

**THE BREEDING STATUS OF CASPIAN TERNS
IN THE SOUTHEASTERN UNITED STATES
(MISSISSIPPI TO VIRGINIA)**

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Abstract.—Caspian Terns (*Sterna caspia*) have expanded their breeding range in the southeastern United States (Mississippi to Virginia) since the early 1960s. Half of the first state breeding records occurred on natural sites (barrier islands), but breeding populations of Caspian Terns have significantly increased at dredge-material islands—not natural sites—since the early 1980s. Three localities in Alabama, Florida, and North Carolina accounted for 94-99% of the current (1995-1997) population in the region; Caspian Terns also colonized another site in Florida (Apalachicola) in 1996. The recent breeding range expansion of Caspian Terns in the Southeast may represent reoccupation of their former breeding range.

Caspian Terns (*Sterna caspia*) have a highly disjunct breeding distribution in North America (Clapp et al. 1983, Clapp and Buckley 1984, Cuthbert 1988, Spendelow and Patton 1988, Cuthbert and Wires 1999). Until the range expansion into the southeastern United States began in the early 1960s (Clapp et al. 1983), the nearest breeding populations occurred on the Great Lakes and the western Gulf of Mexico in Texas and Louisiana (Oberholser 1938, Clapp et al. 1983, Spendelow and Patton 1988; R. Martin *in* Purrington 1990).

The breeding status of the Caspian Tern in the southeastern United States (Mississippi to Virginia) has not been summarized since 1979 (Clapp et al. 1983), and not all information before 1980 was available to them. Furthermore, a substantial amount of new information has accumulated since 1979, particularly from Alabama, Florida, and North Carolina (Cooley 1987, Parnell et al. 1995, 1997; Paul 1996, unpubl. data; McNair and Gore 2000; R. Clay unpubl. data). The range expansion into the Southeast has occurred at both natural and man-made sites. Man-made sites were rare in the Southeast prior to construction of the Intra-coastal Waterway in the 1930s and 1940s (Soots and Landin 1978).

In this paper, I summarize data on population size and review the range expansion of Caspian Terns in the southeastern United States since the 1960s. I specifically ask if Caspian Terns have used man-made islands more often than natural islands, if breeding populations are larger and have increased on dredge-material islands in contrast to populations on natural islands, and if colony site type has influenced the breeding distribution of Caspian Terns (cf., Schreiber 1978).

METHODS

I reviewed the literature including state colonial waterbird atlases and unpublished reports. I also contacted individuals who monitor colonial waterbirds in the Southeast to obtain information on the current (1995-1997) breeding status of Caspian Terns. I categorized each colony type of the Caspian Tern as natural or man-made (i.e., dredge-material island). I grouped breeding records over all years for each colony site or discrete cluster of colony sites by location: artificial sites by the major body of water each site was associated with and natural sites by barrier island (Table 1). The only exceptions were one natural site in Pamlico Sound near Ocracoke Inlet, North Carolina, and one man-made site on Little Dauphin Island, Alabama. Most surveys of colony size were made on the ground; most of these counts of nests or breeding pairs at Caspian Tern colonies were direct and complete. One ground count was an estimate only (St. George Sound, Florida). Only a few counts relied on aerial surveys which were estimates only.

I used linear regression analysis to examine trends in Caspian Tern populations at three dredge-material colony sites or cluster of colony sites. These sites are in Alabama (Gaillard Island: occupied since at least 1983; detailed censuses begun in 1988; 1994 data missing), Florida (Hillsborough Bay: occupied since at least 1974; detailed censuses began in 1980; two years of data missing), and North Carolina (Pamlico Sound near Oregon Inlet: occupied since 1972 when detailed censuses began; nine years of data missing) (Cooley 1987, Parnell et al. 1995, Paul 1996, unpubl. data; D. H. Allen unpubl. data; R. Clay unpubl. data). Data for all three localities were ground counts of nests, other than a few counts of breeding pairs in Florida. I performed the analysis on raw data, but transformed raw data to their natural logarithms to graph the results.

