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A STUDY OF THE MATING OF THE COMMON TERN (*STERNA H. HIRUNDO*).¹

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Fifteen years ago, incident to seasonal studies carried on by the Austin Ornithological Research Station in the Cape Cod, Massachusetts, colonies of nesting *Sterninae*, minor occurrences, such as the repeated occupancy of isolated sites by one or two pairs, suggested that mating might not be a casual affair with all pairings being made annually, uninfluenced by preceding alliances. As, through the following years, the behaviour pattern of this species was revealed with progressive clarity, particularly its most fixed and important trends, there gradually developed a concept that many Common Terns remain mated over a considerable part of their life span. In fact, it became increasingly apparent that most of the more important known habits could not function if an extensive, seasonal interchange of mates occurred. Accordingly, measures were instituted for the acquisition of data which might make possible a fairly correct evaluation of this theory.

For four years, 1943 through 1946, field work was carried on in the Cape's colonies of breeding terns for the identification of mated pairs, and their recapture following seasons. This work yielded the records of 122 known mated pairs of which one or both members nested from two to four different seasons during this interval. These pairs nested a total of 272 times, 215 with the mating unchanged, 57 with the substitution of a new mate. Consequently, 79.1 percent of the time there was a persistence of the original pairing from one season to the next. There were eight instances when only one member of the original pair was retrapped the second year, the same bird being caught again the third year but with a new mate. Since it is not known whether the new alliance was formed the final or the intervening year, to avoid uncertainty, the eight have not been included in the total of 215. Their addition would raise the foregoing percentage to 81.9. This high rate appears to warrant the postulation that Common Terns tend to remain mated from year to year. While the totals on which this inference is

¹Contribution number 42 by the Austin Ornithological Research Station.

based are small by comparison with the large aggregate from which other behaviour habits of the species have been deduced, the affirmative percentage is higher. For that matter, subsequent analysis of several thousand returns did not alter materially conclusions which had been drawn from a mere twenty-nine returns by O. L. Austin, Jr. (1929).

It is not known precisely at what age, when or where Common Terns choose their mates but prolonged observation appears to show that the pairing of at least a majority of the component individuals antedates the arrival of a colony at its nesting site. The first comers show a definite, though not comprehensive, alignment into *pairs*. This arrangement continues in evidence during the early actions of the flock; while they are idling along the shore lines, during their innumerable flights over the ternery and while they are making visits to suitable terrain for the purpose of selecting nesting sites. Sixty-seven years ago William Brewster (1879) wrote: "A few days after the advent of the Little Strikers [Least Terns] . . . the Wilson's (Common) and Roseate begin to appear. They are already mated." Similar observations have led more recent investigators to believe that some terns were mated prior to their return and to surmise that sometimes mating continues unchanged from year to year (Marples, 1934: 63-107, Palmer, 1941: 35-63). These writers, however, appear to think that a relatively large number of single birds select mates after they have reached the terneries. Also that to this end, unmated individuals resort to what has been designated "courtship behaviour." The term courtship comprises "nuptial flights," "posturings," play of various sorts with a fish as the toy, making scoop holes and other procedures. Issue is taken with that opinion. Aside from collecting, the only satisfactory evidence of mating is finding two identified individuals, and no other bird, incubating a specific clutch of eggs. Further, it should not be assumed that a bird unaccompanied by another even the greater part of the time is unmated; conclusive findings to the contrary are available. Until two individuals known beyond doubt to be unattached are found mated subsequent to their exhibition of courtship behaviour it can be stated only theoretically that this behaviour influences mating. Far less justifiable is an assumption that a bird exploiting it is unmated. Unquestionably courtship behaviour is an essential prelude to copulation, much in evidence not only during the first part of a nesting but also when a considerable number of frustrated birds are about to lay second clutches. Much better is considering courtship behaviour a misnomer in the absence of an explicit statement that its definition does not apply to an initial formation of at least a seasonal partnership.

It has been shown (Austin, 1940: 162; 1945: 25; 1946: 24) that the individuals comprising the Cape Cod group of terns tend to maintain, from year to year, the same alignment into colonies, also that each of the colonies is inclined to return seasonally as a unit to the site it had

occupied the preceding year. From this there are always deviations, sometimes minor, occasionally extensive. As a rule they are due to yearly variations in the topography and ecology of the terneries; at times they result from exigencies of diverse sorts; occasionally they are of unknown causation. As a rule, such divergences are only seasonal; there is always a definite trend, in following years, toward a resumption of the original colonial affiliations and site occupancies. Further, many individuals return habitually from season to season to reneest in the same sector of a ternery.

