

**STATUS AND DISTRIBUTION OF COLONIAL
WATERBIRDS IN COASTAL VIRGINIA: 2008
BREEDING SEASON**



**CENTER FOR CONSERVATION BIOLOGY
COLLEGE OF WILLIAM AND MARY - VIRGINIA
COMMONWEALTH UNIVERSITY**

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Front Cover: *Great Black-backed Gull brood in nest. Photo by Bryan D. Watts.*



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EXECUTIVE SUMMARY

Colonial waterbirds are highly visible components of coastal avifaunas that share the unusual characteristic of nesting in dense assemblages. One consequence of having large portions of populations nesting in few locations is that even restricted disturbance may have profound consequences on a population level. Development of conservation strategies for these sensitive species requires current status and distribution information.

During the breeding seasons of 1993 and 2003, a comprehensive assessment of the colonial waterbird community in coastal Virginia was conducted with the purpose of providing information needed for strategic management and future trend analysis. During the spring of 2007, a decision was made by a consortium of partners to conduct a third assessment on the 5th anniversary of the 2003 survey. Due to funding constraints, the 2008 survey did not cover the widely dispersed colonies of Great Blue Herons and Great Egrets in the interior of the western shore or within the portion of the Coastal Plain south of the James River. For this reason, the 2008 survey produced comparable population assessments for 22 of the 24 colonial waterbird species known to nest in Virginia.

Nearly 550 surveys were conducted of 250 colonies during the breeding season of 2008. Colonies supported an estimated 60,758 breeding pairs of 24 species. Gulls were the most abundant group with more than 40,000 breeding pairs. Terns and waders accounted for 9,455 and 4,763 pairs respectively. Laughing gulls were several times more abundant than any other species and represented 61% of the total waterbird community. The barrier island/lagoon system of the Eastern Shore was the most important region for the majority of colonial species encountered. This region supported 20 of the 23 species evaluated during the survey and accounted for greater than 74% and 70% of all breeding pairs and colonies, respectively. For 15 of the 23 species, the region supported more than 50% of the known coastal population.

The colonial waterbird community in coastal Virginia that was assessed during this survey (all species except Great Blue Heron and Great Egret) declined by 28.9% during the 15 years between 1993 and 2004 (Table 3). Population estimates for 14 of 22 species assessed declined since 1993 and 11 of these have declined since the 2003 survey. Declines varied considerably between species with 10 species declining more than 40% and 4 species declining more than 70%. Cattle Egrets showed the highest loss rate, declining from an estimated 1,459 to only 120 pairs. Eight species increased between 1993 and 2008. Dramatic expansions were documented for White Ibis, Great Black-backed Gull, Double-crested Cormorant, and Brown Pelican.

The seaside of the Delmarva Peninsula is the most important region for colonial waterbirds in Virginia. Despite heroic efforts to manage several species, declines have not been abated. Collectively, the waterbird community has declined 33% between 1993 and 2008. Snowy Egret, Tricolored Heron, Cattle Egret, Green Heron, Yellow-crowned Night Heron, Glossy Ibis, Herring Gull, Laughing Gull, Gull-billed Tern, Royal Tern, Forster's Tern, Common Tern, and Black Skimmer all showed a consistent decline across this period. Only species that have colonized the area since 1970 including White Ibis, Great Black-backed Gull, Double-crested Cormorant, and Brown Pelican have exhibited consistent increases. The ecological differences between species showing declines suggest a system-wide problem that is greater than the mammalian predators that have been the focus of recent management actions.

BACKGROUND

Context

In Virginia, colonial waterbirds include herons, egrets, ibises, gulls, terns, skimmers, cormorants, and pelicans. These birds share the unusual characteristic of nesting in dense assemblages. The result of this behavior is that they typically breed in very few locations such that the loss of a few breeding areas may have profound consequences on a population level. Due to their position in the aquatic food web, they are considered to be good indicators of ecosystem health. The most significant threats to colonial waterbirds include human disturbance, predation, habitat loss, and contaminants. Protection of sensitive colonies clearly depends on the availability of timely locational information. Development of strategic management plans to protect these species and breeding areas requires a broader understanding of population trends.

