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PROBABLE COMMON × ROSEATE TERN HYBRIDS[1]

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THIS paper reports the first evidence of mating between probable Common × Roseate Tern hybrids, with descriptions of the hybrid adults and their young.

Four reports of hybrid terns appear in the literature. Degland and Gerbe (1867: 459) suggested that the Common Tern (*Sterna hirundo*) and Arctic Tern (*S. paradisaea*) have hybridized. Hill (1965) reported a hybrid between the Gull-billed Tern (*Gelochelidon nilotica*) and Forster's Tern (*Sterna forsteri*). Perry (1972) watched a nest in the British Isles at which both a Common Tern and a Roseate Tern (*S. dougallii*) incubated the eggs. The young that hatched had "the plumage of a nestling common tern . . . but the call of a roseate nestling!" Robbins (1974) reported watching three nests on Coquet Island, Northumberland, in the British Isles. Mixed pairs consisting of a male Common Tern and a female Roseate Tern attended each nest. All three nests were successful.

MATERIALS AND METHODS

During the summer of 1972 members of a team studying productivity of Common and Roseate Terns on Great Gull Island, New York (Hays and Risebrough 1972) found two nests in which the nestlings as well as the adults (later trapped on them) showed characteristics of both species. This paper refers to these nests as nest 1 and nest 2. A fifth adult resembling these four paired with a Common Tern, and the young in this third nest (nest 3) resembled young Common Terns.

We individually color-banded the adults from nests 1, 2, and 3 as well as the young in nest 1, using three colored plastic bands with a U.S. Fish and Wildlife Service aluminum band (abbreviated USFWS throughout paper) for each combination. We banded the young in nests 2 and 3 with a single numbered color band, but failed to catch them again to give them a four-band combination.

[1] I dedicate this paper to Dr. Ernst Mayr in his 70th year for his encouragement of student and amateur contributions to ornithology.

FRONTISPIECE, Upper: Adult hybrid USFWS 772–87212 calling near nest. Lower: Two hybrid terns from nest 1 in juvenal plumage.

TABLE 1
WEIGHTS AND MEASUREMENTS OF HYBRID TERNS FROM GREAT GULL ISLAND, NEW YORK

Nest	Band number	Date	Weight	Wing	Tail	Tail beyond wings	Tarsus	Culmen	Bill depth base	Bill width base
1	772–87212	6–24–72	112	256	166	25.0	20.4	36.3	9.9	6.2
1	772–87229	6–24–72	115	256	162	20.9	20.0	38.7	10.2	6.7
2	772–87840	7–18–72	120	—[1]	—[2]	—[3]	24.3	37.0	10.3	7.5
2	772–87846	7–19–72	105	255	—[2]	6.5	22.5	39.9	11.4	6.9
3	772–87284	6–26–72	110	255	—[2]	10.4	20.7	37.7	9.4	6.8

[1] Not measured.
[2] Tail worn, did not measure total length.
[3] Tail worn, extends just beyond ends of wings.

Assisted by Grace Donaldson and Catherine LaFarge, I measured the adults with dial calipers to the nearest 0.1 mm, and weighed adults and young with a 500-g (Pesola) balance to the nearest 5 g. Measurements of exposed culmen, flattened wing, tail, and tarsus of the adults are given in Table 1.

Before we released the adults we compared them with skins of one Common Tern and one Roseate Tern that I prepared on Great Gull Island earlier in the season. We also compared them with live adults of both species that we caught on other nests during the same trapping.

Because of the number of intermediate characteristics of all five adults as well as of their young, I consider them probable hybrids between Common and Roseate Terns, but refer to them throughout the paper simply as hybrids. It is not, of course, known whether the adults were F–1, F–2, or backcrosses.

We set up a blind near nest 1 and studied the color-banded adults and young for 20 days, 27 June to 16 July 1972. In 1973 we sighted all five hybrids banded in 1972. Early in May we saw both birds from nest 1 and one bird each from nests 2 and 3. In June we trapped both birds from nest 2 on the same site they used in 1972.

The descriptions of the adult hybrids and their young, with the exception of the remarks on bill color, are based on our notes and photographs of the birds in 1972. The data on bill color change are based on a few observations we made on the hybrids that returned in 1973. The photograph of the eggs (Fig. 1) was taken in 1973.