For the purpose of orientation concerning this particular behaviour, the exact location of 176 nests on Tern Island was determined by measurements made from permanently placed markers. The birds occupying these nests were trapped and identified. The findings were recorded on a map drawn to scale. The following years this same part of the ternery was retrapped thoroughly; all nests were located and mapped in the same manner; the band numbers of the tenanting birds were determined and recorded. In addition, the same procedure was duplicated in other sectors of the island until data relating to 835 nests had been obtained. The details and results of this undertaking have not yet been published but it was found that not only had a considerable percentage of the birds returned to the close vicinity of their former occupancies but even that several had relocated within a foot or two of their previous sites.

Necessarily, the following research was based on the capture of mated pairs and their identification with numbered Fish and Wildlife Service bands. This procedure was simplified by the fact that the Common Tern, aside from its predominant habit of colonial nesting, is absolutely non-communistic in all its breeding activities. In 1943, on that part of the old and very large rookery at Tern Island, where the terrain was essentially of the type known to be preferred by this species, a quadrat seventy-five feet square was marked out with stakes. This tract was selected because it was known to be tenanted largely by older and consequently more stably behaved members of the colony. The quadrat was subdivided equally into sixteen smaller squares. On May 24th when the preponderance of the birds already had selected nesting sites and when egg laying was well under way, a blind was erected on an unoccupied place near the middle of one boundary. As completely as it was found to be possible, all birds nesting within the quadrat or in its immediate vicinity were trapped and banded, their nest sites mapped and the identifying band numbers recorded. To facilitate the recognition of these birds in this and future years, and particularly to increase the likelihood of recapturing any which, consequent to frustration, might reneest elsewhere on Tern Island or in a different ternery, a colored celluloid band was affixed to each left leg. (This Station applies all Service bands to the right leg.) The same procedure was carried out on a small, ovoid hummock or islet, fifty-four by twenty-seven feet in

size, fifty feet west of the island's upland and elevated about three feet above the surrounding marsh. This second site was selected because it has been always more closely tenanted than any other part of Tern Island and for the reason that, like the quadrat area, the majority of its occupants were relatively older birds. Also it had excellent natural boundaries.

At the close of the season it was found that the usual thwarting and reneesting had taken place. Doubtless some of this was consequent to the great amount of continuous time it was necessary to spend in the quadrat and close to the islet in order to complete the capture of both members of some pairs. In 1943 nine color banded individuals were retaken at Tern Island or in other colonies; four of these individuals constituted two pairs mated as they had been in the initial attempt. It is a suggestive fact that not once during the four years of study was a reneesting bird retaken the same year with other than its original mate for the year.

In 1944, the quadrat and islet were worked exactly as they had been the preceding year. In addition, a second quadrat, fifty feet square, was laid out one hundred yards distant from the first. This and a second islet, smaller and fifty feet away from the first hummock were utilized similarly. The complete frustration and wholesale dispersal of the Tern Island colony coincident with hatching (Austin, 1946), brought this work to an abrupt and premature close. To offset this and establish an extensive foundation for a continuation of the investigation subsequent years, throughout the remainder of the season, at Tern Island and in the other colonies as well, much time was devoted to the capture and color banding of mated pairs. The numbers of the Service bands and the colors of the celluloid bands were recorded but not the exact location of the nests in the terneries. From the inception of this study bands of a different color were used in each of the experimental tracts and rookeries.

Identical field work for the acquisition of data was carried out in 1945 and 1946. The results, by reason of such serious obstacles as shortage of personnel and erosion of parts of both quadrats, were far less voluminous than had been anticipated and desired.

Incident to the large scale adult trapping this station carries on each season in all the colonies, it is not unusual, especially when only part of a clutch of eggs has hatched, to take mated pairs under a trap. All pairs caught were given celluloid bands and included in the totals. Whenever in the course of this routine work a color banded bird was taken, persistent efforts were made to determine its mate.

The following table, number 1, correlates and totals the takes of known mated pairs. While most of the data were secured at Tern Island, the small percentages acquired elsewhere are included in the totals without segregation according to sites.

