

ROOSTING BEHAVIOR OF THE HERRING GULL IN CENTRAL MAINE

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COMMUNAL roosting and the environmental conditions affecting roosting have long interested ornithologists. This paper investigates the environmental factors influencing the roosting of the Herring Gull (*Larus argentatus*) population in the upper tidal reaches of the Penobscot River, near Bangor, in central Maine from July through November 1965.

Cullen (1964) reviews the roosting habit in birds and concludes that roosting affords protection and is a means of maintaining the body temperature. Wynne-Edwards (1962) feels that the primary function of roosting is to bring together the members of a bird population for a continuous seasonal epidictic ("meant for display") demonstration, similar to that which occurs during the breeding season, and that as a result of this display, adjustment and regulation of the population density occurs.

Environmental conditions affecting roosting are: time and light intensity, of primary importance in controlling roosting, with the time of roosting varying during the year as the daylight period changes; the amount of cloud cover and its effect on light intensity influences the time of roosting in some species; temperature, wind, social interactions, and other factors usually have little direct effect, but may have some indirect influence in certain situations; and, different species may vary in their response to similar environmental conditions.

METHODS

The roosts were located by observing the direction in which the gulls flew when leaving feeding areas and "clubs." "Club" is defined here as the gathering of gulls during the day when they are not actively feeding. While in the club, the gulls spent their time preening, sleeping, or otherwise loafing. The major feeding spots in this study region were the municipal refuse dumps of Bangor, Orono, and Old Town. These dumps lie in an irregular line from NNE to SSW with approximately five miles between the Old Town and Orono dumps, and three miles between the Orono and Bangor dumps. Each dump had a clubbing area close by, usually an open field within a half mile.

A banding and marking study showed that the gulls frequenting these dumps and clubs make up a relatively discrete population (Schreiber, 1965). During July and August, this population flew to a small group of rocks and an old grounded raft in the Penobscot River within the town limits of Orono (the summer roost). In September, October, and November the flight lines

from the dumps and clubs led to Pushaw Lake, a small lake five miles west of Orono (the fall roost).

Sunset was used as a constant throughout the study and observations were begun daily at two and a half hours before sunset. For recording data, this period of observation was divided into five minute intervals. All birds present at the roost were counted at the beginning of the period and individual birds were counted as they arrived throughout the observation period. Light intensity was measured with a Weston Illumination Meter (Model 756 with Quartz filter) aimed directly overhead. Observations were made so that the sky overhead and to the west was not obscured by shadows and so all directions from which the gulls arrived could be observed. Cloud cover was rated as clear (no clouds), partly cloudy, or cloudy (solid cloud cover with no breaks). Temperature was recorded in degrees Centigrade. The wind for the day was rated as calm, medium, or strong.

The five minute intervals of observation were divided into half-hour groupings for analysis. Using the total number of birds arriving on a specific day, the percentage of birds arriving in each thirty minute interval of that day was calculated. The days were then grouped according to cloud cover and the average percentage of arrivals for each type of day was calculated using the inverse sine transformation. The Orono roost was observed from 10 July to 29 August, on six cloudy, seven partly cloudy, and four clear days for a total of 17 days. The Pushaw roost was observed on 31 days from 19 September to 27 November, consisting of 14 cloudy, 11 partly cloudy, and six clear days.

OBSERVATION

Number of birds utilizing the roosts.—In Figure 1 are given for the two roosts the average number of arrivals up to dark (the time when I could no longer be accurate in counting arriving birds) for two or three days of observation. A decline in the Orono roost population occurred through July and August until 25 September, after which no birds were seen at this roost. The number of birds utilizing the Pushaw roost steadily increased during September until a peak was attained during the second week of November, but on 27 November and thereafter the Pushaw roost was not used consistently. The number of birds feeding in the study area was lowest during the first two weeks of August, when the roosting population was also the lowest. As the feeding population began to increase during the last two weeks of September, the Orono roost was at a minimum while the Pushaw roost enlarged in numbers.

