the natural range of the species. In the case of the adult bird, however, the homing instinct is a powerful influence operating not only to bring it back to the site of its nest of the preceding year, but even to its original winter quarters and probably to feeding and resting areas while en route.

From the evidence presented it appears unlikely that efforts to restock depleted waterfowl marshes with pinioned or hand-reared ducks will be successful. It is desirable, however, to have further data on this subject, to accomplish which all birds liberated for restocking purposes should be banded, and special efforts should be made to capture and band any young that may result from such liberations. The Biological Survey will be glad to furnish bands and otherwise assist in any operation of this character that may be contemplated.

THE STATUS OF CAPE COD TERNS IN 1934[1]

By OLIVER L. AUSTIN, M.D.

THIS season, the Cape Cod tern colonies have experienced an unprecedented prosperity, surpassing what was thought to have been the cyclic peak of 1929. This was subsequent to the occurrence to an almost ideal degree of the major essential ecological conditions, both natural and artificially controlled, which determine the degree of success of a nesting. The elements and the food-supplying ocean were benignant; reclamation work at the site of the Cape's largest colony, Tern Island, adjuvanted greatly. Notwithstanding this, the opinions advanced by the station's staffs in 1932 and 1933 that the success of all tern colonies is cyclic and that the curve for the Cape's tern population is and will continue to be regressive remain unchanged. During the last four breeding seasons the banding of chicks in all the tern colonies has been sufficiently comprehensive to warrant the use of totals for statistical comparisons. Environmental conditions of natural origin have been practically commensurate for all nestings this year. Since the Tern Island chick-banding comprised this year 76 per cent of the total bandings on the Cape, whereas in the total of the three preceding years they were but 34.3 per cent, the difference must be charged in part to constructive human intervention at Tern Island. The sum of immature bandings for the entire

[1] Contribution No. 18 from the Austin Ornithological Research Station.

Cape, exclusive of Tern Island, this year is 16 less than the average of the three antecedent seasons; what it would have been had Nature been less kind is obvious. It is probable that the auspicious conditions of this season, like the numerically record-breaking land migration which traversed the Cape in the fall of 1932, will not recur soon nor with sufficiently effective regularity. The human assistance, so efficiently important at Tern Island this nesting, is not certain of either inception or accomplishment.

Climatic conditions usually play an essential inhibitory rôle in determining the percentage of survival of a hatching; possibly they are the means utilized by the great biological scheme to curtail excessive reproduction. With yearly regularity, at some moment when hatching has been well advanced, a severe, cold easterly storm of from two to four days duration has occurred to take toll amounting to many hundreds of the low-vitalized chicks. Periods of continuous excessive heat or cold have killed large numbers of the inadequately brooded young, while recurring high winds have augmented the mortality. Each June or July a wind-heightened flood tide has obliterated in a few hours one or more badly sited colonies.

Spring was precocious on Cape Cod this year; early May was unseasonably warm and balmy. Long cloudless and fogless days so stimulated sexual activity that nest-building, egg-laying, and hatching ensued two weeks in advance of the customary dates. Aside from three light showers and one day of intermittent and warm sprinkling, there was no rainfall during the whole breeding season. The wind was consistently light and almost uniformly from the warm southerly and westerly quarters; consequently fog occurred infrequently. There were no cold, raw days and no long periods of excessive heat. All the nights of eleven-foot full-moon tides were so still that no flooding of moment covered extensive nesting areas. For some undiscovered reason, this year, even on the low north end of Tern Island, there was but trivial occupancy of tide-inundated locations.

For the consummation of successful reproduction the constant presence of an adequate and suitable supply of food is of almost as great importance as is suitably tempered weather. Also, this must be within close proximity to the colonies. Tern chicks, like nursing humans, thrive only when given heat-producing and tissue-building nourishment at intervals at least twice as frequent as are requisite to adult welfare. When parent birds must travel long distances to obtain food, or spend much time in catching it, the corresponding hiatus in

brooding, especially in inclement weather, determines consequent fatalities. The great scarcity of all small bait fish near Tern Island in June, 1933, resulted in the death of over fifty per cent of the first hatchings. Many times it has been observed that the combination of food-shortage with inclement days has coincided with an otherwise inexplicable sharp rise in the death rate. In preceding years it has been a common occurrence to find a dead chick, even well grown, with close to its head an evidently proffered fish too large to permit its ingestion. This year, from early May until the first of August, Nature was prodigal with an uninterrupted supply of food in the immediate vicinity of the colonies. The sand-eel (*Ammodytes americanus* DeKay), unquestionably the "staff of life" "and the Piece de Resistance" in the tern dietary, was present overabundantly at all times. In 1933 a motley variety of bait fishes were proffered the female by the male during the courtship dance; this year sand-eels alone were utilized. From the observation blinds on Tern Island it was noted that departing parents usually returned to chicks in a very few minutes with food. This explains another determination—that, although it was less requisite for climatic reasons, the chicks were more closely nursed than during previous nestings.

