

Status and Distribution of the Least Tern in Virginia - 1975 to 1988

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ABSTRACT

Small, scattered breeding colonies of the least tern (*Sterna antillarum*) are found on over-wash areas on the beaches of the barrier islands of the Eastern Shore of Virginia. Two large colonies occur in the Tidewater region of Virginia on the western shore of the Chesapeake Bay at Grand View Beach in Hampton and Craney Island in Portsmouth. Data from 14 consecutive breeding seasons indicate changes in the geographic locations and fluctuations in population sizes of the least tern in Virginia. These data show a fluctuating population on the barrier islands with an overall decreasing trend. The colonies at Grand View Beach and Craney Island are increasing in number and currently represent more than half of the total Virginia population. Mammalian, avian, and human disturbances have influenced least tern production and in some cases prevented successful nesting. Least tern populations have responded positively to protection of nesting habitat. Several management techniques have been successfully implemented to attract terns to specific areas at the Craney Island site.

INTRODUCTION

The least tern (*Sterna antillarum*) breeds in scattered colonies along the Atlantic coast of the United States from Maine to Florida, along the Gulf coast to southern Texas (Erwin, 1979), and the Pacific coast from California to southern Mexico (Dement'ev & Gladohov, 1969). In the interior of the United States the least tern is found along the Mississippi drainage where it nests on sandbars and islands of the larger rivers (Hardy, 1957). In Virginia, the least tern breeds on the barrier islands on the seaward margin of the Delmarva Peninsula and on certain beaches located along the west side of the lower Chesapeake Bay.

Bailey (1913) and Murray (1952) recorded the least tern as a breeding species in Virginia. During the last quarter of the nineteenth century, however, least terns along the East coast were virtually exterminated as a result of the decorative use of tern feathers and skins in the women's millinery trade. Plume hunters invaded terneries and slaughtered adult terns by the thousands. The skins were shipped to New York City where they sold for ten cents each (Saunders, 1969). Bent (1921) reported as many as 100,000 terns killed each year along the Atlantic coast during peak harvesting years. In one 3-day period, 2,800 least terns were killed on Cobb

Island, Virginia, with 1,400 taken in a single day. By the turn of the century the least tern population had declined precipitously. Bailey (1913) reported that the Virginia population had been reduced to only a few scattered breeding pairs by the early 1900's.

Legislation was passed in 1918 to protect migratory birds [Federal Migratory Bird Treaty Act]. With protected status least tern populations began to recover. By the 1920's and 1930's much of the east coast had been recolonized. Pearson *et al.* (1942) estimated that the North Carolina population was approximately 25,000 in June 1939. Nisbet (1973) estimated the Massachusetts population reached 1,500 during a peak period between 1945 and 1954. There are no known reports on the least tern population in Virginia during this recovery period.

Colonies of least terns continued to increase throughout the east coast until the 1950's. Between 1950 and 1970, however, decreasing numbers of least terns were again noted (Downing, 1973). In Massachusetts (Nisbet, 1973) and along the South Carolina and Georgia coasts (Tomkins, 1959), all populations were reported to be declining.

Within the Chesapeake Bay and major river systems of eastern Virginia, few least tern colonies were reported from the 1950's to the 1970's, and these were scattered throughout the region (Scott, 1956). In Virginia, estimates of the total least tern population in the 1970's were approximately 1,500 birds per year (Downing, 1973; Akers, 1975; Erwin *et al.*, 1979).

Typical least tern nesting habitat has been described as a broad, flat, open beach area with little or no vegetation (Marples and Marples, 1934). The substrate may be sand, broken shells, or shingle (a combination of crushed shell and pebble) (Bent, 1921; Mosley, 1976). The colony site is usually situated close to water where high winds from spring storms combined with high tides often destroy entire colonies by washing out the nests (Witherby *et al.*, 1941).

The objectives of the study were to determine the status of the least tern in Virginia, to detect changes in population numbers, and determine if population shifts have occurred.

STUDY AREAS

The three primary locations of least tern colonies in Virginia are the barrier islands on the Eastern Shore; Grand View Beach, Hampton; and Craney Island, Portsmouth. From north to south, the islands censused were: Assawoman, Metompkin, Cedar, Dawson Shoal, Parramore, Sandy, Chimney Pole Marsh, Hog, Rogue, Cobb, Little Cobb, Wreck, Ship Shoal, Godwin, Mink, Myrtle, Smith and Fisherman. These 18 barrier islands are under varying degrees of protection and preservation by the Virginia Coast Reserve of The Nature Conservancy, Chincoteague National Wildlife Refuge of the U.S. Fish and Wildlife Service, Assateague Island National Seashore of the National Park Service, the Virginia Department of Game and Inland Fisheries, and private ownership.

