Crecienteros, a vernacular name alluding to the fact that they appear at the season of the annual rise of the Orinoco." I tried to trace where the Dwarf Cuckoo goes during the dry season. But the dates and collecting localities of the 12 specimens in the Phelps Ornithological Collection (Caracas), added to literature references, and my own and other's sightings ($n = 22$), did not reveal a clear seasonal migration or regular dispersal pattern.

Nevertheless, I believe that the climatic extremes of the Venezuelan *llanos* probably control the food for the seasonal cuckoos, but not for the resident species.

I am grateful to Tomás Blohm for the opportunity to study birds on Masaguaral, to William H. Phelps, Jr. for access to the Phelps Ornithological Collection, to Charles T. Collins who made useful suggestions on an early draft and to two referees for their thoughtful reports.

Apartado 80844, Caracas 108, Venezuela. Accepted for publication 30 June 1977.

Condor, 80:106–109

COMMON TERNS RAISE YOUNG AFTER DEATH OF THEIR MATES

IAN C. T. NISBET

KAREN J. WILSON

AND

WILLIAM A. BROAD

Like most sea-birds, Common Terns (*Sterna hirundo*) are monogamous breeders: close co-operation between mates is required for successfully incubating the eggs and for feeding and brooding newly-hatched young. However, once the chicks are old enough to regulate their body temperature, continuous parental care is not required and they can be raised by one parent if sufficient food is available. In seven years of study, Nisbet has not witnessed a single case in which a Common Tern failed to feed or care for its young. However, in 1975 we had an unusual opportunity to record the performance of two single parents after their mates died when their chicks were 7–11 days old.

We studied 56 pairs of Common Terns in a colony of about 2,200 pairs on Monomoy Island, Massachusetts (41°38′N, 69°58′W). Study plots were checked at least once daily throughout the season. Nests and eggs were marked when first seen, and chicks were banded on the day of hatching, so that the order of hatching within each brood was known. The first, second, and third chicks in each brood were denoted A, B, and C, respectively. Forty-six broods were enclosed within a low wire fence for detailed studies (Nisbet and Drury 1972); the chicks in these broods were weighed daily until they died or fledged. The colony was exceptionally productive in 1975 (Nisbet 1976b): most of the A- and B-chicks and about half of the C-chicks fledged successfully (Table 1).

We found the female parents at two adjacent nests, numbered 86 and 136, dead on 25 June and 12 July respectively. On autopsy both birds were diagnosed as having died of poisoning by an unidentified toxic agent. Judging from the growth patterns of her chicks (Fig. 1), the female at nest

TABLE 1. Breeding performance of two pairs of Common Terns whose females died, compared to that of 54 other pairs in the same colony (Monomoy, Massachusetts, 1975).

Pair	Egg	Fresh weight	Date laid	Date hatched	Weight and rank[1] of chick at age 6 days		Outcome	
86 (♀ died 25 June)	A	21.1	25 May	15 June	53.5	31/44	Fledged	15 July
	B	21.9	27 May	16 June	58.5	11/40	Fledged	13 July
	C	20.3	29 May	18 June	40	17/25	Died	27 June
136 (♀ died 12 July)	A	20.9	9 June	1 July	57	24/44	Died	23 July
	B (only 2 eggs)	19.4	11 June	2 July	57	15/40	Fledged	31 July
Median of 54 other pairs	A	20.7	28 May	19 June	58		47/51	Fledged
	B	20.6	29 May	20 June	55.5		43/49	Fledged
	C	20.0	30 May	20 June	46.5		17/31	Fledged

[1] Rank relative to 44 A-chicks, 40 B-chicks and 25 C-chicks weighed in the colony at the same age.

