

139-46024, banded at Hartford, Conn., April 7, 1940, by R. W. Goodale, was trapped and released at banding station at Barre, Vt., April 14, 1940, by Mrs. Howard A. Drew.

CHIPPING SPARROW (*Spizella passerina*)

34-79391, banded at Buck Hill Falls, Pa., June 29, 1937, by Elizabeth F. Norris, was trapped and released at the same station August 11, 1941.

41-10232, banded at North Andover, Mass., October 12, 1941, by O. M. Root, was captured at Tabor City, N. C., December 2, 1942.

HARRIS'S SPARROW (*Zonotrichia querula*)

\*38-111567, banded at Fargo, N. Dak., October 4, 1937, by O. A. Stevens, was killed at Fort Worth, Tex., December 29, 1937.

WHITE-CROWNED SPARROW (*Zonotrichia leucophrys*)

39-168082, banded at Wells River, Vt., May 20, 1939, by W. P. Smith, was shot at Marmaduke, Ark., January 7, 1942.

WHITE-THROATED SPARROW (*Zonotrichia albicollis*)

A183316, banded at East Lansing, Mich., October 2, 1939, by J. W. Stack, was shot 6 mi. from Monroe, La., about February 21, 1943.

40-186761, banded at Norristown, Pa., May 2, 1941, by R. J. Middleton, was caught at Galivants Ferry, S. C., November 18, 1941.

42-156004, banded at South Ozone Park, L. I., New York, October 2, 1942, by J. H. Mayer, was caught at Enfield, N. C., November 3, 1942.

SONG SPARROW (*Melospiza melodia*)

35-116531, banded at Harvard, Mass., April 24, 1936, by J. L. Peters, was trapped and released at the same locality March 26, 1942, and again on October 29, 1942.

141-13543, banded at Brooklyn, N. Y., November 4, 1942, by H. P. Mahnken, was found at Gascons, Bonaventure Co., Que., April 22, 1943.

SNOW BUNTING (*Plectrophenax nivalis*)

38-195998, banded at Toronto, Ont., by H. H. Southam, March 22, 1940, was caught in a net at L'Anse au Clair, Que., April 4, 1942.

Fish and Wildlife Service,  
Washington, D. C.

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THE ROLE OF LONGEVITY IN SUCCESSFUL BREEDING  
BY THE COMMON TERN (*Sterna hirundo*)

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<sup>1</sup>Contribution No. 39 by the Austin Ornithological Research Station.

LONGEVITY in an avian species is of moment, and more than a matter of passing interest, when its incidence and frequency have a direct bearing on the welfare and consequent numerical strength of the species.

The survival of those accomplishing it, especially if it has been in appreciable numbers, must be assumed to have been not merely a matter of chance but rather the result of their having been endowed with virility and adaptability exceeding that possessed by the average member of the species. In order to continue being an asset and not simply nonproductive members of a colony they must have retained, at least to some degree, the procreative ability, physical well-being and mental acuity possessed in their supposedly primer years. For that matter, the conduct of the Common Tern is so fashioned that it precludes the existence of an adult which is dependent on its fellows to even the slightest extent for any of the necessities of life. If those oldsters, during a nesting, comport themselves in a manner which directs and influences the behaviour of the colony as a whole to greater success, their presence is really of major importance.

The life span of the Common Tern has been shown to be ten years (Austin, *The Life Span of the Common Tern*, BIRD-BANDING, Vol. XIII, No. 4, October, 1942) with a small but recognizable number living eleven and twelve years. The latter equal in number the birds, relatively few, which breed the season subsequent to the one in which they are hatched. On a graph made of the percentages of birds banded as chicks which return each year of their age, the points for all more than twelve years are below a base line indicating the presence of none. Thus, according to the definition already made, any bird thirteen or more years of age may be considered to have achieved longevity. The appended tabulation is of all such which have been taken in the Cape Cod group of colonies during the eight-year interval between 1937 and 1944 inclusive. For obvious reasons it differentiates between birds banded while chicks and those banded as adults. Also it shows the percentage these oldsters are of the total returns trapped each year.