The degree of food-abundance can be estimated from the numbers of unconsumed fish found in the colonies. Everywhere the totals of these were multiplied many times beyond those of previous years. Since dead chicks commonly have one or more uneaten fish close by, the unprecedentedly low chick mortality this summer should have diminished the discard. During late visits to the islands numerous little piles of fresh sand-eels were found near robust, husky chicks. During the whole season not over twenty-five dead fish other than lance were seen. At Egg Island, where formerly the food consisted largely of small minnows taken from a salt creek a mile away, every visit found a great majority of the adults catching sand-eels close by. Strikingly infrequent were the customary fights of a dozen half-grown for every meal brought to an open space by an adult. Usually so soon as the young have matured sufficiently to fly well, and are being taught to forage for themselves, they depart promptly to thrive on the greater bounty of the outer beaches and sand-bars. All summer these birds lingered at their natal sites. At Tern Island late July found flocks of thousands of them congregated along the shore and feeding themselves far earlier than customarily in the contiguous shallows. The percentage of adults in these groups was surprisingly low.

Predators, by yearly comparisons, accounted for but a trivial part of this year's unapproachably low chick mortality. While the almost perfectly efficient protection given the Tern Island colony is preponderantly responsible for this, of great value was the success of the first nesting by shortening the period of vulnerability. At Tern Island the rats and at Egg Island the owls, in the two preceding years took a many times greater proportionate toll of the second than of the first hatch. The relatively smaller number of gulls on Cape Cod this year, especially Laughing Gulls (*Larus atricilla*), and the almost complete absence of their tracks as well as those of Black-crowned Night Herons (*Nycticorax n. hoactli*) on the sand of nesting sites eliminates the likelihood of destruction of eggs, at least by these suspected, though unconvicted, species.

Human molestation was unexpectedly slight, at least in the three large groups. Monomoy Point, which cannot be credited with having reared a hatch in recent years, and Pamet Point, almost equally unproductive, were being grievously overrun, so we did not visit them. There were but six first nestings on Nauset Point, none on North Point, and no second breedings on either to be thwarted by picnicking summer residents. Friendly quahaugers fishing regularly close to Billingsgate Island brought reports of its being passed by as a recreation ground. On one of our visits, we found spending the day there a large group of a nationality indicted for two former complete vandalisms of the colony, but they evidenced no interest in either the birds or our work. Egg Island, although in the heart of a busy yachting and fishing field, suffered no damage other than one boyish piling of six eggs into a single nest.

For the purpose of obtaining data on returning birds and thus being enabled to utilize the extensive immature bandings of previous years, an effort was made in 1932, and more intensively in 1933, to trap a large number of adults. These were caught to the number of 1239 during the first, and 2,857 in the second year by the most efficient but exceedingly slow method of placing drop traps over nests containing eggs. This necessitated spending long days in the colonies almost consecutively throughout the entire season. Such constant trapping made the birds unusually excited, jumpy, and wild, until even a trivial noise some distance from a rookery would disrupt the customary peaceful pursuit of requisite parental duties. Inevitably, in spite of efforts to minimize it, a considerable number of eggs were broken and many nests were abandoned. Incubation and brooding were also interrupted sufficiently to cause the spoiling of many eggs and the death of a considerable

number of very young chicks. Trapping was found to be potentially so destructive a factor in reproduction that, in spite of its unmatchable value in distributional, life-history, and ecological studies, it should be foregone absolutely for a period of two years if local tern populations are to be maintained. This year but two adults were trapped, and these were for an important specific purpose. All observation work was pursued from blinds erected before the first arrivals, and the chick-banding was done with meticulous care, the maximum possible dispatch, and the staggering of the work among the several colonies. Consequently not ten eggs were broken, not twenty-five abandoned and infertile nests were found on the final check-ups; and the whole cycle from courtship to the teaching of self-maintenance was carried through with serene and perfectly concentrated effort to a much earlier conclusion.

THE RECLAMATION OF TERN ISLAND

The history of the Tern Island colony from its founding by the remnant of the once very large but ultimately exiled tenantry of North Beach, through its rapid growth into the most important colony on Cape Cod, past its cyclic peak and into its geometrically progressive decadence, may be found in the published reports of other observers and ourselves. In the midsummer of 1932 it was evident that the trend of Nature, historically shown and recently predicted to recur here, had determined the inevitable and rapid dissolution of this colony. It is known also that the Cape afforded no virgin or time-reconditioned site which could offer either sanctuary or pioneering possibilities, as had Tern Island itself twenty years ago. With this colony disseminated and all the others salvable only by some improbable geographical cataclysm, the prognosis would be hopeless. Since Mr. Charles B. Floyd, for many years its enthusiastic conservator, had assigned the care and scientific possibilities of Tern Island to this station, we felt obliged at least to attempt to postpone the consummation of the tragedy. Further, we were beguiled by the problem of ascertaining whether or not human effort could restore the cycle to its peak or flatten appreciably its downward curve.