TABLE NUMBER 1

Year	Nests, Mated Pairs and Single Member of Pairs Identified			Individuals Taken			Banding Status of Birds Taken	
	Nests	Pairs	Singles	Pairs	Singles	Total	Returns	Un- banded
1943	176	134	42	268	42	310	199	111
1944	835	566	269	1132	269	1401	840	561
1945	109	57	52	114	52	166	135	31
1946	155	104	51	208	51	259	174	85
TOTAL	1275	861	414	1722	414	2136	1348	788

The capture of mated pairs proved to be an arduous, tedious, often impossible task particularly in the matter of securing all birds nesting in the quadrats or on the islets. Even more difficult was the locating and trapping of the pairs which returned subsequent seasons to nest outside the experimental areas or in other than their original terneries. Most troublesome and least productive were efforts to recapture both members of pairs reneesting the same season. The total of known pairs could have been increased to considerable numbers, as was done in 1944, by retrapping repeatedly nests located indiscriminately through the rookeries using from thirty to eighty traps simultaneously. The percentage of recoveries found to accrue subsequent years was too insignificant to warrant repeating the procedure. Several handicaps impeded the work, some of considerable magnitude; a few were obvious, others were learned by experience. The aggregate of these was sufficient to account for the comparatively small quantity of data obtained in return for the amount of time spent in their acquisition.

Always about one-third of the tenants of the quadrats and islets were taken promptly with the automatic traps this station employs for routine adult trapping (Austin, 1938: 17). Many more could have been caught with an automatic trap devised by station personnel a few years ago. It captured every bird which returned to a nest over which it had been placed, but after a few days its use was discontinued for it frequently broke eggs or injured birds. So, for securing the remaining two-thirds, it was necessary to resort to drop traps operated by pull strings manipulated from a blind or some nearby cover. This is slow, time consuming work for not more than ten such traps can be managed properly at one time. Often even this was futile; in 1943 only one bird was taken from each of thirty-three of the one hundred and twenty-five nests in the quadrat, twelve of the fifty-three nests on the islet, a failure of 25.5 percent. Some birds would never return to a clutch partly covered by a trap of any sort but would resume incubating soon after the trap had been removed. Also, after the application of variously colored bands had made possible the sight identification of individuals, it was observed that with surprising frequency the greater part of incubation was carried on consistently by one member of a pair. Often a

tern would not walk under a trap unless its mate was present and patently encouraged the act. One occupant of a nest within a few feet of the blind was taken fourteen times before its mate was secured.

Meteorological conditions determined the extent of each day's accomplishment as the amount and consistency of incubation essential to the welfare of the eggs is governed by the temperatures of both the air and the ground. The degrees of these are varied considerably, with the presence or absence of sunshine and the direction of the wind. Observation has shown that a colony incubates more intensively on either very hot, calm days or when a strong, chilling wind blows in from the ocean. Conversely, the many cool, balmy days usual on the Cape in June, reduced the takes to much below the average. High winds interfere with successful trapping in other ways than by lifting the traps from the supporting sticks. When they occur, the colony is always jumpy and wild, the birds covering their clutches for shorter periods at a time and taking much longer than usual to walk to their nests after having alighted—as almost always they do—a few feet away. Of course field work is impossible when it rains, when there is dense fog, even when the terrain is more than a little damp.

Since the only practical method of capturing breeding terns is based on the necessity of their incubating their eggs, obviously the degree of success attained in adult trapping is in direct relation to the degree of assiduity with which incubation is carried on. It has been found, after due allowances have been made for all other known influences, and in spite of unalterable biological necessities, that closeness of incubation varies along fixed lines during the whole incubation period. It is exceedingly casual until complete clutches have been laid; it becomes stabilized at what appears to be an adequate amount until three or four days before hatching begins. Then there is an abrupt change; almost constantly either one or the other adult covers the nest until the last chick has emerged. It was during these last few days that the greatest success was attained in completing the capture of pairs. In the quadrat in 1943, the second member of three pairs was never seen on its nest until the first chick had hatched.

The presence of people always disturbs a ternery and curtails incubation, although to a much less degree in a large colony such as Tern Island or at a closely tenanted site such as Bird Island. One individual, working alone on the capture of pairs, resulted in far less inhibition of nesting activities than occurred when two or more people carried on together. The first month this particular work was done demonstrated that almost always for about one hour the take of birds would be good, dwindling rapidly the second hour, with only an occasional take made in the third. This pointed out plainly that the safety of clutches required limiting the presence of a worker in one of the experimental tracts to seldom more than two consecutive hours.

