

# BIRD BANDING

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## SITE TENACITY, A BEHAVIOUR TRAIT OF THE COMMON TERN (*Sterna hirundo* Linn.)<sup>1</sup>.

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From time to time in preceding papers by this station a phenomenon of Common Tern behaviour called site tenacity has been discussed casually. By site tenacity is meant that tendency for each tern to return for its first breeding to the site where it was hatched, and once having established a breeding site, to return to the same place all following years. Each additional year of work in tern colonies has strengthened the impression that this habit is of major importance. Site tenacity not only preserves the unity of composition of a colony, but also helps maintain the population total of the Cape Cod terns by enhancing the welfare of the component individuals. To prove the existence of this phenomenon and to explain its functioning, some of the pertinent data accumulated in this station's records have been correlated and tabulated. An analysis of them indicates:

1. Young birds tend to elect their natal colonies for their first nesting.
2. Having once nested, terns tend to return from year to year to the sites of previous occupancy.
3. Attachment to a site increases with each additional occupancy, and with the increasing age of the individuals.
4. Provided ecological conditions remain propitious, individuals will nest from year to year within a few feet of formerly occupied sites.
5. If in any season birds renest in a second ternery, they tend to return in following years to the original site.

To determine the existence and magnitude of a behaviour trait there should be definite criteria. Since the writer is unaware of the acceptance of any such standards by ornithologists, certain percent-

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<sup>1</sup>. Contribution number 44 by the Austin Ornithological Research Station.

ages are here designated which are believed to be sufficiently high if the behaviour pattern of the species as a whole is evaluated for consistency. To be of major importance a trait should be exhibited by over 50 percent of individuals under normal conditions and by 25 percent at other times. One manifested by one third of the birds under normal conditions and by 10 percent otherwise is of secondary importance. Any act performed consistently by from five to ten percent of the individuals maybe considered a definite trait rather than an item of erratic behaviour. In this latter category are such matters as variation in the construction of nests. These traits, of course, may be in the process of development or regression.

Apparently, migration is the only behaviour trait that approaches totality. There is no credible record of a Common Tern having occurred at the northern part of the breeding range during the mid-winter months. Of 279 recoveries on the wintering grounds, only 17 were made during the breeding season between 20 May and 31 July. With one exception all of them were birds one year old, and 85 percent of the Common Terns do not breed until their second year. (Austin, 1942; 168).

TABLE NUMBER 1  
RECOVERIES ON WINTERING GROUNDS  
BETWEEN MAY 20TH AND JULY 31

Number	Date banded	Age when banded	Place	Bander	Recoveried	Place	How
404034	7/13/26	juv.	Tern Island	Floyd	6/17/27	Trinidad	Shot
433295	7/6/26	juv.	" "	"	5/28/27	"	"
435207	7/8/26	juv.	" "	"	6/10/27	"	"
678079	7/9/25	juv.	" "	"	7/4/29	Venezuela	Retaken
A-326822	7/6/29	juv.	" "	"	7/4/30	Trinidad	Shot
A-340930	7/5/30	juv.	Sugar Loaf Is., Maine	Pettingill	5/31/31	F. Guiana	Killed
B-256967	6/29/32	juv.	Egg Island	AORS	6/25/33	Venezuela	Captured
B-305658	6/29/32	juv.	" "	"	6/28/33	"	Fd. dead
B-321707	7/2/31	juv.	Tern Island	"	5/17/32	Trinidad	Caught
B-351390	6/23/33	juv.	" "	"	6/22/36	"	Captured
C-296085	7/30/37	juv.	Carlo, Minnesota	Burns	6/26/38	Mexico	Killed
36-309419	7/2/36	juv.	Egg Island	AORS	7/16/37	Trinidad	Shot
38-300507	6/26/38	juv.	Long Island, New York	Mayer	6/8/39	Brazil	Fd. dead
38-317740	7/14/38	juv.	Brant Beach, New Jersey	Colwell	6/5/39	B. Guiana	" "
39-365484	7/15/39	juv.	Long Island, New York	Wilcox	6/6/40	Trinidad	Caught
40-337067	7/7/40	juv.	Tern Island	AORS	7/?/41	Venezuela	Fd. dead
44-308785	7/5/46	juv.	Plymouth	"	6/8/47	Parray, B. W. I.	" "

TOTAL: 17

It is not intimated by the foregoing that all terns breed every year, even though long observation warrants the belief that there are no drones in the nesting colonies. Probably some birds, physiologically incapacitated, remain south. But since the northward migration is initiated by instinct to procreate, the final step in the undertaking should be, and possibly is, a return to the wintering grounds. For all practical purposes, migration by the Common Tern is a universal behaviour trait.

Second only to migration, so far as the number of birds controlled by it goes, is the habit of colonial nesting. From this however, there is always marked divergence. In spite of the progressive disappearance of small colonies and advancing amalgamation of the Cape Cod Terns into four large colonies, at the present time from 500 to 1,000 birds still nest in single pairs or in small flocks in widely scattered places.

All other behaviour traits are much more susceptible to modification by variables. Hence all failures to meet the top percentages specified in the criteria do not necessarily lessen the actual magnitude of any trait.

It is the writer's purpose to substantiate the postulates made above by the use of data presented largely in the form of statistics. The value of these statistics depends on the character and adequacy of the samplings on which they are based. Trapping 50 percent of the component adult population in a large colony such as Tern Island is the maximum possible; 20 percent is the limit in a small one. Even in quadrat work, when trapping is carried on constantly in a limited area through an entire nesting, some residents cannot be captured. When available, large totals and those covering a number of years are used to minimize modifying variables. However, small numbers should not be considered unreliable. For that matter, subsequent analysis of several thousand returns did not alter materially conclusions which had been drawn from a mere 29 returns by O. L. Austin, Jr. (1929).

In every ternery the ecology varies more or less extensively from over one season to the next. Such variables as predation and weather modify the behaviour and prosperity of a colony. Over the years, sufficient work has been done at all nesting sites to learn what occurs under both normal and abnormal conditions. It is not possible to include in this contribution more than a small part of the data available. Consequently records and yearly findings have been selected which represent the average. Care has been taken to exclude small totals which are exceptionally affirmative but to include those which appear to detract from the verity of a conclusion.

These data were obtained in the Cape Cod, Massachusetts tern colonies, which have a constant annual population of approximately

25,000 individuals. These colonies are united into a group which shows only insignificant intercourse with colonies occupying adjacent territory. The group's population is self-maintained, the only exception being the few interchanges of memberships with other colonies which appear to be the result of mating on the wintering grounds.

The first tern banding in the Cape group was done in 1922. From then through 1928 (principally by Mr. Charles B. Floyd) 164 adults and 5331 chicks were banded and 5 returns taken. Work by this Station began in 1929 and since then has continued yearly without interruption. In the 18 seasons from 1929 through 1946 the following terns have been handled:

Chicks banded .....	179,555
Adults banded .....	45,820
Returns taken .....	31,051
Adults trapped more than once in a season .....	4,679
Total individuals handled .....	261,105

For four consecutive seasons, 1943 through 1946, special investigations were carried on at Tern Island to determine whether or not terns remain mated from year to year, and how close to their former sites individual birds re-nested in following years. Some of the data thus obtained have been published (Austin, 1947; 3-8). Each year adult trapping and chick banding have been done as extensively as circumstances allowed. Although usually far more work has been done at Tern Island than elsewhere, all nesting sites have been examined at least once every season. At each site enough birds have been trapped to determine the make-up of its population, and to permit credible comparison with the more thoroughly trapped sites. All of Tern Island was trapped over at least once each season except 1934 when only the chicks were banded there. In 1939 the entire site was covered three times. Since 1943 only a portion of the island has been trapped each year, and the yearly sampling has seldom been more than ten percent of the adult population. In good years, roughly 25 to 30 percent of the 12,000 to 18,000 birds nesting there were trapped, as shown by the following table:

TABLE NUMBER 2  
ADULTS TAKEN AT TERN ISLAND

Year	Number Banded	Returns	Total
1935 .....	2777	315	3092
1936 .....	3197	1082	4279
1937 .....	1995	1289	3284
1938 .....	3422	1746	5168
1939 .....	2881	2185	5066
1940 .....	2048	2096	4144
1941 .....	2042	2360	4402
1942 .....	1809	2870	4679
1943 .....	2229	2566	4795

Some renesting always occurs so adult trapping is usually continued as long as a justifiable number of clutches remain.