RESULTS

Since their regional range expansion began in the early 1960s, Caspian Terns have nested in six coastal southeastern states (Table 1). With the exception of pre-1916 nest records in Virginia (Bailey 1913, Weske et al. 1977), first state breeding records in the Southeast were from 1962-1976 (Florida-1962, Mississippi-1966, South Carolina-1970, North Carolina-1972, Virginia-1974, and Alabama-1976). The only colony site on the Atlantic coast of Florida was discovered in 1973. Caspian Terns have not nested in South Carolina since 1974, Mississippi since 1976, and the Atlantic coast of Florida since 1980 (Table 1).

Three out of six of the first state breeding records of Caspian Terns during their range expansion occurred on natural islands (McDaniel and Becket 1971, Jackson et al. 1979, Kain 1987), where Caspian Terns usually nest on flat areas just above the high tide line (McDaniel and Becket 1971; B. Williams, *in litt.*). Breeding populations at colony sites on natural islands have remained low (Table 1); the largest colony of 15 pairs occurred in Mississippi (Jackson et al. 1979).

Since the early 1960s, the number of different colony sites or cluster of colony sites on man-made islands has exceeded the number on natural islands by more than two to one, regardless of whether this comparison is based on the total number of colony sites or the total number of colony sites for each year in which nesting occurred (Table 1). From 1995-1997, all birds except a single pair in Virginia nested on

Table 1. Natural and man-made colony types, colony location and size, and count type and year of the Caspian Tern in the southeastern United States (Mississippi to Virginia) from 1962 to 1997.

State	Colony Location	Colony Size ¹	Count Type	Count Year(s)	Reference
Natural Colony Sites					
MS	Horn Island	5 N	Ground	1966	Portnoy 1977
MS	Petit Bois Island	15 N	Ground	1967-1968	Jackson et al. 1979
SC	Cape Island	1-2 N/P	Ground	1970, 1972, 1974	McDaniel and Becket 1971, McNair and Post 1993
NC	Pamlico Sound near Ocracoke Inlet	1-2 N	Ground	1984-1987	Parnell and Shields 1990, Parnell et al. 1995
NC	Ocracoke Island			1989-1991, 1995	D. H. Allen and W. Golder, unpubl. data
NC	Hatteras Island: Cape Point	1 N	Ground	1986	D. A. Allen, unpubl. data
VA	Barrier Islands	0-4 N/P	Ground	1974-1997	Weske et al. 1977, Kain 1987, Spindelow and Patton 1988; B. Williams, unpubl. data
Artificial Colony Sites (Dredge-Material Island)					
MS	Mississippi Sound: Horn Island Pass	4 Ad	Aerial	1976	Portnoy 1977
AL	Little Dauphin Island	132 Ad	Aerial	1976	Portnoy 1977; Cooley 1987
AL	Mobile Bay: Blakeley Island	340 Ad	Ground	1979	Winn and Winn 1987
AL	Mobile Bay: Gaillard Island	59-606 N	Ground	1983-1997	Cooley 1987; R. Clay, unpubl. data; see text
FL ²	St. George Sound	4-8 N/P	Ground	1978-1979	Stevenson 1979; Stevenson and Anderson 1994
FL ²	Apalachicola Bay	29-39 N	Ground	1996-1997	McNair and Gore 2000
FL ³	Boca Ciega Bay	1 N	Ground	1962	Woolfenden and Meyerrieks 1963
FL ³	Tampa Bay	1 N	Ground	1967, 1972	Rohrer 1968, Schreiber and Dinsmore 1972
FL ³	St. Joseph Sound	1 N	Ground	1969-1970, 1972	Schreiber and Dinsmore 1972
FL ³	Gasparilla Sound	1 N	Ground	1973, 1978	Dunstan et al. 1975, Kale 1979b
FL ³	Charlotte Harbor	1 N	Ground	1974	Dunstan et al. 1975

Table 1. (Continued) Natural and man-made colony types, colony location and size, and count type and year of the Caspian Tern in the southeastern United States (Mississippi to Virginia) from 1962 to 1997.

