the temperature falls so low and the nights become so long that the urge or need to leave the roost occurs before there is sufficient light to which the birds are accustomed, then the disruption in the energy balance must be compensated by moving to regions of longer daylight and warmer nights, that is, southward (Seibert, 1949).

During the cool months, at latitudes distant from the equator, nocturnal birds are at an advantage since associated with the cooler temperature is a longer night for feeding. In this case, it is interesting to note that the Black-crowned Night Heron, of the herons in New Jersey, is the earliest spring arrival and the latest fall migrant. During open winters it can be found throughout the year. The Green Heron is the next earliest migrant and this fact can be correlated with the species' possessing a longer feeding day than any of the white herons.

SUMMARY

1. A count was made on a heron roost during the late summer of 1948 and 1949 at Ocean City, New Jersey.

2. The time and sequence of arrival and departure of four species to and from the roost were tabulated. It was found that:

a) The mean arrival time of Little Blue Herons, American Egrets, and Snowy Egrets was between 16 and nine minutes before sunset;

b) The mean arrival time of Green Herons was between seven and 14 minutes after sunset;

c) The mean departure time of Black-crowned Night Herons was between 16 and 19 minutes after sunset.

In the morning the same sequence occurred in reverse.

3. Time of sunset and sunrise was found to be the most important factor controlling the arrival and departure of all species in the morning and in the evening.

4. The condition of the tide had little, if any, influence.

5. All night-roosting herons departed from the roost at a lower mean light intensity than that when they returned, whereas the day-roosting herons departed at a higher intensity than when they returned.

6. A causal relationship between migration dates, day and night feeding habits, time of arrival and departure to and from the roost, and the time spent on feeding activities is suggested as follows:

a) That herons leaving the roost to feed respond to a lower light intensity threshold than those returning to the roost because of an added hunger stimulus;

b) That on nights of cool temperatures, night-roosting herons leave the roost earlier in the mornings; on days of cooler temperatures, day-roosting herons leave earlier in the evenings because of increased energy demands;

c) That the earlier spring migration of the Black-crowned Night Heron in New Jersey is associated with its night feeding habits and that the Green Heron is the next earliest migrant because it possesses a longer feeding day.

LITERATURE CITED

SEIBERT, H. C. 1949. Differences between migrant and non-migrant birds in food and water intake at various temperatures and photoperiods. Auk, 66: 128–153, 8 figs., 3 tables.

STONE, W. 1937. Bird Studies at Old Cape May. (Delaware Valley Orn. Club, Phila.), Vol. 1: xiv + 520, illus.

URNER, C. A. 1929–1930. Southern herons in New Jersey. Cassinia, 28: 9–14.

*Contribution No. 45 from the Department of Zoology, Ohio University, Athens, Ohio, February 21, 1950.*