Tern Island, as the result of conservation measures continued yearly since they were started in 1933, has remained the most extensive and most constant nesting site, and has been occupied by the largest of the Cape's colonies. It has afforded excellent opportunity for the study of site tenacity over a period covering twice the average ten year life span of the Common Tern. Unfortunately, other nesting sites have had shorter occupancies. Egg Island, used by 5,000 birds in 1931, declined so rapidly it was abandoned in 1939. Billingsgate Island, originally domiciling 2,500 birds, came to a similar end in 1941. Several sites utilized by small colonies have either disappeared or deteriorated beyond usability. Several seasons a majority of the Tern Island colony failed in the first nesting, (Austin, 1932, 150-152). In 1944, the entire hatch died in the nests (Austin, 1946); one fourth renested there and the others at Ram Island, Bird Island and Plymouth. These last sites were trapped more thoroughly than usual the remainder of that and the following seasons.

YOUNG BIRDS TEND TO ELECT THEIR NATAL COLONIES  
FOR THEIR FIRST NESTING.

Data to substantiate this concept are taken in the first instance from eighteen years' work at Tern Island and appear in Table Number 3. A table showing the aggregate first returns of all chicks banded in the Cape group's colonies has not been prepared because the picture it would present is distorted by many inadequate samplings and by the disappearance of several once important nesting sites. For example, Ram Island, due to its inaccessibility, has been trapped with comparative infrequency and only in small sections; Egg Island and Nauset Point no longer exist. Inevitably there are deficiencies in the percentages obtained in the various colonies but these are explained easily by orienting the variables to which they are due.

For the sake of diversity, at least one year's findings will be given for each of the large colonies in the Cape group excepting Ram Island and North Point. The latter site, separated from Tern Island by merely a mile of open water, is occupied only sporadically and at such times almost exclusively by members of the Tern Island flock. Consequently, of all chicks banded at North Point recaptured later years in the Cape area, 91 percent were taken first at Tern Island.

TABLE NUMBER 3  
FIRST RETURN OF CHICKS BANDED AT TERN ISLAND

Year banded	Number returned	First Return to Tern Island number	percent	First Return elsewhere
1923.....	3	1	33.3	2
1924.....	9	5	55.5	4
1925.....	28	23	82.2	5
1926.....	62	50	80.6	12
1927.....	58	41	70.7	17
1928.....	90	61	67.7	29
1929.....	122	78	63.9	44
1930.....	43	32	74.4	11
1931.....	126	99	78.6	27
1932.....	12	9	75.0	3
1933.....	121	97	81.7	24
1934.....	624	545	87.3	79
1935.....	513	445	86.8	68
1936.....	325	234	72.0	91
1937.....	118	93	78.9	25
1938.....	137	122	89.0	15
1939.....	29	27	93.2	2
1940.....	223	205	91.9	18
Totals....	2643	2167	81.9	476

The findings derived from the Tern Island data are the most credible, for always this has been the largest as well as the most thoroughly and consistently trapped colony. But even these deviate somewhat from verity. Due to a potent behaviour trait designated group adherence (Austin 1945, 25-27) there is a constant trend for members of other colonies to join the Tern Island flock. This applies to birds making their first nesting so that of all terns from other Cape colonies which failed to select their natal site, 69.7 percent were taken at Tern Island. (See table 4).

TABLE NUMBER 4  
FIRST NESTINGS OF BIRDS HATCHED ELSEWHERE THAN TERN ISLAND WHICH DID NOT RETURN TO THEIR NATAL SITE.

Where Hatched	First Nesting at Tern Island	First Nesting neither at Tern Island nor natal site
Egg Island	29	13
Billingsgate	7	15
Plymouth	166	55
Bird Island	4	6
	206 69.7 percent	89 30.3 percent

The great variation in the yearly Tern Island percentages between the two lows of 33.3 and 55.5 and the high of 93.2 is the result of insufficient sampling during the early years. Trapping adults in large numbers did not begin until 1932. The average for the years 1923 through 1929 is 64.8 percent; for 1930 through 1940 it is 84.0 percent, for the entire period 81.4 percent.

TABLE NUMBER 5  
WHERE BIRDS BANDED AS CHICKS AT TERN ISLAND MADE THEIR FIRST NESTING  
Year Banded

Site of First Nesting	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Tern Island	32 74.4	99 78.6	9 75.0	97 81.7	545 87.3	445 86.8	234 72.0	93 78.9	122 89.0	27 93.2	205 91.9
Other Sites, in Number of Birds.											
North Point	2			2	19	10	34	13	1	1	4
Egg Island	3	4		5	14	8	2		1		
Plymouth		2	1	3	19	35	40	4	3	1	6
Billingsgate	3	9		3	4	2	3		3		
Bird Island					1	1	5				7
Pamet Point	1			1	1	3					
Jeremy's Point		4	2	1	15	9	6	4	1		
Ram Island		1			4		1	1	4		1
Nausett Point				3	1			1			
Nausett Marsh		1		2	1			2	2		
Little Sipson	2	6		4							
Total All Sites	43	126	12	121	624	513	325	118	137	29	223
Total Returns	2271										
First Returns to Tern Island	1908										
First Return Elsewhere	363										
	84.0 percent										
	16.0 percent										

Table 5 shows the wide diversity of site selection by the 16 percent of the Tern Island chicks which did not return to Tern Island for their first nesting. That the drift was toward locating in other large colonies is shown by the following table:

TABLE NUMBER 5A

WHERE TERN ISLAND CHICKS MADE THEIR FIRST NESTING ELSEWHERE THAN  
TERN ISLAND

North Point .....	86
Plymouth .....	114
Jeremey's Point .....	42
Billingsgate Island .....	27
Egg Island .....	37
	—
	306

306 is 84.3 percent of the 363 not making their first nesting at Tern Island.

Distance is no factor, for with the exception of North Point which is practically an appendage to Tern Island, all these large colonies are on the circumference of the Cape groups terrain. It has been found that North Point is occupied only years when the Tern Island colony has maximum populations or when the ecological desirability of Tern Island has been lessened greatly by some mishap like rat predation. The percentages shown in table 5 for the years 1934, 1935 and 1936 are the most reliable. They are derived from large numbers of individuals and cover years when the Tern Island colony was bigger than average. But these percentages, as the result of at least one important variable, are probably lower than they would have been under normal conditions. All three years, a considerable number of defeated Tern Island birds re-nested in other colonies and were trapped after the first week in July. Among them were first nesting Tern Island banded chicks which may have been defeated in an initial laying at Tern Island.

At Egg Island the first extensive chick banding (5425) was done in 1932. Since only 15 percent of Common Terns breed before their third year the first nesting of a substantial portion of these chicks did not occur until 1935, when erosion had eliminated one third of the 1932 territory of Egg Island. Compactly nested in 1932, in 1935 the territorial holding of each breeding pair was reduced one third, leaving practically no available terrain for new-comers. From that year on the population consisted essentially of older birds as shown by a rise in the percentage of returns from 1.9 in 1932 through 62.3 in 1937 to 43.8 in 1938.



TABLE NUMBER 6  
ADULTS TAKEN AT EGG ISLAND  
New birds Returns

	New birds	Returns	Percent
1932 .....	55	1	1.9
1933 .....	1402	62	4.2
1934 .....	0	0	0
1935 .....	620	133	17.7
1936 .....	1537	527	25.5
1937 .....	126	208	62.3
1938 .....	289	225	43.8
	<u>4029</u>	<u>1156</u>	<u>21.6</u>

After 1935 the erosion of Egg Island advanced so rapidly that there was a final small nesting in 1939. The maximum concentration of nests ever observed in the Cape's colonies was at Egg Island in 1938.