From June through Labor Day weekend, Pushaw Lake is highly congested with summer residents and there is much motorboat activity even after dark

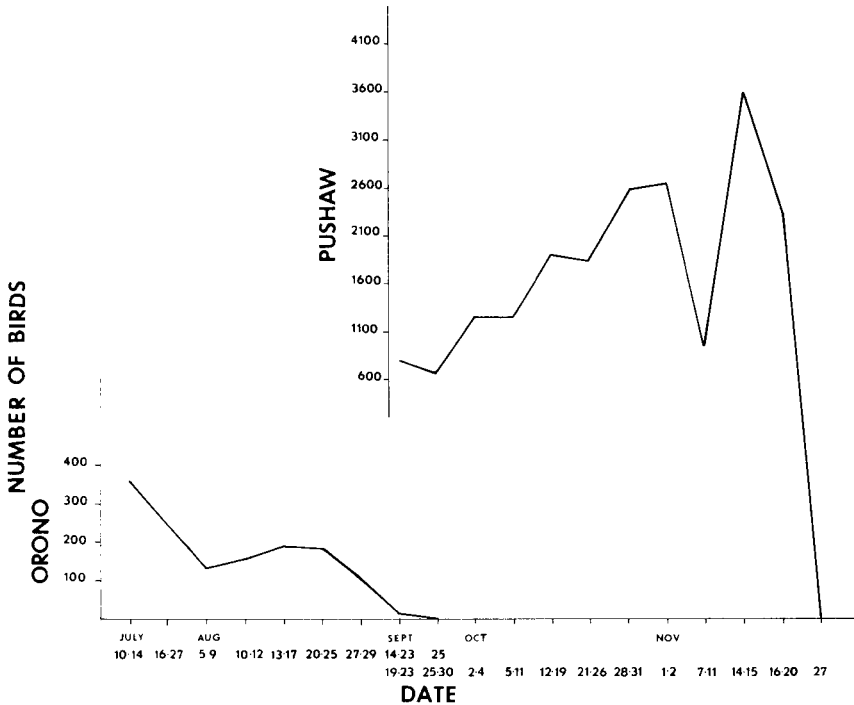


FIG. 1. Seasonal fluctuations in the numbers of gulls using two roosts near Bangor, Maine between 10 July and 27 November 1965.

making it an unsuitable roosting site. The Orono roost, on rocks in the swift flowing river, can hold only so many birds per night. During the summer the 300 to 400 gulls in the area can rest comfortably in Orono, but in the fall, when the population is building up to over 4,000 birds, they must move to a place with greater area. After Labor Day weekend, there are few boats on Pushaw Lake and the shores are relatively deserted. The gulls, a gregarious species, all go to Pushaw where the entire population can spend the night on the water in relative quiet. No birds were observed during the night on Pushaw in the summer and none came to Orono after 25 September. When the gulls left Pushaw on the morning of 27 November, after a very calm, cold night, there was a thin film of ice on the lake. That night the gulls moved down the Penobscot River to roost. During the following two weeks Pushaw was alternately open and frozen, and, depending on the condition of the water, the gulls either spent the night there or moved to the river. By 6 December the lake was completely frozen and the birds stopped going there at night.

Roosting flights.—Wind velocity and time of arrival had a pronounced effect on the mode of flight to the roost. On still days the gulls arrived at the Pushaw roost from the dumps and clubs with a direct flapping flight or with an easy flapping and gliding while overland. When over the edge of the lake, they began a long straight glide to the flock of gulls already on the water. The gulls gathered in a flock about 400 yards out from the southern edge of the lake. If the birds did not glide directly to the flock, they would fly over the flock and then spiral down to the water. At the Orono roost, the birds invariably flew over the rocks and circled back, turning their heads sideways as if picking out a suitable spot for landing. At both roosts on still days, the early flights (two hours to a half hour before sunset) were at an estimated height of 50 to 150 feet above the trees.

When the wind was blowing in the direction of the roosting flights, the birds tended to glide and soar a great deal. When the wind opposed the direction of flight, the flying appeared labored and was very erratic in its direction. The stronger the wind, the more erratic became the flight. In a strong wind, the gulls flew very close to the tree tops (5 to 35 feet). During the fall, upon reaching the edge of Pushaw Lake, the gulls would drop quickly down to about three feet above the water and then proceed to the gathering flock. Many of the gulls would fly along the lee shore of the lake until reaching the point of land nearest the flock. During windy weather the gulls flying to the roost in large flocks tended to fly less compactly than on a calm day.

During the summer the gulls tended to come to the roost, throughout the arrival period, singly, in pairs, or in small groups of between 10 and 30 birds, with a slight increase in group size near dark. During the fall, with few birds arriving early, the gulls tended to fly to the roost in massed groups, often numbering as many as 600 birds in one flock.