Reaction to intrusion, like all items of tern behaviour, varies in individual birds, some tolerate it to an incredible degree, others react immediately and drastically to very little of it. In 1943 two pairs never returned to their clutches in the quadrat after the first member of each had been trapped and banded; both these color banded birds were taken later the same season on new nests elsewhere on Tern Island. The occupants of a nest one yard distant from the blind were seldom away from it in spite of the presence of a worker; on another clutch only five feet beyond the opposite side of the blind no bird was ever seen, yet all three eggs in the clutch hatched.

The average incubation period for the Common Tern is 25.7 days with a maximum of 30 (Austin, O. L., Jr., 1932: 127). Over the years it has been found that at Tern Island site selection and egg laying regularly take place about one week earlier than they do at other sites. Excepting in an abnormally late season, in this rookery the great preponderance of laying has been completed by the first of June. Also it is known that the older members of the flock make site selections and deposit their eggs in advance of their younger associates. To prevent interfering with the acquisition of territories, it was expedient to delay trapping until the major part of the colony had become well established in their chosen domains. Table number 2 shows when the taking of pairs began each year, it being noted that in 1944 an exceptionally large colony nested at Tern Island more than a week earlier than usual. (Austin, 1946: 11).

Lest some of these dates suggest inconsistency, it must be stated again that the quadrats and islets were known to be tenanted largely by older members of the colony.

TABLE NUMBER 2

DATES WHEN TRAPPING BEGAN EACH YEAR		
	In Quadrats	On Islets
1943	May 28th	June 10th
1944	May 26th	May 31st
1945	June 12th	June 8th
1946	June 3rd	May 31st

It is apparent that three, at most four weeks is the total period of time over which the taking of pairs from the initial nesting could be carried on with reasonable profit. Even less time was available for locating and identifying throughout all the colonies birds known to have had membership in recognized pairs preceding years. Every season, from time to time, even up to mid July, new nests were found in all the experimental areas. However, the Station's records show that almost one-half of the occupants of these late nests were—comparatively—very young birds; of the remainder, many proved to be renesting individuals taken earlier in the same year in other sectors of Tern Island or even in a different ternery, Plymouth in particular.

The loss of bands, not only the colored celluloid ones of which the durability had been untested, but even the numbered metal Wildlife Service bands was found to be much larger than had been suspected. The celluloid bands, at the time of their application the same size as the number three Service bands used for terns, deteriorated rapidly. Some unrolled so quickly that they dropped off a few days after they had been affixed. This amounted to a loss the same season of nearly five percent, between ten and twenty percent the following one; only two or three percent survived two years wear. As a result, the identification of a number of birds which had been members of established pairs preceding years could be made only by checking their Survey band numbers on prepared lists of the birds found mated during previous nestings. So doing added no great difficulty to work in the experimental areas but it was far too time consuming to warrant continuing to do it for all banded birds taken during the routine trapping of the remainder of Tern Island and the other sites.

Of greater moment was the disappearance of numbered Service bands. In the belief that, with wide exceptions both ways, the average number three bands, when applied to terns, last for ten years, it is routine for this station's field workers to replace all bands in service for that length of time, also all others showing excessive wear. The last two seasons, 1945 and 1946, it was found that the recent series with the key numbers forty, forty-one and forty-two were much softer than their forerunners, many of them having been so thinned by two years of wear that substitution was necessary. Solely from impressions received during many years of work in tern colonies, it had been suspected that some of the new adults trapped from time to time were individuals which had lost their previously applied bands. In 1944, two birds were trapped, each wearing one of the comparatively short lived celluloid bands but both without the Service bands which they were carrying when the former were affixed; eight such were taken in 1945; four in 1946. Of the thirty-seven color banded terns trapped elsewhere than in the experimental areas in 1945, six, or seventeen percent were found to have lost their Service bands. It cannot be doubted that the loss of bands of one type or the other reduced considerably the total recaptures of identified pairs.