TABLE NUMBER 7  
SITE OF THE FIRST NESTING, 1935 THROUGH 1938, OF CHICKS  
Banded at Egg Island in 1932

Egg Island .....	64	60.4%
Tern Island .....	29	27.3%
Plymouth .....	4	3.8%
Little Sipsion Island .....	1	1.0%
Billingsgate Island .....	8	7.5%
	<u>106</u>	<u>100.0%</u>

A correct interpretation of the contents of table 7 is enhanced by allowing for three important behaviour trends which had been noted at Tern Island (1) usually the older birds nest well in advance of the younger (Austin, 1940; 162, 1945; 27). (2) A majority of the newcomers nesting in territory tenanted largely by older birds are themselves old individuals. Of birds nesting for the first time in 1944 in the quadrat established in 1943 (Austin, 1940), 48.1 percent were between 6 and 16 years old. Elsewhere at Tern Island a similar age group constituted 31.2 percent of the population. (3) Young birds tend to locate in sparsely occupied parts of the rookery as is shown by a drop there of roughly 20 percent in the percentage of returns and their ages. Since these traits must characterize terns as a whole (Austin, 1947; 16), it is probable that many of the 1932 Egg Island chicks returning there for their first nesting in 1935 and 1936 were unable to obtain sites and nested elsewhere. The fact that the number of these 1932 chicks making their first nesting at Egg Island is only 20 percent lower than the average for all the Cape's colonies corroborates the postulate under discussion.

The one table submitted for Billingsgate Island covers the interval when the largest number of returns were taken in relation to preceding chick bandings, the years 1937 and 1938 when the majority of the 649 chicks banded in 1934 were likely to make their first nestings. Adult trapping on this site, by reason of the almost complete absence of vegetation and cover, was always less successful than in the other rookeries.

TABLE NUMBER 8

SITE OF FIRST RETURN OF CHICKS BANDED AT BILLINGSGATE ISLAND IN 1934

Tern Island .....	8	36.4 percent
Billingsgate Island .....	7	31.4 percent
Jeremy's Point .....	4	
Egg Island .....	1	
North Point .....	1	
Little Sipson Island .....	1	
	22	
Billingsgate Island .....		31.4 percent
Elsewhere .....		63.6 percent

Billingsgate like Egg Island was washed away persistently, until in 1941 there remained only a small sandbar all but submerged by normal high tides. Concurrently the colony, numbering from 2,000 to 4,000 terns in the early thirties, had shrunk to 500 by 1937. The last nesting there was in 1941. In both 1937 and 1938, nesting was necessarily on land so low that the high course tides in June washed away one fourth of the clutches. It is probable that some of these belonged to 1934 birds. In support of this surmise is the finding that six of the fifteen 1934 chicks taken in other colonies in 1937 and 1938 were trapped in mid-July and so must have been renesting. In spite of the foregoing, the 31.4 percent of the Billingsgate birds which followed the trend under grossly unfavorable conditions establishes it as a major behaviour trait.

At Plymouth a small colony had nested for many years. In the middle thirties it began to enlarge, reaching a peak of 10,000 individuals when this station first investigated it 7 July, 1939. Since then what is believed to be its normal population of 3,000 to 4,000 birds always has returned to the site at the beginning of the season. Some years the flock remains and nests; others it disperses as a whole or in part to breed in other terneries. Plymouth is a location preferred for renesting by large groups frustrated elsewhere. It never escapes predation by rats and, in addition, it has experienced more handicaps of diverse sorts than any other of the Cape's colonies.

TABLE NUMBER 9

WHERE BIRDS BANDED AS CHICKS AT PLYMOUTH MADE THEIR FIRST NESTING

Year Banded	1939		1940		1941	
	Number	Percent	Number	Percent	Number	Percent
Site of first nesting						
Plymouth .....	51	25.4	18	50.0	59	52.7
Tern Island .....	128	63.6	14	38.9	24	21.4
Bird Island .....	17	8.5	4	11.1	15	13.4
Ram Island .....	2	1.0			13	11.6
North Point .....	3	1.5			1	0.9
Total .....	201		36		112	
Total returns			349			
First return to Plymouth			128	35.7 percent		
First return elsewhere			231	64.3 percent		

The percentages in the foregoing table are higher than the minimum necessary to show that these Plymouth chicks complied with the postulated major behaviour trait. But they are much lower than those obtained in other colonies and are the result of abnormalities occurring during the seasons concerned. Table 10 shows the years when two-thirds of the birds accounted for in table 9 made their first nestings (Austin, 1942; 168). Table 11 shows the populations at Plymouth during these years and number of birds trapped.

TABLE NUMBER 10

Year Banded	Years when 3 and 4 years old
1939	1942 and 1943
1940	1943 and 1944
1941	1944 and 1945

TABLE NUMBER 11

Year	Adults Nesting	Adults Trapped
1942	2,000	582
1943	500	0
1944	None	0
1945	4,000	335

In 1943, 500 birds came to Plymouth in May; 24 June that year less than 100 remained and no eggs nor chicks were found. There was no nesting there in 1944. Consequently, the first nesting Plymouth birds were compelled to nest and were trapped in other colonies.

Bird Island is the most stable of all the Cape colonies. It has not experienced any known handicap. It is composed of about 5,000 adults in approximately equal numbers of Common and Roseate Terns. Although always compactly nested, for the site's area is small, in 1944 it accepted at least 2,000 renesting birds from Tern Island after the break-up of that colony that year (Austin, 1946).

TABLE NUMBER 12

WHERE BIRDS BANDED AS CHICKS AT BIRD ISLAND IN 1941 MADE THEIR FIRST NESTING

	Number	Percent
Bird Island .....	31	75.6
Ram Island .....	5	12.2
Tern Island .....	4	9.8
Plymouth .....	1	2.4
	41	100.0
Total returned .....	41	
First return to Bird Island .....	31	75.6 percent
First return elsewhere .....	10	24.4 percent

By reason of difficult terrain, only one third of this island can be trapped satisfactorily. Most years hatching is well started by the time the first trapping is done, thus reducing the number of first nesting birds which otherwise might be taken. It is believed that

table 12 represents closely what would be found in all the colonies, all years under normal conditions.

The data presented for the several sites are correlated in the following table:

TABLE NUMBER 13

	First return to Natal Site		First return Elsewhere	
	Number	Percent	Number	Percent
First return to all sites all years .....	2397	75.4	774	24.6
Lowest return Plymouth 1939 .....	7	31.4	15	68.6
Highest " Tern Is. " .....	27	93.2	2	6.8

This table shows that the trend of terns to return to their natal sites for their first nesting is a major behaviour trait. When variables are minimized by using only findings in the two most stable colonies, Tern Island 1930 through 1940 and Bird Island, the percentage rises from 75.4 to 82.8. After all, it is the existence of the trait rather than the degree of compliance that is important.

#### HAVING ONCE NESTED, TERNS TEND TO RETURN FROM YEAR TO YEAR TO THE SITES OF PREVIOUS OCCUPANCY

The existence of this trend was first observed in the early thirties during the identification and recording of returns. The passing years not only confirmed the impression but also showed this trait to be more consistently obeyed than the one just discussed. Substantiating it statistically is made difficult by many annual variables. Some colonies such as Billingsgate, Egg Island and Nauset Point were dispersed by destruction of their sites. There were rookeries occupied only transiently for a few years at North Point, Little Sipson Island and Jeremy's Point. Due to ecological deficiencies there were seasons when even Tern Island was sparsely tenanted; there was no nesting at Plymouth in 1943 and 1944. Occasionally there were years when no trapping was done in a large colony, such as at Tern Island and Egg Island in 1934, and Bird Island in 1942. Disruption in mid-season of a big colony as Billingsgate in 1930, and Tern Island in 1944, resulted in the late capture in other locations of returns which had nested earlier on sites they had used the preceding year. Often the returns taken in small colonies were too few to warrant credible interpretation. To minimize these and other variables, the data selected for presentation were obtained in larger colonies during years when deterrents were relatively small.

In 1936, over a period of 12 days, 1,000 adults were banded in a small part of Tern Island, closely nested by matured members of the flock as indicated by the ages of returns taken simultaneously. The known life span of the Common Terns (Austin; 1945) indicates the probable disappearance of all these birds by 1947. Two lone survivors

were taken at Tern Island in 1947, none anywhere in 1948. All the returns of these birds during the eleven years after their banding have been condensed into the following table.

