

SEASONAL DISTRIBUTION AND SITE TENACITY OF THE GREAT LAKES COMMON TERN

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INTRODUCTION

In recent years Common Terns (*Sterna hirundo*) breeding on the Great Lakes have apparently decreased (Morris and Hunter, 1976; Blokpoel, 1977). A number of traditional colony sites now have few or no breeding Common Terns. These include Mohawk Island in Lake Erie (Palmer, 1964), Gull Island (Blokpoel, 1977), Muggs Island and Hamilton Harbour (Morris and Hunter, 1976) in Lake Ontario, and South Limestone Island (Morris and Hunter, 1976) in Georgian Bay.

To understand and evaluate the effect that the declines of these colonies have on the Great Lakes Common Tern population as a whole, information is needed on (1) distribution and size of colonies both in the present and the past, (2) reproductive success of this species throughout the Great Lakes, (3) the degree of emigration from and immigration into the Great Lakes and (4) the degree of interchange between colonies within the Great Lakes.

Censuses of breeding Common Terns on the Great Lakes and studies of their reproductive success have been conducted or are in progress (Morris et al., 1976; Blokpoel, 1977; Blokpoel and McKeating, Ms; Scharf et al., 1978; Haymes and Blokpoel, Ms).

Emigration, immigration, and interlake shifts are largely governed by site tenacity and group adherence. These two concepts were described by Austin (1949, 1951) who made an extensive study of the terneries at Cape Cod, Massachusetts. He found that individual terns returned to the same breeding colony and often the same site within the colony year after year (site tenacity), and that individuals tended to nest with the same neighbors year after year even when the colony or subcolony was forced to move to a different location (group adherence).

We obtained information on emigration, immigration, and intercolony shifts from banding data. When analyzing the band recoveries of Common Terns banded or recovered on the Great Lakes we also studied their seasonal distribution. Band recoveries of Common Terns nesting in North America prior to 1951 were analyzed by Austin (1953), but since that date many more recoveries have been reported.

This paper reports on seasonal distribution and site tenacity, in terms of emigration from and immigration into the Great Lakes and intercolony shifts of Great Lakes Common Terns.

METHODS AND MATERIALS

From the early 1920's to 1976, there were 1,957 band recoveries of Common Terns banded in colonies on the Great Lakes. Of these, 1,185 were banded in the province of Ontario and 695 in the state of Michigan. The remaining 77 recoveries were of birds banded in the remaining

states with Great Lakes' shoreline. Of the total band recoveries 12% were not used in the analyses because the information on them was incomplete regarding age class or recovery date.

The data were organized into four age groups: less than 1-year-old (from hatching until 1 June of the following year), 1-year-old, 2-year-old, and 3-or-more-year-old birds. Because 1 June is the approximate hatching date for Common Terns on the Great Lakes, it was taken as the date when birds progressed into the next year class.

Although Common Terns are present in the breeding colonies on the Great Lakes from late April through August, June and July were considered the breeding season because breeding birds are most likely to be in their breeding colony at that time.

Banding locations are filed by the Banding Office in blocks of 10' longitude and 10' latitude. When more than one colony fell into a particular 10' × 10' block they were considered as one unit. These blocks will be referred to as "breeding blocks."

Recovery areas were grouped into nine regions according to geographical location. Table 1 lists these regions and the states, provinces, or countries they include.

TABLE 1
The geographical regions of Common Tern band recoveries.

Region	Provinces, states or countries included in region ¹
1. Great Lakes	Ontario, Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, and the Great Lakes shorelines of Pennsylvania and New York.
2. Northeast Coast	Newfoundland, Quebec, Maine, Massachusetts, Connecticut, and coastal New York.
3. Southeast Coast	Maryland, Virginia, North and South Carolina, and Georgia.
4. Florida	Florida.
5. Gulf Coast	Alabama, Mississippi, Louisiana, Oklahoma, and Texas.
6. Central America	Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama.
7. Caribbean	Cuba, Jamaica, Hispaniola, Puerto Rico, Lesser Antilles, and Bahamas.
8. West Coast of South America	Colombia, Ecuador, Peru, Bolivia, and Chile.
9. North Coast of South America	Venezuela, Guyana, Surinam, and French Guiana.

¹ Only the provinces, states, or countries where at least one recovery was reported.