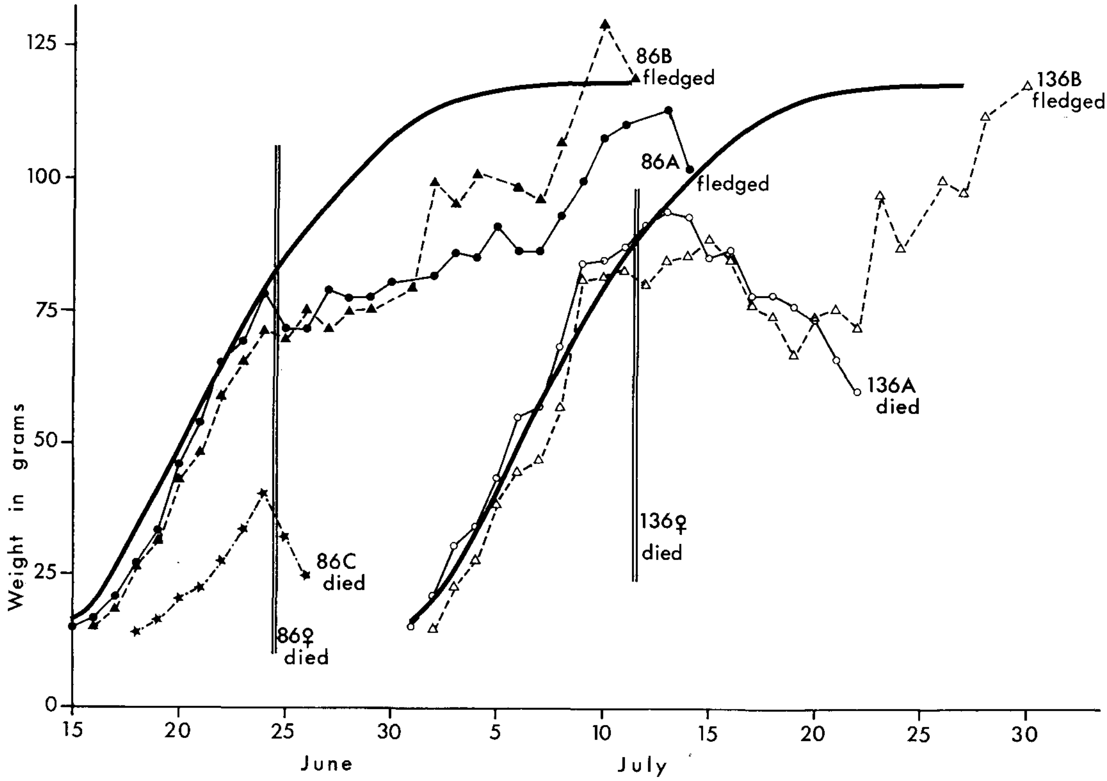

FIGURE 1. Daily weights of Common Tern chicks in broods 86 (left) and 136 (right). Circles: A-chicks. Triangles: B-chicks. Stars: C-chick. The double vertical lines mark the dates when the female parents died. The heavy solid lines show the average growth patterns of 46 A-chicks weighed daily in the same colony (Monomoy, Massachusetts, 1975).

86 had been feeding them effectively until the day of her death, but the chicks at nest 136 stopped growing rapidly two days earlier. The deaths of these birds at adjacent nests were probably coincidental: we found only eight other adults dead in this large colony during the entire season.

At nest 136, the chicks had been growing slightly faster than the average for the colony until 9 July (Fig. 1, Table 1). Their growth was then checked abruptly, and although their weights were maintained until 16 July, both then lost weight until the older chick (136A) died on 23 July. During this period the male parent fed both chicks, but in 13 hours of observation between 19 and 22 July he brought only 16 food items (1.2 items h^{-1}), mostly small fish or shrimps. For comparison, 9 males studied earlier in the season had brought food to their chicks at an average rate of 1.92 items h^{-1}; these food items were almost all larger fish. After the older chick died, the male brought food more rapidly—25 items in 11 hours of observation (2.3 items h^{-1}) on 23, 26 and 28 July. The younger chick (136B) then grew rapidly and eventually fledged at the age of 29 days, several days later than normal. There was destructive competition for food between the siblings, compounded by the small amount of food brought by the male prior to 23 July.