TABLE NUMBER 14

SERIES 35-317001 THROUGH 35-318000

1,000 ADULTS Banded AT TERN ISLAND MAY 19 THROUGH MAY 30, 1936;

NUMBER RETURNED ONE OR MORE TIMES 532 53.2 PERCENT

Times returned	Number	Percent	
One year	270	50.7	Total returns 1004
Two years	140	26.3	
Three years	66	12.4	
Four years	35	6.7	
Five years	14	2.6	
Six years	6	1.1	
Seven years	0	0	
Eight years	1	0.2	
	532	100.0 percent	
	Site of First Return		
Tern Island	521	97.9 percent	
Elsewhere	11	2.1	"
	532		
	Site of Last Return		
Tern Island	521	97.9 percent	
Elsewhere	11	2.1	"
	532		
First return to Tern Island, then elsewhere, later back to Tern Island	7	1.3 percent	
Never back to Tern Island after being taken elsewhere	7	1.3 percent	

In determining the consistent reuse of Tern Island by this group of birds it is justifiable to include the seven which located elsewhere one season between contiguous nestings on Tern Island. Doing this raises the affirmative percentage to 99.3. From a statistical analysis of a portion of this station's data, Dr. Charles H. Blake has prepared a table showing in percentages the ages of the Tern Island population. It is based on age at the time of disappearance. Using it for a measuring stick shows that the 35-317000 group of birds were two or more years older than the colony as a whole. Behaviour patterns become more fixed as age increases, so it may be inferred that all Common Terns tend to exhibit the trait under discussion to a degree comparable to their ages.

The 3030 adults banded at Tern Island in 1938 have been selected for a follow-up not only for the additional value of the large total but particularly because variables in that and the following years were relatively fewer and less serious. Their returns following years are shown in the following table:

TABLE NUMBER 15  
SITES TO WHICH ADULTS Banded AT TERN ISLAND IN 1938 RETURNED SUBSE-  
QUENT YEARS

Number banded	3030	
Number returned	1298	42.8 percent
Returned to Tern Island	2885	96.3 "
Returned elsewhere		
North Point	45	
Bird Island	14	
Ram Island	4	
Plymouth	35	
Egg Island	4	
Jeremey's Point	3	
Penikese Island	2	
Nausett Marsh	1	
	<u>108</u>	3.7 percent

Since North Point is practically an adjunct of Tern Island it is proper to include the 45 birds which nested on the former site in the total of those which used the latter. This raises the percentage to 97.8. It is not intimated that similar, almost comprehensive reaction to the trend occurs all seasons in all colonies. Rather, it is desired to demonstrate not only the existence of this trait but especially its potency by showing what a large colony of Common Terns did under normal conditions.

For Egg Island the adults banded there in 1933 have been selected for study. That was the first year a large total was trapped and there was opportunity for their repeated return before erosion of the site had advanced too far.

TABLE NUMBER 16  
RETURNS OF ADULTS Banded AT EGG ISLAND IN 1933

Number Banded	Number Returned	Percent Returned	Times Returned				
1,393	370	19.5	383				
No trapping done in 1934							
Place of Return	Year of Return					Total	Percent
	'35	'36	'37	'38	'39		
Egg Island . . . . .	60	122	19	16	11	228	67.2
Tern Island . . . . .	35	22	7	20	11	95	28.6
Billingsgate Is. . . . .	1	2		1	2	6	1.8
Little Sipson Is. . . . .	1					1	0.3
Jeremey's Point . . . . .			6	1		7	1.8
Plymouth Beach . . . . .		1				1	1.3
Pamet Point . . . . .				1		1	0.3
North Point . . . . .		1				1	0.3
Total . . . . .	97	148	32	39	24	340	100.0

TABLE NUMBER 16  
NO NESTING ON THIS SITE

Place of Return	Year of Return										All Years		
	'40	'41	'42	'43	'44	'45	'46	'47	'48	Total	Percent	Total	Percent
Egg Island .....												228	59.6
Tern Island .....	9	7	7	6	4		3		2	38	88.4	133	34.8
Bilingsgate Is. ....						1				1	2.3	7	1.8
Little Sipson Is. ....												1	0.2
Jeremy's Point .....												7	1.8
Plymouth Beach .....	2		1				1			4	9.3	5	1.4
Pamet Point .....												1	0.2
North Point .....												1	0.2
Total .....	11	7	8	6	4	1	4		2	43	100.0	383	100.0

The final and small nesting on this site was in 1939. After that year all of the 21 survivors of the 1933 bandings were compelled to nest elsewhere. If the 43 returns of the 21 individuals after 1939 are discarded the percentage of the 1933 birds always returning to Egg Island is raised to 67.2 percent. No trapping was done at Egg Island in 1934. Other tables in this article show that the largest return to the same site of birds banded as adults occurs the year after banding. If it is assumed that 90 of the 1933 bandings returned to Egg Island in 1934 and 20 to Tern Island, this being in conservative ratio to the number which did return in 1935 and 1936, the percentage is raised to roughly 75. To justify this assumption it may be said that the Egg Island colony was even more stable than the one at Tern Island. Unlike the latter, it received almost no accessions of émigrés from other colonies. As the island rapidly wasted away the colony maintained its fealty by the expedient of accepting territorial rights of smaller size.

The table shows that as early as 1935 an exodus to Tern Island was in progress. Of the 155 returns of the 1933 bandings taken elsewhere, 133 or 85 percent were at Tern Island. From 1940 through 1948, 21 of the 1933 birds were trapped elsewhere than Egg Island 43 times, 38 times or 88.4 percent at Tern Island. Many of the 84 birds which went to Tern Island were retaken there more than one season as is shown in the following table:

TABLE NUMBER 17

Number of Years Returned to Tern Island	Number of Birds	Total Returns
One	53	53
Two	21	42
Three	6	18
Four	1	4
Five	2	10
Six	1	6
	84	133

} 36.9 percent } 60.1 percent

Only one of the 84 was ever taken elsewhere than at Tern Island. This bird nested three seasons at Tern Island, was taken 20 July the next one at Plymouth, then the following two at Tern Island. The foregoing shows that site tenacity continues to govern the behaviour of Common Terns after the disappearance of a site with which they had established a liaison.

The unpropitious status of the Billingsgate Island colony and its site have been described. So, as is to be expected, findings there while sufficient to substantiate our postulate, show percentages below the average.



TABLE NUMBER 18  
SITES OF RETURNS OF ADULTS Banded AT BILLINGSGATE ISLAND IN 1934 AND 1935

Year 1935 1936	Number Banded		Year of Return							Percent Returned		Times Returned		Percent for both years		
	'36	'37	'38	'39	'40	'41	'42	'43	'44	'45	'46	Total	%		90	119
Place of Return	25	7	6	7	1							46	51.2	46	68.6	
Billingsgate		7	23	4	7	3						44	37.2	41	57.8	63.1
Jeremey's Pt.		7	3	3								13	14.5	13	19.4	21.0
1936		14	1	1								16	13.5	16	22.5	
1935		2		2	1	4	2	6		1		18	20.0	5	7.5	
Tern Island		2	2	4	4	11	6	15	5	1	4	54	45.5	12	16.9	
1936		6	3		1		2			1		13	14.3	13	4.5	
Other Sites					2	1	1	1		1		5	3.8	2	3.8	
1935	31	19	9	13	2	4	4	6		2		90	100.0	67	100.0	
Totals	1936	23	26	9	13	15	6	16	5	2	4	119	100.0	71	100.0	