RESULTS

Seasonal Distribution

Breeding season.—The distribution of recoveries of <1-year-old and of 1-year-old Common Terns are summarized in Table 2 and those of 2-year-old and of ≥ 3 -year-old Common Terns are summarized in Table 3. The majority of recoveries of <1-year-old birds were reported from the breeding areas shortly after banding. Recoveries of <1-year-old birds in April and May on the breeding grounds were of birds that probably died the previous fall and were found after spring ice breakup.

Of 62 1-year-old birds recovered during the breeding season, 40 were from the Great Lakes. Again, we suggest that most of these were recoveries of birds that died the previous fall. For example, 20 of the recoveries of 1-year-old birds were found dead on 1 July 1937 at the same colony in Lake Huron in which the birds were banded the previous summer. Possibly these birds migrated south, returned to the colony where they were banded and died, but we consider it more likely that they died the previous year. Furthermore, no recoveries of <1-year-old birds were reported for the migration route (regions 2–3) from February through May. However, two live captures of 1-year-old birds were recorded from Mohawk Island in Lake Erie during the breeding seasons of 1956 and 1957. Thus, although a few individuals return to the breeding grounds the summer following hatching, we suggest that they do not return to the extent indicated by the banding data.

Only 57 recoveries of 2-year-old birds were obtained. Thirty-five of these birds were recovered in June and July on the breeding grounds and no recoveries were reported outside the breeding range during that period. Thus, these 35 2-year-old birds will be included with older birds in the following sections.

Birds, ≥ 3 years old, recovered from May through August, were all reported from the breeding areas (regions 1 and 2), except for one recovery of a dead bird in North Carolina in May.

Winter season.—Although some birds completed their southward migration by September, December through March will be considered the winter season because very few recoveries were reported north of Florida during those months. Common Terns, ≥ 2 years old (Table 3), were recovered in Florida and Central and South America during the winter months, whereas <1-year-old and 1-year-old birds were also recovered in relatively high numbers on the Gulf coast and the Caribbean Islands.

The majority (almost 80%) of South American recoveries were from the west coast of the continent.

Migration season.—The migration route used by all age groups appears to be along the Atlantic Coast. The only two recoveries of terns large distances from the usual migration route or wintering grounds were those of birds ≤ 1 year old. One was recovered in the middle of the Atlantic Ocean west of the Azores and the other in the Hawaiian Islands. The latter bird was banded in the Thunder Bay area of Lake Huron,

TABLE 2
Bi-monthly distribution of <1-year-old and 1-year-old Common Terns banded in the Great Lakes.

Region	Age	Months												Total for all months
		June-July		Aug-Sept		Oct-Nov		Dec-Jan		Feb-Mar		Apr-May		
		<1	1	<1	1	<1	1	<1	1	<1	1	<1	1	
1. Great Lakes	253	40	360	12	49	6	3	0	4	0	16	1	685	59
2. Northeast Coast	0	0	2	0	2	1	0	0	0	0	0	0	4	1
3. Southeast Coast	0	2	8	5	16	1	1	0	0	0	0	1	25	9
4. Florida	0	4	9	5	40	1	13	1	2	0	2	0	66	11
5. Gulf Coast	0	0	1	2	15	0	3	1	0	0	0	0	19	3
6. Central America	0	13	2	4	34	2	31	1	7	0	7	3	81	23
7. Caribbean	0	1	1	2	28	0	11	0	5	0	5	0	50	3
8. W. Coast S. America	1	1	1	3	26	4	24	3	9	1	3	0	64	12
9. N. Coast S. America	0	1	1	0	2	3	11	0	0	0	1	0	15	4
10. Other	0	0	0	0	1 ¹	0	0	0	0	0	0	1 ²	1	1
Total for all regions	254	62	385	33	213	18	97	6	27	1	34	6	1,010	126

¹ At sea west of the Azores.

² Hawaii.

TABLE 3
Bi-monthly distribution of recoveries of 2-year-old and ≥ 3 -year-old Common Terns banded in the Great Lakes.