For the years prior to the mid-1970s, systematic information on the abundance and distribution of colonial waterbirds in Virginia does not exist. Information during this period is available only from a smattering of nesting records (e.g. Murray 1952), accounts of individual colonies (e.g. Abbott 1955), and area bird lists (e.g. Grey 1950). During the 1975 and 1976 breeding seasons, the first systematic survey of wading bird colonies in coastal Virginia was completed in association with a broad-based survey covering the entire Atlantic Coast (Custer and Osborn 1977). During 1977, the first systematic survey of all colonial waterbird species was conducted in association with the "Maine to Virginia" project (Erwin and Korschgen 1979). In the early 1980s an additional survey was conducted in association with a broad status assessment (Spendelow and Patton 1988). All three of these surveys focused primarily on the coastal fringe and did not attempt to cover the entire Coastal Plain. In 1993, a systematic survey was conducted that covered the entire Coastal Plain from the outer coastline to the fall line (Watts and Byrd 1998). This survey was the most comprehensive assessment to date of the colonial waterbird community in coastal Virginia. The effort covered 446 colonies supporting an estimated 94,947 pairs of 24 species. The 1993 benchmark survey was repeated in 2003 (Watts and Byrd 2006). During the spring of 2007, a decision was made to conduct a third assessment on the 5th anniversary of the 2003 survey.

Objectives

The purpose of this investigation was to generate population estimates for the majority of colonial waterbird species nesting in the Coastal Plain of Virginia in 2008. The survey included 22 of the 24 species known to nest in Virginia. Great Blue Herons and Great Egrets are widely distributed throughout the coastal plain and occupy many nesting sites. Due to funding limitations, the majority of colonies supporting these species was not surveyed and any resulting population estimate is incomplete.

Information compiled for remaining species is intended to (1) be integrated into biological databases to be used in the environmental review process, (2) provide information for comparison to past and future surveys for the purpose of assessing long-term population trends, and (3) be used in the formulation of management recommendations.

METHODS

Field Surveys

An extensive aerial survey was conducted using fixed-wing aircraft in 2008 during early stages of the breeding season. All barrier islands, Bay islands, and marshlands were overflown and searched for colonies of colonial waterbirds. Surveys for Great Blue Heron and Great Blue Heron/Great Egret colonies were not attempted in 2008. Aerial surveys for all other colonial nesters were conducted by systematically flying over areas at an altitude of approximately 100-150 m and searching for evidence of breeding colonies. Once detected, a colony was circled long enough to allow observers to map the colony location and estimate its size. All colonies were given a unique alpha-numeric code and plotted on 7.5 min topographic quadrangles. Groups of breeding pairs were considered independent colonies if they were: (1) separated from other groups within a continuous habitat by at least 400 m, (2) separated from other groups by a distinctive barrier, or (3) separated from other groups by a significant habitat discontinuity (e.g. birds in dune grassland adjacent to birds in a patch of deciduous saplings).

Follow-up ground counts were conducted for all locations except extensive gull colonies within seaside and bay island marshes. These colonies are often in remote locations and are difficult to survey on the ground due to their aerial extent. It is more cost effective and logistically efficient to survey these colonies from the air.

Population Estimates

Colony size estimates were based primarily on counts of active nests, and occasionally on the number of adults present. The number of breeding adults was used when nest counts were impractical or when deemed inappropriate due to colony disturbance. Colony size was based on complete counts whenever possible. However, due to the large size of many colonies, estimates were derived for a large portion of the colonies. All estimates for aerial surveys were performed by the same observer. Many different observers were involved with ground surveys. To reduce observer bias across surveys, data resolution for estimates was reduced by rounding off reported numbers to the nearest value using the following graded scale: nearest 5 for <50, nearest 10 for 50-200, nearest 25 for 200-400, nearest 50 for 400-1,000, nearest 100 for 1,000-2,000, and nearest 200 for >2,000. Complete counts were used when reported without rounding.