The summer roost flights were not as direct as in the fall and the gulls did more circling and towering on updrafts. At both seasons the gulls leaving the dumps and clubs either flew directly toward the roost at about 50 to 150 feet or would circle up to about 500 feet from whence it appeared that they glided and flapped in a straight line to the roost. This roosting flight seemed quite "purposeful" and I felt that I could tell very soon after a bird took off if it was going to the roost rather than just changing places in the dump or moving to the club.

Display flights.—During the later weeks of October and through November, as the population at Pushaw built up, there was mass circling above the roost site. At this time the early arrivals gathered together at the southern end of the lake. As darkness approached and the number of birds present

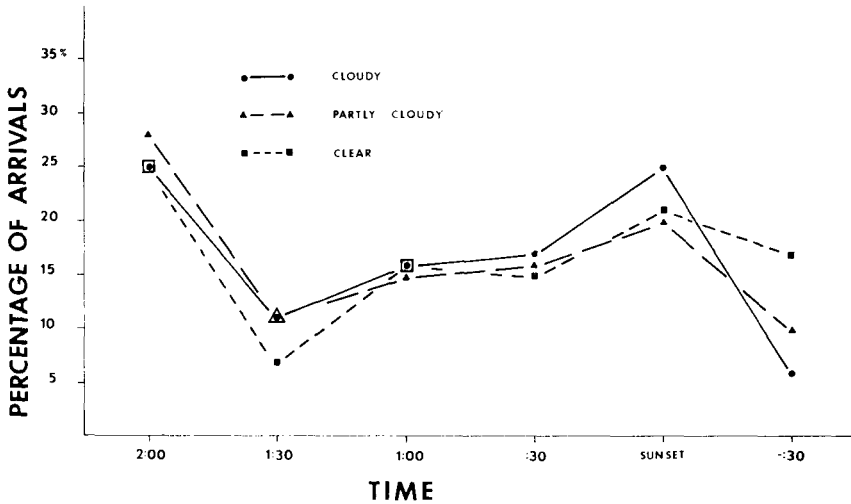


FIG. 2. Percentages of arrivals during half hour intervals with sunset as a parameter at the Orono roost by gulls between 10 July and 16 September 1965.

increased, the whole flock would rise and wheel in circles. Usually, a majority of the birds would then move north to settle farther up the lake. The remainder would settle again on the water in the original gathering site. By sunset all of the birds would have moved north and the late arrivals flew directly toward this northern congregation. At the Orono roost there was little movement within the roost once the birds had settled, and no mass display flights were observed unless the gulls were disturbed.

Pre-flight activity.—The birds leaving the club for the roost also exhibited a type of social interaction. The gulls gathered in the clubs were quite still, either sitting quietly or sleeping, during most of the afternoon. As the light failed, a number of birds would begin to preen, stretch, stand up, and walk around. It appeared as if the birds grouped closer together. The intensity of the movement increased as more birds became active and after about ten minutes of this activity a number of birds would take off and fly toward the roost. The birds which took off first were those which had been more active. Usually several birds which had not been “restless” would fly up and follow the leaders. A period of quiet would ensue and after five to ten minutes the activity would begin again and the sequence would be repeated. The number of birds leaving during each sequence increased as darkness approached until only four or five birds remained. These either left as individuals or as a group when the light intensity was near zero. Each time

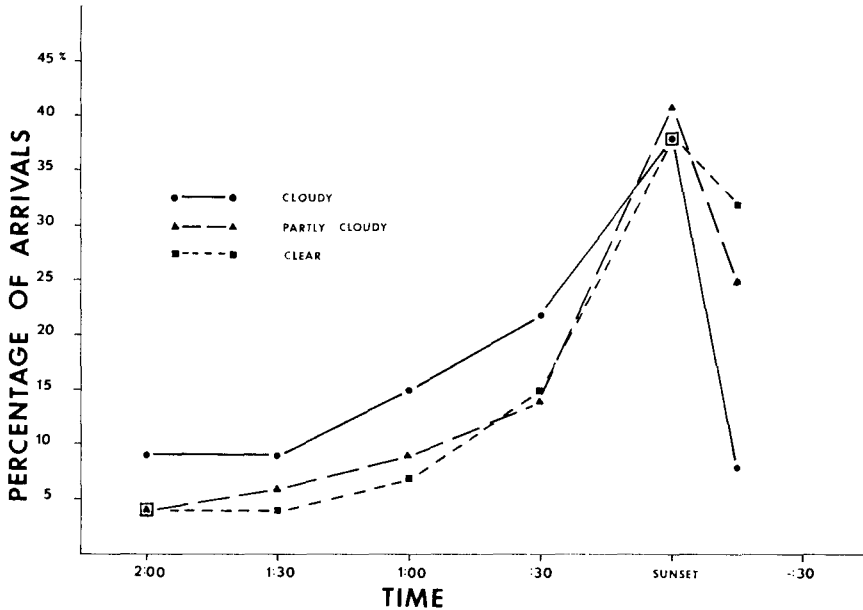


FIG. 3. Percentage of arrivals during half hour intervals with sunset as a parameter at the Pushaw roost by gulls between 17 September and 27 November 1965.

the club was observed, this type of behavior was noticed. Miskimen (1955) also found a distinct pre-roosting activity in ducks.