In 1933 effort was directed toward determining by observation and experiment all the patent etiological factors, their relative importance and their interrelations, and to the discovery and trial of methods of inhibiting or augmenting them. A résumé of much of this work was given in *Bird-Banding*, Vol. IV, No. 4, pp. 190–198, but one important incident was omitted. July 11th, when frustrated pairs were renesting extensively, the whole jungle of beach grass, together with its

stolons, was uprooted by hand and removed from an area fifty feet square in the heart of the most densely overgrown and sparsely tenanted part of the island, leaving a smooth plot of sand. Two days later this was so well dotted with nest hollows that a similar denudation was done in another locality. On July 19th both sites were more closely egg-covered than any other part of the island, and eight incubating birds were trapped on the first tract. At the end of the season we were committed to four essential desiderata: the complete removal by its roots of 90 per cent of the beach grass, or at least its thinning to a corresponding extent; the elimination of rats—the consummation of the latter depending greatly on the achievement of the former; the conservation of the first nesting; and the maintenance of sanctuary by the minimizing of human visitation. The efficiency of these measures would depend unquestionably on Nature being propitious or at least neutral.

The ideal site for a tern nesting is an insular stretch of sand lightly dotted with isolated tufts of beach grass or single low-leaved plants such as dusty miller and beach pea, and the cyclic peak of a colony always coincides with the maximum attainment of suitable environment. Open places facilitate nest-building, nest-approach, and incubation, and they are preëmpted invariably by the first arrivals, the foliage and grass affording tender chicks essential shelter from the elements. These conditions unobtainable, open beach fringing the site is esteemed more than densely covered locations. Roseate Terns (*Sterna d. dougalli*) elect the base of a clump of grass on the edge of an open area. Some colonies, with considerable success, however, continue to occupy sites overgrown with bushes several feet high, such as those on Hopkins Island on the Cape, and such low jungles as nearby Muskeget and Penikese Islands, but, considering relative populations, they do not achieve a proportionately equal reproduction. The obvious reasons for this persistence are the well-recognized homing instinct of birds and the existence of some favorable ecological condition which over-compensates the disadvantageous floral excess, and also the unavailability of a more suitable terrain.

Beach grass cannot be eradicated by hoeing or grubbing, for from every clump stolons several feet long branch out in all directions and interweave into a firm mat deeply below the surface. Ploughing, harrowing, and raking were chosen as the perfect answer, but conditions prevented their employment. Thus limited to the slow but efficient method of pulling out grass and roots by hand, we began at the southern

tip of the island a complete denudation, leaving only a strip four feet wide along the edge of the western bank to act as a binder against erosion by the tides. The station groundskeepers, augmented by other laborers when procurable to as many as nine, continued the denudation until late in the fall. Considerably more than the lower third was bared, also an extensive, wide strip northward in the center through the area of greatest density. By the repeated use of dynamite and fire we destroyed an old landmark, the wreck of a large scow, beneath which we exhumed a rodent colony. All litter, comprising driftwood, the remains of gunning-blinds, accumulations of thatch, and also the windrows of tide-deposited flotsam along the shores, was raked into piles to dry out for burning. When autumn had withered the grass yet standing and rendered it consumable, the uprootings were burned, and the renovation was almost complete. A careful survey in the late winter showed, by the recently opened mussel shells, the persistence of but one tenanted rat burrow. Red squill was planted generously, and subsequent inspections warranted the belief that no living rats remained. In April, this year, the shoreline was cleaned, observation blinds were erected, and another firing disposed of all remnants of the former season's grass. The island was satisfactorily clean. It was certain that not one rat remained. The grass had begun to sprout up in the area which had not been denuded.

According to the credible statements of the observant and interested fisherman, Mr. Howard Eldredge, whose home and fish-house are on the mainland shore less than one hundred yards from the island, a considerable portion of the colony returned almost in a body directly to the nesting-places the last few days in April. The unusual earliness of this event and the unexampled size of the vanguard were emphasized by the fact that he had not seen, on his daily trips to fishing-grounds far off shore, any of the birds "hanging around outside" during the preceding week as is their custom. The flock augmented rapidly, and courtship and nest-building, fostered by warm clear weather, were consummated speedily. On May 13th there were approximately ten thousand birds present densely concentrated on the southern part of the rookery, with a moderate number of pairs nesting elsewhere. The entire open area was so closely covered with nests that it was thought, in view of the terns' insistence on territorial rights, a maximum occupancy was attained. No such nest approximation had occurred since 1929 before overgrowth of vegetation began. At least one fourth of the nests in the grass-

less stretches already contained an egg, whereas only an occasional egg was found in those situated otherwise.