Breeding chronology was taken into account when designing the survey. Coastal marshes and islands supporting gulls, terns, and allies were flown between mid-May and mid-June. Ground counts of urban areas were conducted during April, May, and June. Ground counts of barrier islands, Bay island, and marshlands were conducted during June and July.

Due to the differences in breeding chronology and circumstances, different surveys were used to generate population estimates for different species. Ground surveys were used for all urban colonies and colonies on barrier and bay islands. Ground surveys were also used for colonies on marshlands with the exception of extensive gull colonies. Gull colonies often cover many hectares making estimation of nest numbers much easier from the air.

Population estimates are presented as breeding pairs. Breeding pairs were estimated on a colony by colony basis and compiled to generate an overall population estimate. For colonies surveyed using nest counts or estimates, a one-to-one relationship between nests and pairs was assumed. For colonies surveyed using count or estimates of adults, a one-to-one relationship between adults and pairs was assumed. The portion of population estimates that were based on nests is provided to allow the reader to recalculate population estimates based on number of adults.

Geographic Regions

For the presentation of gross distribution patterns, the Coastal Plain was broken down into five geographic regions (Figure 1). Regions included were: 1) Eastern Shore seaside – barrier island/lagoon system along seaward margin of the Delmarva Peninsula northward to the Maryland/Virginia boundary line, 2) Bayside and Bay islands – western shoreline of the Delmarva Peninsula to the Maryland/Virginia border, and Chesapeake Bay islands of Virginia, 3) Urban – major urban areas of lower tidewater, including the cities of Virginia Beach, Norfolk, Portsmouth, Chesapeake, Newport News, and Hampton, 4) Western Shore – south shoreline of the Potomac River to the south shoreline of the James River including all areas from the western shore of the Chesapeake Bay west to the fall line, and 5) Southside – lands south of the James River to the Virginia/North Carolina border including all land between the Atlantic Ocean and the fall line (except areas designated as urban). Unlike in the 1993 (Watts and Byrd 1998) and 2003 (Watts and Byrd 2006) surveys, the “Southside” region was not surveyed in 2008. Similarly, inland areas of the “Western Shore” region were not surveyed in 2008. These geographic areas support mixed Great Blue Heron and Great Egret colonies that were not the focus of the 2008 survey. For this reason, no population estimate for these species was generated that is comparable to the 1993 or 2003 estimates.