RESULTS

Comparison (Table 2) of all five hybrid adults with skins of an adult Common Tern and an adult Roseate Tern, as well as with live birds of both species, showed that in certain characters the hybirds resembled one or both of the parent species, while in others they appeared intermediate.

The pattern of black and white in the primaries is the most diagnostic of the hybrid characters, enabling those familiar with this pattern in Common and Roseate Terns to distinguish hybrid adults and young in the hand throughout the year. In the 10th, 9th, 8th, 7th, and usually

FIG. 1. Eggs of hybrid pair trapped in 1973.

6th primary of the Common Tern (Fig. 2A) the white of the inner edge of the primary ends in a V in the black band running along both sides of the vane of the feather. The ends of the feathers are completely black. In the 10th primary the V is very slight compared to the deeper V's of the other primaries.

In the 10th, 9th, 8th, 7th, and 6th primaries of the Roseate Tern (Fig. 2B) the black and white in each feather meet along a straight edge, and the white continues to the end of each primary, sometimes even bordering the end of the feather.

Hybrid primary feathers showed patterns reminiscent of both the V-marks as well as the straight edge. Individuals varied in the number of primaries marked with either pattern (Fig. 2C, 2D). In the 10th, 9th, and 6th primaries (Fig. 2C), of the first hybrid (USFWS 772–87212) we trapped on nest 1, black and white meet along a straight edge as in the Roseate Tern, but the ends of the feathers are black as in the Common Tern. In the 8th and 7th primaries a small white indentation breaks the line along which black and white meet, reminiscent of the pattern in the Common Tern. However, the white continues for a short distance beyond the indentation toward the end of the feather in a somewhat broader band than found in Common Tern primaries.

The depth of the indentation or V in the primaries of the hybrids varied within as well as between wings of the same bird, and was often less deep than are those of the Common Tern. Fig. 2D shows the wing

TABLE 2
CHARACTERS OF COMMON, ROSEATE, AND HYBRID TERN ADULTS

	Common Tern	Hybrid	Roseate Tern
P[1] 10, 9, 8, 7, 6	P 10, 9, 8, 7, usually 6 white V in black	Primary patterns vary, some V's or indentations of white in black, others black and white meet along straight edge	P 10, 9, 8, 7, 6 black and white meet along straight edge
Secondaries	Gray	Intermediate	Light gray
Bill color on arrival	About ½ red	Some ½ red, others black	Black
Cap	Black, sometimes brownish cast	Jet black, no brownish cast	Jet black, no brownish cast
Mantle	Gray	Intermediate	Light gray
Length of outer rectrices	Do not extend beyond ends of wings	Extend beyond ends of wings, but not as long as Roseate	Extend beyond ends of wings
Outer web of outer rectrices	Usually black, sometimes dark gray	Light gray, always paler than gray of Common Tern	White

[1] P = primary.

of the first bird (USFWS 772–87840) we trapped on nest 2. The V pattern in the feathers varies from a slight indentation in the 9th primary to a deeper V in the 8th and 7th. The depth of the V's in the primaries of the other adult (USFWS 772–87846) we trapped on nest 2 measured: right wing, 8th primary 10.0 mm, 7th primary 6.8 mm; left wing, 8th primary 15.1 mm, 7th primary 11.3 mm.

The shade of gray in the secondary feathers was intermediate between the shade of these feathers of Common and Roseate Terns, i.e. lighter than the Common and darker than the Roseate.

Measurements of exposed culmen (Table 1) for the hybrids averaged 37.9 mm, a little more than that given by Ridgway (1919) for average measurements of exposed culmen for a series of male Comomn Terns, 37.2 mm, and for a series of females as 35.7 mm; and a little less than Ridgway's average measurements of exposed culmen for a series of male Roseate Terns, 38.3 mm, but more than for a series of females, 37.6.