COMMON TERNS MORE THAN TWELVE YEARS OLD  
BANDED WHILE CHICKS OR ADULTS

Years Old Taken in	13 Years			14 Years			15 Years		
	Adult	Juvenile	Total	Adult	Juvenile	Total	Adult	Juvenile	Total
1937		1	1						
1938					1	1			
1939		2	2						
1940		3	3		6	6	1	1	2
1941		3	3		4	4		5	5
1942	5	9	14		3	3		3	3
1943	2	2	4	5	7	12			
1944				1	1	2	4	4	8
	7	20	27	6	22	28	5	13	18

Years Old Taken in	16 Years			17 Years			18 Years		
	Adult	Juvenile	Total	Adult	Juvenile	Total	Adult	Juvenile	Total
1937									
1938									
1939									
1940									
1941		2	2						
1942		7	7		1	1			
1943		2	2		5	5	2		2
1944		1	1	1	2	3		3	3
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		12	12	1	8	9		5	5

TOTALS

Year	Adult	Juvenile	Total	Returns for Year	Percent of Returns
1937	0	1	1	1996	0.05
1938	0	1	1	2656	0.04
1939	0	2	2	3214	0.06
1940	1	10	11	3098	0.4
1941	0	14	14	3243	0.5
1942	5	23	28	3786	0.7
1943	7	18	25	3376	0.7
1944	6	11	17	2500	0.7
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	19	80	99	23869	0.41

The aggregate population of the Cape Cod group of breeding colonies is approximately 30,000. The content of banded birds has varied between a minimum of 43.7 percent in 1937 and a maximum of 59.1 percent in 1942. For the aggregate of eight years covered by the above tabulation the number of banded birds present should be about 120,000. The returns for this period were 23,869 which is 19.9 percent of the estimated total or roughly one out of every five constituents. This sampling should be considered sufficient in quantity and duration for the elimination of all important variables. Comprehensive chick banding began in the Cape's colonies about 1928, so it was 1941 before it could be expected to find thirteen-year-olds present in representative numbers. Consequently an even more accurate estimate of the number of oldsters present is obtained if only the last three years in the table, 1941 thru 1944 are used. For this period the returns were 21.5 percent of the estimated number of birds present. Of these returns the percentage of longevity individuals remained constant each year of the three at 0.7 percent. A number of the birds included in the table returned from two to five times over the eight-year period to reduce a little both totals and percentages. A final analysis appears to indicate that of the terns nesting each year one of every two hundred is thirteen or more years old.

The distribution of such advanced aged birds through the colonies is not even, but it is in direct ratio to the size and age of the colony.

(For the alignment, make up and interrelationship of the colonies see Austin, *Some Aspects of Individual Distribution in the Cape Cod Tern Colonies*, BIRD-BANDING, Vol. XI, No. 4, October, 1940). Over 90 percent of all taken were trapped at Tern Island, the present home of the Cape's oldest and largest colony. Egg Island, now destroyed but for many years tenanted by a large and prosperous colony, yielded a few of these very old birds. One was taken on that site each of the last two years of its existence when so little nesting territory remained that clutches were concentrated to within eighteen inches of each other. But one oldster has been taken at Plymouth and that occurred late in July near the end of the season when there had been extensive emigration to this site for renesting by birds frustrated earlier at Tern Island.

From the tabulation it is seen that from thirteen years, the age of the oldest individual taken in 1937, the limit has been increased by one digit annually to eighteen years excepting in 1939 but in 1940 two were added. This must not be considered a definite ultimate, on the contrary the trend demonstrated by the table makes possible further elevations by forthcoming nestings. The only certain ages are those of birds banded the year they were hatched; all banded as adults are at least one year older than the table indicates. Of the survivors of a season's hatch only 1.6 percent breed the following year, 15.7 percent the second, less than out of five before the third. This increases the likelihood that many birds banded as adults are actually much older than they are shown to be by the data. For example, number 404860, rebanded 37-332004, was taken in an automatic trap in the particular sector of Tern Island where it had been banded as an adult after capture with a pull-string trap by Mr. Charles Floyd in 1927. It has been learned from the trapping of 71,798 adults in the Cape's colonies that birds one and two years old come to nests under pull-string traps far less promptly and frequently than do those birds which are more matured. At the time of its initial capture the bird in question was nesting in a densely populated tract and we know that very young birds, as a rule, do not acquire territory in such locations. In view of these facts it is an even possibility that this bird was more than one year old when banded, beyond eighteen when last taken.

The exceeding thinness and fragile condition of bands which have been worn by terns for ten or more years implies that a considerable number of those affixed in the middle twenties have been lost by the wearers. Substantiating this is our having found in a nest in 1943 a partly open band of the sort and capturing on the nest two unbanded adults. Almost all of the advanced aged birds taken during the last four years were identified, not by the original bands but by replacements applied in the thirties.

