A STUDY OF THE FEEDING OF YOUNG COMMON TERNS AT ONE SITE IN ONEIDA LAKE DURING 1980

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The availability of food often limits the reproduction of birds. Food supply can affect the number of eggs laid and/or the percentage of nestlings that fledge (Lack, 1954, 1968; Ashmole, 1963). Since the abundance of food may vary during the nesting season, the exact time of nesting could affect reproductive success. In this study we looked at the rate of feeding of young by Common Terns *(Sterna hirundo)* throughout the nesting season 1980 at Oneida Lake. We observed nests that were started early, in the middle and late in the nesting season. We measured the frequency of feeding and the size of prey that the adults brought to chicks of different age. Results for 1980 show that the size of prey and frequency of visits did change during the nesting season. These results suggest that terns nesting in the middle of the 1980 nesting season had better feeding conditions. To establish the reliability and significance of our observations would require further studies in other years.

METHODS

Our study was conducted on Long Island (76° 00' N, 43° 13' W), one of several small islands located in Oneida Lake. The Common Terns nested on three separate areas of the island: at both ends and near the center portion. All our observations were made at the center colony, which covered 56 square meters.

Observations were made from a blind placed at the edge of the colony. Only one nest was watched during each 45-minute observation period. The size of the fish presented to the chick was estimated against the bill size of the adult for each feeding trip. Observations made over the length of the summer were divided into three periods. During Period I (14 June-19 June), observations were made randomly on five of these six days. During Period II (24 June-8 July), we made observations on eleven days and during Period III (13 July-26 July), we made observations on nine days. Observations during Periods II and III were made according to a predetermined rotation schedule to ensure that chicks of all ages would be observed during all hours of the day. The rotation pattern consisted of a day with a morning set of observations (6 AM - 11 AM) followed by a day of late afternoon observations (4 PM - 8 PM), followed by a day of early after-

noon observations (11 AM - 4 PM). Each set of observations was divided into four or five 45-minute periods separated by a break of 10 to 15 minutes. The chicks' ages were classified into three categories: just hatched to 3 days old, 4 to 7 days old, and 8 to 28 days old. Whenever possible, each age category was observed with equal frequency on each day and especially within the timespan of a period. Nests were flagged, numbered, and checked daily for new eggs, pipped eggs, and chicks. All chicks were banded within several days of hatching. By regular observation, it was evident that a particular chick belonged to a corresponding nest. Feeding occurred consistently at the nest or within several feet of it. The colony consisted of chicks of a wide range of ages, so chicks could be distinguished by size and individual markings.

RESULTS

Frequency of Feeding Throughout the Summer

From 24 June to 26 July 1980 the adults averaged 1.6 feeding trips per hour. The averages for the three periods of the breeding season were 2.1, 1.5 and 1.6 trips per hour from early to late in the season. The number of trips during a 45-minute observation period was highly variable, ranging from none (frequently) to as many as seven (once). The small differences in trips per hour for the three periods likely resulted from random variation. Since the method used to collect the data during Period I differed from the method used during Periods II and III, it is not appropriate to combine the data to test for a statistical difference.

Frequency of Feeding During the Day

Observations were made with equal frequency for all hours from 6 AM to 8 PM. Over the entire summer the number of trips per hour for the morning, early afternoon and late afternoon were 1.6, 1.4, and 1.6 respectively. Additionally, we were in the blind past sunset or before sunrise on a few occasions. There was no apparent difference in feeding rates during these extreme times compared to our routine times. Initially we thought that the adult terns might make more frequent trips just after sunrise, since the chicks would have fasted throughout the night, but our data show the same rate of feeding throughout the day.

Prey Length

Table I shows the length of prey items brought to chicks. For Periods I, II, and III the mean lengths were 4.6, 4.8 and 4.4 cm respectively, combining data for chicks of all ages. These results show

that the average size of prey brought to chicks during 1980 did not vary much throughout the breeding season. However, the range of prey sizes decreases dramatically from Periods II and III.[1] For example, for Period II 41% of the prey were between 4 to 6 cm, compared to 78% for Period III.

The paucity of small prey during Period III compared to II is likely due to the growth of fish hatched in that year. For example, young Yellow Perch *(Perca flavescens)* constitute a significant portion of the chicks' diet, $\bar{m}$ 27% of identified prey in 1980. The mean length of young perch caught in seine samples near areas where the terns foraged during Period II was 3.3 cm and by Period III was 4.5 cm. Other prey species also grew during this season just as the perch did. We do not know why the terns captured fewer large prey during Period III than they did earlier in the season, during Period II. Perhaps the larger fish moved into deeper water as many of the larger Yellow Perch do (Forney, 1971).

Age of Chicks *vs.* Prey Size and Frequency of Feeding

Table 2 shows the length of prey items brought to chicks of the three age categories. During Period II small chicks were fed more small prey while large chicks were fed more large prey.[2] In contrast, during Period III there was no statistical difference in the proportion of large to small prey brought to chicks of different age.