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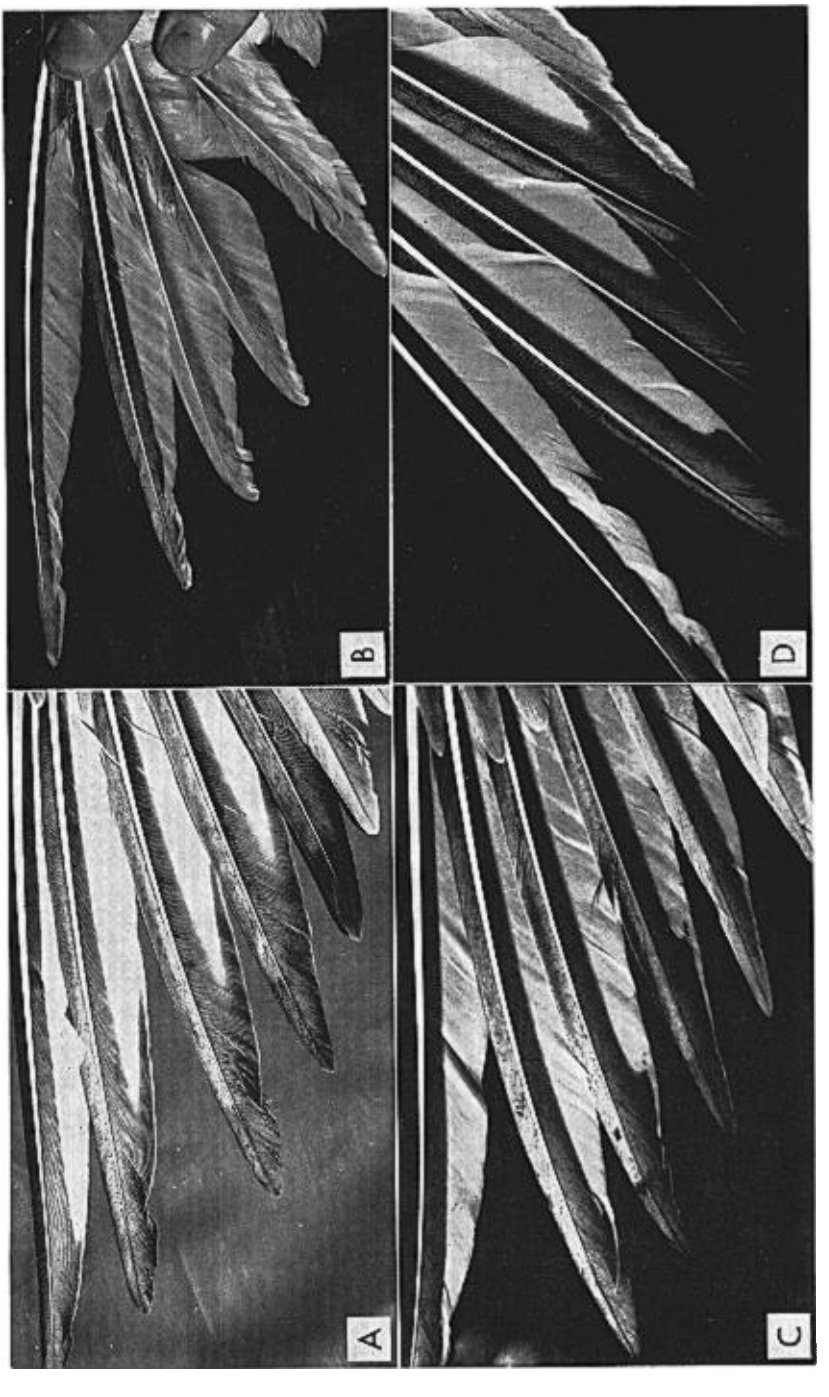
FIG. 2. A, primaries of Common Tern. B, primaries of Roseate Tern. C, primaries of hybrid USFWS 772–87812. D, primaries of hybrid USFWS 772–87840.


A
B
C
D

The caps of the hybrids were black, resembling the cap of the Roseate adult. This contrasts with caps of adult Common Terns, which often have a brownish cast.

The mantle was not as dark gray as that of the Common Tern, nor as light as that of the Roseate Tern. The underparts of the hybrids were whiter than in the Common Tern, but not so white as in the Roseate.

The outer rectrices of the five hybrids, although not so long as those of the Roseate, extended beyond the ends of the wings (frontispiece, upper; Table 1), whereas in the Common Tern they do not.

The outer web of the outer rectrices in the hybrids was washed with very pale gray for most of their length, fading to white at the base in all birds examined. This contrasts with those of the Roseate Tern, which are white, and with those of the Common Tern which are usually black. The outer web of the outer rectrices of a few Common Terns trapped were gray; but all the grays we noted were darker than the extremely pale gray of the hybrid tail feather outer web.