On May 24th it was believed that the peak population of between twelve and fourteen thousand birds had been reached about five days earlier, for there were eggs in all nests. Some courtship parading continued, but it did not terminate in copulation, as before, confirming the opinion that the males do not cease proffering food to their mates until hatching has been completed. The late comers had domiciled on the northern side of the island, where the grass, eight to ten inches tall, was not yet over dense. Here the clutch-average corresponded with that of the open terrain, suggesting that the date of important egg-laying had been passed. The egg total was unquestionably below an estimate predictable from the size of the colony, the sittings consisting of a much higher percentage of two eggs and lower of three eggs than in former years, while groups of four were exceedingly uncommon. There were very few nests close to the high-water line and but two on the low and marsh-grassed northwestern peninsula inviting eradication by leap tides.

The usual ratio between Common and Roseates Terns appeared to be unchanged from other years, also to be uniform throughout the season. The latter species, as always, had selected with but few exceptions well-grassed locations. The relative tardiness of egg-laying in this territory must not be construed to indicate a corresponding late arrival date for this species; we are seeking proof of a concept that courtship is more prolonged and fecundation longer delayed by Roseate Terns. A new group of at least twenty pairs of Arctic Terns (*Sterna paradisæa*) settled on the southern tip of the island.

Only three dead terns had been found, these presenting no evidence of mangling. Diligent search did not uncover evidence to warrant even a suspicion of rat presence. Since this eminently successful conclusion of the first and important part of the season afforded so auspicious an outlook, it was decided to restrict our visits, until hatching had been well advanced, to infrequent and short inspections. No indication for intervention having occurred in the meanwhile we returned to the island June 24th to make a comprehensive survey and begin chick-banding. Our note entry at the end of the day reads, "This colony is prospering as it has not in years." During this elapsed period the weather had been uninterruptedly favorable, while other important ecological conditions were also continuously auspicious. The control of vegetation, the banishment of rats, and the curtailment of disrupting an-

noyance by humans appeared to have been maintained sufficiently to have preserved well a precocious and exceedingly virile hatch. The uncovered spaces had not regrown beyond the outcropping of a few scattered shoots of beach grass and an occasional plant of dusty miller and beach pea. Elsewhere the grass had regrown abundantly, but the clumps were almost uniformly discrete and upstanding, permitting easy inspection of the clean underlying sand, the exceptions comprising four expanses, each from thirty to fifty feet square, along the eastern border, so densely overgrown that their exploration was tedious. Not one of the sixteen dead adults found gave evidence of violence; no burrows or other indication of rat invasion were uncovered. A full day of intensive work in banding two thousand terns provoked far less clamorous protestation, angry swooping and interruption of breeding activities than would have resulted in a much visited rookery. Although allowance for the unusual forwardness of this year's reproductive cycle had been made in the selection of the date for the commencement of banding, the degree of its advancement and prosperity exceeded our rashest anticipation. Not only had more than two thirds of the eggs in the open stretches hatched, but, of greater moment, well-grown chicks swarmed everywhere, many ran off to escape by swimming, and a considerable number were sufficiently muscled and feathered to attempt flight; only 235 dead were found.

From June 24th banding at suitable intervals was continued to its completion on July 13th, when the findings of the three final searchings signified the probable persistence of less than one hundred unbanded chicks and twenty-five abandoned clutches. During this interval two momentarily ominous discoveries were made. On June 26th, a few feet from the dune's edge on the extreme northeastern edge of the island, close to the last known tenanted rat-hole, four piles of eggs, approximating one hundred each, were found hidden beneath thick clumps of grass. A few of the shells were empty; all had the appearance and malodor of equally advanced decomposition, with no indication of periodic or recent addition of fresher eggs. The absence both then and subsequently of dead adults or chicks in the vicinity, together with the survival of all neighboring clutches, acquitted rats and convicted some unidentified humans. On June 27th, in the eastern center of the colony, within a radius of one hundred and fifty feet, were counted 49 freshly killed Roseate adults. Of two only the heads and wings remained; all the others had been bitten through the head or neck without any partial consumption of

the bodies. There being no augmentation of this group on the following days and no later repetition, the slaughter was ascribed to a casual visit by a wanton weasel or an unsuspected predator. A continuous drought not only restrained the growth and spread of vegetation but also withered the grass progressively, thus facilitating the completeness of our work. A last survey, August 2d, demonstrated the absence of renesting, the departure of the adult portion of the colony, and a scantness of the malodorous litter usually consequent to a large nesting.

It is reasonably sure that this season, for the first time in six years, not one rat subsisted on the island's munificence. This was due not alone to there being no winter-surviving members of this prolific species awaiting the return of the colony, but considerably to the failure of hunger or persecution to become grievous enough to impel the swarm of rodents known to infest near-by fish houses to emigrate across the intervening channel.

