lated with temperature, particularly average night temperature. No statistical correlation was obtained with precipitation, relative humidity, wind velocity, or total possible hours of sunshine (p. 112).

Number of broods.—There was only one second brood completed in the area in 1940 as compared with at least three in 1941, probably correlated with the earlier season. This illustrates how progress of spring may influence the amount of reproduction since apparently a second brood is more likely to be attempted at this latitude when the first brood is completed fairly early in June.

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THE LIFE SPAN OF THE COMMON TERN (*Sterna hirundo*)

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THIS paper is based solely on work which has been done in a group of colonies of Common, Roseate and Arctic Terns which breed annually on Cape Cod, Massachusetts. This group's present composite population of about 30,000 individuals has remained practically stable for the last thirteen years. The banding of chicks in these terneries which was instituted in 1922 and trapping their adult members, first done in 1928, have been continued through the 1942 nesting season without interruption and with progressively increasing thoroughness. Personnel from the Austin Ornithological Research Station began work in these colonies in 1929 and since 1931 their study and conservation has been one of this station's major undertakings. Descriptions of these colonies as they have varied from time to time, their locations and histories as well as

[1] Contribution No. 37 by the Austin Ornithological Research Station.

some of the results of their investigation have been reported in a series of articles, first by Mr. Charles B. Floyd, more recently by ourselves, enumerated in the appended bibliography.

At the conclusion of the 1942 nesting there have been banded in this group 144,886 chicks. Although during the earlier twenties this marking of juveniles was done more or less superficially, since 1933, especially in the larger and more productive sites it has been as comprehensive as the welfare of these colonies has permitted, approximating 90 to 95 percent of the hatch. During the same interval a total of 56,986 adults, including returns, have been trapped and banded. As a rule, only one of the pair tenanting each nest has been caught each year, the capture being indicated by placing

TABLE NUMBER 1

WORK DONE IN THE CAPE COD COLONIES CONSISTING OF COMMON (*Sterna hirundo*), ROSEATE (*Sterna dougalli*) AND ARCTIC (*Sterna paradisaea*) TERNS

	BANDINGS							
	Adults		*Chicks*		*Total Adults and Chicks*		*RETURNS*	
Year	*Hirundo*	*All Species*	*Hirundo*	*All Species*	*Hirundo*	*All Species*	*Hirundo*	*All Species*
1922	0	0	94	151	94	151	....	....
1923	0	0	298	380	298	380	....	....
1924	0	0	1,000	1,689	1,000	1,689	....	....
1925	0	0	2,570	2,594	2,570	2,594	....	....
1926	0	0	4,057	4,830	4,057	4,830	....	....
1927	0	0	4,703	4,703	4,703	4,703	....	....
1928	164	164	4,131	5,331	4,295	5,495	5	5
1929	918	918	3,283	5,100	4,201	6,018	31	31
1930	248	248	2,789	3,344	3,037	3,592	16	16
1931	117	123	7,552	8,648	7,669	8,771	11	11
1932	1,231	1,239	6,588	7,834	7,819	9,073	80	80
1933	2,601	2,648	3,642	4,376	6,243	7,024	209	209
1934	4	4	12,398	15,820	12,402	15,824	7	7
1935	3,113	3,424	11,920	15,851	15,033	19,275	619	629
1936	4,991	5,435	6,210	8,781	11,201	14,216	1,891	1,990
1937	2,529	2,556	4,845	6,552	7,374	9,108	1,996	2,005
1938	4,378	4,798	6,654	9,322	11,032	14,120	2,656	2,694
1939	3,559	3,855	10,244	11,441	13,803	15,296	3,214	3,242
1940	3,446	3,885	8,846	10,903	12,292	14,788	3,098	3,177
1941	3,433	3,811	8,858	10,981	12,291	14,792	3,243	3,314
1942	2,482	2,660	3,999	6,255	6,481	8,915	3,786	3,838
Total	33,214	35,768	114,681	144,886	147,895	180,655	20,847	21,248

a wooden marker at the nest, but retrapping nests a second and even a third time during the season has resulted many times in taking the mates of individuals already caught, thus improving the sampling in case either sex preponderates in the incubation. It further accomplishes the inclusion of birds which nest later than the average, also those renesting after frustration. The annual adult take for the last five years has been about one-fourth of the estimated population. Of course the percentage of their constituents caught varies in the several rookeries, for trapping is always many times more successful in an old and large colony where behaviour is more consistently concerted and the birds are less wild. The capture of