Located on the western shore of the Chesapeake Bay, the Grand View Beach site (N 37° 06.3', W 76° 17.2'), under the management of the Department of Hampton Parks, differs from the Eastern Shore habitat in that it is to some extent protected from direct ocean waves and is infrequently washed over by spring storms and high tides.

Craney Island (N 36° 55', E 76° 22') is a man-made, dredge-spoil disposal site operated by the Norfolk District of the U. S. Army Corps of Engineers since the 1950's and is an atypical tern site for Virginia. This site covers about 41 square kilometers and extends 6.5 kilometers into Hampton Roads from the original shoreline. Colonies are located on relatively high areas where the substrate tends to be drier than the surrounding flats. These sites are not affected by tidal action, but nests are at a greater risk of flooding by heavy rain because of the high silt content of the substrate.

Small groups of least terns arrive on the coast of Virginia in late April and early May over a period of seven to ten days. The colonies have synchronous reproduction where young hatch by the second week in June if weather conditions are favorable.

METHODS

Barrier Islands - Each year from 1975 to 1988, the Virginia barrier islands have been censused in conjunction with the annual colonial nesting bird survey for the Colonial Bird Register (Williams, 1975). The barrier islands data were collected by the authors, working as a team, during this 14-year period. Based on experience and observations prior to 1975, the third and fourth weeks of June were selected as the most likely time to find eggs, young, and renesting attempts. All barrier island surveys were conducted within this time period.

In each survey, team members walked the entire beach area (mean high water to primary dunes including wash-over areas) of all 18 islands looking for nests and birds. Three to four days were required to cover the approximately 84 kilometers of shoreline from Fisherman Island to Assawoman Island. The location of each tern colony site was marked on U.S. Geological Survey topographical charts (7.5 minute series).

The specific phase of the breeding cycle was identified and recorded for each colony. For colonies of fewer than 100 nests, an attempt was made to count each nest. After the nest count, the observer(s) walked through the colony to flush and count the number of adult birds. With larger colonies, multiple observers recorded their individual estimates of nests and the number of adults before and after the birds were flushed. The individual estimates of adult birds and nests were compared and reconciled in the field.

The duration of colony disturbance was kept to a minimum. The observer(s) moved steadily through a colony without lengthy pauses to permit the birds first disturbed to return to their nests and thereby minimize stress on the eggs and young.

Grand View Beach and Craney Island - Grand View Beach and Craney Island were studied in detail by one of the authors (Akers). Field work began in 1973 with weekly or daily observations of these colonies from April 15 to July 30 (Akers, 1975). Since 1975, the same intensive observation schedule has been maintained by the same observers.

Adults were counted weekly until the peak of hatching. Typically, this procedure provided five independent counts of adults per breeding season. Multiple nest counts were also conducted until hatching began. With the onset of hatching, young were counted during each weekly survey. Fledged young were also recorded.

Since 1977, a total of 1,971 young have been banded at Grand View Beach. Because of the potential danger of driving young into nearby ditches and ravines, fewer than 50 young were banded over the course of this study at Craney Island.

In 1985 the United States Army Corps of Engineers, the Department of Biology at the College of William and Mary, and Virginia Department of Game and Inland Fisheries cooperated to establish potential tern nesting sites. During each winter, the superintendent of the Craney Island Project for the Corps of Engineers identified anticipated low use areas not required for dredging operations in the coming spring and early summer. The superintendent and one of the authors (Beck) conducted on site inspections to assess each area for its potential as a least tern breeding colony site. The most promising areas were designated on the Craney Island Site Plan. The Corps then improved the selected sites as necessary by elevating them for better drainage. The areas were then covered with sand and white shell fragments to attract the terns. The Corps then limited vehicular traffic around the boundaries of these areas. This cooperative effort is expected to continue.

From 1985 to 1988, the Craney Island colony has consisted of three to five separate groups. Beginning in 1986, 50 wooden least tern decoys were constructed and displayed in each of three potential nesting sites. The purpose of this experiment was to attract adult least terns to specific locations. From 1986 through 1988, the terns used two of the three sites. All tern colonies were identified and posted. To prevent disturbance by vehicular traffic the Corps constructed circumferential trenches and blocked roads passing through terneries when necessary.

RESULTS

The location of least tern colonies censused in the 14 years of this study, status of the sites (active/inactive), and number of active sites each year are given in Fig. 1. The presence of territorial adults and nests with eggs or young determined an active site. The total number of adults at the three primary locations plus Chincoteague National Wildlife Refuge each year are given in Table 1. Data from Chincoteague National Wildlife Refuge (Ailes, 1985) are also included in Fig. 1. Census data from 1978 to 1988 at that site have been used with our data to obtain a more complete understanding of least tern population trends and movement on the Eastern Shore of Virginia.

Cedar, Hog, Metompkin, and Ship Shoal Islands had breeding colonies in all 14 years, and colonies were on Cobb and Smith Islands in all but one year.