State	Colony Location	Colony Size ¹	Count Type	Count Year(s)	Reference
FL ²	Hillsborough Bay	13-93 P/N	Ground	1974-1997	Dunstan et al. 1975; Kale 1979b; Spendelov and Patton 1988; Paul 1996; R. T. Paul, unpubl. data; see text
FL ⁴	Indian River Lagoon	1-10 P/N	Ground	1973-1980	Salata 1979; Kale et al. 1979a; Portnoy et al. 1981; Stevenson and Anderson 1994; McNair and Gore 2000
NC	Pamlico Sound near Oregon Inlet	1-36 N	Ground	1972-1997	Parnell and Soots 1976, 1979; Portnoy et al. 1981; Parnell and McCrimmon 1984, Parnell and Shields 1990, Parnell et al. 1986, 1995, 1997; D. H. Allen and W. Golder, unpubl. data; see text
NC	Pamlico Sound near Hatteras Inlet	1 N	Ground	1974	Parnell and Soots 1976

¹Abbreviations are: Ad = total number of adults, N = nests, P = pairs of breeding adults.

²Data are from colonies located on the northern Gulf coast.

³Data are from colonies located on the central Gulf coast.

⁴Data are from one colony located on the central Atlantic coast.

dredge-material islands; few (4-5) colony sites were occupied in any year (Table 2).

The sizes of dredge-material islands used as colony sites by Caspian Terns have ranged from 0.1 ha to greater than 240 ha. Caspian Terns may nest both on top of the dome or dike (Parnell and Soots 1976, 1979; Stevenson 1979, Paul 1996, McNair and Gore 2000, R. Clay *in litt.*), or on less elevated portions of diked or undiked dredge-material islands (Woolfenden and Meyerriecks 1963, Dunstan et al. 1975, Paul 1996, McNair and Gore 2000). Caspian Terns have moved to the domes of dredge-material islands when vegetation grew over the lower elevations where birds nested the preceding year (McNair and Gore 2000; R. T. Paul unpubl. data).

Colony sizes have ranged from one to 606 nests (Table 1). All colonies formed before the 1980s were small (15 pairs or less), except at dredge-material islands in Alabama and Florida (Hillsborough Bay). Since the 1980s, the number of locations with small colonies has decreased compared to the earlier period (1960s-1970s: 12 locations; 1980s-1990s: 3 locations on natural islands only, all in North Carolina; colony locations which spanned both decade groups excluded). The reasons for the disappearance of all small breeding populations of Caspian Terns at dredge-material islands prior to the 1980s are rarely documented. The only breeding population on the Atlantic coast of Florida vanished because habitat became unsuitable (see McNair and Gore 2000).

The largest colonies have grown on a few dredge-material islands since the 1980s, primarily along the Gulf coast, especially at Gaillard Island in Mobile Bay, Alabama (Cooley 1987; R. Clay *in litt.*; this paper). Current (1995-1997) population estimates for breeding Caspian Terns in the Southeast range from 367-729 pairs (Table 2). The largest estimate in 1996 excludes breeding populations in North Carolina,

Table 2. Population size and number of colony sites of Caspian Tern in the southeastern United States (Mississippi to Virginia) from 1995 to 1997. No colonies occurred in Mississippi, Georgia, and South Carolina.

State	Population Size ¹		
	1995	1996	1997
Alabama	245 (1)	606 (1)	522 (1)
Florida	84 (1)	122 (2)	106 (2)
North Carolina	37 (2)	U ²	26 (1)
Virginia	1 (1)	1(1)	0
TOTAL	367 (5)	729 (4)	654 (4)

¹Number of colony sites are enclosed in parentheses. All colonies are on dredge-material islands except for natural estuarine islands in Virginia.