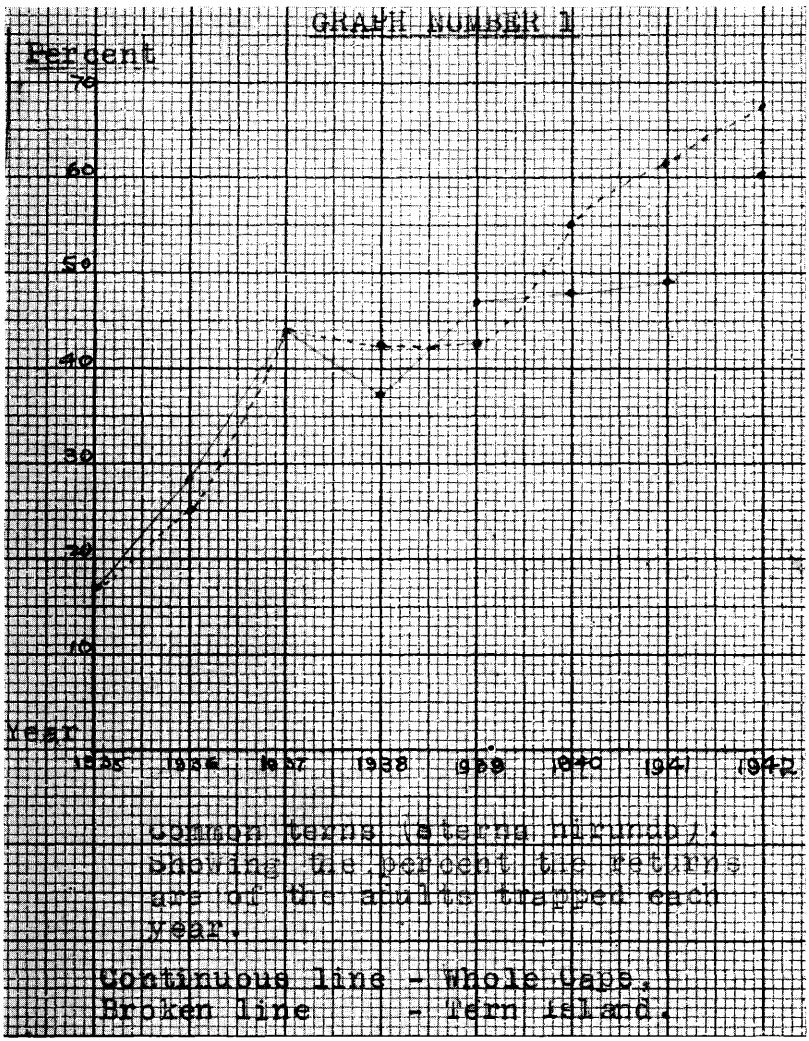
birds banded preceding years, so-called returns, total 21,218. Many individuals—657 in 1942—are taken twice or more yearly. Although our work has been carried on more intensively in two or three of the larger colonies by reason of the greater stability of their individual content over a period of years, all known colonies of as few as ten individuals have been trapped routinely.

The records of this field work have been inscribed carefully in the station's records in a variety of ways, statistically arranged, graphed and analyzed. Every tern taken subsequent to its original banding as a chick or capture as an adult has an individual card—these being arranged serially—on which are noted the time and place of its first handling, its age at that time, followed by similar details of all its succeeding takings, also the date and cause of its death when known. Since only personnel from this station have done work in the Cape colonies since 1930 omission of pertinent details are obviated. From time to time it has been found necessary to change the status previously assigned some individual birds and make small corrections in published totals.

These data, as has been pointed out (Austin, 1940) delineate a picture of a distinct, concrete group of tern colonies which is self-sustaining, its membership consisting almost absolutely of its own progeny. This offspring has been banded regularly for a decade and a half covering a span of years greater than their value to the group as breeding components. The inevitable result of such systematic work has been a consistent increase in the percentage of banded birds in the yearly take of adults. This is shown on graph no. 1. From 6 percent in 1932 it has risen to 57.9 percent in 1942. Allowing for the impracticability of banding the entire hatch and capturing more than one-third of the adults present each year, this percentage is close to a theoretical maximum. The Tern Island colony, which is the largest in the group and the one in which the component individuals are most consistently those of preceding years, has been worked more thoroughly than have the others. As is shown on graph no. 1, the annual percentage of returns from there is higher than it is for the group as a whole, likewise the yearly rate of increase in this percentage is greater. The curve thus delineated more nearly approximates the maximum it is feasible to obtain and is a reasonably adequate basis for drawing credible conclusions. Since the capture of banded adults is the *sine qua non* in any population or survival study of a species, the returns we have obtained constitute the central figure in the picture.

Since the exact age of an individual bird can be determined only by the band it wears, it is unfortunate that those placed on terns last, as a rule, only about ten years. This is varied in both directions by some unknown environmental activities experienced, for one

band, still fairly legible, and seventeen years old was found on a tern this summer. Some series, notably the 34-300,000, have disintegrated more rapidly than others. Since all the bands carrying



GRAPH NO. 1

Common terns (*Sterna hirundo*). Showing the percent the returns are of the adults trapped each year.

numbers anteceding 500,000 we have recovered on trapped adults are so very much eroded and their ends so far apart that gentle handling frees them from the birds' tarsi it is probable there are surviving in the colonies some individuals which have lost bands affixed to them in the earlier years. We have obviated partially this detriment to exactness by routinely placing a second new band on the other leg of all adults wearing bands either well worn or over nine years old. The demonstrated tenacity with which individual terns occupy a precise spot in a ternery year after year and their repeated capture there suggests to experienced workers the possible age of such individuals but this, of course, must not be utilized for any accurate scientific determination. It must be realized that in the Cape group are a goodly number of adults whose ages are not known, this being the result either of their having lost their bands or of having missed being trapped.