The behaviour of the Common Tern is the antithesis of communistic in most important respects such as incubation, the brooding and rearing

of chicks, sharing food with other adults—excepting when so doing is a part of courtship procedure—and giving nourishment to the progeny of other parents. In the upbringing of chicks there are only two known deviations from this pattern:—the insistence on territorial rights and the attitude of adults toward young birds prematurely swimming away from the ternery. When an undisturbed colony is observed from a blind, young which have strayed into the domain of parents other than their own are promptly head-pecked and driven off. Almost every adult flying over a chick in the water beyond the shore line swoops down over it in a patent endeavor to drive it shoreward. Once a colony has become well domiciled the only concerted actions which have been noted are responses to alarms—the entire colony will occasionally leave the site in a body—the mobbing of an intruding predator or human and concentration over a school of food fish.

In sharp contrast to the above are two dominating behaviour traits observed consistently during our fifteen consecutive years of work in the Cape's colonies and confirmed by the analysis of extensive pertinent data. In this station's contributions they have been designated group adherence and site tenacity. By the former is meant an individual's continued retention of membership in the group and especially in a specific one of the group's component colonies, not only during a nesting season but from year to year. By the latter is implied an annual return to the same ternery, even close to the same spot in it, which the bird had occupied preceding seasons. While both trends motivate members of the Cape Cod group there is no actual evidence they function similarly in all this continent's colonies. However, Common Terns have a bias toward colonial nesting which is markedly potent and their habits, on the whole, are not easily altered. On the wintering ground, where are congregated birds from widely separated nesting sites, the behaviour pattern must be of general application as it is for any species inhabiting a given area recurrently for long periods. It is inconceivable that the groups into which the species break up to breed in different but not widely diversified places should then carry on in ways which are essentially different or be influenced by trends which are not common to all.

In the biological order of things the organization of individuals into groups for concerted action is an asset, the extent of its efficacy being in direct ratio to the degree to which a species is specialized. As has been shown in one of this station's contributions, Common Terns, at least here on Cape Cod, are thus congregated into several colonies united into a group which is self perpetuating, uncommonly exchanging memberships with other groups of terns. The cohesion is brought about and continued by the trend we have termed group adherence. Due to its influence every individual has a dominating loyalty to the group as a whole and also, to a somewhat less degree, to one of the group's com-

ponent colonies. The frequent yearly changes of membership made by some from one colony to another is not the result of lessened attachment to the original colony but to seasonal ecological variations in the several nesting sites. There exists no tendency for the birds to scatter out, rather the drift is always toward amalgamation, smaller flocks joining larger ones, individuals returning to the colony from which they had been absent one or more seasons. An excellent illustration is that this year, 1944, for the season's first nesting all the colonies were united on Tern Island with no occupancy of other sites excepting Bird and Ram Islands. Behaviour of this sort is of great advantage, theoretically because concerted action by an aggregation of individuals is always better directed than is that of a scattered few, practically since as a general rule reproductive success increases as a colony grows in size. The increase, however, is not simply one in numbers, it is in the percentage the chick yield is of the adult population of the colony, or, in other words, the number of young raised by a given number of adults. Another instance of the value of group adherence is that renesting is much more effective when done by a considerable number rather than by a few birds.

All colonies, and particularly their component individuals, impelled by the habit already defined as site tenacity, return from year to year to the terneries they occupied the preceding season unless changes purely environmental influence them to locate elsewhere in the group's territory. No other conclusion can be drawn from a tabulation of the returns showing the yearly make up of all the colonies. From twenty-three to seventy-six percent of any membership had nested at some previous time on the same site excepting, of course, a newly occupied location such as Plymouth. More convincing are the records of birds which have been taken from three to seven different seasons for of the total returns made by all such multiples less than ten percent have been to any but the usual site. In order of their effectiveness are first the adoption of the place of their nativity by birds coming for their initial breeding, next the return of individuals to a territory once occupied and last, increasingly effective with every added year of tenure, the persistent occupancy of the same ternery. How closely site tenacity is focused has been shown by work this station carried on the last two years investigating the mating of the Common Tern. A considerable percentage of the birds whose nest sites had been mapped exactly by the quadrat method returned to nest this year not only in the same rookery but on almost the identical spot used the year before. However, such outstanding behaviour by individuals simply emphasizes the duplicating custom of the colony as a whole. Exceptions to this general rule, while of constant occurrence and often extensive, may be ascribed almost always, and satisfactorily, to alterations, sometimes advantageous at others prejudicial, in the site itself or in its ecology. The value of site tenacity

to the success of a nesting, while of importance theoretically, is shown by our statistics to be considerable. In a rookery consistently occupied by the same birds, abandonment of clutches consequent to intercurrent disturbances occur less readily, incubation and the care of chicks are carried on with increased conscientiousness and the chick yield is always larger than in one whose tenants are more transient.