When we trapped the hybrids in 1972 their bill color at the time resembled that of the Common Terns in the colony at the same stage in the nesting cycle. Observations of the hybrids returning to the island in 1973 suggested that the timing of acquisition of the red color in some of these birds was later than that of the Common Terns, but earlier than the Roseates; and the rate of acquisition of the red was comparable to that described for the Roseate (Donaldson 1968). Nothing has been written about the rate of acquisition of red for the Common Tern.

When Roseate Terns arrive at the island in early May their bills are completely black (Donaldson 1968), contrasting with those of Common Terns, which on arrival are one-third to one-half red and fairly bright in color.

On 3 May 1973 Catherine Pessino spotted one of the hybrids (USFWS 772–87846) from nest 2 standing on a dock piling on Great Gull Island; the bird's bill was completely black. On 8 May I saw the hybrid (USFWS 772–87284) from nest 3 on the dock, and its bill was completely black except at the corners of the gape, where it appeared dull red. On 14 May I saw the pair of hybrids (USFWS 772–87212 and 772–87229) from nest 1 displaying at their 1972 nest site. Their bills were dull red at the base for about one-third of their length, falling within the range of variation in color seen in Common Terns at this time of year.

Later in 1973 we found eggs (Fig. 1) of the pair of hybrids we trapped on nest 2. By 18-20 June, when their young hatched, the bills of both adults trapped on the nest had turned almost half red, considerably more in extent and brightness of red than one might expect at this time of year in Roseate Terns on hatching eggs (Donaldson 1968) and in-

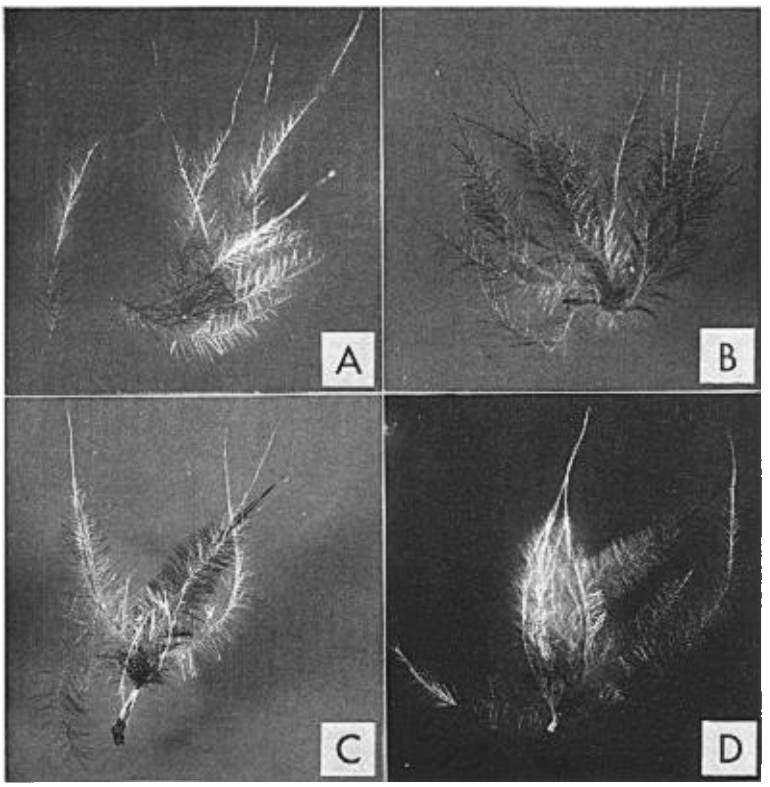


FIG. 3. A, down from young Common Tern. B, down from 6-day-old young nest 1. C, down from 8-day-old young nest 1. D, down of young Roseate Tern.

distinguishable in terms of amount of red from those Common Terns in the colony at the same stage in the nesting cycle.

Voices and postures.—After setting up the blind at nest 1 in 1972 we did not discuss the calls of the adults until everyone had had a chance to watch the birds and hear them. All eight observers agreed that the call of one of the adult birds, Blue (USFWS 772–87229), seemed to contain elements of both the "kee-ar" of the Common Tern as well as the "churree" of the Roseate Tern. Its mate, Yellow (USFWS 772–87212), sounded like a Common Tern.