The epoch of years covered by the work with this group of terns

TABLE NUMBER 2

RETURNS

	Hirundo			
Year	*Banded as Chicks*	*Banded as Adults*	*Total*	*All Species*
1928	5	0	5	5
1929	28	3	31	31
1930	10	6	16	16
1931	6	5	11	11
1932	38	42	80	80
1933	78	131	209	209
1934	0	7	7	7
1935	174	445	619	629
1936	310	1,581	1,891	1,990
1937	361	1,635	1,996	2,005
1938	639	2,017	2,656	2,694
1939	723	2,491	3,214	3,242
1940	706	2,392	3,098	3,177
1941	581	2,662	3,243	3,314
1942	....	....	3,786	3,838
Total	3,659	13,417	20,862	21,248

is sufficiently long and the sampling of the colonies is quite large enough as well as comprehensively representative to eliminate errors which would result if these factors were of shorter duration and less voluminous. Season abnormal mortalities, accretions and emigration from one site to another, balance each other and tend to cancel out during the time covered. The yearly variations in chick yield and survival is similarly leveled to a consistent figure for the period as a whole. If the figures for a single year or two are tabulated, comparison with other similar compilations shows not inconsiderable divergences; if they are graphed, sharp breaks appear in the curves. But every additional year's numbers included smooths off these irregularities more and more completely. This, confirmed by other evidence secured, demonstrates that seasonal variations are of small moment in the long run, that the causes of

mortalities and the adjuvants to conservation equalize each other, if not in any given year, assuredly they do in the aggregate of a number of seasons.

In 1930, by statistical methods of analysis, conclusions were deduced from a meagre 781 adults trapped in a single rookery of which only 29 were returns (O. L. Austin, Jr.). The very large amount of data acquired since then has shown that these inferences were substantially correct. So it is justifiable to believe that by a simple analysis of the enormous totals already given it is possible to determine the life span of the Common Tern, to show what part the composite individual plays during any given year or total of years in the status of a group of colonies, even to infer from these findings that this Cape Cod group's future may be foretold as satisfactory. This last is predicated also on what we have learned to be this species' reaction to occurrences and environmental changes which could affect its welfare.

It is solely a matter of passing interest to know the extreme ages attained by terns; one known to be sixteen years old probably corresponds to a human centenarian. It is of scientific value to know the period of years they are able to carry on an efficient response to their primary and most compelling motivation to perpetuate their species, not alone as individuals but as breeding colonies or similar aggregations. By this is meant an ability to maintain their population level and to raise it if this must be done to compete successfully with other species in ecological contact with themselves. We are led to believe this purpose has been accomplished during the last decade not alone by counts and estimates made in our field work but by correlating three other credible findings. The first is the number of individuals of a year's hatch found in the colonies each year of their lives, this being the average for a number of years rather than for any single one; second is the probable death rate for terns at each year of age; third is their total life span.

We have no evidence that the Common Tern is highly specialized in such important attributes as food requirements, territorial requirements and even in their behaviour as a whole, consequently there can be no shrinkage in their population total such as occurs in species whose essential needs are so limited that they are unable to substitute for the deprivations which always occur. A species which has made so great a numerical comeback after the devastations of plumage hunting, evictions from nesting sites and thwartings of many and varied sorts must have an inherent ability to make readjustments to the necessities of altered environment. Although the span of twenty years covered by work done in the Cape Cod tern colonies is but a small fraction of the time thought to be necessary for recognizable evolutionary or degenerative changes to come

to pass in a species, it appears to have been sufficient for the development of a trend toward increased productivity. It seems to have been much greater than what has been accomplished by efficient conservation measures during the last ten years. There have been no evidences of a drift toward increased specialization such as the laying of smaller clutches, obstinate tenacity of deteriorating nesting sites and emigration because there has been a great and growing shortage of their preferred food, the sand eel.

TABLE NUMBER 3

BANDED AS CHICKS

Years Old

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*Total*
Taken in 1938...	3	20	183	257	47	23	48	11	28	7	7	4	0	1	...	....	639
1939...	9	27	132	198	201	57	23	33	10	18	5	3	6	1	...	....	723
1940...	22	30	51	184	173	148	36	12	17	3	14	7	3	5	1	....	706
1941...	10	22	51	49	145	106	119	27	7	17	4	10	3	4	5	2	581
Total ..	44	99	417	688	566	334	226	83	62	45	30	24	12	11	6	2	2,649
Percent	1.7	3.7	15.7	25.9	21.3	12.6	8.5	3.1	2.4	1.7	1.1	0.9	0.5	0.4	0.2	0.08	

BANDED AS ADULTS

Years Since Banding

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*Total*
Taken in 1938...	561	791	420	16	144	58	7	9	10	1	3	1	....	....	...	....	2,021
1939...	854	452	666	350	8	97	42	4	5	6	....	....	....	....	...	....	2,484
1940...	787	564	295	436	214	4	57	28	5	3	6	....	....	....	1	....	2,400
1941...	759	656	436	252	316	156	8	52	19	2	2	4	....	....	...	....	2,662
Total ..	2,961	2,463	1,817	1,054	682	315	114	93	39	12	11	5	....	....	1	....	9,567
Total of Both...	3,005	2,562	2,234	1,742	1,048	649	340	176	101	57	41	29	12	11	7	2	12,216