At nest 86 the growth rates of the chicks had been close to average through 24 June (Fig. 1, Table 1). After the death of the female parent the youngest chick (86C) declined immediately and died within two days; the other two chicks stopped growing. On 3 July the younger chick (86B) overtook the older (86A) and fledged on 13 July at age 27 days. 86A grew very slowly until 7 July, but then improved and eventually fledged on 15 July at age 30 days.

We watched this brood at close quarters from a blind on six days (Table 2). On 29–30 June and 6–7 July the male parent (86♂) brought comparatively little food, averaging 1.1 items h^{-1}. Although most of the food it brought was taken by the younger chick (86B), even this chick grew appreciably on only one day (Fig. 1). At this period other parents were bringing food more slowly than the seasonal average: the mean feeding rate of 9 other males on 27–28 June was only 1.39 items h^{-1}. Some chicks in

TABLE 2. Performance of the male Common Tern at nest 86 in feeding its chicks after the death of its mate.

Date	Hours watched	Food items fed by male to 86A	86B	Total	Items stolen by 86A
29 June	3.0	1	3	4	0
30 June	1.5	0	2	2	1
6 July	2.0	0	2	2	2
7 July	3.2	0	3	3	8
8 July	2.0	2½	2½	5[1]	0
9 July	1.4	2	2	4	0

[1] One fish was torn in half by the two chicks in a competitive struggle.

other broods grew slowly or lost weight in this period and several died.

By 30 June, the older chick (86A) had almost stopped begging for food from its parent, and on 30 June and 6–7 July it spent almost all of its time trying to steal food from neighboring broods. It habitually stood in the open 2–3 m away from the other broods, waited until an incoming parent landed with a fish, and then dashed in and tried to seize the fish at the moment when it was passed to the other chick. On a few occasions when it ran in too early, the incoming parent flew off again with the fish, or 86A was attacked and driven off by another adult. It concentrated on stealing fish from chicks of its own age or slightly younger: it was less successful in stealing from much smaller chicks (including those at nest 136) because they were more effectively guarded by their parents. Its technique was generally effective, and during 6.7 h of observation it succeeded in stealing 11 fish in 39 attempts, thereby obtaining more food than its sibling did from 86♂ (Table 1). However, while seeking food in this way it was repeatedly attacked and severely pecked by the parents of the chicks from which it stole fish, and by parents from neighboring territories into which it intruded. It was sufficiently injured on the back and head to cause lasting disarrangement of the feathers, still visible three weeks later.

On 8 and 9 July, 86A had returned to its territory and was again seeking food primarily from its parent. 86♂ was then bringing more fish of substantially larger size than on the preceding days (Table 2). He successfully fed both chicks; they thereafter grew rapidly and fledged on 13 and 15 July. We had color-marked both chicks and saw 86A frequently flying in and out of the study-plot until 31 July, 16 days after fledging (see Nisbet 1976a): there 86♂ fed it at intervals until at least 28 July. 86B was also fed in the study-plot by 86♂ until at least 20 July.

Nisbet had already studied the breeding performance of 86♂ in the preceding year: he had banded it (no. 782-82103) on its nest on 16 June 1974 and had retrapped it on 31 May 1975. In 1974 86♂ and its mate were one of 7 among 39 pairs studied which raised 3 chicks to fledging. They laid early (in the second or third decile for the colony), laid large eggs (ranked 7th of 30 pairs based on total clutch weight), and fed their chicks efficiently (ranked 5th of 22 pairs based on combined growth rate of the 3 chicks). In 1975 this bird and its mate again laid early, laid large eggs, and the early growth rates of their chicks were about average (Table 1). This male was an exceptionally heavy bird, weighing 140 g in 1974 and 143.5 g in 1975: these are the second and third highest weights Nisbet has recorded for incubating adults, excluding gravid females (Nisbet 1977). By contrast, the birds at nest 136 were among the last to lay in 1975 and laid only two eggs, whose average size was below the mean for the colony (Table 1). Although their chicks grew slightly faster than the colony mean up to 9 July (Fig. 1), they were feeding only two chicks and they were probably bringing less food than the average for the parents studied in 1975.