TABLE NUMBER 19  
SITES TO WHICH ADULTS BANDED AT PLYMOUTH IN 1939 AND 1940 RETURNED FOLLOWING YEARS

Year of Return	Number Banded		Year of Return												Percent Returned		Times Returned		Percent for both years
	'40	'41	'42	'43	'44	'45	'46	'47	'48	Total	Percent	Less '43&'44	percent	160	519				
1939	36	22	13			4	3	2	3	83	51.9	83	61.5					70.3	
1940		135	96			21	21	16	9	298	57.4	298	73.4						
1939	12	12	16	16	7	1	2			67	41.9	44	32.6					23.3	
1940		18	55	46	31	4	3		2	159	30.5	82	20.2						
1939	4	1			4				1	10	6.2	4	5.9					7.4	
1940		4	2	14	22	8	3	4	5	62	12.2	36	5.4						
1939	52	35	29	16	11	5	5	3	4	160	100.0	135	100.0					100.0	
1940		156	153	60	53	33	27	20	16	519	100.0	406	100.0						

Year  
1939  
1940

Number Banded  
310  
1223

Number Returned  
115  
339

Percent Returned  
37.1  
27.7

Times Returned  
160  
519

Year of Return

Less '43&'44

Percent for both years

Site of Return  
Year Banded  
Plymouth  
Tern Island  
Other Sites  
Totals

TABLE NUMBER 20  
SITE OF RETURN OF ADULTS BANDED AT BIRD ISLAND IN 1941 AND 1943

Year	Number Banded		Number Returned		Percent Returned		Times Returned					
	1941	1943	'42	'43	'44	'45	'46	'47	'48	'49	'50	
1941	167			4	6	2	4	6	3	25	86.2	83.0
1943	257				21	3	11	7	11	53	81.5	
			1			1	1	1		4	13.8	17.0
					4	2	2	2	2	12	18.5	
Totals			1	4	6	3	5	7	3	29	100.0	100.0
					25	5	13	9	13	65	100.0	

No trapping done on this site in 1942.

Year of Return

Total Percent

Average Percent for Both Years

TABLE NUMBER 21  
 RETURNS TAKEN AT TERN ISLAND SHOWS THE PERCENTAGE WHICH HAD BEEN BANDED THERE

Year	Banded as Adults			Year	Banded as Chicks			Percent Tern Is.
	Tern Is.	Elsewhere	Total		Percent Tern Is.	Elsewhere	Total	
1929	3	0	3	1929	18	0	18	100.0
1930	5	0	5	1930	9	0	9	100.0
1931	1	0	1	1931	3	0	3	100.0
1932	21	2	23	1932	22	1	23	95.7
1933	66	13	79	1933	37	0	37	100.0
1934	2	0	2	1934	0	0	0	....
1935	192	123	315	1935	99	21	120	82.5
1936	952	130	1082	1936	131	30	161	81.4
1937	1129	160	1289	1937	256	30	286	89.5
1938	1529	217	1746	1938	478	58	536	89.2
1939	1926	259	2185	1939	510	90	600	85.0
1940	1874	222	2096	1940	403	79	482	83.6
1941	2029	331	2360	1941	403	58	461	87.4
1942	2472	398	2870	1942	452	124	576	78.3
1943	2157	403	2560	1943	494	177	671	73.6
1944	1401	200	1601	1944	372	118	490	75.9
1945	587	48	635	1945	152	21	173	87.9
1946	721	71	792	1946	220	31	251	87.7

Average for 18 years

86.8

Average for 17 years

82.5

No adults trapped in 1934 at Tern Island.  
 Average for 18 years both Adults and Chicks 86.1

Bird-Banding  
January

Jeremey's Point bears the same relationship to Billingsgate Island, less than one mile away, that North Point does to Tern Island. In reality, tenants of the two former sites constitute a single colony. From this standpoint, since 116 of the 145 returns anywhere were to these two sites, the percentage rises to 80.0 from 63.1 for Billingsgate Island alone. Duplicating exactly what was shown for Egg Island, 55 or 85.9 percent of the 64 returns from 1941 on were to Tern Island.

The abnormalities observed at Plymouth have been described in part; the complete absence of nesting in 1943 and 1944 is stressed. Further, usually very little adult trapping was done at that site before late June when many of the early nesting birds had hatched their eggs. But in spite of deterring influences, of all the adults banded there in 1939 and 1940 which were retaken following years, more than two-thirds were again nesting at Plymouth.

Since there was no nesting at Plymouth in 1943 and 1944, the 140 returns nesting elsewhere those two years should be discarded in determining the percentage returning to that site, thus found to be 70.3 percent. It is seen that only 7.4 percent of the returns were elsewhere than to Plymouth and Tern Island. A follow up of all the birds which were taken at Tern Island show that 92.8 percent remained there consistently. Of the 62 taken there in 1943, none were recaptured at another site.

Although the findings for Bird Island are based on a rather small number of birds, the writer believes they are what would be found in all colonies under normal conditions

Of course there is some deviation from accuracy because no trapping was done at Bird Island in 1942, the year after the first bandings shown in the table had been done. This, however, does not detract from the validity of the findings, for as has been shown to be the rule in other colonies, data collected in 1942 would have raised rather than lowered the 83.0 affirmative percent obtained.

The postulate has been proven by showing where birds banded as adults nested in following years. Corroboration is obtained by reversing the procedure and showing where returns taken had either banded or trapped before. To this end several tables are presented. Table number 21 shows that 86.1 percent of all the returns taken at Tern Island during a span of 18 years had been banded there. Since table number 21 does not indicate where the birds nested in intervening years, table number 22 based on 2282 returns taken at Tern Island in 1938, is interpolated. This shows not only the number of returns each year to Tern Island and other rookeries but also that 98.6 percent of them, counting the year of banding, were to Tern Island. The percentage is raised to 99.3 if the 1938 returns



are included. The highest return elsewhere than to Tern Island any one year was 2.6 percent in 1933.

Table number 23 shows that eventually 1298 of the chicks banded during the first 11 years of work at Tern Island nested there, 80.2 percent for their first nesting, 83.8 percent the last year. Fifty-one of them nested elsewhere one intervening year; 40 or 78.4 percent of the latter returned a later season to nest at Tern Island.

Number returned .....	1298	
First return to Tern Island .....	1041	80.2 percent
Elsewhere .....	257	19.8 "
Last return		
Tern Island .....	1088	83.8 percent
Elsewhere .....	210	16.2 "
First and last returns at Tern Island, taken elsewhere intervening years ....	40	3.1 percent
First at Tern Island then elsewhere and not back to Tern Island.....	11	0.8 "

The last two tables epitomize with small variations in percentages, what occurred at Tern Island all years.

Table number 24 is inserted to demonstrate that considerable allowance must be made for variables.

TABLE NUMBER 24

RETURNS TAKEN AT TERN ISLAND IN 1943

Number banded at Tern Island .....	2651	81.9 percent
Number banded elsewhere.....	586	18.1 "
	3237	
Number of returns which were banded on sites extinct in 1943 .....	568	
Subtracting the 568 from the returns banded elsewhere shows that the per- centage of Tern Island banded returns is		99.4 percent

To avoid what otherwise would necessitate a lengthy narration of variables and a discussion of their effect on percentages, only one report is included to show the findings in other colonies than Tern Island. Table number 25 shows that 79.5 percent of all the returns taken at Egg Island during five years had been banded there.

TABLE NUMBER 25

RETURNS TAKEN AT EGG ISLAND SHOWS PERCENTAGE Banded THERE AND ELSEWHERE

Year	Banded as Adults			Banded as Chicks		
	At Egg Island			At Egg Island		
1935	At Egg Island	97	95.1 percent	At Egg Island	20	64.5 percent
	Elsewhere	5		Elsewhere	11	
		102			31	
1936	At Egg Island	368	86.7 percent	At Egg Island	80	78.4 percent
	Elsewhere	57		Elsewhere	22	
		425			102	
1937	At Egg Island	135	75.0 percent	At Egg Island	18	64.3 percent
	Elsewhere	45		Elsewhere	10	
		180			28	
1938	At Egg Island	123	69.5 percent	At Egg Island	30	62.5 percent
	Elsewhere	54		Elsewhere	18	
		177			48	
1939	At Egg Island	100	76.4 percent	At Egg Island	20	87.0 percent
	Elsewhere	31		Elsewhere	3	
		131			23	
Average for 5 years		81.0 percent	Average for 5 years		72.4 percent	
Average for both Adults and Chicks 79.5 percent						

It has been found by this method of study, that, the results obtained in the other colonies bear the same ratio to those shown for Tern Island as was demonstrated when the system of analysis was reversed.