The high death rate of the birds selected for this investigation by reason of their average advanced age, lessened very much the possibility of their being recaptured in nestings subsequent to the first. In a former contribution (Austin, 1942), the rather short life span of the Common Tern was shown to be only ten years and graphs demonstrated that approximately five-sixths of a colony disappear between their fifth and eighth years of age at definite rates. The best sample to which the foregoing facts can be applied as a measuring stick in estimating the number of mated pairs likely to return consists of the birds comprising the

pairs taken in 1943. Of the three hundred and ten, roughly one-third or one hundred and eleven were unbanded leaving one hundred and ninety-nine to whose ages there was some clue. Of the one hundred and ninety-nine, thirty-eight were banded while chicks and the average of their exactly known ages is 5.8 years, 7 for the islet birds, 4.7 for those from the quadrat. The average period of survival of the birds banded as adults, from the time of their original capture until they were retaken in the experimental tracts, had been 3.6 years. It having been shown that less than ten percent of the Cape's terns breed until their third year of life (Austin, 1942: 168), the probable age of the adult banded birds was 6.6 years when they became identified with this study. So, in spite of possible variables it is safe to assume that the average of all the three hundred and ten individuals, including the newly banded, was 6.0 years. Graphs 2 and 3 in the contribution referred to show that these birds may be expected to disappear during the next three years at rates shown in table number 3.

TABLE NUMBER 3
RATE OF DISAPPEARANCE OF ADULTS AT SEVERAL AGES

	Banded as Chicks	Banded as Adults
Between the sixth and seventh years	33.8 percent	63.3 percent
Between the seventh and eighth years	41.2 percent	12.5 percent
Between the eighth and ninth years	5.9 percent	12.5 percent
Total	80.9 percent	88.3 percent

Even allowing the wide margin of ten percent for possible error, it appears the number of pairs available for recapture decreased annually to an important extent.

The amount of time it was possible to devote to this special study was curtailed greatly by other activities it was inexpedient to forego. For instance, much field work was required to prevent the occurrence of any hiatus in the trapping of adults and the thorough chick banding this station has carried on for the past eighteen consecutive years in all the Cape colonies, always more comprehensively at Tern Island than elsewhere. In particular, the attention it was possible to give to finding returned color banded birds nesting at large in the terneries was exceedingly inadequate. Although from one-tenth to (in one instance at Tern Island) one-half of the adult population of all the colonies was trapped, even this afforded only a small chance of securing the desired birds. Certainly efforts to capture all mates with pull string traps was out of the question.

In planning this study of mating, great store was placed on the known trend of Common Terns to return yearly to the site of their former tenures. While this trend contributed much to what was accomplished, its functioning was inhibited greatly, even thwarted at times, by mishaps which befell Tern Island. Not only were important ecological desiderata

altered seriously but even former nesting sites were destroyed. A history of the practically complete frustration of this colony in its initial 1944 nesting has been published (Austin, 1946). The mass emigration to other sites for renesting which followed—the usual sequence to a major catastrophe in a tern colony—resulted in the departure of most of the pairs recognized the preceding year before they could be trapped. However, a number were taken a little later in other rookeries, one pair at Tern Island sixteen days after it had been trapped near the second quadrat at Tern Island. In mid July there was extensive renesting on Tern Island. During this, of the pairs identified in 1943, two were taken on the islet, another four feet from the site it had occupied in June, and a single member of six pairs in various parts of the rookery. In September, the same year, a severe storm with a gale of wind at the time of high course tides, eroded extensively one shore of the island, washing away one-fourth of the first and one half of the second quadrats. In 1945, early in the third week of May, the colony was twice the size it had been at the same time other seasons but during the ten succeeding days, for some unknown reason, there was an exodus of two-thirds of these birds to nest elsewhere. In the fall of that year, dredging operations deposited mounds of sand over much of the area where many pairs had been taken in July, 1944. In April, 1946, after the island had been given its annual clean-up, a storm piled up so much debris on both the islets that almost no nesting territory remained. In addition, an overgrowth of beach grass in another fourth of the first quadrat and in the greater part of what remained of the second, made this terrain unappealing to nesting terns.

These several handicaps which have been discussed in detail in conjunction with others not mentioned, limited to one hundred and twenty-seven the number of pairs retaken in years subsequent to their primary identification. In the three years 1943, 1944 and 1945 a total of seven hundred and fifty-seven pairs were taken. Of these, ninety-nine were recaptures once or twice of pairs taken seasons before, reducing to six hundred and fifty-eight the total of known pairs. Of this last number the one hundred and twenty-two retaken any one of the years 1944, 1945 and 1946 constitute 18.5 percent, roughly one of every five. While this is a rather small sample, it is believed that attempts to obtain a larger one would have been too difficult, impracticable and inimical to the welfare of the colonies. Since no modifying data would be likely to accrue from continuing a follow-up of the already identified pairs, unfortunately, further study must be made from a fresh start.