²U = Unknown; census not conducted.

which were not censused that year. Since the 1980s, Caspian Terns have only occupied one new man-made site, on a dredge-material island at Apalachicola, Florida (McNair and Gore 2000). This site was created in 1995 and in 1998 it was the largest Caspian Tern colony in Florida (McNair and Gore 2000).

The three most persistent populations on dredge-material islands in the Southeast all increased in size. The regression of number of breeding pairs or nests of Caspian Tern recorded by year was statistically significant (Alabama [Gaillard Island]: $F = 11.18$, adjusted $R^2 = 0.56$, $P = 0.01$; Florida [Hillsborough Bay]: $F = 51.88$, adjusted $R^2 = 0.80$, $P = 0.00001$; North Carolina [Pamlico Sound near Oregon Inlet]: $F = 21.75$, adjusted $R^2 = 0.58$, $P = 0.0003$; Fig. 1). The rate of population increase indicated each colony doubled in size about every five (Alabama) to nine years (Florida), although a notable population increase in North Carolina was delayed until the 1990s (cf., Parnell et al. 1997). These three localities accounted for 94-99% of the total population in the region from 1995-1997.

DISCUSSION

Since the breeding range expansion of Caspian Terns began in the early 1960s, dredge-material islands have apparently influenced their breeding status in the Southeast. Disappearance of breeding popula-

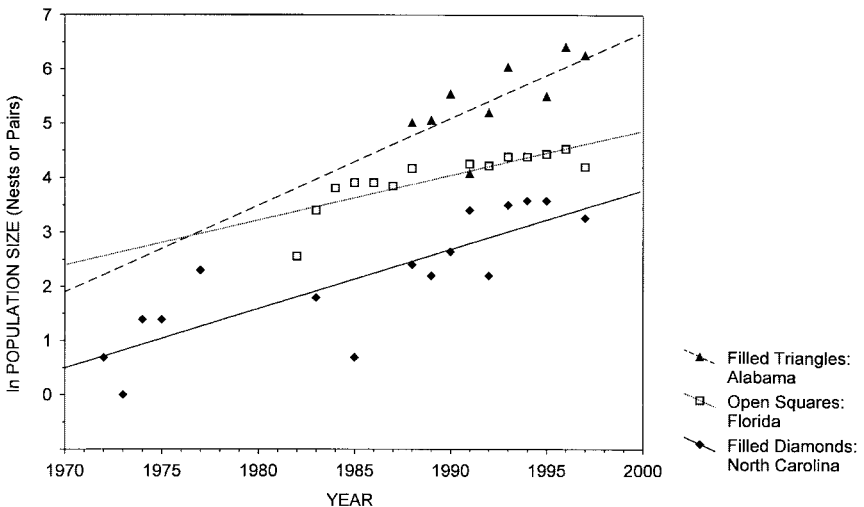


Figure 1. Regression of total number (ln) of nests or pairs of Caspian Terns by year at three colony sites or colony site complexes on dredge-material islands in the southeastern United States (Gaillard Island, Alabama, filled triangles; Hillsborough Bay, Florida, open squares, Pamlico Sound, near Oregon Inlet, North Carolina, filled diamonds).