DISCUSSION

The history of these two families illustrates several features of the breeding biology of Common Terns:

1. The availability of food appears to be an ultimate factor limiting the number of young that can be raised. In the absence of predation, most deaths are attributable to starvation (Nisbet, in press). After the deaths of the female parents at nests 86 and 136, their chicks ceased growing abruptly (Fig. 1). Although 1975 was an exceptionally favorable year at this colony, as judged by the survival and growth of the C-chicks (Table 1; Nisbet 1976b, in press), the surviving males were unable to bring enough food to sustain growth of even two chicks (Fig. 1).

2. The number of young raised is further limited by the competence of the parents. Previous studies have suggested that the ability of the male to catch fish and bring them to the female (prior to egg-laying) and to the chicks is associated with early laying, large clutches, large eggs, rapid growth and survival of the chicks (Nisbet 1973, 1977). As judged by these criteria, the performance of 136♂ was probably below average, and this male was able to raise only one chick alone. 86♂ was above average accordingly, and was just able to raise two chicks alone, although he probably would not have done so but for the enterprise of 86A in securing food for itself when food was scarce.

3. Siblings compete intensely for the food brought by the parents. Asynchronous hatching is often regarded as an adaptation to limit the destructive effects of this competition. At times of scarcity all the food is channelled to the older siblings, so that none is wasted on the smaller chicks, doomed to starve anyway (Lack 1954, Nisbet and Cohen 1975). This is illustrated by the fate of 86C, who was eliminated promptly after the death of one parent (Fig. 1). However, the hypothesized mechanism did not work well for the A- and B-chicks in either brood. In each case there appears to have been destructive competition for the limited food; all four chicks suffered severe growth retardation, and in each brood the B-chick eventually grew the best (Fig. 1). Under these circumstances, in which both chicks were well grown and vigorous at the time when their food supply was curtailed, the small difference in age and size appeared insufficient to give the older chick a decisive edge in competition. In more normal circumstances, when food is limited from the start, A-chicks usually gain an early competitive advantage over B-chicks, and if only one chick survives from a brood it is usually the A-chick.

4. Stealing food from chicks in neighboring broods is often a profitable method of foraging, and is frequently attempted both by adults and chicks, especially when food is scarce. It probably helps to limit breeding success, because it requires parents to devote time that could otherwise be spent foraging to defending their broods from thieving neighbors. However, the case of 86A is one of only two or three cases we have observed in which food-stealing clearly made the difference between life and death for an individual chick. This chick stole food from at least five neighboring broods: C-chicks in two of these broods died from starvation during this period and it is likely that the activities of 86A contributed to their deaths. Chick 86A was successful because it was one of the oldest chicks in the colony. By contrast, the chicks at 136 were the youngest in the plot; even when starving, they made only a few weak and ineffective attempts to steal food from their older neighbors. This illustrates a subtle advantage that accrues to early-hatched chicks.

SUMMARY

Two female Common Terns (*Sterna hirundo*) died of poisoning when their chicks were 7–11 days old.

Their mates continued to feed the chicks: one male raised two to fledging while the other raised only one. This difference in success reflected differences in performance between the males as judged by other criteria. One chick survived a period of food-shortage by stealing fish from neighboring broods. These observations show the importance of food availability and parental competence in breeding success, the role of asynchronous hatching in limiting destructive competition between siblings, and the importance of food-stealing in competition between families.

We thank G. Faddoul of the Suburban Experiment Station, University of Massachusetts, for conducting the autopsies, and the Patuxent Wildlife Research Center, U.S. Fish & Wildlife Service, for pesticide analyses. This work was supported by a grant from the Frederick W. Beinecke Fund. This note is Contribution no. 147 from the Scientific Staff, Massachusetts Audubon Society.