Insomuch as the factual material used in this paper has been obtained in the single collection of tern colonies comprising the Cape Cod group recently described (Austin, 1940), it may be questioned whether the conclusions herein expressed are applicable to Common Terns as a whole. This is unwarranted, first by reason of the complete absence of evidence to the contrary. Further, variations in behaviour from that of the Cape Cod group, narrated as having been observed elsewhere, are duplicated by divergences in the several colonies which make up the Cape Cod group itself. These are simply inevitable adjustments to dissimilar environmental conditions and they do not impair reproductive accomplishment over a period of a few years. The procreative instinct is so primal and compelling that it functions for terns as a whole exactly as do

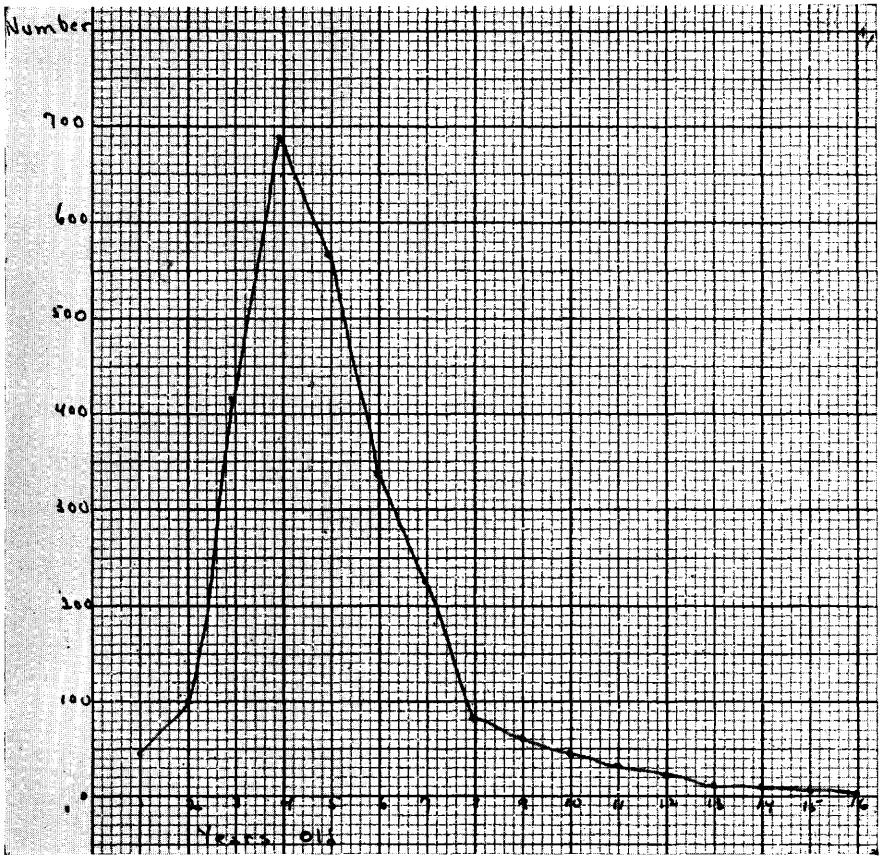
the physiological processes which transmit plumage characteristics. Accordingly it does not vary in potency and accomplishment in the species as a whole regardless of what variations in environment component groups experience during a nesting season.

In the biological order of things it is of no moment how long the members of a species live provided the span allotted them to reach and maintain sexual maturity is long enough for a generation to duplicate the achievement of its predecessor. The longer this span the less the tendency toward specialization although an unduly long period of productive efficiency might result in a numerical increase so great the species' adaptability would necessarily deteriorate. That the life span of the Common Tern is now of a desirable length may be assumed from the fact that for more than a decade this species appears to have maintained a fixed numerical level. This applies at least to the Cape Cod group, the largest known in North America, sufficiently numerous to obviate under all probable handicaps and mishaps what inevitably happens to a species which has been reduced in numbers to an unsafe maximum. This is not jeopardized but rather it is enhanced by the peculiar manner in which Common Terns are found to be segregated into groups which do not exchange memberships to any practical extent, for a major disaster occurring in any single group is solely a local affair and can have no effect, for at least a decade, on the normal replacement in other groups. Seasonal failure to yield the customary number of chicks can occur in a colony for at least three consecutive years without reducing its population sufficiently to disrupt and disperse it; almost always there is a subsequent year or two of at least average success, either on the original or a new nesting site. It is not necessary for either a single colony or a group of them to keep the population total uniform from season to season provided there is no consistent trend toward reduction. Our findings have been that the life span is sufficiently long to afford ample opportunities for a generation to balance its failures and successes.