If the birds were disturbed (either while feeding or in the club) early in the day, the flock would take off, circle and the majority would again land and resume their activity. If the club was disturbed, all of the birds took off, circled, and landed again at a "safe" distance. Again, none moved toward the roost. This behavior was observed during the day until about an hour and a half before sunset or until a light intensity of below 900 foot candles was reached. Once this threshold was reached, and the birds were disturbed, a number could be seen heading toward the roost. As sunset approached and/or the light intensity dropped below 900 foot candles, more and more of the flock would go to the roost. It was possible on some days to disturb the birds enough so that they would all leave for the roost well before the usual time.

Roost flights and environmental conditions.—The time of roosting by the gulls in this region appears to be controlled by light intensity and the length of daylight.

Figures 2 and 3 show the percentage of the total roost population arriving

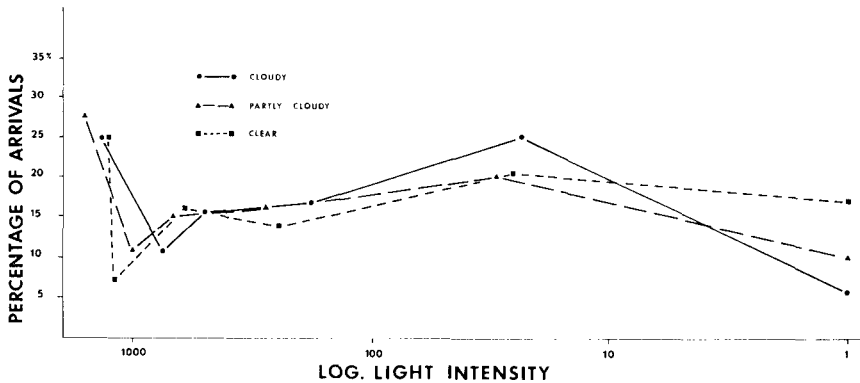


FIG. 4. Percentage of arrivals during the two and a half hours before dark plotted against the log. of light intensity measured in foot candles. At the Orono roost between 10 July and 16 September 1965.

during half-hour intervals with sunset time treated as a constant throughout the observation period. At the Orono summer roost (Fig. 2) no difference at the 95 per cent confidence level exists between the percentage of birds arriving on cloudy, partly cloudy, and clear days at the respective time intervals. At the Pushaw fall roost (Fig. 3), a significant difference exists between cloudy and clear days, $P > 0.05$. During the summer at two hours before sunset between 25 and 28 per cent of the arriving birds were already present at the roost. At the fall roost only four to nine per cent of the arriving birds were present two hours before sunset. There is a significant seasonal difference between these early arrivals, $P > 0.05$.

Figures 4 and 5 show the percentage of birds arriving during half-hour intervals, plotted against the logarithm of light intensity. At the Orono summer roost (Fig. 4) a slight peak in the arrivals was reached at sunset, but a fairly constant number of birds arrived throughout the period, with a distinct drop after sunset on cloudy days. The clear day arrivals stay quite high at the lower light intensities. A different situation exists at the fall roost (Fig. 5), however. Here, between 80 and 85 per cent of the birds arrive at the roost at light intensities lower than 300 foot candles. On cloudy days the light intensity drops from 300 to zero foot candles over a period of one hour, but on partly cloudy days and clear days the same change occurs over a period of 30 minutes (Fig. 6). The arrival percentages reached a distinct peak at sunset. Again, cloudy day arrivals dropped off distinctly after sunset but the partly cloudy and clear day percentages remained high at the very low light intensities.