Chicks to a total of 12,498 were banded, as follows:

Date	*Banded*
June 24	1,999
26	2,500
27	1,200
29	850
July 1	1,223
3	473
4	534
5	875
6	1,724
7	490
9	458
13	88
16	84
Total	12,498

So thorough were the repeated ransackings of the rookery that this aggregate, with the addition of the 1012 dead found and buried, represents at least 98 per cent of the hatch, the remainder consisting almost exclusively of birds eluding capture by flight. The escape of the 2 per cent might have been obviated by banding very young chicks, a procedure certain to increase mortality and so avoided. The banding percentages were: Arctics .06, Commons 81.43, Roseates 18.51. Since these represent the attainment of an almost perfect nesting and vary only fractionally from those for all immature bandings on the Cape since 1922 (see table), they must coincide with the percentages for adult populations. Roseates constituted 17.80 per cent of the first four days' bandings and 29.36 per cent of

the last four days, confirming our belief in a relatively later reproduction date for this species. On July 1st 62.2 per cent of the bandings were completed; on July 7th 94.9 per cent. The attainment of these percentages is shown by our records to have been from ten to fourteen days earlier than usual.

From observations and numerous but incomplete counts made over a period of five years it was inferred that the average chick mortality is between 20 and 25 per cent. This season all dead birds were counted and buried when discovered, and records were made of the band-numbers of those previously ringed, with the following findings:

Unbanded	1,012 =	7.48 per cent of total hatch
Banded	439 =	3.52 per cent of total bandings
Total	1,451 =	10.74 per cent of total hatch
Commons	91.50 per cent of banded dead	
Roseates	8.11 per cent of banded dead	
Arctics	.29 per cent of banded dead	

The usual ecological circumstances of this season, already shown, preclude considering 1.74 per cent an average death-

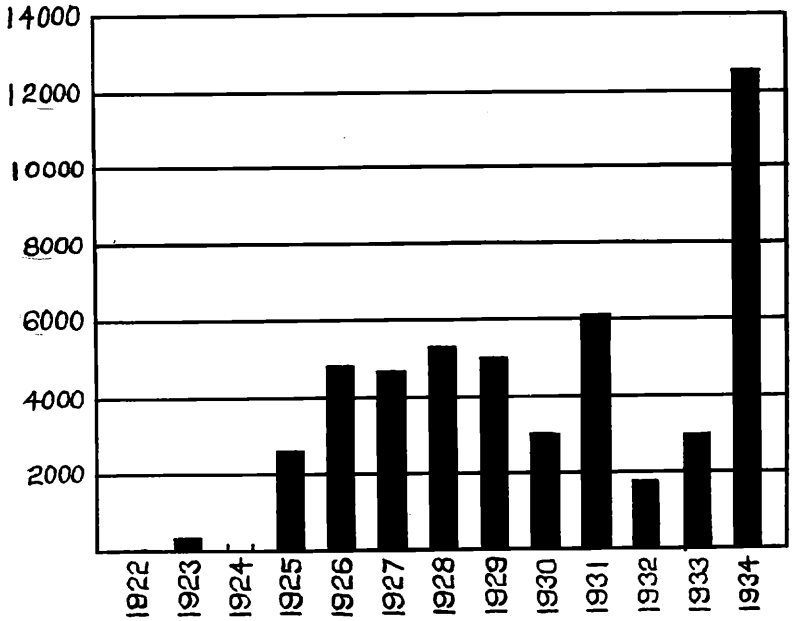

Figure 1. Histogram showing yearly bandings of immature Terns on Tern Island.

rate; nevertheless the salutary effect of human intervention is evident. Nor does it indicate survival and replacement rates, for we continue to receive from near-by points bands removed from dead young of the year. The disparity of Common and Roseate mortalities is evidently the result of divergent nesting habits. Concentration of dead occurs invariably in the open areas where greater exposure results in the killing of an overwhelming proportion of recently hatched Commons. Roseates elect the shelter of the most densely vegetated tracts and hatch later when the growth is more advanced. Their chicks, except when the parents are present, huddle well under the grass and exhibit none of the *wanderlust* observed from blinds to activate young Commons. After chicks have been frightened into cover, Roseates are usually found at the very bottom of a well-hidden pile. Head-pecking, in preceding seasons the cause of a considerable mortality and discussed in a former article from the standpoint of its inferred relationship to territorial