The amount of food returned to a chick is determined by both the size of prey and the frequency of visits. Table 3 shows the frequency of visits for the three age categories of chicks. During Period II, older chicks on average were fed once for every two observation periods, while younger chicks on average were fed 1.6 times for each observation period. Thus, during Period II older chicks were fed less frequently than younger chicks.[3] In contrast, during Period III, when all ages of chicks were fed prey of the same size, the feeding rates for all ages showed no statistical difference.

[1] The Chi-square contingency value obtained by combining observations for prey of 7 to 11 cm length equals 15.52 with 4 degrees of freedom which has a less than 1% chance of resulting from random variation. See Table 1.

[2] The Chi-square contingency value equals 14.56 with 2 degrees of freedom and has less than a 1% chance of resulting from random variation. See Table 2.

[3] The Chi-square goodness of fit value assuming equal frequency of visits to each age category is 14.80 which has less than a 1% chance of resulting from random variation. See Table 3.

Table 1. Length of prey brought to chicks during the three periods of the breeding season; n is the number of times a prey of a given length was observed.

	Period I		Period II		Period III	
	(n)	(%)	(n)	(%)	(n)	(%)
Prey Length (cm)						
2-3	7	32	14	36	6	17
4	6	27	9	23	18	50
5	2	9	5	13	5	14
6	4	18	2	5	6	17
7	2	9	3	8	0	0
8-11	1	5	6	15	1	5
mean	4.6		4.8		4.4	

Table 2. The length of prey brought to chicks of different age during Period II and Period III; n is the number of times prey of a given length was observed.

Period II	Chick Age (days)		
	1-3	4-7	8-28
Prey Length (cm)	(n)	(n)	(n)
2-4	10	10	3
5-11	1	8	7
mean	3.6	4.6	6.7
Period III			
Prey Length (cm)			
2-4	4	5	15
5-11	2	4	6
mean	4.7	4.8	4.3

Table 3. The frequency of feeding for 3 age categories of chicks during Period II and Period III.

	Chick Age (days)		
Period II	1-3	4-7	8-28
	(n)	(n)	(n)
Number of feeding trips	11	18	10
Number of observation periods	7	9	20
Period III	1-3	4-7	8-28
	(n)	(n)	(n)
Number of feeding trips	6	9	21
Number of observation periods	8	10	19

DISCUSSION

There are two reasons to suspect that in 1980 the food supply during Period II was better than during Period III. It is probably advantageous to bring small prey to small chicks. On several occasions we observed that the very young chicks attempted but did not or could not eat some larger prey items brought by the adults. The time between feeding trips in 1980 was highly variable but averaged 40 minutes. A chick of a three-chick nest would be fed on average about every two hours, and if it missed a feeding trip because the prey was too large, it might be four hours between feedings. With bad weather, or for the youngest or least aggressive chick of a three-chick nest, a missed feeding could contribute to their higher death rate (Langham, 1972). In this event, the scarcity of small prey during Period III would be detrimental).

Furthermore, an advantage may result when adults are able to bring back larger prey for older chicks. The weight of young fish increases approximately in proportion to the cube of their length. Weights of some of the prey fish could be estimated when the species of fish was recognized. Very tentative calculations suggest that during Period II older chicks received a greater total weight of prey than younger chicks, despite the fact that the adults made trips less frequently.

Our data suggest two remarkable adaptations of adult terns in selecting prey. Small prey are selected for small chicks when small prey are available. On the other hand, the adults sometimes select larger prey for the older chicks, thus reducing the number of trips necessary to supply the same or more food to older chicks, and probably conserving adult effort.

Our results during 1980 may show the adaptations of terns to relatively poor feeding conditions. In Oneida Lake young Yellow Perch are usually very abundant, such that the weight of young perch is usually greater than the summed weight of all other young fish (Forney, 1974). However, in 1980 young perch abundance was the 6th lowest in 21 years of study (Forney, pers. comm.). Even during this relatively poor year young perch were still a significant portion of the chicks' diet. It would be interesting to compare our results to the feeding of chicks during normal years when the young perch might be two to five times more numerous.

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LITERATURE CITED

Ashmole, N. P. 1963. The regulation of numbers of tropical oceanic birds. *Ibis* 103b: 458-473.

Forney, J. L. 1971. Development of dominant year-classes in a yellow perch population. *Trans. Am. Fish. Soc.* 100: 739-749.

Forney, J. L. 1974. Interactions between yellow perch abundance, walleye predation, and survival of alternate prey in Oneida Lake, New York. *Trans. Am. Fish. Soc.* 103: 15-24.

Lack, D. 1954. *The Natural Regulation of Animal Numbers.* Clarendon Press of Oxford Univ., London. 343 pp.

Lack, D. 1968. *Ecological Adaptations for Breeding in Birds.* Methuen, London, 409 pp.

Langham, N. P. E. 1972. Chick survival in terns. *Sterna* spp. with particular reference to the Common Tern. *J. Anim. Ecol.* 41: 385-395.

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