The barrier islands and Chincoteague population data exhibit extreme variability in numbers from year to year (Fig. 2). Abundance increased dramatically in 1981 followed by an overall decreasing trend through 1988. Data for the Grand View Beach colony also exhibited large changes in numbers from year to year and a sharp rise in population after 1980 (Fig. 3). The overall trend was toward increasing numbers. The Craney Island colony exhibited a doubling in numbers in 1981 after recolonization of this site in 1980 (Fig. 4). From 1981 to 1985, there was a gradual increase each season followed by a drop in 1986. Significant increases occurred in 1987 and 1988.

In Fig. 5, all data sets have been combined to show the total least tern population in Virginia from 1975 to 1988. There is clearly a significant change in the population

NAME OF GEOGRAPHIC LOCATIONS	SURVEY YEAR													
	75	76	77	78	79	80	81	82	83	84	85	86	87	88
VIRGINIA BARRIER ISLANDS														
♦ ASSAWOMAN	-	-	■	-	-	-	-	-	-	-	-	-	■	■
♦ CEDAR	■	■	■	■	■	■	■	■	■	■	■	■	■	■
♦ CHIMNEY POLE MARSH	-	-	-	-	-	-	-	-	-	-	-	-	-	-
♦ COBB	■	■	■	■	-	■	■	■	■	■	■	■	■	■
♦ DAWSON SHOAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
♦ FISHERMAN	-	-	-	-	■	■	■	-	-	-	-	-	-	-
♦ GODWIN	-	-	-	-	-	-	-	-	-	-	-	-	-	-
♦ HOG	■	■	■	■	■	■	■	■	■	■	■	■	■	■
♦ LITTLE COBB	-	■	■	■	■	-	-	-	-	-	-	-	-	-
♦ METOMPKIN	■	■	■	■	■	■	■	■	■	■	■	■	■	■
♦ MINK	-	-	-	-	-	-	-	-	-	-	-	-	-	-
♦ MYRTLE	■	■	■	-	-	■	■	-	■	■	■	■	■	■
♦ PARRAMORE	■	■	■	-	-	-	-	-	-	-	-	-	-	-
♦ ROGUE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
♦ SANDY	-	-	-	-	-	-	-	-	■	-	-	-	-	-
♦ SHIP SHOAL	■	■	■	■	■	■	■	■	■	■	■	■	■	■
♦ SMITH	■	■	■	■	■	■	■	■	■	■	■	■	-	■
♦ WRECK	-	-	-	■	■	-	-	-	-	-	-	■	-	■
CRANEY ISLAND	■	■	■	-	-	■	■	■	■	■	■	■	■	■
GRAND VIEW ISLAND	■	■	■	■	■	■	■	■	■	■	■	■	■	■
CHINCOTEAGUE NWR	-	-	-	■	■	■	■	■	■	■	■	■	■	■
NUMBER OF ACTIVE LOCATIONS	10	11	11	10	10	11	11	10	10	10	11	10	11	11

FIGURE 1. Locations of active least tern colonies surveyed from 1975 to 1988. (Data from the Chincoteague National Wildlife Refuge/Assateague Island provided by I. Ailes, unpublished report).

occurring with the 1981 breeding season. A straight line, least squares fit to these data from 1975 to 1980 has a slight negative slope indicating an annual decrease of about 18 birds (Slope = -18.46, $R^2 = 0.04$). After the large population jump in 1981, a straight line, least squares fit to the 1981-1988 data, indicates an annual decrease of 88 birds (Slope = -88.24, $R^2 = 0.32$).

A similar fit to the combined least tern population west of the Chesapeake Bay indicates an annual decrease of about 12 birds during the 1975-1980 period (Slope = -12.57, $R^2 = 0.08$). However, in the period from 1981 to 1988, there is an annual increase of approximately 61 terns (Slope = 61.76, $R^2 = 0.65$).

The ratio of the number of least terns on the west side of the Chesapeake Bay to the total population in Virginia shows an apparent shift in the population from the barrier islands to the west during the latter half of this study (Fig. 6). From 1981 to 1988, the growth of the population west of the Bay increased approximately 4% each year (Slope = 0.04, $R^2 = 0.80$). In addition, more than half of the least tern population of Virginia was located west of the Bay in 1985, 1987, and 1988.

Of the 1,971 least tern young banded at Grand View Beach and Craney Island, only ten have been recaptured since 1977.

TABLE 1. Adult population sizes of least terns in Virginia, 1975-1988.