Pairs of Common and of Roseate Terns nested within 6–8 feet of nest 1, interacting with each other as well as with Blue and Yellow. Two postures and their accompanying calls were often performed by both species as well as by the hybrids. Common and Roseate Terns threatened intruders using a low staccato series of notes described by Palmer (1941) for the Common Tern as "kek-kek-kek-k-k-k." The Roseate call is

FIG. 4. A, 6-day-old tern from nest 1. B, 8-day-old tern from nest 1. C, two young terns from nest 2. D, leg of downy young Common Tern. E, legs of two hybrid young from nest 1. F, leg of downy young Roseate Tern.

very similar, but a little deeper. Common Terns sometimes give this call while sitting on the nest. If standing, their bodies are parallel to the ground, the neck drawn in, and the tail is often raised. The crown feathers, on occasion, seem to be a little flattened and the scapular feathers may be raised slightly.

Roseate Terns when giving the call assume a somewhat different posture. Their bodies are held parallel to the ground, but often the breast is lowered, the neck stretched, and the head bobs up and down as they call. The tail is slightly raised. Their scapular feathers are raised and so are the crown feathers.

Blue's posturing while giving this call resembled that of the Roseate. It gave the call with stretched neck, head bobbing, slightly raised scapulars and raised crown feathers. On one occasion I watched Yellow give

TABLE 3
CHARACTERS OF EGGS AND YOUNG OF COMMON, ROSEATE, AND HYBRID TERNS

	Common Tern	Hybrid	Roseate Tern
Eggs	Rounder, often dark background and blotched markings	Tend toward being round, light background, finely marked	Long and pointed, light background, finely marked
Young[1]			
P[2] 10, 9, 8, 7, 6	P 10, 9, 8, 7, usually 6 white V in black	A: P 10, 9, 6 black and white meet along straight edge, P 8, 7 small white V in black B: like Roseate young	P 10, 9, 8, 7, 6 black and white meet along straight edge
Forehead	Brown	Streaked	Streaked
Nape	Black	A: black B: streaked	Streaked
Scapulars	Broadly marked with gray, edged with brown	A: similar to Common B: similar to Roseate	Broad band of fawn contrasted with narrowed darker brown band running through it
Outer rectrices	Outer edge black	A: blacker than Common B: less black than Common	White
Leg color	Pinkish white	A: brown B: black	Black
Tarsal scutes	No small reticulate scutes proximal end tarsus	Small reticulate scutes, but they do not extend distally as far as do those of the Roseate young	Small reticulate scutes proximal end tarsus

[1] Based on A and B from nest 1 at 24 and 26 days of age respectively. Where young vary in a character they are treated separately.
[2] P = primary.

the "kek-kek-kek-k-k-k" call. It did not stretch its neck and its crown feathers appeared slightly flattened, resembling the posturing of the Common Tern.

Both Common and Roseate Terns occasionally call holding their wings stretched high over their backs. Common Terns in this posture may give a two-syllable call that sounds like "kee-ar." Roseate Terns in a similar posture give a low one-syllable call that sounds like "raanh." The call is given at times when they face a bird that is landing, has landed, or

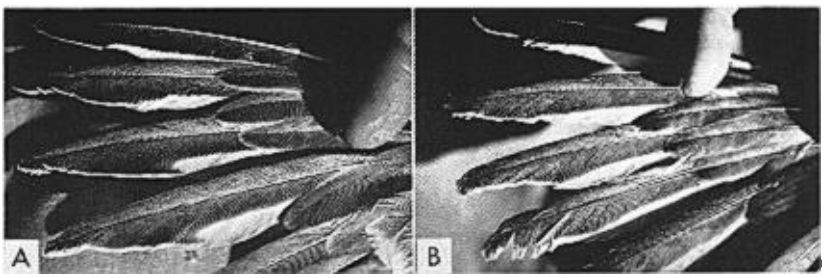


FIG. 5. A, primaries of A from nest 1. B, primaries of B from nest 1.

is flying over. Blue in this posture gave the one-syllable call that sounds like "raanh." I did not see Yellow in this posture.

We studied the second pair of hybrids at nest 2 for only 1 day because we could not set up a stable blind on the concrete near the nest. The adults appeared nervous. I was afraid they would move their young out of the territory if we kept them away while we set up a better blind. The few calls we heard from both adults sounded like calls of Common Terns.