During July and August the time between sunrise and sunset was 14 to

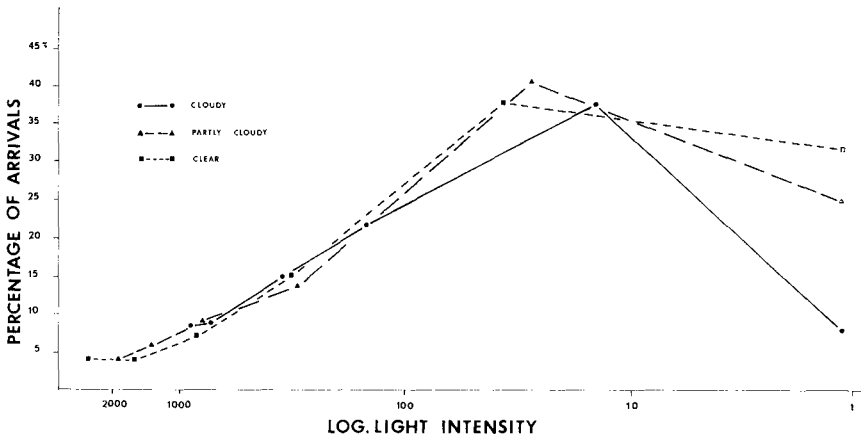


FIG. 5. Percentage of arrivals during the two and a half hours before dark plotted against the log. of light intensity measured in foot candles. At the Pushaw roost between 17 September and 27 November 1965.

15 hours. During October and November this time was 9.5 to 10.5 hours. In August, twilight lasted for 45 minutes after sunset but by the end of October it was dark within 15 minutes after sunset. As far as I was aware, all birds arrived at the roost before complete darkness and there was a distinct reduction in the number of arrivals at light intensities under two foot candles.

DISCUSSION

From the above observations we can draw some conclusions about environmental conditions and their role in affecting roosting behavior in the Herring Gull in central Maine.

Season of the year.—The season of the year has the most marked effect on the time of roosting. During the summer when the days are long and the temperature is moderate to warm, the gulls tend to move to the roost quite early relative to sunset and at times when the light intensity is high (above 2,000 foot candles). During the shorter, cool days of fall, the gulls do not move to the roost until nearly dark, when the falling light intensity causes the roosting flights to occur. There is little seasonal change in the amount of food present in the dumps in this region but with the longer foraging time available during the summer the gulls probably become satisfied more quickly than during the winter and so move to the roost when satisfied rather than remain at the feeding areas until dark. With the shortening day length and the longer, cold nights of fall, the physiological demands involved