Year	Virginia Barrier Islands	Chincoteague National Wildlife Refuge	Grand View Beach, Hampton	Craney Island, Portsmouth	Virginia Total
1975	766		350	150	1266
1976	886		160	160	1206
1977	1013		160	120	1293
1978	429	20	400	0	849
1979	407	350	300	0	1057
1980	795	120	300	100	1315
1981	1869	200	600	200	2869
1982	550	854	600	200	2204
1983	1381	392	900	220	2893
1984	1217	210	600	222	2249
1985	717	104	800	250	1871
1986	1413	43	950	200	2597
1987	884	22	970	300	2176
1988	731	120	650	510	2011

DISCUSSION

The estimation of large flocks of birds on the wing, under varying light and weather conditions, is a skill developed slowly over time and with much practice. Precise counting of flocks of greater than 100 birds is usually not possible and the variation between the estimates of multiple observers increases with the size of the flock. Each of the authors have a minimum of 20 years' experience in both land and aerial surveys of terrestrial and pelagic avian species. The individual experience and the experience of working as a team over many years tends to minimize observer error.

Typically, we are able to obtain counts which deviate by no more than approximately 5% for flocks in flight of 100 to perhaps 300 birds under good conditions. At higher numbers the estimates may differ by 10%. Even under good observing conditions, discrepancies can arise between the estimates of multiple observers. The procedure used consistently by the authors has been to average the estimates from two observers; drop the high or low estimate of three observers and average the two remaining; and drop both the high and low estimate when there are four observers and average the two remaining numbers.

Estimation of the number of nests within a least tern colony is also a skill refined over time. In Virginia, the size of least tern colonies are generally less than 100 nests. Experience has shown that our individual estimates are consistent to within approximately 5%.

Although many obvious adverse factors on the population can be delineated, there exists a spectrum of others that may or may not play a role in the large

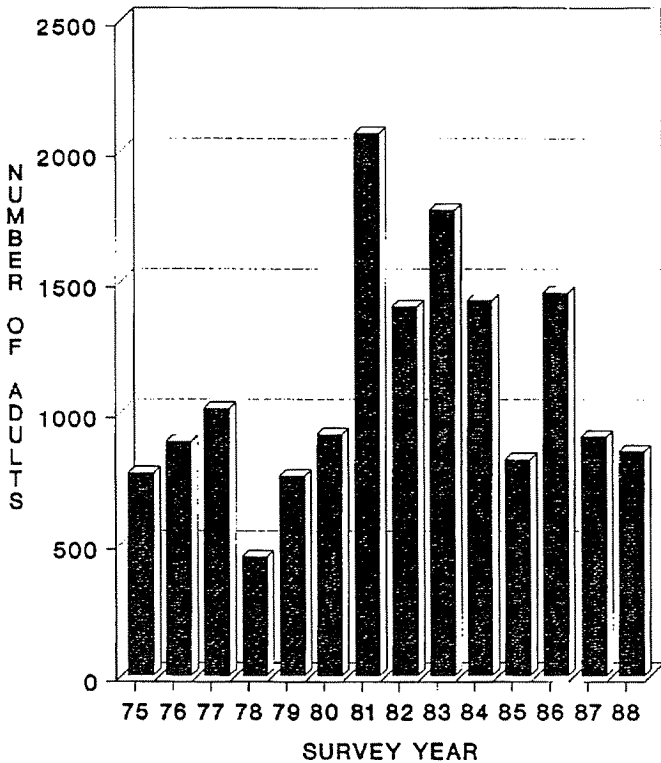


FIGURE 2. Combined number of adult least terns observed in yearly surveys on the barrier islands and the Chincoteague National Wildlife Refuge from 1975 to 1988. (Data from the Chincoteague National Wildlife Refuge covers the years from 1978 to 1988).

variations observed in the duration of this study. In the following discussion, those factors adversely affecting the colonies observed during our surveys will be addressed in an attempt to understand the population variability in Virginia.

Barrier Islands - Least tern colonies located on the Virginia barrier islands are subjected to a wide range of adverse conditions, both natural and man-related, that can destroy large numbers of young and eggs, and force relocations of colonies from year to year. Under favorable climatic conditions, however, dramatic increases in the population can occur in a single breeding season (see Fig. 2).

Weather plays a paramount role in nesting success or failure. The habitat preference of the least tern exposes nesting sites to the full impact of high winds, driving rains, and high seas. Flooding is the single greatest threat with its potential to obliterate entire colonies in a few hours. Although least terns will re-nest two or three times in a single season, repeated wash-outs have occurred at critical intervals with devastating effect on the colonies. In the 1978 and 1979 breeding seasons, large storms lasting several days repeatedly pounded the barrier islands, wreaking havoc on the colonies through wash-over and cold rain. The adverse effects of these storms are clearly reflected in sharp population declines in these two consecutive years for the lowest numbers observed in this study (Fig. 2). As an indication of the severity of these storms in 1978-79, Little Cobb Island was obliterated and remained