Area	Age	Months												Total for all months	
		June-July		Aug-Sept		Oct-Nov		Dec-Jan		Feb-Mar		Apr-May		2	≥ 3
		2	≥ 3	2	≥ 3	2	≥ 3	2	≥ 3	2	≥ 3	2	≥ 3		
1. Great Lakes	34	365	11	73	0	8	0	0	0	0	1	6	26	51	473
2. Northeast Coast	1	16	0	1	0	0	0	0	0	0	0	0	2	1	19
3. Southeast Coast	0	0	0	3	1	1	0	0	0	0	0	0	1	1	5
4. Florida	0	0	0	0	0	2	0	0	0	0	2	0	0	0	4
5. Gulf Coast	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6. Central America	0	0	0	0	0	3	1	4	0	2	0	1	1	1	10
7. Caribbean	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8. W. Coast S. America	0	0	0	0	1	4	1	4	1	1	1	0	2	3	11
9. N. Coast S. America	0	0	0	1	0	0	0	0	0	1	0	0	0	0	2
Total for all regions	35	381	11	78	2	18	2	8	2	8	1	7	6	32	524

27 June 1960 and was collected on the island of Oahu, 25 April 1961. We could find no definite record of the Common Tern occurring on the Hawaiian Islands or in the central Pacific in the literature.

Site Tenacity

Emigration from and immigration into the Great Lakes.—Fourteen birds, ≥ 2 years old, from the Great Lakes were recovered during June and July in colonies in Massachusetts and one in coastal New York. All of these birds were recovered alive and were probably breeding. This represents 4% of all ≥ 2 -year-old birds recovered (dead or alive) during the breeding season. Interestingly, 12 of the recoveries from Massachusetts were birds banded at four different colonies in the Saginaw Bay area of Lake Huron from 1936 through 1939. In the opposite direction, only one bird banded on the east coast was recovered on the Great Lakes during the breeding season (as defined) whereas three probable breeders were recovered in May.

No birds banded on breeding grounds other than the Great Lakes or Atlantic Coast have been recovered on the Great Lakes during the breeding season. Thus the level of emigration from and immigration into the Great Lakes appears very low and limited to isolated incidents.

Shifts between colonies within the Great Lakes.—Some exchange of breeding Common Terns, ≥ 2 years old, from one lake to another breeding area has occurred with apparently the greatest movement occurring from Lake St. Clair and Lake Huron (Table 4). The largest number of recoveries of birds banded in a different lake (23) were reported from Lake Erie. The numbers recovered outside or inside a lake are dependent upon banding and recovery efforts in all lakes. These figures alone are therefore insufficient to establish trends.

TABLE 4

Band recoveries of ≥ 2 -year-old Common Terns during the breeding season (June–July) by lake.

Lake where band	Lake where recovered							Total outside banding lake	
	Ontario	Erie	St. Clair	Huron	Michi- gan	Super- rior	Other	n	% ¹
Ontario	109	16	1	1	0	0	3	21	16.2
Erie	5	122	2	1	1	0	0	9	6.9
St. Clair	0	4	21	7	2	0	0	13	38.2
Huron	0	3	0	37	1	0	12	16	30.2
Michigan	0	0	0	1	16	0	2	3	15.8
Superior	1	0	0	0	0	1	0	1	50.0
Total	115	145	24	47	20	1	17	63	17.1

¹ Percent of banding lake total.

Exchanges of breeding birds between "breeding blocks" (10' longitude \times 10' latitude) occurred and the frequency of these exchanges was dependent upon the age of the birds at banding (Table 5). Birds that were banded as adults (i.e., breeding birds) were more likely to return to the breeding block in which they were banded, whereas those banded in their hatching year were more likely to breed in a different breeding block. This difference was highly significant ($\chi^2 = 51.68$, $P < .0001$, 2×2 contingency table, Yates correction for continuity; Siegel, 1956). The average of the estimated distances between the breeding colony and the recovery colony was 61.1 km for those banded as chicks ($n = 46$) and 37.4 km for those banded at breeding age ($n = 15$).

TABLE 5

Distribution of live recoveries during the breeding season (June–July) of ≥ 2 -year-old Common Terns according to age at banding.

Age at banding	Recoveries inside breeding block ¹ where birds were banded		Recoveries outside breeding block where birds were banded		Total	
	n	%	n	%	n	%
Young-of-the-year	15	24.6	46	75.4	61	100
Breeding bird	78	83.9	15	16.1	93	100

¹ A block of 10' latitude \times 10' longitude.

DISCUSSION

Seasonal Distribution

Recoveries of Common Terns banded on the Great Lakes suggest the winter range of this species to be the coast of the Gulf of Mexico, the Caribbean Islands and Central and South America (Tables 2 and 3). Recoveries from South America were concentrated (approximately 80%) on the northwest coast of the continent. The band recovery data suggest age-dependent differences in winter range. All adult (≥ 2 years old) recoveries were limited to the mainland areas whereas many juvenile (≤ 1 year old) recoveries were reported from the Caribbean as well.