Group adherence and site tenacity, while essentially different, function cooperatively. Each encourages an individual's reaction to the other. The first of these is of much greater moment than is the second yet without the influence of the latter even a closely adherent body of terns might elect to occupy an unpropitious site thus lessening the success of their nesting.

The two details of behaviour just specified vary in effectiveness according to the age of the birds. Although both originate in instinct, as the individual grows older they become progressively more and more matters of habit even to the degree of influencing some to continue accepting environmental conditions which have become markedly disadvantageous. Thus, birds which survive to longevity, as defined previously, may be expected to and in fact do respond most consistently to such impulses. Years of adult trapping show they are the first to acquire territory and begin egg laying, usually in the rookery to which they hold the greatest allegiance. Such action is an example which influences younger birds, whose habits are less well fixed, to become members of the colony in which they were bred and to assume nesting locations on the site to which their inheritance naturally directs them. Birds wearing very old bands attract the attention of field workers. They become associated with particular locations in the terneries so we have come to expect to find them and we do when we trap these spots from year to year. This season, incident to the quadrat work previously mentioned, we found, together with others of much advanced age, one seventeen-year-old on a nest only four feet distant from the one it had tenanted last year, another thirteen years old located five feet from its previous occupancy. Further, the histories of birds which have returned from five to seven times show, with but few exceptions, routine occupancy of the same rookery.

From a variety of causes, mostly environmental, but at the same time some intrinsic in the birds themselves, each year a varying number of breeders lose either their eggs or their hatched chicks. Then fairly promptly, by reason either of the potency or persistency of the procreative urge, or perhaps simply from habit, the great majority make a second attempt spoken of as renesting. Evidence substantiating this is amply abundant especially that obtained by a second and third re-trapping of a ternery during a season. How quickly terns realize their initial fruition and make readjustment may be inferred from our having taken at Bird Island on a newly made nest, a pair of colored banded

birds known to have lost their first clutch six days earlier at Tern Island. Up to the present we have not discovered a third attempt. The several behaviour patterns of renesting and the most important trends particularly in the matter of location have been discussed in former contributions from this station. Although with some outstanding and valuable exceptions, renesting usually fails to accomplish its purpose it does serve to preserve the integrity of the group. To this end the role played by longevity birds is a major one. Our statistics show that they renest quite as consistently as do those of supposedly more virile age. Moreover, excepting when mass emigration of the greater part of a colony to a different site for the second attempt occurs, they remain to re-lay on the original site and not stray off as do younger birds to join smaller colonies where the chances for success are exceedingly less. The very extensive and important renesting which occurred at Tern Island this year was encouraged if not initiated by such behaviour on the part of these very old birds.

Each added year of observation strengthens our opinion that all members of a colony present on a site during the nesting season are active breeders with the exception of some twice thwarted birds. The latter do not enter the nesting territory itself but rather idle in bunches along the rookery's shore line toward the end of the season, probably awaiting the time when the migration instinct has matured sufficiently to result in their departure southward. Accordingly it is postulated that in the breeding period there is an absence of advanced aged, sterile birds. For the Common Tern, procreation is an annual affair. To this there may be some individual exceptions but there are no observations of which we are aware that some remain on the wintering grounds without breeding during the late spring and summer. If there exist very old birds incapable of procreation and so remaining on the wintering grounds it is likely their presence there would have been remarked. Further, the list of recoveries in that area of banded birds does not show the capture of any such during the interval when others of the species are in the summering region. Consequently it is warranted to assume that in the Common Tern fecundity is not limited by age, also that the relationship to a colony or group of colonies of birds reaching advanced years is in no way minimized.

The success of a nesting depends to no small degree on how well the individual birds, the colony as a whole and the group of colonies follow the most propitious behaviour pattern or at least its most essential details. It having been determined that birds arrived at the status of longevity measure up better in this respect than do their juniors, their presence in a colony and their value to it are not merely matters of interest but rather of real importance.

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