tions of Caspian Terns from Mississippi (although see Cuthbert and Wires 1999) and South Carolina and from the Atlantic coast of Florida coincides with a general decrease in number of small colony sites since the early 1980s. The growth of breeding populations of Caspian Terns since the early 1980s at three dredge-material island colony sites or colony site complexes (Gaillard Island, Alabama; Hillsborough Bay, Florida; Pamlico Sound near Oregon Inlet, North Carolina), and now a fourth large colony at Apalachicola (McNair and Gore 2000), may be responsible for the population increase in the Southeast. In the western Gulf in Texas and Louisiana, long-established breeding populations of Caspian Terns have also become larger and increasingly restricted to dredge-material islands in contrast to their former distribution on natural sites (Bent 1921, Oberholser 1938, Clapp et al. 1983; R. Martin *in* Purrington 1990; Purrington 1994; R. P. Martin and G. D. Lester unpubl.). Thus, long-established and recently established Caspian Tern populations in the Southeast have shifted to use of dredge-material islands as colony sites. This suggests that Caspian Terns favor man-made sites although the evidence is largely circumstantial.

All dredge-material sites in Alabama, Florida, and North Carolina rely upon deposition of fresh fill to provide suitable breeding habitat (Parnell and Shields 1990, Paul 1996; Parnell et al. 1997; R. Clay *in litt.*). Deliberate habitat management for beach-nesting seabirds in addition to deposition of fresh fill is conducted at the Hillsborough Bay site in Florida (Paul 1996 *in litt.*). Nevertheless, abrupt Caspian Tern colony relocations from island to island in the Hillsborough Bay complex have occasionally occurred (R. T. Paul *in litt.*). Without regular disturbance, dredge-material islands in the Southeast remain suitable breeding habitat for Caspian Terns for about four years (Soots and Parnell 1975, Parnell and Shields 1990, Leberg et al. 1995). The number of species of beach-nesting seabirds currently breeding on dredge-material islands (e.g., Parnell et al. 1997) suggests that unused sites exist for Caspian Terns. This may indicate that Caspian Terns have specialized habitat requirements that we have not yet identified.

The near absence of breeding records of Caspian Terns in the Southeast until the 1960s, 20-30 years after dredge-material islands were readily available (Soots and Landin 1978), suggest that breeding populations from the western Gulf of Mexico and Great Lakes were not expanding. Since the 1960s, both populations have expanded (Shugart et al. 1978, Clapp et al. 1983, Spendelow and Patton 1988; Cuthbert and Wires 1999), so the origin of breeding populations of Caspian Terns in the Southeast could be from either source or both, but no direct evidence exists for either colonizing source. Although breeding populations on the Great Lakes are larger than in the western Gulf (Clapp et al. 1983, Spendelow and Patton 1988, Cuthbert and Wires 1999), Shugart et al.

(1978) argued that little mixing occurred between disjunct breeding regions, and the proximity of eastern Gulf coast colonies suggest that they were probably colonized by birds from the western Gulf (Bent 1921, Oberholser 1938, Clapp et al. 1983; R. Martin *in* Purrington 1990).

Finally, prior to the recent range expansion of Caspian Terns, a small (12 pairs or less) isolated historical population nested on natural sites prior to 1916 in Virginia: the only confirmed historical breeding population of Caspian Terns in the Southeast (Weske et al. 1977, McNair 1994a, b). This Virginia population was eliminated by humans (Weske et al. 1977). The recovery of breeding populations of many other species of larids in the Southeast after enactment of the Migratory Bird Treaty Act of 1916 when human persecution was greatly reduced included re-colonization of historical colony sites where birds had been extirpated and occupation of geographic regions where birds had probably nested before (Bent 1921, Kale et al. 1965, Sprunt and Chamberlain 1970, Clapp et al. 1983, Clapp and Buckley 1984, Robertson and Woolfenden 1992, McNair 1994b, Stevenson and Anderson 1994, Parnell et al. 1995, 1997; Thompson et al. 1997). This included Laughing Gulls (*Larus atricilla*) which is the most abundant seabird in the Southeast (Clapp and Buckley 1984). Thus, Caspian Terns may once have been more widely distributed and their recent range expansion may possibly represent reoccupation of their historical breeding range. Elimination of similar small and patchily distributed breeding populations on natural sites in the Southeast outside Virginia could have gone undetected.

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