The Cape's largest colony has nested at Tern Island, Chatham for the last twenty years. Its population has varied from time to time between ten and twenty thousands; its chick yield under normal ecological conditions is always abundant. In 1932 and 1933 by reason of predation, it matured only a fraction of its usual number, yet the following year it raised almost twice as many young as it had before or has since. Every year one or more of the colonies which make up the Cape group fail more or less completely, yet the number of birds comprising the group as a whole remains almost stationary. This, however, is somewhat contingent on the plethora of new-born that Nature always provides in the scheme for perpetuating a virile species. We have found that when one of our fairly large colonies

has been deprived of its nesting site by the elements or other destructive forces, the following season it appears nesting as a fairly complete unit in one of the other rookeries. This was done in 1941 by the several thousand birds which in 1940 had accomplished a successful nesting on North Point. But when, as is of more common occurrence, there is a gradual reduction over a few years of available nesting territory in a ternery by reason of continued erosion or progressively increasing overvegetation, the evicted birds amalgamate with the other colonies according to a predictable pattern based on their ancestry and the ecological desirability of available sites. This happened to the Egg Island colony in Lewis Bay, in 1932 a prolific aggregation of 5,000 birds, reduced by 1940 to a dozen pairs; the Billingsgate colony has dispersed similarly. The adult trapping of foster colonies during the years of such realignments by which this has been shown, has demonstrated also that the disappearance or death rates for former members of these defunct colonies is only a small percent greater than they are for normally functioning components of the Cape group. Since all Common Terns, in so important a matter as reproduction must function alike, it is believed that adult trapping would have shown that this is what had happened to colonies believed to have been destroyed in other sections of the species' breeding range. It is highly probable that less propitious terminations of these and similar occurrences would have affected adversely the maintenance of the population level and since it has required a period of from two to six years to avert their taking place, direct evidence is afforded of the adequate length of the life span.

To facilitate comprehension, some portions of our data have been segregated and presented in tables and graphs. There is a table (no. 1) showing the distribution by years of the chick and adult bandings and the returns for the group as a whole. Recoveries of Cape banded terns elsewhere have been reserved for another study. Since only returned adults which were banded the year of hatching afford accurate material for a study which concerns their age, a table (no. 2) is included showing the number of chick banded adults which have been taken each year. In view of what has been stated before, it is believed correctness will be increased by limiting our consideration largely to such returns as have been taken in the four most recent years available at this moment, 1938 through 1941. (Table no. 3.) This will allow the inclusion of a higher percentage of birds known to be from three to eight years old, the epoch of their lives, as will be shown, when they are of numerical importance in the maintenance of a population level. The total returns for these four years is 12,211 of which 2,649 or 21.7 percent were banded as chicks. A graph (no. 2) has been made of these chick-banded birds



GRAPH NO. 2

Common terns (*Sterna hirundo*). 2,649 returns taken in 4 years, banded as chicks, showing age when taken as returns.

Taken in 1938	639
Taken in 1939	723
Taken in 1940	706
Taken in 1941	581
	2,649

based on their age at the time of their capture during this interval. As a suggestive corollary, a graph (no. 3) shows the duration of life attained by birds banded while adults which were taken during this quadrennial. Greatest accuracy is attained in graph no. 4 which

depicts the percentage the chick-banded birds are at each year of their age of the total number of chicks banded during the four years preceding the first year of age reached.

Taking into consideration only the greater of the known variables it is surprising how small the deviations are in graphs 2 and 4 from the line of a true curve, also that there is not greater disparity between the yearly points in the two. There are large differences, from year to year, in the number of chicks hatched, the percentages of the hatch which are banded and the ratios of survival, not only in the individual colonies but in the group as a whole. There are annual disparities in the fractions of the adult populations trapped. Some seasons, excessive predations have raised the death rate of adults above the normal. In spite of their thoroughness the samplings do not duplicate each other yearly. Since deviations which result from these and other causes are not more marked for the four year period which is more than one-third of that part of the terns' life span, it is probable that even these divergences would be ironed out by duplicating data which covered a dull decade.

The greatest ages attained by Common Terns is shown in the following table:

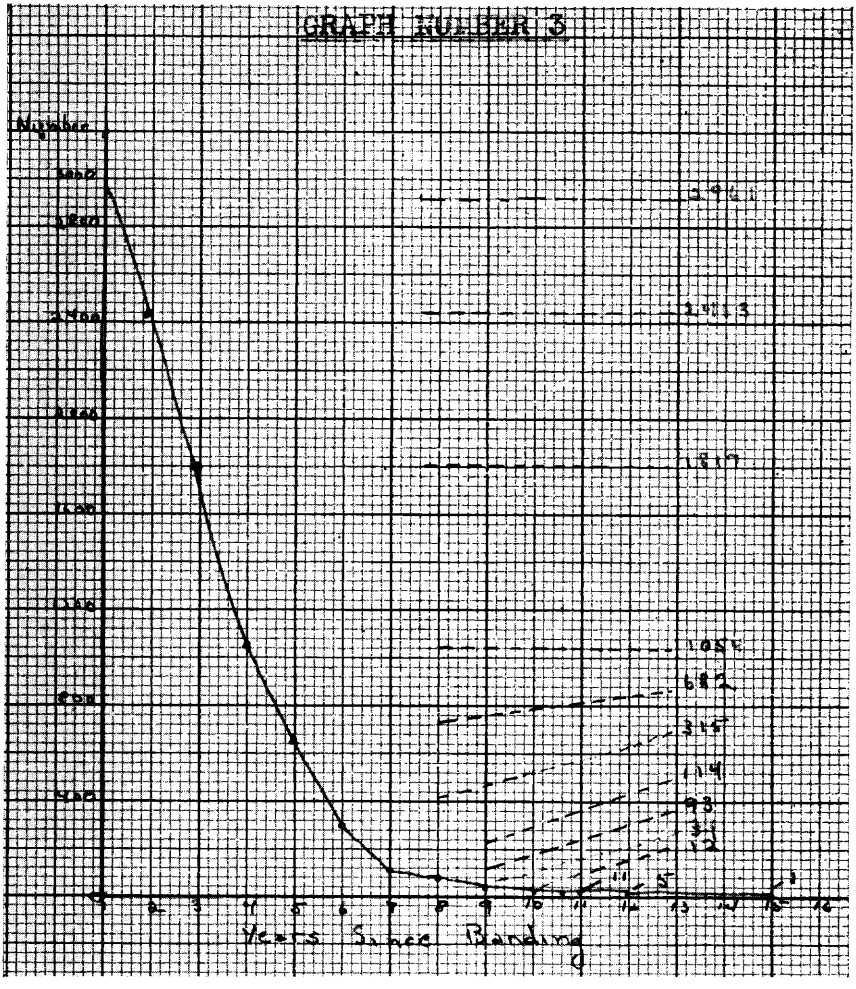
Years old	14	15	16
Taken in 1938	1	..	..
1939	1	..	..
1940	5	1	..
1941	4	5	2
Total for 4 years	11	6	2

In 1940 one bird banded as an adult fifteen years before was caught, so, when retaken, it must have been at least sixteen years of age. It cannot be gainsaid that this individual was not even older for the graph shows that only forty-four or 1.6 percent of all the returns taken in the four years bred their first year. This season, 1942, a Common Tern seventeen years old was trapped at Tern Island. Accordingly, at the time of this writing, seventeen years must be considered the extreme of a Common Tern's life expectancy. But since each of the last three seasons a year has been added to the then known limit, seventeen years must not be adjudged the absolute ultimate. The Marples have postulated the presence in one of their colonies of an older bird but with no credible supporting evidence. The only concrete evidence of the advanced age of birds is based upon recapture of adults which were banded as chicks; there is no other way of even surmising that terns have reached advanced ages. It must be stated in retraction of previous suggestions (Austin, 1938) that two years of careful observation have convinced us that, in behaviour, very old birds differ from their younger associates only in the matter of tenacity to former nesting

sites; also that there are neither plumage changes nor variation in the coloration of soft parts incident to or characteristic of their senility. Since unusual longevity is possible for any bird, these very old breeders must be considered simply interesting but unimportant anomalies with one reservation—their consistent return to their former tenures is a factor in maintaining flock adherence which, in the long run, enhances reproduction.

It is axiomatic that the number or percentage of a season's banded hatch found breeding subsequent years indicates two things: first, the degree to which the urge and ability to procreate functions during the several years of their lives; second, their value, according to their ages, to the primary purpose of a nesting. Since there is much evidence indicating that, once achieved, the ability to procreate continues until death, the first applies to the first few years and until the maximum of the hatch have become consistent breeders. This peak is reached in their fourth year. The second indication bears especially on the remainder of their lives, for after full maturity has been achieved the death rate rises with progressively increasing rapidity as age advances. Observations made during the last few years indicate, in contradiction of formerly expressed opinions, that neither juveniles with undeveloped gonads nor sexually defunct birds hold membership in breeding colonies. Such were supposed to form a part of the flocks of birds seen along the shore-lines of terneries. Now it is thought that early in the season these assemblages consist almost entirely of breeding members of the colony without clutches to incubate. Later in the summer they comprise birds migrated to the site for renesting and others which, having either raised their young or become otherwise impotent, respond to a well developed social tendency. At all times they contain nesting members of the colony.

The life of a Common Tern, in spite of variance by a negligible percentage of individuals, appears to be divided consistently, and, from a practical standpoint, rather definitely into three epochs which may be designated youth, maturity and destruction. The word youth is used rather than adolesence because sexual activity does occur during this period and the term implies a behaviour pattern not so propitiously developed and fixed as it is in fully developed birds. By rights, this should be subdivided into there parts demarcated by radical differences in the degree of physical development, changes in environment and mortality. Maturity has been selected for its appropriateness without intimating its literal definition. Destruction has been chosen rather than senility because all available evidence indicates that in this species the procreative instinct, potency and fecundity persist without waning until death. In view of this, if physiology alone is made the basis



GRAPH NO. 3

9,567 returns taken in four years banded as adults showing years of survival after banding.

Taken in 1938	2,021
Taken in 1939	2,484
Taken in 1940	2,400
Taken in 1941	2,662
	9,567

for partitioning a tern's life, these last two epochs should be combined into one. On the other hand, as shown by graphs 2 and 4, there is so sharp and angular a leveling off of the curve at the suggested dividing line between maturity and destruction that a definite change in the status of terns of this age as a whole is indicated. The abrupt cessation at this point of the rapid annual decrease in numbers breeding suggests that those surviving are no longer an important factor in the colony's prosperity.