Regardless of what procedure is used to interpret the data, it is apparent that the trend of Common Terns to return to their former nesting sites is a major behaviour trait.

ATTACHMENT TO A SITE INCREASES WITH EACH ADDITIONAL  
OCCUPANCY AND WITH THE INCREASING AGE OF THE INDIVIDUALS

The simplest way of demonstrating the first part of this trend is by an analysis of multiple returns. That term is used to describe birds which have been retaken any two or more seasons after the one when they were banded. Table number 26 based on 2,964 multiples trapped in 1943 and 1944 shows a rise in the percentage which re-



TABLE NUMBER 26  
MULTIPLE RETURNS TO ALL SITES IN 1943 AND 1944

Years Returned	Number Returned		To the Same Site		To a Different Site	
	1943	1944	Number	Percent	Number	Percent
Two	904	619	747	82.6	157	17.4
Three	482	308	418	87.6	64	12.4
Four	239	179	204	85.4	35	14.6
Five	94	82	66	90.4	9	9.6
Six	16	32	15	93.7	1	6.3
Seven	4	5	4	100.0	0	0.0
Total	1739	1225	1473	954	266	271

TABLE NUMBER 27  
MULTIPLE RETURNS TO ALL SITES IN 1946

Times Returned	Always to Same Site	First Taken on Extinct Site In 1946	Number with Birds from Extinct Sites	Taken elsewhere		Last taken in 1946 Elsewhere than Original Site
				Between First & Last Returns	Last Returns	
One time	1202		75.2%		395	24.7 percent
Two	295	11	79.4	306	76	"
Three	158	4	85.4	185	27	"
Four	95	5	86.9	115	8	"
Five	38	3	100.0	41	1	"
Six	20	3	92.0	25	0	"
Seven	8	3	100.0	3	3	"
Eight	3	0	100.0	0	0	"

Birds in second column were first taken at Billingsgate or Egg Islands, both extinct since 1940. All remained consistently on the new site.

TABLE NUMBER 28  
MULTIPLE RETURNS TO TERN ISLAND IN 1946

Times Returned	Always to Same Site	First Taken on Sites		Number with Birds from Sites	Taken Elsewhere		Last Taken in 1946 Elsewhere than Original Site
		Extinct in 1946	Extinct in 1946		between first and Last Returns	Elsewhere than Original Site	
One	1091	74.3%	36	1127	0	376	28.7%
Two	241	71.9%	23	264	1	94	21.2%
Three	160	86.4%	3	163	18	24	11.4%
Four	90	82.6%	5	95	8	19	13.0%
Five	27	90.0%	3	30	2	3	0.0%
Six	21	84.0%	3	24	1	4	4.0%
Seven	8	72.8%	3	11	0	3	0.0%
Eight	3	100.0%	0	3	0	0	0.0%

Birds in the second column were first taken at Billingsgate or Egg Islands, both extinct since 1940. All remained consistently on the new site.

TABLE NUMBER 29  
WHERE OLD AGE BIRDS BANDED AT TERN ISLAND WERE LAST TAKEN IN 1942 THROUGH 1946 (Note 4)

Year Taken	1942		1943		1945		1946		1942		1943		1945		1946	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Age																
12	5	100.0	20	100.0	4	66.6	16	72.8	0	0	0	0	0	0	6	27.2
13	11	100.0	3	100.0	3	100.0	10	100.0	0	0	0	0	0	0	0	0.0
14	2	100.0	9	100.0	1	100.0	5	100.0	0	0	0	0	0	0	0	0.0
15	1	100.0	2	100.0	1	100.0	3	75.0	0	0	0	0	0	0	1	25.0
16	4	100.0	3	100.0	2	100.0			0	0	0	0	0	0	0	0.0
17	2	100.0	1	100.0			2	100.0	0	0	0	0	0	0	0	0.0
18		Note (1)														
19																
Total	25		38		11		37		0		0		2		7	
	Taken at Tern Island		Total 111, 93.0 Percent		Taken Elsewhere		Total 9, 7.0 Percent									

Note 1: In 1942, during the last week in July, 38 birds trapped earlier that season at Tern Island, including this 17 year old bird, were trapped re-nesting at North Point.

Note 2: Nine of the 38 birds had been taken once in another colony, 2 at North Point 7 at sites extinct in 1940; none were over six years old when taken elsewhere; all were retaken later years two or more times at Tern Island, nowhere else.

Note 3: One of these two birds had been taken at Tern Island in 1937 and not again since it was caught at Ram Island 3 July, 1945. It has not been taken since then. The other had returned to Tern Island eight seasons before it was trapped at Plymouth July 21, 1945, obviously re-nesting. It was caught again at Tern Island in 1947.

Note 4: The year 1944 is omitted because, due to the break-up of the colony, very little adult trapping was done.

turned consistently to the same site from 76.5 for a second return to 100.0 for a seventh. All birds taken on a different site during an intervening year have been assigned to the non-conforming column. Tables number 27 and 28 founded on the 1946 multiples are added to show that the rise in percentage is more marked when an important variable has been eliminated.

To prove that attachment to a site increases as terns grow older, submission of tables showing behaviour in this matter during their usual life-span of ten years is obviated by establishing what occurred during the second decade. Development of a behaviour pattern by one individual is a gradual process so the rise from roughly a 70 percent compliance during early years to 100 percent by the twelfth must have been by degrees. Table number 29 shows that of 120 birds from 12 to 19 years old taken at Tern Island in four years, 93 percent had returned consistently to Tern Island. If notes at the bottom of the table are credible only one bird failed to comply and the percentage rises to 99.

Additional evidence in support of this trend will be found by comparing these last ten tables with those which showed where birds nested for the first time. Suggestive also is the drop, as the season advances, in the percentages of returns incident to adult trapping for, as a rule, the older birds nest well in advance of their juniors. This is exemplified in the following table.

TABLE NUMBER 30  
SEASONAL CHANGES IN PERCENTAGES OF RETURNS AMONG  
ADULTS TRAPPED AT TERN ISLAND

Trapped in 1942		Trapped in 1943	
May 28	68.2%	May 28	76.2%
" 29	75.7	" 30	78.8
" 30	78.9	June 4	67.0
June 2	73.0	" 6	71.9
" 19	60.2	" 18	59.5
" 20	50.3	" 19	55.1
" 21	45.0	" 21	56.2
" 24	42.5	" 22	47.2

Further, as a ternery disappears gradually by erosion with a resulting drop in the population of the tenanting colony and a concentration of its nests, there is a rise in the percentage of returns. For instance, at Egg Island this percentage increased from 18.5 in 1935 to 45.3 in 1939. The individual records of these final returns show that most of them were older birds and that they had had previous close association with this site. It does not detract from the evidence that one or more seasons some of the individuals which have returned many times are impelled by ecological changes or other variables to locate elsewhere than in their customary breeding place.

PROVIDED ECOLOGICAL CONDITIONS REMAIN PROPITIOUS MANY  
INDIVIDUALS WILL NEST FROM YEAR TO YEAR WITHIN  
A FEW FEET OF FORMERLY OCCUPIED SITES.

From time to time various incidents casually observed had suggested the existence of this trend. Repeatedly at Tern Island the serial band numbers of returns taken on a given day would be too nearly consecutive to be a mere coincidence. Reference to the station's daily notes, which tell the part of a nesting site where adult trapping is done each day, revealed that the bands in question had been applied one or two years before in the same territory. The behaviour of some birds in their reaction to human intrusion is so individualistic, so much in variance from that of others in the extent of belligerency or tameness that their recognition is easy. After some of these identifiable birds had been found two or more seasons, each time in the same part of their respective terneries, their nests were located and the birds trapped. It was found that they had returned annually to the same segment of the site. One event was especially significant.