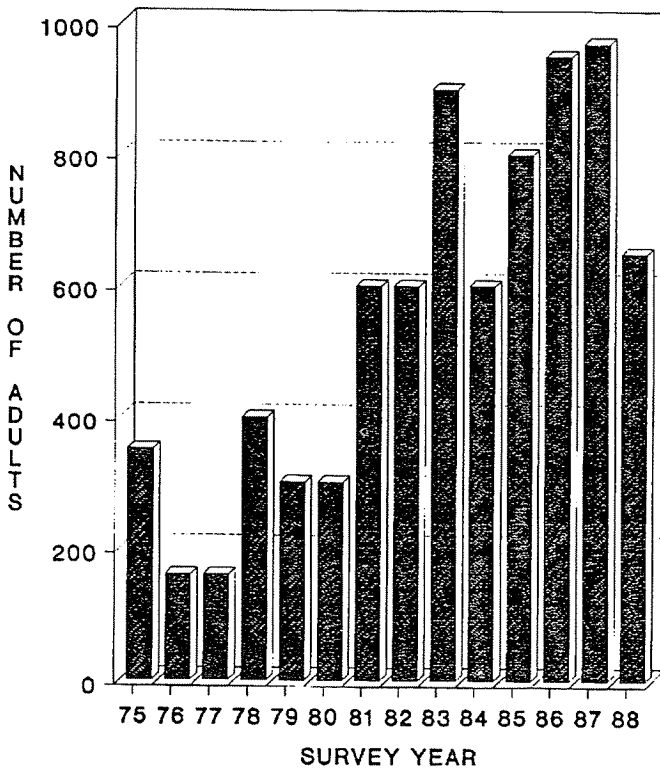


FIGURE 3. Yearly population counts of least tern adults at Grand View Beach, Hampton, Virginia.

below high tide until 1988. In 1982 a severe storm raked the islands prior to the census and resulted in the largest single-year decrease in the least tern population on the barrier islands. Population declines in 1985, 1987 and 1988 may be related to severe weather conditions during the breeding cycle.

The dynamic nature of the barrier islands has forced colonies to relocate on the same island or to abandon an island altogether. Island accretion can produce suitable tern habitat in a matter of months; erosion can destroy it in a few days. Even those islands with somewhat stable dimensions become unsuitable least tern habitat with increasing vegetation development. Establishment of gull colonies in these areas may further influence the terns. The Islands of Chimney Pole Marsh, Godwin, Mink, and Rogue are heavily vegetated with grasses and low shrubs, and no least terns have nested on these islands during the course of this study. Sandy Island, also heavily vegetated, has had only one least tern colony within this study period. Parramore Island has not been used by least terns since 1977, possibly as a result of severe storms in 1978 and 1979. Vegetation increased at the former colony site following 1979, along with mammalian and avian predation. Wreck Island is mostly covered with vegetation with areas of marginal beach habitat which have been sporadically used by least terns. Dawson Shoal has not been used as a nesting

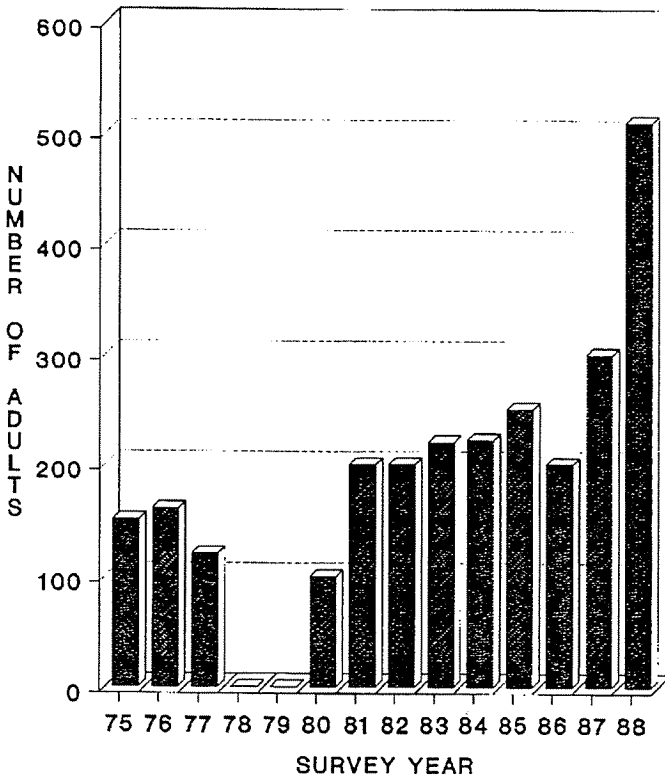


FIGURE 4. Yearly population counts of least tern adults at Craney Island, Portsmouth, Virginia.

site possibly because it is subject to frequent tidal flooding and suitable substrate is not available.