Our data indicate that Great Lakes Common Terns migrate along the Atlantic coast, with no overland or Mississippi River route from the Great Lakes to the Gulf of Mexico as was first suggested but later retracted by Austin (1951, 1953).

Austin (1942, 1953) stated that fewer than 25% of Common Terns reach breeding status during their first two years and that only 1.6% return to breed the spring following hatching. In our study, however, all 35 recoveries of 2-year-olds during June and July were from the breeding areas and two 1-year-old birds were captured alive and 38 others were found dead on the breeding grounds. We suggested above

that many of the 1-year-old birds found dead died in the summer or fall of the previous year. As Austin (1953) found no evidence to indicate the presence of nonbreeding birds in the Cape Cod colonies, we further suggest that the 2-year-old birds found on the breeding grounds were breeders.

Site Tenacity

Emigration from and immigration into the Great Lakes.—The recovery data indicate that the rate of emigration from and immigration into the Great Lakes is low. These rates, however, are dependent on the banding and recovery efforts inside and outside the Great Lakes.

Common Terns breeding in some colonies on the Great Lakes are apparently declining (Morris and Hunter, 1976; Blokpoel, 1977) because of the loss of habitat to Ring-billed Gulls (*Larus delawarensis*) (Morris and Hunter, 1976) and/or low reproductive success (Morris et al., 1976). Low reproductive success may be due to high levels of toxic chemicals in eggs and adults (Gilbertson and Reynolds, 1972; Gilbertson, 1974).

This poor reproduction, if widespread on the Great Lakes, might well have serious effects on total population levels because of the apparent low rate of immigration.

Shifts between colonies within the Great Lakes.—Austin (1953) suggested that the Great Lakes Common Tern population was divided into three discrete, self-sustaining geographical units or "domains" within which the birds nested although some intercolony movement, within the "domain," could occur. The "domains" were delineated as: (1) Lakes Erie and Ontario and the Upper St. Lawrence River; (2) Lakes Huron and Michigan; and (3) western Lake Superior and central Minnesota. Our results (Table 4), however, suggest that although interlake shifts are, for the most part, limited to adjoining lakes, they are not limited to the "domains" suggested by Austin.

Our results for recoveries of birds banded as adults (i.e., breeding birds) subsequently recaptured in or near the same colony (Table 5) are consistent with the concept of site tenacity. Birds banded in their hatching year, however, tend to be recaptured in a colony other than the one in which they were banded. Austin (1940) found that 81% of all birds banded in their hatching year and trapped between the ages of two and four years were found breeding in the colony where they were hatched. Although our figures are not directly comparable to those of Austin, they do suggest that Common Terns banded during their hatching year are less likely to be found breeding in their natal colony than was the case with birds from the Cape Cod area of Massachusetts. This tendency for birds banded as chicks to be recovered in a different colony may indicate the difficulties of young birds to establish themselves as breeders in the natal colony. For example, when most of the available nesting sites in the natal colony are occupied by experienced breeders, young birds may be forced to seek nesting sites in other colonies.

The only evidence to corroborate the concept of group adherence is the case of 12 individuals, banded from 1936 to 1939 in the Saginaw Bay area of Lake Huron and recovered breeding in the Cape Cod area of Massachusetts from 1940 to 1956. It is unknown whether these birds first went to Massachusetts as a group but the recoveries suggest an adherence that was apparently initiated on the breeding ground and maintained in the wintering areas.

SUMMARY

Banding records were used to study seasonal distribution, emigration from and immigration into the Great Lakes, and intercolony shifts of Great Lakes Common Terns. Adult Common Terns wintered primarily on the mainland of Central and South America whereas juveniles were frequently recovered in Florida and on the Caribbean Islands. Many terns returned to the Great Lakes probably to breed at two years of age and a small number returned the first year after hatching. Common Terns banded as breeding adults were most likely to be found in the same colony in subsequent breeding seasons, whereas those banded in their hatching year were most likely to be found breeding in a different colony. Exchange of breeding birds between colonies on the Atlantic coast and the Great Lakes is rare but exchange among the Great Lakes' colonies is frequent and normally limited to colonies on the same or adjacent lakes. Because of the lack of immigration into the Great Lakes, loss of habitat and low reproductive success may seriously reduce the numbers of Common Terns on the Great Lakes.

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