The records and all the tabulations amassed during this investigation are too voluminous to warrant publication. Accordingly, with much care being taken to exclude all uncertainties but to include all findings which might contradict what the final evaluation appears to show, the end results are condensed and amalgamated into tables 4, 5 and 6.

TABLE NUMBER 4

ALL THE MEMBERS OF IDENTIFIED PAIRS recovered with the same or a new mate any subsequent year. The table shows the year of original identification, the years in which one or both members were retaken also the number of pairs in each classification.

Same mates 1943 and 1944	39
Same mates 1943, 1944 and 1945	1
Mated in 1943, neither taken in 1944, same mates 1945	1
Same mates in 1943 and 1944, one new mate in 1945	4
Mated in 1943, one with new mate in 1944	17
Mated in 1943, both with new mates in 1944	1
Mated in 1943, one taken in 1944, same mates in 1945 and 1946	2
Same mates in 1943 and 1944, one taken in 1945, same mates	
in 1946	2
Mated in 1943, one taken in 1944 and 1945 and with a new	
mate in 1946	1
Same mates 1943 and 1944, one taken in 1945 and with new	
mates in 1946	1
Same mates in 1943 and 1944, neither taken in 1945, one with	
new mate in 1946	2
Same mates 1943, 1944 and 1945, one with new mate in 1946	1
Same mates 1944 and 1945	12
Same mates 1944, 1945 and 1946	3
Mated in 1944, one taken in 1945, same mates in 1946	4
Mated in 1944, neither taken in 1945, one with new mate in 1946	3
Mated in 1944, neither taken in 1945, same mates in 1946	1
Mated in 1944, one with new mate in 1945	14
Same mates in 1944 and 1946	5
Mated in 1945, one with new mate in 1946	2
Mated in 1945, both with new mates in 1946	2
Five birds numbered 1, 2, 3, 4 and 5, mated in the following	
combinations:	
1943 1 and 2	
1944 1 and 3 also 4 and 5	
1945 2 and 4	
1946 2 and 5	4
Total number of mated pairs of which one or both members	
were retaken following years	122

TABLE NUMBER 5

PATTERNS OF CONTINUED AND NEW MATINGS by banded pairs of terns retrapped in seasons subsequent to year of original capture. Table shows year of first identification, status of mating each following season, and the number of pairs in each classification.

		x—Member of original pair.				n—New mate.
Class I	Pairs with complete records of identical matings.	1943	1944	1945	1946	No. of pairs
		xx	xx	xx		1
			xx	xx	xx	3
		xx	xx			39
			xx	xx		12
				xx	xx	5
						—
	Total					60 pairs

Class II Pairs with incomplete records, but which were identically mated at last trapping, and therefore may be presumed to have maintained original mating throughout.

1943	1944	1945	1946	No. of pairs
xx	x	xx	xx	2
xx	xx	x	xx	2
xx		xx		1
	xx	x	xx	4
	xx		xx	1

Total 10 pairs

Class III Pairs of which one member *only* was recaptured with new mate. Failure to capture the other member of the original pair may indicate in each case that the new mating resulted from the death of the original mate.

1943	1944	1945	1946	No. of pairs
xx	xx	xn		4
xx	xn			17
xx	x	x	xn	1
xx	xx	x	xn	1
xx	xx		xn	2
xx	xx	xx	xn	1
	xx	xn		14
	xx		xn	3
		xx	xn	2

Total 45 pairs

Class IV Pairs of which *both* members were retrapped with new mates.

1943	1944	1945	1946	No. of pairs
xx	{xn xn			1
		xx	{xn xn	2

Total 3 pairs

Class V A unique group of matings in which five birds nesting close together in one of the quadrats interchanged mates each year. The combinations were as follows:

1943—Birds 1 and 2.
1944— " 1 and 3; 4 and 5.
1945— " 2 and 4.
1946— " 2 and 5.