Predation on least tern colonies has been observed both directly and indirectly at all sites within Virginia. Least terns are among the most active of the Sterninae in defense of the colony. They react to predators by vocalizing, defecating, and occasionally striking at the mammalian or avian intruder. Such defensive measures are of no avail against larger mammalian predators such as red foxes (*Vulpes fulva*) and raccoons (*Procyon lotor*). Within the time period of this study, tracks and scat of both raccoons and red foxes have been documented (K. Mayne, pers. comm.), and repeated visual sightings have been made since 1986 on Metompkin and Cedar Islands. Evidence of raccoons and foxes has also been found on Assawoman Island. Parramore Island has an apparently increasing number of red foxes whose predation may have contributed to abandonment of that site by the least terns. Another, albeit rare, mammalian predator, the coyote (*Canis latrans*), has been sighted on Smith Island. This animal was first observed in 1986 and photographed in 1987 (J. Hall and B. Truitt, pers. comm.). Uncontrolled domestic dogs (*Canis familiaris*) have been observed within least tern colonies on Cedar and Metompkin Islands. No feral dogs are known to be on the barrier islands.

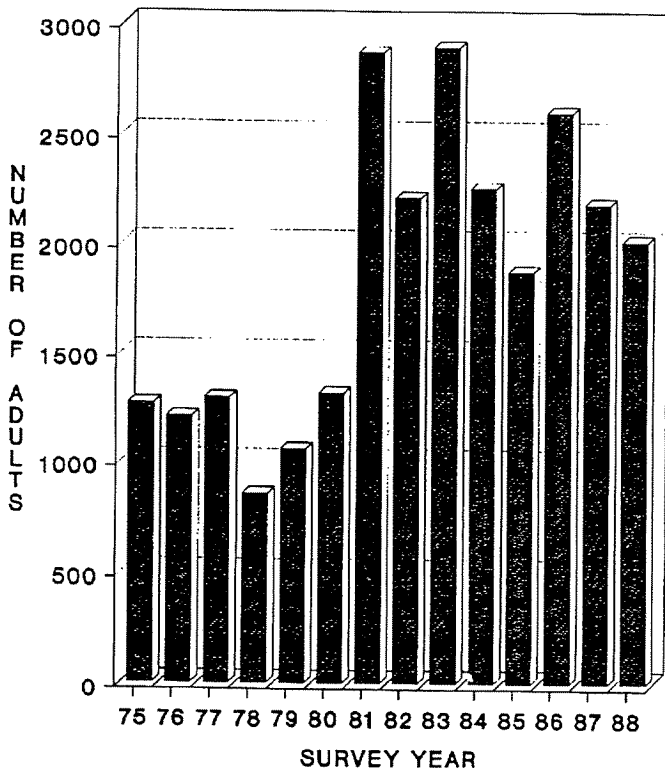


FIGURE 5. Total number of least tern adults observed in Virginia during yearly surveys from 1975 to 1988.

Avian predators include both raptors and gulls. Herring gulls (*Larus argentatus*) and great black-backed gulls (*Larus marinus*) have been observed removing chicks and eggs from least tern colonies. Raptor predators include the peregrine falcon (*Falco peregrinus*), northern harrier (*Circus cyaneus hudsonius*) and fish crow (*Corvus ossifragus*). Peregrine falcon predation of least tern adults was observed over the past six years on Metompkin Island near a hacking tower. The northern harrier has been observed in the vicinity of tern colonies at Wreck, Cobb, and Hog Islands harassing adults and taking young terns. Among these avian predators, our observations suggest that gulls represent the greater threat to a colony simply because of their large numbers and close proximity to the terns.

Feral cattle have previously been a threat to least tern colonies on Hog Island. These animals periodically wandered through colonies causing extended disturbance to the adult birds and trampling nests. The cattle were removed in 1986 under the direction of The Nature Conservancy.

Human disturbance of colonies and modifications of habitat has increased. The degree of disturbance varies from island to island. Since 1985, for example, Cedar Island has undergone substantial development including a new, larger boat dock to handle vehicles and machinery. Numerous light and heavy vehicles use the beach as the only suitable track on this island. Houses have been constructed and snow fences erected along the primary dune line. The tracks of all-terrain vehicles have