Nest sites and eggs of hybrids.—In 1972 the sites of hybrid nests 1 and 2 were in open rocky sections of the shoreline and nest 3 was in the grass bordering some traprock. The sites of all three could have been used by either species. In 1973 Common Terns used the sites 1 and 3.

In general Roseate Tern eggs are longer and more finely marked than those of the Common Tern, which in comparison are usually rounder and often have quite a blotchy pattern. The background color of Roseate eggs is usually light, contrasting with the darker background color of most Common Tern eggs. Still overlap in all the above characteristics occurs in eggs of both species.

Fig. 1 shows the hybrid eggs marked in 1973. Though rounder than most Roseate eggs, they have light backgrounds and are finely marked as are many eggs of this species.

Young of the hybrid pairs.—We were able to follow the young in nest 1 from the time they were 7 and 9 days old respectively until they fledged. We were not so fortunate with the young in nest 2, where we found the younger tern dead at 7 days of age, and we did not see the older tern after its 10th day when it moved into the rocks.

Down of the young from nest 1 (Fig. 3B, 3C) is compared with that of a Common Tern (Fig. 3A) and that of a young Roseate Tern (Fig. 3D). In color and structure the hybrid down resembles more closely that of the young Roseate Tern.

Fig. 4 compares the two young from nest 1 (A and B) at 4 and 6

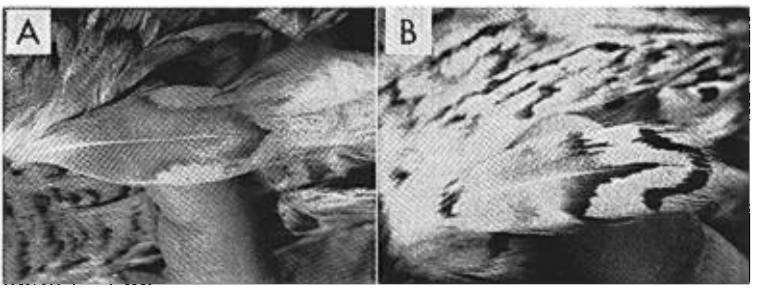


FIG. 6. Scapular feathers of young Common Tern (A) and young Roseate Tern (B).

days respectively, with young (C) from nest 2. In appearance the hybrids fall between the young Common Tern (D) and the young Roseate Tern (F) pictured below them.

At hatching A's legs were pinkish white resembling those of a young Common Tern, while B's were purplish pink resembling those of a young Roseate Tern. By the time they were 4 and 6 days old respectively, the legs of both chicks darkened to brown (Fig. 4E). A's legs remained brown, a color darker than that of any young Common Tern (Fig. 4D); B's legs turned black, but took longer to do so than do those of young Roseate Terns.

The frontispiece (lower) and Table 3 compare the two young: A, with black nape (USFWS 752–90676), and B (USFWS 752–90677) from nest 1 at 24 and 26 days respectively. The similarity of A to a young Common Tern of the same age and the resemblance of B to a young Roseate Tern is striking.

The primaries of A (Fig. 5A) are patterned with shallow V-marks similar to those of the hybrid adults and reminiscent of the Common Tern pattern, but the white border of the inner edge of the feather continues beyond the V's to the end of the feather, giving the primary a more marked white edge than is usual for young Common Terns. In the primaries of B (Fig. 5B) the black and white meet along a straight edge, as in young and adult Roseate Terns.

Both birds have foreheads streaked with gray and a little black. The streaking extends across the top of the head and resembles that of young Roseate Terns, but the black nape of A is characteristic of young Common Terns.

Scapular feathers of A are broadly marked with gray and edged with brown as in young Common Terns (Fig. 6A); those of B have a broad band of fawn contrasted with a narrower darker brown band running through it as do young Roseate Terns (Fig. 6B).