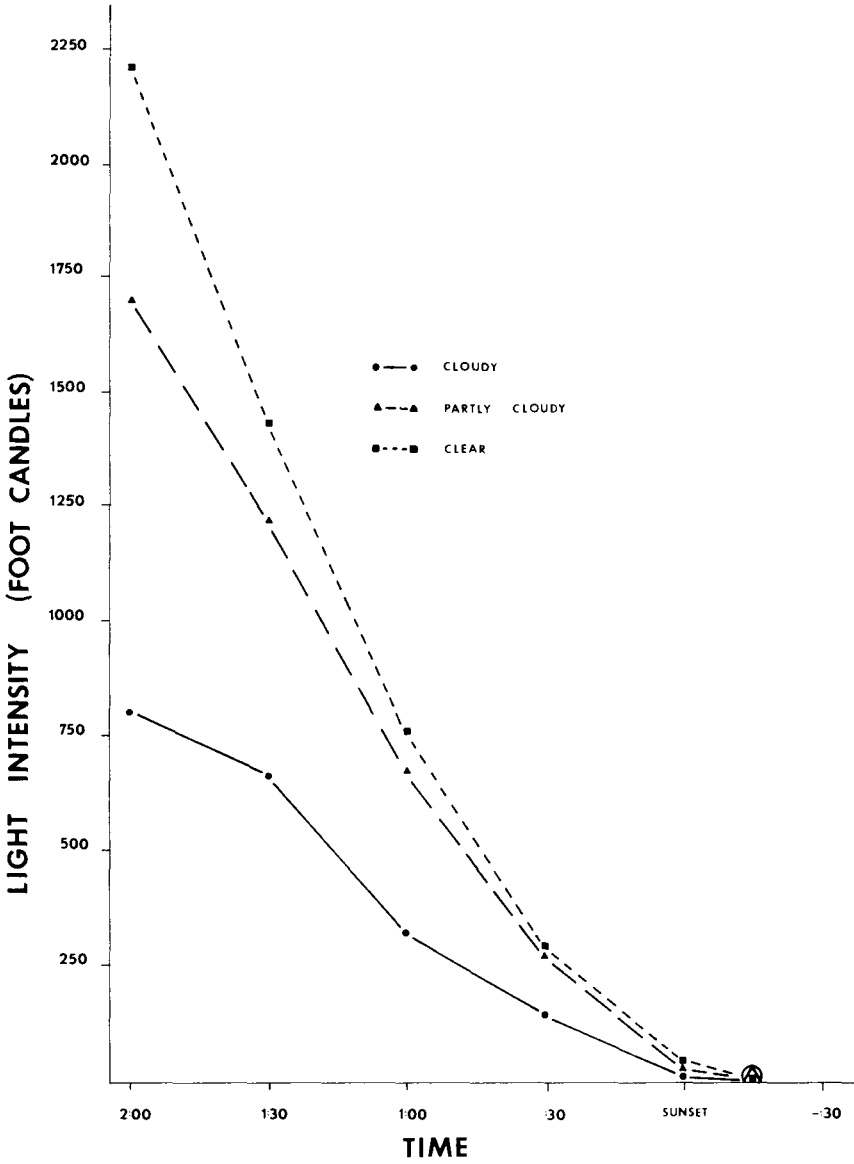


FIG. 6. Changes in light intensity measured in foot candles on cloudy, partly cloudy, and clear days during the two hours preceding sunset from 17 September to 27 November 1965.

in maintaining the body temperature are more stringent and it seems that there is an increased utilization of available light for feeding.

Light intensity.—During the fall the majority of the gulls arrive at the roost when the light intensity falls below 300 foot candles, with a peak of arrivals being reached between 115 and ten foot candles. Summer roosting does not appear to be controlled so directly by light intensity but, with approaching darkness, there is a peak in the arrivals at the roost between 50 and five foot candles. Hiller's observation (cited by Kellogg and Hutchinson, 1964) that gulls moved toward the roost during an eclipse in July but returned to feed after the light returned would confirm that light intensity may still be a factor during the summer, even though not as strong a stimulus as during the periods of shorter day length. In the summer there is no difference between clear and cloudy days in terms of rate of arrival. However, during the fall, on cloudy days significantly more birds arrive at the roost early than on clear days.

Wind, temperature, and social factors.—Wind velocity and direction appear to have little effect upon the time of roost flights. Schnell (1965) has recorded the flight speed of gulls at a breeding colony under varying wind velocities, using a Doppler type radar unit. Assuming his data will also hold for gulls away from the colony, the gulls leaving the major dump and club in this study region would take approximately 12 minutes to reach the roost on a still day, 16 minutes flying into a wind of up to 15 mph, and 8 minutes flying with such a wind. Gulls in this study area did not leave any earlier for the roost on windy days than on calm days even though it took them longer to reach the roost on such days. Temperature does not have a direct effect on roosting time but indirectly affects the time of roosting by its effects on maintenance of body temperature. Disturbances at the feeding and clubbing areas tend to cause earlier departure to roosting sites and there is an element of social interaction in the gulls leaving the clubs.

The above data suggest that there is a specific light intensity threshold for roosting in the individual gull but that this may be modified by many factors in the environment. This hypothesis cannot be verified in a field experiment but it would be interesting to test it with birds under controlled laboratory conditions.

SUMMARY

1. During the summer and fall of 1965 the roosting behavior of Herring Gulls in central Maine was studied with a view of attempting to correlate this behavior with environmental factors.
2. The summer roost was on rocks in the swift flowing Penobscot River within the town limits of Orono. The fall roost was five miles distant on Pushaw Lake.
3. During the summer the Penobscot River roost was used by up to 400 gulls but

by 25 September no birds roosted there. Beginning in September the roost at Pushaw Lake was used and by the middle of November as many as 4,000 gulls were using this roost. When the ice formed on the lake no gulls spent the night there. These changes in the location of the roost are explained in relation to the numbers of gulls in the area and the human activity on the lake.

4. A significant difference exists between the time of roosting during the summer and fall. During the summer the gulls roost earlier relative to time of sunset than during the fall. These differences are probably caused by changes in the physiological needs of the gulls and by the changes in day length.

5. During the fall the majority of the gulls arrive when the light intensities are under 300 foot candles; a peak movement is reached between 115 and ten foot candles.

6. During the summer the rate of arrival does not vary between clear and cloudy days, but during the fall significantly more birds arrive at the roost earlier on cloudy than on clear days.

7. Wind velocity and direction, and temperature do not have a direct effect on roosting time, but may have an indirect effect.

8. Social interaction and disturbances at the feeding and loafing areas of the gulls may hasten roosting flights.

ACKNOWLEDGMENTS

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