Since the members of the original pairs are involved in four different matings, they are counted as

	4 pairs
Grand total	122 pairs

TABLE NUMBER 6

ANALYSIS OF TABLES NUMBERS 4 AND 5

Mating status of 122 pairs recaptured following years

Same mating all years	70	57.4 percent
New mating	52	42.6 percent
	122	100.0 percent

One or both members of original pairs were taken 272 times:

<i>Same mating</i>	
Same mating continued in all captures	205 times
Same mating continued after an interval of one year in which neither was taken	2 times
Same mating after one year in which one member was taken	8 times
Same mating continued	215 times
	79.1 percent
<i>New mating</i>	
New mating on each return	54 times
One member taken with new mate after an interval of one year in which neither of original pair was taken	3 times
Mating changed	57 times
	20.9 percent

Years mating continued with no change of mates

Number of Years	Number of Pairs	Percent of Pairs Taken	Percent of Pairs Banded
Two years	56	45.9	8.8
Three years	10	8.2	1.5
Four years	4	3.2	0.6
	70	57.3	10.9

Number of years mating continued with no change or until a new mate was taken

Number of Years	Number of Pairs	Percent of 122 pairs retaken
Two years	63	51.6
Three years	11	9.0
Four years	4	3.2
	78	63.8

Number of years one or both members of original pairs were taken

Number of years	Number of pairs	Same mating	Percent same mating is of pairs
Two years	96	63 times	65.6
Three years	18	11 times	61.1
Four years	9	4 times	44.4
		Average for the three	57.0

Relation of returned mated pairs to mated pairs identified (See table 1)

Number of pairs captured in 1943, 1944 and 1945	757
Number of pairs recaptured in 1944, 1945	99

Total number of new pairs 658

122 pairs recaptured is 18.5 percent of identified pairs.

122 pairs recaptured total of 151 times 19.8 percent of all pairs captured.

To show the effect of increasing age and deteriorations in environment on the number and percentage of recaptures

	Identified in 1943	Identified in 1944	Identified in 1945
	134 pairs	566 pairs	57 pairs
Returned in 1944	57 42.6 percent		
Returned in 1945	7 5.3 percent	27 4.4 percent	
Returned in 1946	10 7.5 percent	12 2.0 percent	9 15.9 percent

These tables show that in eighteen instances one or both members of a pair were not taken in the year intervening between their first capture and their subsequent recovery with or without a change in the mating. For statistical purposes—and to be on the safe side—it has been assumed that the eight times birds of this group were taken with a new mate after the lapse of a year or more, the new alliance was in existence the intervening year. Conversely, it has been thought proper to consider there had been no interruption in the mating of the other ten pairs during the interregnum. In justification it may be stated that no mating was found ever to have been resumed subsequent to its dissolution.

The last items in the tables four and five show an involved inter-relationship of five individuals during the four year period which cannot be interpreted with unquestionable satisfaction in spite of several excellent clues. Bird number 1 disappeared the third year; number 3 was taken only once; number 4 appeared the third and fourth seasons; number 5 was trapped the second and fourth; number 2, a member of the original pair, was taken every year excepting the second. All five were of mature age, number 2 being seven years old in 1943, the first year. Each had been taken as a return at least once prior to 1943. All nests concerned were in the same eighteen feet square subdivision of the first quadrat. Every one of the clutches was laid early in the nestings. Four things are suggested as having some possible bearing on the incident: first, close association of the individuals and propinquity of their nests for several successive seasons; second, the not impossible continuation of the same group adherence on the wintering grounds; third, failure of one or more of the birds to breed by reason of a temporary inadequacy of gonadal development and stimulation; last, a rare deviation from the known anti-communistic behaviour of the species even though no tern has ever been seen incubating more than momentarily, eggs not its own. However, since these five birds constituted only 1.7 percent of the two hundred and ninety-two known members of the one hundred and twenty-two recaptured pairs, and especially because only one incident of the affair is known to have been duplicated, it appears justifiable to consider the melange solely another one of the inevitable divergences from any behaviour pattern and of no other significance.

Five times both members of previously mated pairs were retaken with both members of all pairs allied to new mates; two of the five were involved in the incident discussed in the preceding paragraph. The five represent 4.1 percent of the one hundred and twenty-two pairs, approximately one of every twenty-five. In only two of the new pairings which resulted had the new partner been a member of a pair found mated any preceding year and in both cases the previous mate of the newly acquired partner was never retaken. Certainly these five vagaries, of which the causation is not even suspected, are too small a percentage of the pairs

known to have done otherwise to militate against considering the existence and potency of a behaviour habit.