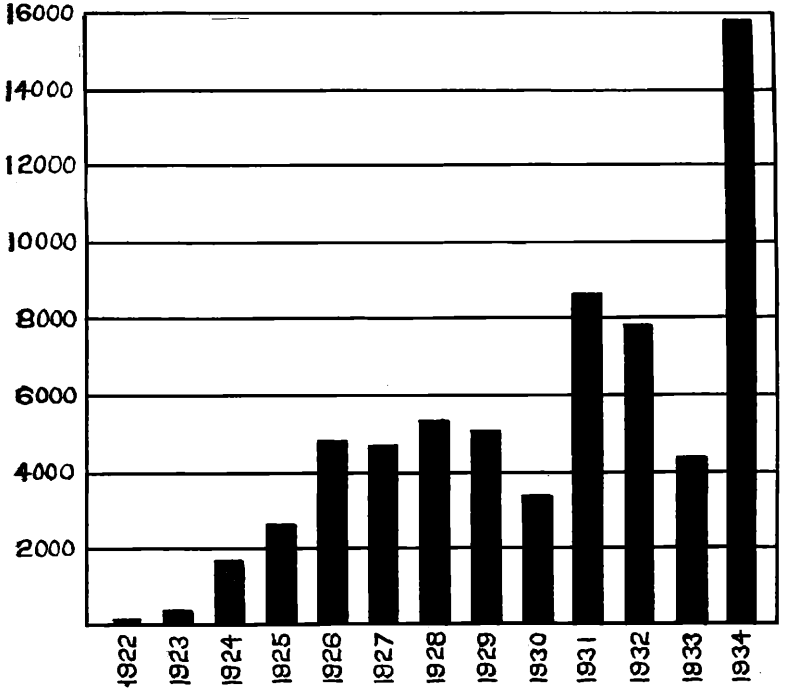

Figure 2. Histogram showing yearly bandings of immature Terns on Cape Cod.

rights, inexplicably was found to have occurred only six times.

Although our records contain a considerable amount of unused confirmatory data, it is believed there are sufficient facts in the foregoing narration to demonstrate conclusively the almost maximum attainable efficiency of this first nesting. Indubitably, second clutches were laid, but to so small an extent and so early in the season that they over-lapped and were indistinguishable from the primary egg-laying. We are certain that no thwarted members of this colony repaired, for a second endeavor to other sites as they had last year.

Two histograms are presented to point out the relative yearly success of this colony and its close duplication of the annual accomplishment of the aggregate Cape tern population, particularly since the comprehensive bandings of all colonies began in 1931.

The future of this key colony is precarious. Unless reclamation work is continued and even better protection is given, a prompt reversion to its baneful status in 1933 is inevitable. It is equally portentous that in two years natural forces have built out from the southern end of the island a chain of sand-bars and grassed mud-banks until at low tide only a narrow, easily fordable strait of water separates it from the mainland. A return to its former peninsularity is not unlikely. However, this station anticipates continuing its experiment and is endeavoring to discover more efficient and less costly methods of reclamation, profiting by this year's work which has been, for instance, a radical grass-thinning rather than a complete denudation.

EGG ISLAND

The deterioration of this colony, which attained in 1932 an almost ideal perfection, has progressed more rapidly. This is the result of the overbalancing of an otherwise favorable environment by two serious etiological conditions, a diminution of nesting territory and the overgrowth of vegetation. The original sparsely plant-grown, low-lying ellipse of sand has been divided by storm-driven tides into four small islets, connected only at low water by sand-bars with an erosion of more than one third of its territory. The greater part of surviving land is covered now by a dense conglomeration of widely spread clumps of dusty miller, tall beach grass, and dried thatch. The importance of this is shown by the increase in Roseate chick-bandings from 16.1 per cent in 1933 to 30.9 per cent this year. Since the island had supported a probable maximum occupancy the former season, the estimated shrinkage of the flock to the extent of one third was inevitable. The only known

vicissitude it experienced was the usual unimportant depredation by owls, they having consumed 30 adults during the early part of the nesting and later an equal number of well-grown Roseate chicks. While its cycle, as always, began and ended later than Tern Island's, it similarly attained consummation two weeks earlier than ever before; likewise no renesting was perceived. Its reproductiveness and its unparalleled survival accomplishment are shown by the following totals:

Chicks banded	2,620	
Dead unbanded chicks	22	
Dead banded chicks	55	= 2.09 per cent of bandings
Total dead	77	= 2.93 per cent of the hatch

Proof of the postulated gradual dispersal of this colony is afforded by there having been banded less than one half as many chicks this year as in 1932. This is not controverted by a doubling, this season, of the 1933 aggregate, insomuch as in that summer storms decimated the first hatch and the second laying was even less fruitful.