In 1932, when the duration of incubation was being studied at Tern Island, several quadrates were taped out. The tenanting adults were trapped and banded and the exact location of their nests in the quadrates was recorded on maps. For individual identification out of hand, a few of them in one quadrate were marked with colored celluloid bands. In June, 1935, one of these color-banded birds was taken on the site of one of these quadrates. A sufficient amount of the old tape marking the nearby angle of the quadrate was uncovered to fix the present location of the bird's nest in relation to the angle. Reference to the map showed that the same bird had nested in practically the same spot in 1932. As it became increasingly more apparent that site tenacity might contribute to the welfare of breeding terns, it was obvious that this particular phase of the habit should be investigated.

Accordingly in 1943, on that part of Tern Island where the terrain was most suitable, a quadrate seventy-five feet square was marked out. This tract was selected because it was known to be tenanted largely by older and consequently more stable members of the colony. 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 possible, all birds nesting within the quadrate or in its immediate vicinity were trapped and banded, and their exact nest sites mapped. To facilitate the recognition of these birds in this and future years, and particularly to increase the likeli-

hood of recapturing any which might reneest elsewhere, 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 heavily tenanted than any other part of Tern Island and for the reason that, like the quadrate area, the majority of its occupants were relatively older birds. Also it had excellent natural boundaries. The same two sites on the quadrate and islet were trapped and mapped intensively the three following years. The data thus obtained have been correlated in the following tables and histogram, particularly the proximity of each bird's nest to others it had occupied during the four seasons.

TABLE NUMBER 31  
315 INDIVIDUALS TAKEN

Where Taken	Quadrate	Islet	Both
Number Taken	221	94	315
Number Returned a Subsequent Year	86-38.5%	55-58.5%	141-44.8%
Number never Returned	135-61.5%	39-41.5%	174-55.2%
Returned to Quadrate or Islet	67-29.9%	48-51.1%	115-36.5%
Returned Elsewhere on Tern Island	18	6	24-15.1%
Returned to Another Rookery	1	1	2-0.6%
Returned to Quadrate or Islet Once	46-20.9%	36-38.3%	82-26.0%
Twice	11- 4.5%	7- 7.5%	18- 5.7%
Thrice	10- 4.5%	5- 5.2%	15- 4.8%
	67-29.9%	48-51.0%	115-36.5%

98.6 percent of the returns were to Tern Island.

TABLE NUMBER 32

QUADRATE

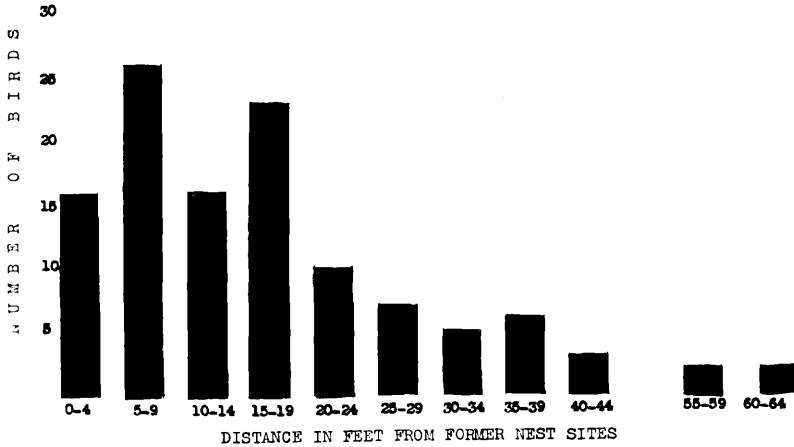
DISTANCE FROM ORIGINAL SITE OF THE NESTS OF ALL BIRDS RETURNED FROM ONE TO THREE TIMES IN 1944, 1945 AND 1946 INCLUDING FIRST NESTINGS IN 1944 AND 1945.

115 INDIVIDUALS

Distance	Number	Percent of 115
2 to 5 ft.	23	19.6
6 to 10 "	21	18.1
11 to 15 "	21	18.1
16 to 20 "	17	14.8
21 to 25 "	10	8.6
26 to 30 "	7	6.1
31 to 35 "	4	3.4
36 to 62 "	12	11.3
	115	100.0

				Shortest distance	2.1 feet	
				Longest distance	62.0 "	
				Average distance	16.8 "	
Distance	Number			Average Distance	from Original Nest	
1 to 15 ft.	65	56.6%		8.2 ft.		
16 to 30 "	34	29.6%		21.5 "	12.7 ft.	
31 to 62 "	16	13.8%		41.9 "	28.1 "	16.8 ft.

115



The normal annual mortality rate for Common Terns in colonies of over 1,000 birds is 17.2 percent; it is somewhat higher for the older group of birds involved in this experiment. This applied annually to the 315 birds taken the first year should have yielded 178 returns for the three following seasons; the number taken was only 141. The discrepancy is accounted for by hindering occurrences. In June, 1944, before more than a part of the nests in the quadrat and on the islet had been trapped, the frustrated Tern Island colony disbanded to re-nest elsewhere (Austin, 1946). September, that year, a severe storm washed away some of the east side of the quadrat. In 1945 and even more in 1946, the over-growth of beach grass in the quadrat prevented closer re-occupation of former tenures. This necessarily increased the distances shown in table 32. Late in May, 1946, a northwest gale accompanying high course tides deposited on the islet massive pieces of wreckage obliterating two thirds of its area.

Table 31 shows that 98.6 percent of the quadrat and islet birds which returned did so to Tern Island and that 81.5 percent of these returned to the experimental tracts in which they had been first taken. Table 32 shows that 19.6 percent of the quadrat birds re-

nested within five feet of the preceding season's tenures, 55.8 per cent within 15 feet. Mathematical precision is impossible not only because of the major deterrents just mentioned but also as the result of many minor accidents. As most tern nests are only shallow holes in the sand, the growth of a small clump of vegetation where the preceding year's nest was placed results in the selection of some more desirable location nearby. This is analagous to the behaviour of other species. The Chipping Sparrow which breeds yearly in the same cedar tree by the station's porch never uses the same branch two successive years; neither does the Barn Swallow always build on the identical portion of the shelf under the eaves.

On the islet, the first year, a numbered metal marker was inserted close to each nest. All but a half dozen of them were removed by the elements the following winter. This prevented learning the exact distance between the old and new nests of returning birds. A rim of dense grass three feet wide around the islet reduces the greatest possible distance between nests to 48 feet. Since the nests are concentrated over the central portion of the islet it is not unlikely that the average distance between old and new nests was even less than it was in the quadrate.

IF IN ANY SEASON BIRDS RENEST IN A SECOND TERNERY THEY TEND  
TO RETURN FOLLOWING YEARS TO THE ORIGINAL SITE.

Usually, Common Terns, defeated by the loss of either eggs or chicks in their first effort to reproduce, make a second attempt the same season. This is termed renesting. No instance of relaying in the original nest the same year has ever been observed in the Cape colonies. No bird has been known to lay a third time in the same year. As a rule, either the second clutch of eggs is laid in a new and often considerable distant sector of the rookery or, as occurs frequently, the birds repair to a different site altogether. When only a few birds are involved, older ones in particular, the majority remain at the same site. When large numbers are concerned most of them depart in large groups to renest in other rookeries. The recapture subsequent years of some of these renesting individuals where they had first nested the year before suggested that so doing might be a phase of the trend toward site tenacity. Therefore the following tabulations have been made to show what occurred. Since large numbers of returns are necessary to show the trend, only data of Tern Island renesters have been used. Years have been selected when extensive renesting elsewhere had occurred the years before and much late trapping had been done.