Youth embraces the first two years of life and ends at the beginning of the third summer when, as the graph shows, more than one half of those of a hatch which are still alive have begun annual procreation. That a great change in both the physiological and psychological functionings has taken place abruptly is indicated not only by the numbers involved but also by the development of concerted action in flock formation and the adoption of flock behaviour. The first subdivision terminates when the young leave the terneries; the next covers the remainder of the first year; the last in the second year. As is conventional for most living things, the period as a whole is one characterized from its beginning by an enormous mortality which gradually drops to safer levels in accord with the progressive acquisition of physical plenitude and protective adaptability. It is that portion of a tern's life when ancestry and inheritance appear to count most, as is shown not only by the greater chance for survival a grey plumage-phased chick has in comparison with one of brown coloration, but also by the observation that a much larger proportion of the offspring of some colonies commonly reach the epoch of maturity than do those of others.

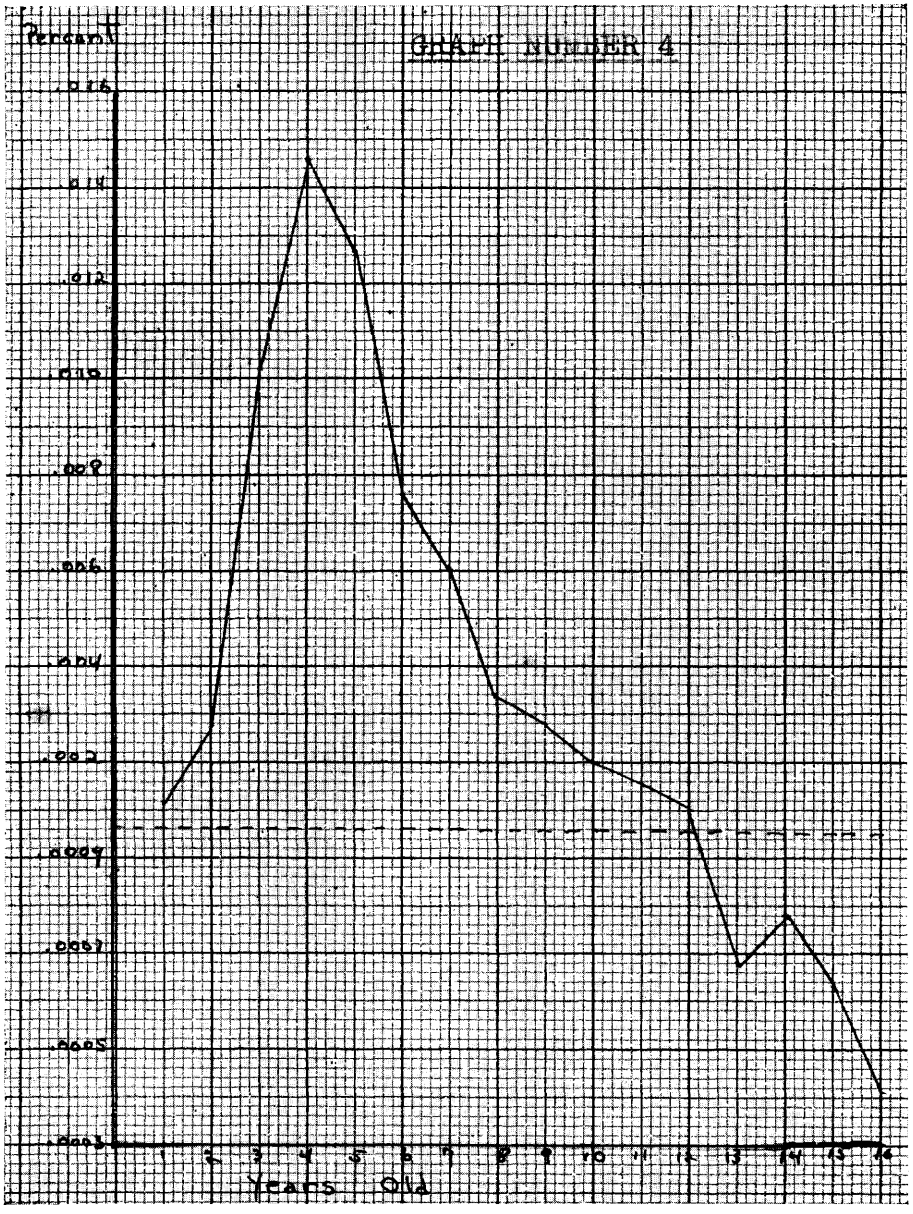
The first subdivision of the period of youth is the most precarious for it is during these few weeks that death takes its greatest toll. The inevitable minimum, which is large under the most favorable conditions, is increased exceedingly by the incidence of such deleterious occurrences as severe storms, predation and parental neglect. Of course there is a prompt decrease so soon as chicks have learned to fly. In 1939, a highly successful year at Tern Island, superficially incident to other work we buried dead chicks totalling 21.5 percent of the hatch. It is believed that of the entire hatch in a large colony which has had a season of average success, seldom more than two-thirds and often much less survive to leave the vicinity of the site. There is also another important but intangible cause of chick mortality concerning which we are not orientated. In the Cape group there is a colony at Jeremys Point with a population which fluctuates seasonally between 200 and 2,000, often augmented at midseason by renesting birds which have been frustrated elsewhere. On this site the normal number of average sized clutches are laid and hatched but invariably the chicks die within one or two days or