BILLINGSGATE ISLAND

The persistent group of terns which, allured by some compelling ecological conditions as isolation and the assurance of an overabundant food-supply, had returned annually to confront unescapable adversities on this site, fared well this season. During the winter, sand-depositing currents unhindered by destructive storms had built up considerably the tide-flooded sand-bar which, last summer, was all that remained of this formerly inhabited island. Shaped like an L, five hundred yards long, varying in width from fifty to two hundred feet, and at most six feet above the usual high-water mark, it was absolutely devoid of vegetation. The reports which came in early June of the presence of an unusually large number of birds were interpreted to refer to the flocks of Herring Gulls always congregated there. Subsequent tidings of extensive egg-laying corrected this misapprehension, but it was believed the imminent spring tide would efface the nesting, as it had last year. Neither this nor any other mishap betided; consequently, July 12th, after a preceding scrutiny, the entire eminently successful hatch of 641 well-grown chicks, exclusive of approximately 50 already on the wing, were banded. For the facilitation of completeness and the prevention of escape by swimming a corral was erected in the center of the island, with wings of wire fencing extending diagonally outward on both sides some distance out into the water. Into this the chicks were driven from both extreme ends. A repetition of

this year's achievement and a restoration of the island itself are contingent to events so improbable that anticipation is unwarranted.

OTHER COLONIES

That to the preponderance of terns the homing instinct is far less bionomically impelling than the obtainment of advantageous environment may be inferred from the minimal occupancy, this summer, of small and disadvantageous sites. First endeavors on all the large breeding grounds were so prosperous that no renesting impulse induced emigration from there to previously futile locations. Not one pair nested on either North Beach or Nauset Marsh, and merely twenty primal couples on Nauset Point, whereas in 1933 all three places were well occupied, particularly during July. A careful exploration of Jeremy's Point demonstrated for the second year a complete absence of nesting. The usual diminutive flock on Rocky Island repeated its ineluctable fiasco.

The exact status of Hopkins Island, the home in 1929 of a promising, ecologically favored colony composed chiefly of Arctics, was not determined. Half of the three hundred adults which had arrived early in May were continuing breeding deportment in mid-July, but rank overgrowth precluded an interpretation. The whole top of the island, excepting a small plot of tangled grass and vines, and the sides almost to the marsh-edge, were a thicket of bushes from four to seven feet high screening a recently built elaborate gunning-stand and limiting the aggregate of passably suitable nest-sites to fifty square feet. What occurred in such terrain it was impossible to discover. July 8th, by dint of extraordinary searching, 32 well-grown chicks were banded, and 15 nests were found, containing a total of 38 eggs. Renesting as an explanation of the lateness of this egg-persistence is not tenable for it was determined by adult trapping late last year that birds defeated here repaired to Nauset Point for a reattempt.

The correctness of preceding assumptions is established by the banding of 15,820 chicks and by the comparison of this total with those for former years. It is hoped this station will be permitted to continue this tern study in 1935 for the most enticing feature of the work has been the repeated refutation of concepts and deductions by subsequent observations.

Because there have been many obvious errors in totals and tables recently published, all available records of tern-bandings on Cape Cod have been studied and all obtainable data appraised. Correct statistics have been secured by listing and verifying all band-numbers. These have been compiled in the appended tables.

TERN BANDINGS ON

Year	*Pamet Point* Immat.	Adult	*Tern Island* Immat.	Adult	*North Beach* Immat.	Adult	*Hopkins Island* Immat.	Adult	*Billingsgate Is.* Immat.	Adult	*Cotuit* Immat.	Adult
1922	102	.....	49	.....	.....	.....	.....	.....	.....	.....	.....	.....
1923	4	.....	376	.....	.....	.....	.....	.....	.....	.....	.....	.....
1924	.....	.....	.....	.....	1,689	.....	.....	.....	.....	.....	.....	.....
1925	.....	.....	2,594	.....	.....	.....	.....	.....	.....	.....	.....	.....
1926	.....	.....	4,830	.....	.....	.....	.....	.....	.....	.....	.....	.....
1927	.....	.....	4,703	.....	.....	.....	.....	.....	.....	.....	.....	.....
1928	.....	.....	5,331	164	.....	.....	.....	.....	.....	.....	.....	.....
1929	25	67	5,005	577	.....	.....	5	70	26	204	39	.....
1930	194	.....	3,020	201	.....	.....	129	.....	.....	38	.....	.....
1931	125	35	6,119	39	.....	.....	122	12	426	.....	.....	.....
1932	5	12	1,754	707	256	287	163	1	118	52	.....	.....
1933	42	108	2,971	831	2	5	3	.....	.....	139	.....	.....
1934	.....	.....	12,498	4	.....	.....	32	.....	649	.....	.....	.....
Total	497	222	49,250	2,523	1,947	292	454	83	1,219	433	39	.....

TOTAL BANDINGS ON CAPE COD.