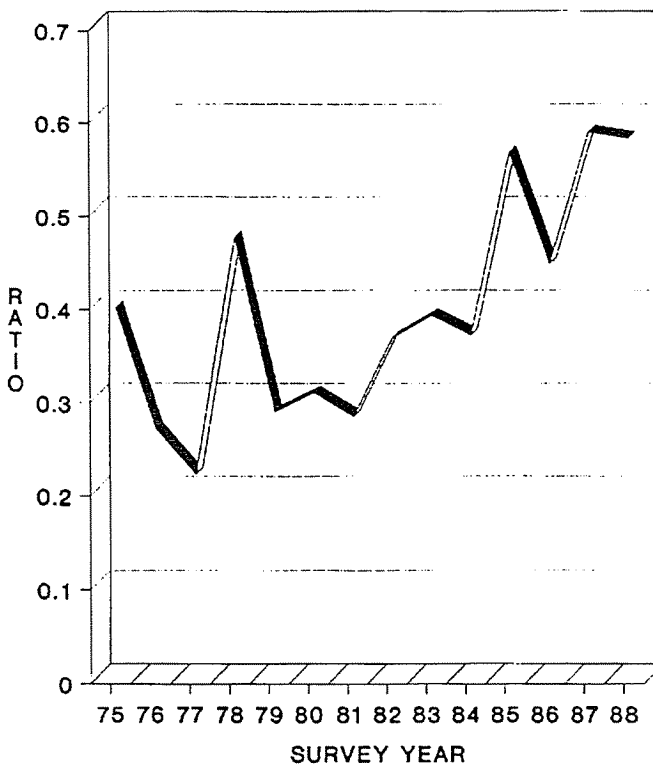


FIGURE 6. Ratio of the population of adult least terns on the west side of the Chesapeake Bay to the total Virginia population as a function of survey year.

been found crisscrossing the colonies of least terns and other beach-nesting species. Pedestrians and their dogs have been observed lounging within colonies. Least terns on other islands experience their greatest disturbance on weekends and holidays with boaters, overnight campers, and fishermen moving through the colonies or utilizing space within them. Since suitable nest site substrate for this species often occurs along island inlets, disturbance at these locations is enhanced by increased human accessibility. In the early 1980's, the boundaries of least tern colonies exposed to high human disturbance were posted with signs indicating the sensitive nature of the nesting area by the Virginia Coast Reserve of The Nature Conservancy. In addition, the Virginia Department of Game and Inland Fisheries also posts areas under its control.

Movement of breeding least terns into the colonies surveyed in this study from other areas must be considered as well as population losses to other areas. Chincoteague National Wildlife Refuge, located approximately 24 kilometers north-northeast of Assawoman Island, typically has had few least terns. In 1978, 20 adult least terns were observed on the refuge (Fig. 7). In 1979, the year with the lowest least tern count in this study, 350 were counted on the refuge. In addition, the Grand View Beach colony increased from 160 birds in 1978 to 400 in 1979. In 1982 the barrier island population showed the largest single-year decrease in this study; however, the refuge observed an increase of 854 least terns (Ailes, 1985). There

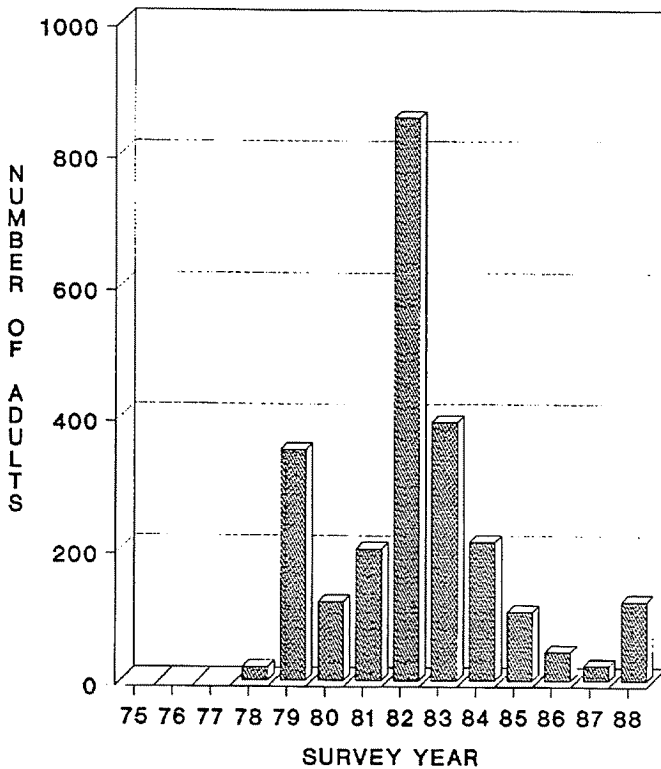


FIGURE 7. Number of adult least terns located on the Chincoteague National Wildlife Refuge from 1978 to 1988.

appears to have been a shift from the barrier islands to the west side of the Bay. However, it could be argued that the least terns normally using the barrier islands of Virginia are shifting to barrier islands of neighboring states, whereas the Craney Island and Grand View Beach colonies represent stable, growing populations. There is insufficient evidence to prove that population shifts are occurring in Virginia; however, it would seem to be an entirely plausible nesting option for this species.

A single explanation for the observed large fluctuations in numbers from year to year is perhaps not possible in view of the multiplicity of threats to the nesting environment of this species. A systematic, annual census provides only an indication of trends and potential problems and cannot address detailed questions related to natural population dynamics, predator control, and conservation strategies. The status of the least tern should continue to be monitored, and if possible, multiple surveys should be conducted each breeding season on the barrier islands to better delineate those factors which positively or adversely affect their breeding success.