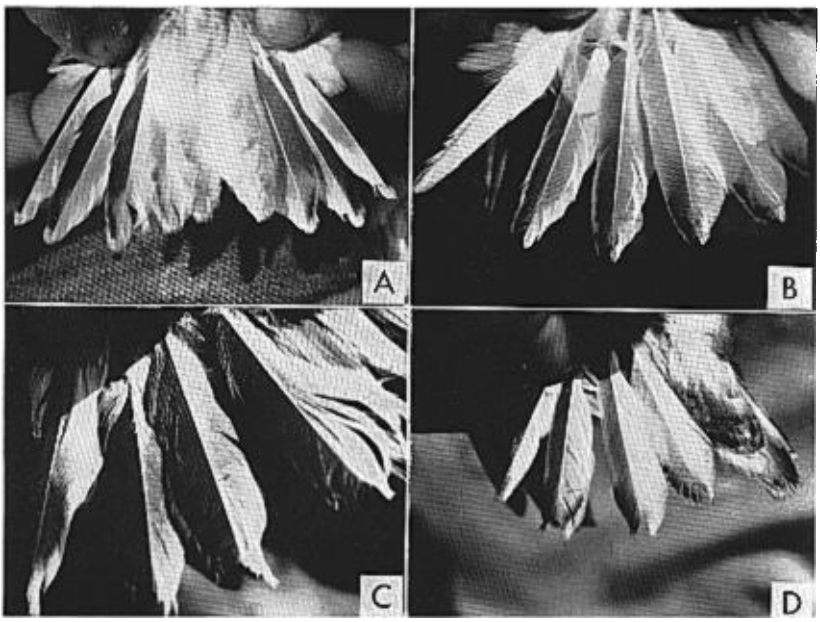


FIG. 7. A, tail feathers of young Common Tern. B, tail feathers of young Roseate Tern. C, tail feathers of A from nest 1. D, tail feathers of B from nest 1.

Many of the tail feathers of bird A are dark edged (Fig. 7C), more so than those of the young Common Tern (Fig. 7A), while those of bird B (Fig. 7D) have less black than the Common Tern. The outer tail feathers of B, however, are not white as are those of the young Roseate Tern (Fig. 7B).

Tarsal scutellation of the hybrid young is shown in Fig. 8 (left), compared with the patterns in a young Roseate and a young Common Tern (Fig. 8, right). It is clear that the small reticulate scutes prominent at the proximal end of the black tarsus of the young Roseate are not present in that of the Common. Although present in the hybrids these small scutes do not extend distally so far as they do in the young Roseate Tern (also of Fig. 4D, 4E, 4F).

At 24 and 26 days the young weighed 96 and 99 g respectively. This falls within the lower limits of the range in weights of young Roseate Terns of the same age (LeCroy pers. comm.) as well as young Common Terns of the same age (LeCroy and Collins 1972).

DISCUSSION

In most colonies where Common and Roseate Terns nest along the east coast of North America, the Commons far outnumber Roseates.

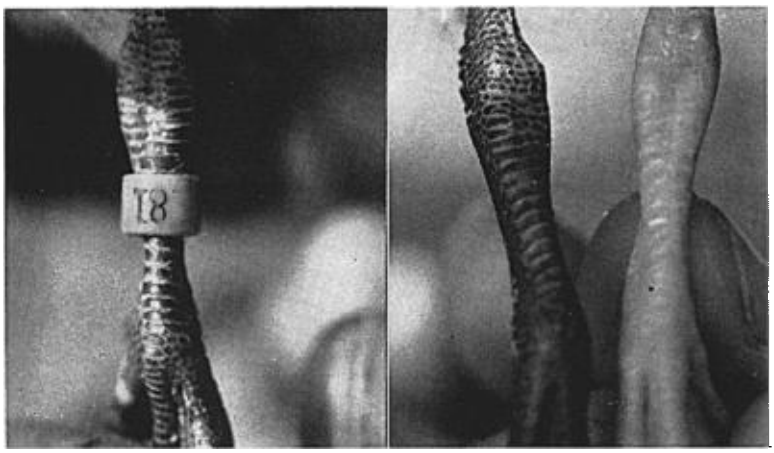


FIG. 8. Tarsus of hybrid young (left) compared with black tarsus of young Roseate Tern and light tarsus of young Common Tern.

Nisbet (1973) reviews figures for both species nesting in Massachusetts and mentions only 12 colonies where more than 50 pairs of Roseate Terns have nested during this century.