Year	*Adults*	*Chicks*
1922	0	151
1923	0	380
1924	0	1,689
1925	0	2,594
1926	0	4,830
1927	0	4,703
1928	164	5,331
1929	918	5,100
1930	248	3,344
1931	86	8,648
1932	1,239	7,834
1933	2,648	4,376
1934	4	15,820
Total	5,307	64,800

CHICKS BANDED ON CAPE COD

Year	*Tern Island*	*Elsewhere*
1922	49	102
1923	376	4
1924	0	1,689
1925	2,594	0
1926	4,830	0
1927	4,703	0
1928	5,331	0
1929	5,005	95
1930	3,020	324
1931	6,119	2,529
1932	1,754	6,080
1933	2,971	1,405
1934	12,498	3,322
Total	49,250	15,550

CHICKS BANDED ON CAPE COD—1922 THROUGH 1934

	Roseate	*Common*	*Arctic*	*Least*
Pamet Point	5	486	6	0
Tern Island	9,121	40,106	23	0
North Beach	203	1,743	1	0
Hopkins Island	0	452	2	0
Billingsgate Island	24	1,195	0	0
Cotuit	0	39	0	0
Stony Island	0	35	0	0
Jeremys Point	0	1	0	0
Nauset Point	0	14	5	11
Nauset Marsh	0	150	5	0
Egg Island	2,289	8,883	0	0
Little Sipson Island	0	1	0	0
Total	11,642	53,105	42	11
Per cent	17.97	81.95	00.07	00.01

North Eastham, Cape Cod, Massachusetts.

CAPE COD, MASSACHUSETTS

Stony Island		*Jeremys Point*		*Nauset Point*		*Nauset Beach*		*Egg Island*		*Little Sipson Is.*	
Immat.	*Adult*	*Immat.*	*Adult*	*Immat.*	*Adult*	*Immat.*	*Adult*	*Immat.*	*Adult*	*Immat.*	*Adult*
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
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.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	9	1	.....	.....	.....	.....	.....	.....	.....	.....	.....
31	.....	.....	.....	9	.....	41	.....	1,775	.....	.....	.....
4	.....	.....	.....	.....	.....	108	126	5,425	54	1	.....
.....	.....	.....	.....	.....	.....	6	163	1,352	1,402	.....	.....
.....	.....	.....	.....	21	.....	.....	.....	2,620	.....	.....	.....
35	9	1	.....	30	.....	155	289	11,172	1,456	1	.....

BIBLIOGRAPHY

AUSTIN, O. L.

1932. "The Status of Cape Cod Terns in 1932." *Bird-Banding*, Vol. III, No. 4, October, 1932, pp. 143–156.

AUSTIN, O. L., JR.

1929. "Contributions to the Knowledge of the Cape Cod Sterninæ." *Bull. N. E. B. B. A.*, Vol. 5, No. 4, October, 1929, pp. 123–140.

1930. "The Statistical Trends of Banding." *Bird-Banding*, Vol. I, No. 1, January, 1930, pp. 20–28.

1932. "Further Contributions to the Knowledge of the Cape Cod Sterninæ." *Bird-Banding*, Vol. III, No. 4, October, 1932, pp. 123–139.

1933. "The Status of Cape Cod Terns in 1933." *Bird-Banding*, Vol. IV, No. 4, October, 1933, pp. 190–208.

BAYNARD, O. E.

"Foods of Herons and Ibises." *The Wilson Bulletin*, No. 81, Vol. XXIV, pp. 167–169.

BENT, A. C.

1921. "Life Histories of North American Gulls and Terns." Smith, Inst., U. S. Nat. Mus., *Bull.* 113, 1921, pp. 236–264, 109–112, 160–161.

1926. "Life Histories of the North American Marsh Birds." Smith, Inst., U. S. Nat. Mus., *Bull.* 135, 1926, pp. 207-208.

BREWSTER, W.

1879. "The Terns of the New England Coast." *Bull. Nuttall Ornithological Club*, Vol. 4, No. 1, January, 1879, pp. 13–21.

FLOYD, C. B.

1925. "Six Days in a Massachusetts Tern Colony." *Bull. N. E. B. B. A.*, Vol. I, No. 4, October, 1925, pp. 58–60.

1926. "Additional Experiences in Banding Terns at Tern Island." Chatham, Mass., *Bull. N. E. B. B. A.*, Vol. II, No. 4, October, 1926, pp. 68–72.

1927. "Notes on the Development of Young Common and Roseate Terns." *Bull. N. E. B. B. A.*, Vol. 3, No. 4, October, 1927, pp. 95–101.

1928. "Notes on Banding Terns at Chatham, Mass., for 1928." *Bull. N. E. B. B. A.*, Vol. IV, No. 4, October, 1928, pp. 125–132.

1929. "Notes on Banding Terns at Chatham, Mass., for 1929." *Bull. N. E. B. B. A.*, Vol. V, No. 4, October, 1929, pp. 144–148.

1930. "Further Banding Notes from Tern Island, Mass." *Bird-Banding*, Vol. I, No. 4, October, 1930, pp. 181–184.

1932. "Report of Tern Banding on Cape Cod During 1932." *Bird-Banding*, Vol. III, No. 2, April, 1932, pp. 63–65.

FORBUSH, E. H.

1925. *Birds of Massachusetts and Other New England States*, Vol. I, pp. 105–126.