simply disappear. It is rare for one of this colony's young to live to flying age. Every season we have found the same thing occurring elsewhere on the Cape but not consistently in any one colony. This year it has taken place in a generalized way in all the terneries but to a much smaller degree. The result has been that in spite of almost unprecedented freedom from predation, meteorological inclemencies and other detrimental incidents, the chick survival has been the smallest in nine years. Further, the Tern Island colony, in 1934 and 1935, no larger in those years than it has been this summer, produced more than twice the number of young it has this nesting. It is comprehensible that this has occurred to a considerable sector of this group of terns simply by the more common functioning of its unknown cause. Obviously an affair of this sort must be the result of something inherent in the chicks themselves, if not disease perhaps some temporary digression from their usual physical inheritance.

There is evidence that a large number of chicks perish during the remainder of their first year. From late July until the end of October a considerable number of the banded young of the year are picked up dead or moribund widely over the Cape and the adjacent mainland, also along the shore line to the south and inland in nearby states. Later in the winter, the mortality remains high by reason of an insufficiently developed protective reaction to the vicissitudes of an unfamiliar environment. This is suggested by the fact that of all the recoveries made on the wintering grounds, eighty percent at least are birds of the year.

Very little is known of the whereabouts and status of terns during the second and last year of youth, although it is known that some of them have remained on the wintering grounds. The number nesting this particular summer is only double that of the few which do so the first after the one of hatching, whereas it is multiplied sevenfold the one which follows.

The epoch of maturity embraces a span of six years beginning with the third one in a tern's life—collectively speaking—reaching its numerical peak in the fourth and ending with the eighth. If the demarcations we are making were based solely on the number of birds found breeding each year of their lives, graph no. 2 would fix the seventh year as the credible termination, since the total of those taken in their eighth summer is less than it is in the second year of youth. If the criterion is the percentage of banded chicks which do return the several years of their lives, graph no. 4 necessitates adding the eighth year to this era. This because of equal importance with numbers is the sharp angulation in the line of the graph to a new and continuous degree of curvature with a new average for the sizes of the abscissae. Obviously, this is the portion of the



GRAPH NO. 4

Common terms (*Sterna hirundo*). 2,649 returns banded in four years as chicks. Graph shows the percentage the returns at each age are of the total number of chicks banded the four years preceding the first year of each age reached.

life span of the Common Tern which is essential to the maintenance of the population total. Under ordinarily favorable ecological conditions, the remaining part could be eliminated without causing jeopardy for, as table Number 3 shows, of the 2,649 chick-banded adults taken in four years 2,334 or 87.1 percent were between three and eight years of age. Adjuvating this great numerical preponderance, is a well developed, propitious and fixed behaviour pattern which exhibits very little of the vagaries of youth and a minimum of the fixed and deleterious habits of senility. Most of the changes which take place in its outlines are for the better since they represent a reaction to experience by individuals at the height of their virility. Of additional value and in marked contrast to the sudden transition from youth into maturity which results from the abrupt onset of gonadal functioning is the slower decline subsequent to the fourth year peak. This is due not to causes intrinsic in the birds themselves but rather to influences originating in environment.

The final epoch is simply the progressive extinction of those remaining individuals which either possess inherent constitutional superiority or greater adaptability, or else have unusual good fortune.

On graph no. 2, in contrast to the almost vertical line for the middle period, is one almost horizontal yet with a consistently downward trend to the sixteenth year when extinction is almost complete. This trend, while much less visually patent in graph no. 4 is emphasized by all the points subsequent to the twelfth year being below the line horizontal to the point for the first year. The status of behaviour and the procreative ability during this era have been suggested in preceding graphs but it is of interest that in the single instance in which we trapped the mate of a bird twelve years old, both banded as chicks, the second was six years younger.

We entertain no delusion that what has been written is conclusive and final. It simply offers our interpretation of the data available at the moment. Either our work embraces too short a period of time or the determining facts have not been obtained for, from a purely theoretical standpoint, especially if the reasoning is done in reverse, the Common Tern may well have a life span of twenty or more years.

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RETURNS FROM BANDED BIRDS: SOME LONGEVITY RECORDS OF WILD BIRDS

BY MAY THACHER COOKE

(*Continued from page 119*)

TOWHEE. *Pipilo erythrophthalmus*

*B223710, banded at Demarest, N. J., on August 8, 1933, by Keahon Garland, was retrapped at same place June 25, 1937, rebanded with B223755, and again retrapped May 12, 1938.

B237662, banded at Summerville, S. C., on April 10, 1933, by W. P. Wharton, was retrapped at same place January 31, 1937.

*C126037, banded at Demarest, N. J., on August 3, 1932, by B. S. Bowdish, was