In 1973 we estimated that 3000 Roseate Terns and 5000 Common Terns bred on Great Gull Island. I believe that two factors, both man-made, have contributed to the buildup of both species during the 18-year period that terns have nested on the island. The remains of former Fort Michie (Cooper et al. 1970), as well as the boulders deposited around the edge of the island to prevent erosion, provide relatively stable nesting sites because invasion of these areas by vegetation is slow or nonexistent. Common Terns nest on the exfoliating concrete sections of the fort as well as on the rocky beaches, while Roseate Terns, for the most part, nest under the boulders around the island's periphery. Grass edge sites used formerly by Roseates for nesting have in most instances become overgrown and are no longer used, and only occasionally in this colony do we find Roseate nests on the open rocky beaches. Possibly the relatively stable boulder sites have permitted the Roseate population on Great Gull Island to nest in larger numbers than would be possible in less stable habitats.

The first hint that hybridization might be occurring in the Great Gull Island tern colony came in 1968, when, as part of a postbreeding dispersal study, Grace Donaldson and I checked both Common and Roseate Terns along the Connecticut shore. On 2 September at Old Saybrook, Connecticut, we saw a bird we had color-banded on Great Gull Island as a young Roseate being fed by what appeared to be an

adult Common Tern. The young had black legs as do Roseate young; its bill was black, characteristic of a Roseate young, but with an orange stripe running from the base of the culmen toward the nares. The stripe is characteristic of Common Tern juveniles, but not of young Roseate Terns.

Although we do not know why hybrids are appearing in the Great Gull Island colony, the following observations suggest a way hybridization may have occurred.

Between 1964 and 1974, the period we have worked on Great Gull Island, the number of terns nesting has increased from an estimated 5000 to about 8000 birds. The vegetation on the island has also noticeably increased in extent and thickness, reducing the space available to both species for nesting.

In 1971, coincident with the increase in the number of terns breeding in the colony and the apparent reduction of suitable nesting habitat, we found two nests containing Roseate and Common eggs. In the first nest we marked three eggs as they were deposited. The first appeared to be a Common Tern egg and the final two were Roseate eggs. Two Roseate young hatched from the latter and the first egg did not hatch. It is quite possible that both species used the same site, the Common deserting its single egg and the Roseate moving in and adding two eggs.

When we found the second mixed clutch in 1971 it contained three eggs. A young Common Tern hatched first, a young Roseate hatched next, and from the last egg in the nest a young Common Tern hatched. The adults trapped on the nest were both Common Terns. We checked the three young for five days, after which they all disappeared. The oldest Common young and the Roseate young appeared to be growing and gaining weight during the period we checked them, suggesting that the Common parents were feeding them both.

Stevenson et al. (1970) demonstrated that young Common Terns recognize the calls of their parents. Auditory cues may well be important for species recognition as well, and may be learned by the young in the nest. The occurrence of mixed clutches, together with evidence that the Common Tern, at least, will feed a young Roseate if one hatches in its nest, provide a mechanism for hybridization between the two species. It is tempting to hypothesize that if the Common Tern were successful in raising the Roseate young, when it was time for the young Roseate to pair it might respond to the calls of a Common Tern adult rather than to a Roseate Tern. Carried one step further, in a nest where one parent is a Common Tern and one a Roseate Tern, the young may respond to calls of both species. When this young hybrid pairs it may "prefer"

another hybrid, a bird in which the call may contain elements of the calls of both species rather than a member of one species or the other.

It is noteworthy that at two of the three nests at which we trapped hybrids both members of the pair were hybrids. Chance mating of two hybrid pairs amid so many terns, with thousands of choices available, seems improbable. It seems to me quite possible that during the display flights we see early in the season, one hybrid could find and pair with another responding to a combination of highly specific elements in their calls. Analysis of the calls of both Common and Roseate Terns as well as of the hybrids combined with field tests of young and adults is essential before further speculation is warranted.

ACKNOWLEDGMENTS

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I am most grateful to David Duffy, Alan Poole, and Catherine LaFarge, who trapped the adult hybrids; to Joan Black, Grace Donaldson, and Helen Lapham, who took pictures of adults and young as we discovered them; and to Robert E. Logan and Arthur Singer for the black-and-white prints for the figures.

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SUMMARY

In 1972 five adult terns were trapped on Great Gull Island, New York, that appeared to be hybrids between the Common Tern and the Roseate Tern. The hybrids and their young are described and a possible mechanism for hybridization in this colony is discussed.

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