Table number 33 shows that of the 254 birds which nested first at Tern Island then renested the same year in a different rookery, 88 or roughly one third were retaken some subsequent year. Seventy



TABLE NUMBER 33  
TERN ISLAND BIRDS RENEESTING ELSEWHERE THE SAME YEAR

	1936	1939	1941	1944	Total
Number renested elsewhere than Tern in same year . . . . .	96	93	18	47	254
Number never returned after year renested . . . . .	62	53	11	40	166
Number returned after year renested . . . . .	34	40	7	7	88
Number returned to Tern Island . . . . .	28	33	6	3	70
Number returned elsewhere then to Tern Island . . . . .	2	2	0	0	4
Number returned to Tern Island then elsewhere then Tern Island again . . . . .	1	1	0	0	2
Number returned elsewhere and never back to Tern Island . . . . .	3	4	1	4	12
Final return to Tern Island . . . . .	31	36	6	3	76
	91.2%	90%	85.7%	42.9%	84.1%
Number returned after year renested . . . . .	88	88	34.7 percent		
First subsequent return to Tern Island . . . . .	76	76	84.1 percent		
First return to Tern Island . . . . .	70	70	79.5 percent		
Final return to Tern Island . . . . .	76	76	84.1 percent		

of the 88 or 79.5 percent returned to Tern Island and remained there. Six more ultimately returned to Tern Island raising to 84.1 percent the number found at Tern Island when they were last taken. The recapture of 22.2 percent of the 88 was delayed until the third season. The 1944 data are included because the percentage they yield is the lowest at hand. That was a year of disaster at Tern Island and extensive late adult trapping was done in the other colonies to locate renesting birds. Both following years the Tern Island colony was unprecedentedly small, adult trapping was limited largely to the quadrat tracts and only small portions of the remainder of the site were covered. But extensive trapping was done at Bird Island, Ram Island and Plymouth. Consequently, the few birds taken at Tern Island in comparison with larger captures elsewhere is a misleading picture of what probably occurred. Four of the seven 1944 birds which returned in 1945 and 1946 elected to remain where they had renested in 1944. Field work done since 1944 suggests that a similar percentage of the other birds which abandoned Tern Island in 1944 have not returned to that site. Tables number 34 and 35 are inserted to show how consistently the individuals remained at Tern Island where they returned after having renested elsewhere.

TABLE NUMBER 34  
WHERE BIRDS NESTING AT TERN ISLAND IN 1936 AND  
RENESTING ON ANOTHER SITE THAT YEAR, NESTED FOLLOWING YEARS.

1936	'37	'38	'39	'40	'41	'42	'43	'44	'45	'46
NP*		T		T						
IS	T									
E	E	T				T	T	T		
E				J						
E			T							
E			T							
F		E	T							
E	E	E								
E						T				
E	T									
E			T	T	T		T			
E	T						T	T		
E		T	T	T						

TABLE NUMBER 34 (Continued)  
WHERE BIRDS NESTING AT TERN ISLAND IN 1936 AND  
RENESTING ON ANOTHER SITE THAT YEAR, NESTED FOLLOWING YEARS.

1936	'37	'38	'39	'40	'41	'42	'43	'44	'45	'46
E	T		P	T	T					
E	E									
E					T					
NP	T	T			T	T	T			T
NP	T			T						
NP	T									
NP	T									
NP		T								
NP		T								
NP				T		T				
NP		T	T							
NP	T	T								
NP			T	T						
NP	T									
NP				T	T	T	T			
NP	T									
NP	T									
NP	T	T	T				T			
NP			T	T						
NP				T						
NP	T									

ABBREVIATIONS: NP--North Point; LS--Little Sipson; T--Tern Island; E--Egg Island; J--Jerney's Point; P--Plymouth.

Total reneesting elsewhere than at Tern Island		
in 1936	96	
Number returned after 1936	34	35.5 percent
Returned to Tern Island	28	82.4 percent of the returns
First to Tern Island then elsewhere then to		
Tern Island	1	
First elsewhere then Tern Island	2	
Returned elsewhere and not back to Tern Island	3	
Final return to Tern Island	31	91.2 percent of returns

TABLE NUMBER 35  
WHERE BIRDS NESTING AT TERN ISLAND IN 1939 AND RENESTING ON ANOTHER  
SITE THAT YEAR, NESTED FOLLOWING YEARS

1939	1940	1941	1942	1943	1944	1945	1946
P <sup>2</sup>			T				
P		T		T			T
P		P					
P			T				
P	T	T		T	T	T	T
P				T	T		
P			T				
P			T				
P	T						
P	T	T					
P	P					T	T
P	T	P	T				
P	T		T	T	T		
P	T						
NP	T						
NP			T				
NP	T						
NP	NP		T	NP			
NP	T						
NP	NP						
NP	T						
NP	T	T					
NP	T		T				
NP					T		
NP			T				
NP					T		

TABLE NUMBER 35 (Continued)  
WHERE BIRDS NESTING AT TERN ISLAND IN 1939 AND RENESTING ON ANOTHER SITE THAT YEAR, NESTED FOLLOWING YEARS

1939	1940	1941	1942	1943	1944	1945	1946
NP			T	T		T	T
NP	T	T	T	T	T		
NP		T					
NP		T			T		
NP	NP						
NP	T	T	T		T		
NP	NP		T				
NP		T		T			
E			T		T		
E				T			
J		T	T	T			
J		T					
J	T	T	T				
J			T		T		

ABBREVIATIONS

<sup>a</sup>ABBREVIATIONS: NP—North Point; T—Tern Island; E—Egg Island; J—Jeremy's Point; P—Plymouth.

Total nesting elsewhere than at Tern Island in 1939	93	
Number returned after 1939	40	43.0 percent
Returned to Tern Island	33	82.5 percent of returns
First to Tern Island then elsewhere then to Tern Island	1	
First elsewhere then Tern Island	2	
Returned elsewhere then to Tern Island then elsewhere	1	
Returned elsewhere and not back to Tern Island	3	
Final return to Tern Island	36	90.0 percent of returns

It is a corollary to site tenacity that terns have a second preference. This concept, like the several trends already discussed, originated in impressions received during field work and while recordings were being made. Although its validity has not been determined by an analysis of available data some confirmation can be given. During the early thirties there was a close affiliation between the Tern Island

and Egg Island colonies. Tern Island birds went to Egg Island when rats had dispossessed them in 1932. Table number 34 shows that in 1936 almost one half of renesting Tern Islanders went to Egg Island. As Egg Island washed away, roughly 90 percent of its surviving tenants were trapped at Tern Island. Since 1937, a majority of the birds not returning to former sites have joined the Plymouth colony. As smaller colonies have been broken up, their members not going to Tern Island have elected Plymouth. In mid season, abrupt increases in the size of the Plymouth colony have been coincident with decreases in population elsewhere. In June 1944, when the Tern Island colony broke up, the greater part went to Plymouth before, having found no nesting there, they finally located elsewhere.

As previously stated the functioning of site tenacity is modified somewhat by another behaviour trait termed group adherence. By this is meant a tendency for terns to amalgamate into closely knit aggregations during the breeding season. It affects site tenacity most when small groups are concerned. The result is that the percentages of colonies returning to the same sites over a period of years decreases in direct ratio to the size of the colonies.

Because site tenacity with its various ramifications is a major behaviour trait, its influence on the welfare of the species is important particularly in the maintenance of populations. Over specialization is dangerous for most avian species, likewise any habit encouraging its development if followed too consistently. Comprehensive as site tenacity appear to be, it does not always prevent terns nesting on other than their natal or customary sites when doing so is advantageous. Exceptions to this are made mostly by comparatively young and very old birds. Group adherence influences some first nesters to join large colonies rather than the small one in which they have been hatched; North Point chicks repair to Tern Island; Jeremy's Pointers join the Plymouth flock. Oldsters persist in returning to small sites where they had experienced repeated defeats. For years a small flock of terns came regularly every May to Nauset Marsh and even renested there after their clutches had been floated away by the June high tides. Sometimes, however, a large colony of mixed aged individuals will continue to re-occupy an unsafe ternery such as rat infested Plymouth.

In view of an average life-span of but ten years and a high mortality rate—17.2 percent annually—continued prosperity of the Cape's terns depends on adequate reproduction. In an average normal year, at least one chick should be reared for each breeding adult. (Note A) But this is not accomplished equally by all the colonies. The records show that the ratio between chick yield and adult population usually is far higher in large than in small colonies.

In 1934, at Tern Island 13,000 adults raised 12,498 young, whereas at Billingsgate Island, where much more thorough banding was accomplished by the use of a corral, 1,600 adults hatched but 649 chicks. This implies that any factor assisting in the preservation of large colonies is of considerable importance. To this end, site tenacity appears to serve its most useful purpose.

**Note A:** This postulate is the result of a preliminary statistical analysis of some of this Station's data. It will be discussed in a future contribution.

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