LITERATURE CITED

LACK, D. 1954. The natural regulation of animal numbers. Clarendon Press, Oxford.

NISBET, I. C. T. 1973. Courtship-feeding, egg-size and breeding success in Common Terns. Nature 241:141–142.

NISBET, I. C. T. 1976a. Early stages in postfledging dispersal of Common Terns. Bird-Banding 47:163–164.

NISBET, I. C. T. 1976b. Returns from terns. Massachusetts Audubon Society Newsletter 15(8): 3–5.

NISBET, I. C. T. 1977. Courtship-feeding and clutch-size in Common Terns (*Sterna hirundo*), pp. 101–109. *In* B. Stonehouse [ed.], Evolutionary ecology, Vol. 2. Macmillan, London.

NISBET, I. C. T. Dependence of fledging success on egg-size, parental performance, and egg-composition in Common and Roseate Terns, *Sterna hirundo* and *S. dougallii*. Ibis, in press.

NISBET, I. C. T., AND M. COHEN. 1975. Asynchronous hatching in Common and Roseate Terns, *Sterna hirundo* and *S. dougallii*. Ibis 117:374–379.

NISBET, I. C. T., AND W. H. DRURY. 1972. Measuring breeding success in Common and Roseate Terns. Bird-Banding 43:97–106.

Massachusetts Audubon Society, Lincoln, Massachusetts 01773. Address of second author: 437 NW 16th Street, Corvallis, Oregon 97330. Address of third author: P.O. Box 3541, Stanford, California 94305.
Accepted for publication 14 July 1977.

Condor, 80:109–111

DESERTION OF NESTS BY BLUE GROUSE

FRED C. ZWICKEL

AND

ROBERT G. CARVETH

Interpretation of the significance of nest desertion seems to be a recurring problem in studies of nesting success. It is difficult to determine whether desertion is an artifact of one's methods or a natural phenomenon (Patterson, The Sage Grouse in Wyoming, Sage Books, 1952; Sowls, Prairie ducks, Stackpole, 1955; Zwickel, Condor 77:423–430, 1975). As well, the time in the nesting cycle at which desertion might occur has potential theoretical implications.

We recently reanalyzed the data presented by Zwickel (1975) for nesting success of Blue Grouse (*Dendragapus obscurus*) on Vancouver Island, along with additional samples from 1974, 1975, and 1976. Larger samples allowed us to make a more detailed analysis, which provides a better opportunity for interpreting the significance of desertion.

Study areas were the same as before (Zwickel 1975) and methods and terminology were essentially the same. The only exceptions were cases where nests were deserted prior to the loss of all eggs, in which the eggs were disappearing one by one. We now classify these cases as predation rather than desertion. Unless specified, all nests were active when found.

We separated all nests as to whether they were found during laying or incubation (Table 1). Of 22 nests that were deserted, 21 were found prior to incubation. Only three times was a female that deserted seen on the nest after first contact, and in only one case was another egg laid.

TABLE 1. Fate of active Blue Grouse nests in relation to whether found during laying or incubation, 1963 to 1976.

	Number of nests	Percent
Found during laying	51	
No. deserted	21*	41
No. to predation	16	32
No. hatched	14	27
Found during incubation	113	
No. deserted	1	1
No. to predation	36	32
No. hatched	76	67

* One nest found during laying was deserted during incubation.

The number of eggs in a nest at the time of desertion seemed to affect whether the female deserted or not (Fig. 1). Over 90% of nests found with less than four eggs were deserted, but only 40% of those with four or more eggs ($P < 0.01$). Of nests in which incubation had begun, only two were deserted and these could easily have been situations where females were killed away from the nest. Of all nests found during laying, 27% hatched, compared to 67% of those found during incubation ($P < 0.001$); the majority of losses during laying were a result of desertion (20/36, Table 1). Of 215 nests (active and inactive) located from 1969 to 1976, only 3 had been