Grand View Beach - This area is similar in structure to the barrier islands. It, however, escapes the worst of the storms that pound the barrier islands by virtue of its location on the west side of the Chesapeake Bay.

The least tern colony at this site dates back to (at least) 1889, when Bailey (1913) states that a large colony nested at the entrance of the Back River into the

Chesapeake Bay. The colony was destroyed by plume hunters and no information has been found concerning recolonization. A large, scattered and continuously breeding aggregation, the Grand View ternery is spread over an area of dunes that stretches southward about 300 to 350 meters from the northern tip of a small peninsula extending into the confluence of the Back River and the Chesapeake Bay. From 1975 to 1988, this colony has been among the largest in Virginia, exceeded only by the Metompkin Island colonies in 1977 and 1981.

Of the least tern young banded at Grand View, only 10 have been recovered to date. Six of these, however, were trapped as breeding adults in Dorchester County, Maryland, during 1986-87 (J. McKernan, pers. comm.). In the absence of multiple recoveries from other locations, no significance can be attached to the Maryland recoveries in terms of population recruitment and/or shifts.

Predation by gulls does not appear to be a major problem at Grand View Beach. Gull numbers, however, continue to increase around the boundaries of the colony. Peregrine falcon predation, on the other hand, is strongly suspected with the finding of 23 adult least tern skulls, wings, and notched sternums in the 1988 breeding season. Northern harriers have been observed harassing and taking young terns at Grand View Beach. In 1987, the nest of a pair of northern harriers was found on this site (F. Day, pers. comm.).

Although evidence of predation by red foxes on Grand View Beach was observed in the early 1970's, no evidence of fox predation has been observed since the early 1980's.

Grand View Beach is public property and human disturbance of the least tern colony by boaters, picnickers, fishermen, and swimmers frequently prevented the terns from incubating eggs or caring for their young. Dogs were commonly found in the colony. In 1974, the contents of 14 nests were taken by vandals and heaped in a pile in the middle of the Grand View ternery (Akers, 1975). In an attempt to reduce the high-level human disturbance in and around the colony on Grand View Beach, two of the authors (Akers, Beck) began posting the boundaries of the colony in 1982 with the cooperation of the Hampton Department of Parks.

From 1977, this population has maintained an overall strong rate of growth. The year-to-year changes do not appear to be correlated to those of the barrier islands nor are the fluctuations as great as those of the barrier islands. However, the increasing demand for public access to this area is a continuing concern and possibly represents the greatest single threat to the long-term growth and, perhaps, survival of this colony. Continued close monitoring of this site is required and increased effort must be made to heighten public awareness of the need to protect this area as a least tern breeding site.

Craney Island - The primary avian predator at this site is the herring gull. This species has been documented removing eggs from the Craney Island site (B. Trott, pers. comm.). Immature herring gulls and great black-backed gulls have been observed walking into the colony on Craney Island.

The northern harrier has been observed in the vicinity of tern colonies at Craney Island but there has been no evidence of tern predation. The American kestrel (*Falco sparverius*), however, was observed harassing and taking young terns in 1982 and 1985.

The only known mammalian predator at this site is the red fox. In one documented case, a red fox destroyed 13 nests in a single night (Akers, 1975). At present there is no evidence to suggest that foxes are a serious threat to the terns on Craney Island.

Human activity, on the other hand, has had devastating impact on the nesting efforts at this site. In 1978 and 1979, the terns were driven from the area through extensive earth moving operations within the colony. The terns returned in 1980 and slowly increased from 200 in 1981 to 250 in 1985.

The measures taken on Craney Island with the cooperation of the Corps of Engineers have apparently resulted in a sharp increase in this population from 200 in 1986 to 510 in 1988. The current management strategy at Craney Island has the potential of becoming a model for the protection and preservation of this species at other locations. Obviously, more data are necessary before cause and effect relationships can be established.

ACKNOWLEDGEMENTS

This study was supported in part by the Virginia Coast Reserve of the Nature Conservancy and the Virginia Department of Game and Inland Fisheries. The Williamsburg Bird Club and the Hampton Roads Bird Club of the Virginia Society of Ornithology supplied material and manpower for the posting effort at the Grand View beach site.

Data on the least tern population at the Chincoteague National Wildlife Refuge were provided by Mr. Irwin Ailes, Assistant Refuge Manager.

The authors express their appreciation to those individuals who have contributed to this study in a variety of ways: Barry Truitt and John and Karen Hall of the Virginia Coast Reserve for their cooperation and support during the barrier island surveys; Hank Williamson of the U.S. Army Corps of Engineers Craney Island Project for his cooperation and active support in protecting the colonies on Craney Island; Tom Daniel of the Hampton Parks Department for his efforts at the Grand View Beach site; Kelly Payne for assisting in organizing field data and in typing the manuscript; and Sherwin Beck for preparing the figures.

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