Correlation of data has resulted in findings which assist in recognizing the purport of the field work. There were fifty-two ultimate returns of members of pairs with new mates, 48 times—a little more than one-third of the total one hundred and twenty-two returns—by only one member of the original union. Never were any of the first mates of the forty-eight retaken in any of the terneries. As a rule, birds selected for mates individuals from the same era of the life span as their own (Austin, 1942). Constancy of mating was greatest the first season after the initial capture and diminished with increasing rapidity each following year. Longer continuation of matings and by a higher percentage was evidenced by pairs tenanted the first islet and two particular subdivisions of the first quadrat than by those taken from other portions of Tern Island. All pairs retrapped while reneating the same season, even on a different site, had continued the original matings.

It is believed that the contents of the foregoing tables are sufficient substantiation of the postulate expressed at the beginning of this article to consider continuity of mating from year to year not only a trend but even an important part of the behaviour pattern of the Common Tern. Any act which is repeated more than half the time by a majority of a group of individuals should be considered a habit. All percentages in the table meet this requirement with more than ample margins. Certainly four years is a sufficient amount of time to preclude the possibility that these figures may have been raised above their normals by the sum of intercurrent variables. Rather, it is not improbable that the series of mishaps at Tern Island lowered the percentages by preventing the recapture of many of the pairs most likely to have remained mated. No trend in tern behaviour is followed consistently by all individuals for so unfortunate an event is not compatible with the degree of virility and adaptability possessed by the species. From the most compelling of all trends, colonial nesting, there are always many digressions even to the point of frequent isolated nestings by single pairs. Likewise, the percentage of individuals failing to follow the potent proclivity to group adherence and site tenacity equals if it does not exceed the percentage of birds which do not remain mated.

It may be objected that the sample obtained is too small and not representative. However, the two hundred and ninety-two birds which at any time were members of the one hundred and twenty-two pairs, amount to at least one thirtieth of the average population of Tern Island during the four year period. Also, careful and detailed analysis obviates the necessity for the data being more numerous. It is true that a more diversified selection could have been made particularly in respect to age, but the use of a preponderance of middle aged individuals with well developed habits was intentional. Such birds would not have the

instability of youth nor the unadjusting persistence which is usual in old age for the potency of a behaviour trait increases with age (Austin, 1945). After all, middle aged birds always constitute the vast majority in all tern colonies. Thus it is reasonable to contend that the trend under discussion characterized the behaviour of the Tern Island colony as a whole. A previous contribution (Austin, 1940) has shown that behaviour traits function in all other Cape colonies quite as they do at Tern Island with the exception of such minor deviations as are necessitated by variations in the ecology of the several nesting sites. Consequently, it is believed that a trend toward continued mating governs the entire Cape group. That this applies to the species as a whole is solely an unproved assumption. Albertsen (1943) announced the recapture in Helgoland of two pairs of Common Terns mated exactly as they had been two years before. Aside from this there is no known report of any duplication of this study elsewhere in the breeding range.

LITERATURE CITED

- ALBERTSEN, W.
1934. Gatten treue bei der Flusseeeschwalbe, *Sterna h. hirundo* L. *Vogelzug*, 5: 192.
- BREWSTER, WILLIAM.
1879. The Terns of the New England Coast. *Bulletin of the Nuttall Ornithological Club*, vol. IV, no. 1, January.
- AUSTIN, O. L., JR.
1929. Contributions to the Knowledge of the Cape Cod *Sterninae*. *Bulletin Northeastern Bird-Banding Association*, vol. V, no. 4, October.
1932. Further Contributions to the Knowledge of the Cape Cod *Sterninae*. *Bird-Banding*, vol. III, no. 4, October.
- AUSTIN, O. L.
1933. Some Results from Adult Tern Trapping in the Cape Cod Colonies. *Bird-Banding*, vol. IX, no. 1, January.
1940. Some Aspects of Individual Distribution in the Cape Cod Tern Colonies. *Bird-Banding*, vol. XI, no. 4, October.
1942. The Life Span of the Common Tern. *Bird-Banding*, vol. XIII, no. 4, October.
1945. The Role of Longevity in Successful Breeding by the Common Tern. *Bird-Banding*, vol. XVI, no. 1, January.
1946. The Status of the Cape Cod Tern in 1944, *Bird-Banding*, vol. XVII, no. 1, January.
- MARPLES, GEORGE AND ANNE.
1934. *Sea Terns or Sea Swallows*. London, England.
- PALMER, RALPH S.
1941. A Behaviour Study of the Common Tern. *Proceedings of the Boston Society of Natural History*, vol. 42, no. 1, pages 1-119.

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