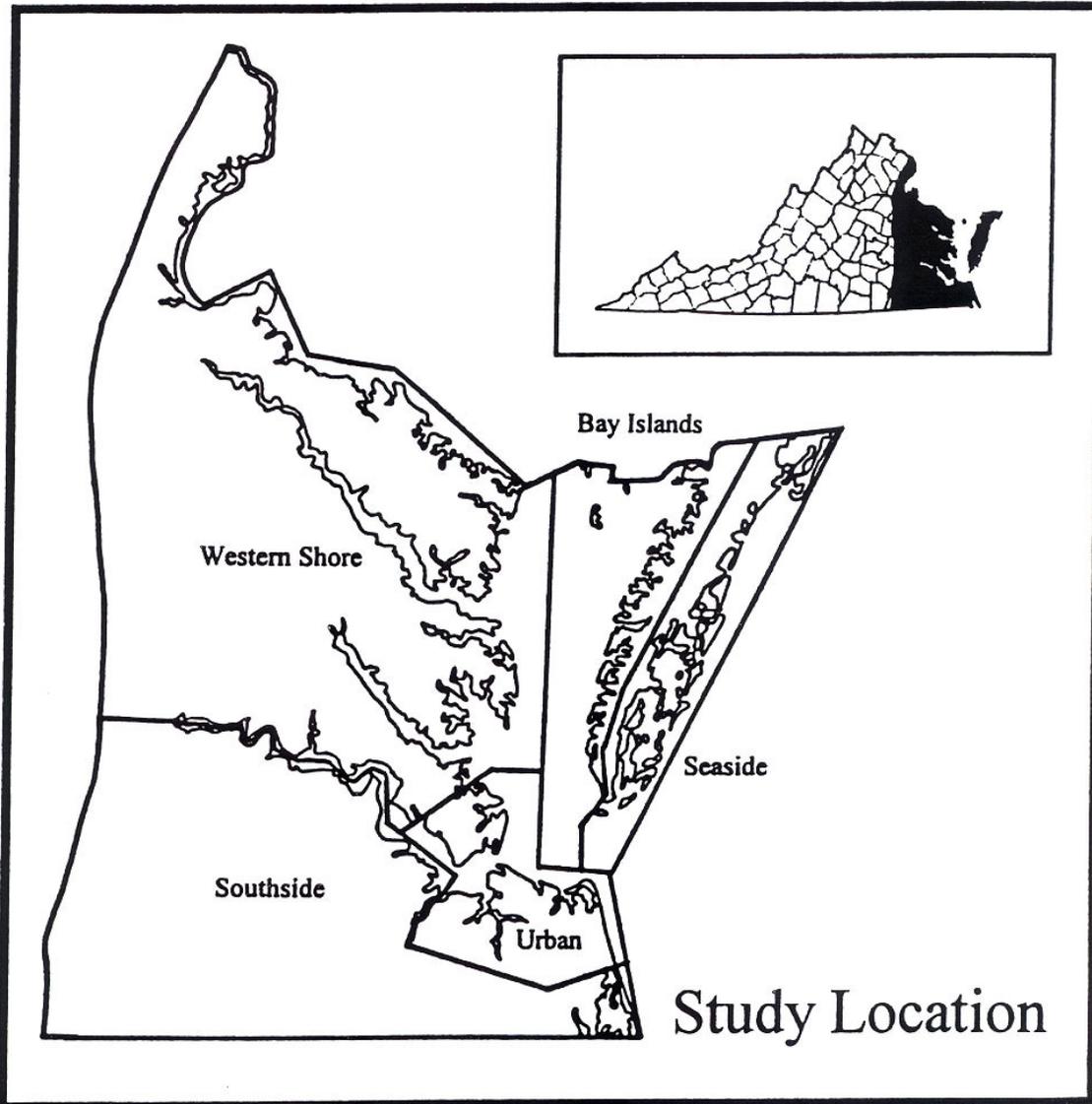


Figure 1. Map of study area. The Coastal Plain was subdivided into geographic regions including (1) seaside, (2) Bay island, (3) urban, (4) western shore, and (5) southside. The southside region was not surveyed. Only the Chesapeake Bay fringe of the western shore region was included in the survey.

RESULTS

Population Estimates

A total of 250 different waterbird colonies was mapped and surveyed during the 2008 breeding season. Colonies contained an estimated 60,758 breeding pairs of 24 species (Appendix I). Colony size varied from 2 to 5,351 pairs with 70.4% of colonies containing less than 100 pairs and 88.8% containing less than 500 pairs. More than 67% of all colonies larger than 500 pairs were Laughing Gull colonies. The majority

(62%) of colonies contained only one species and 90.4% contained three species or less. Eight mixed-species rookeries contained seven species or more.

Abundance varied widely between species and species groups (Table 1). Gulls were the most abundant group with >40,000 breeding pairs. Terns and waders accounted for 9,455 and 4,763 pairs respectively. It should be noted that populations of Great Blue Herons and Great Egrets were not surveyed throughout the coastal plain. These 2 species are the numerically dominant waders in coastal Virginia, typically accounting for 12,000-14,000 pairs. Laughing Gulls were several times more abundant than any other species and accounted for 61% of the total waterbird community. Other than Laughing Gulls, only Royal Terns, Forster's Terns, and Herring Gulls exceeded 2,500 breeding pairs. The remaining 19 species accounted for less than 25% of the total breeding pairs.

Geographic Distribution

The barrier island/lagoon system of the Eastern Shore was the most important region for the majority of colonial species encountered (Table 2). In 2008, this region supported 20 of the 23 species evaluated during the survey and accounted for greater than 74% and 70% of all breeding pairs and colonies, respectively. For 15 of the 23 species, the region supported more than 50% of the known coastal population. Many of these species were found almost exclusively in this region. Only the Caspian Tern, Forster's Tern, Yellow-crowned Night Heron, Double-crested Cormorant, and Brown Pelican were more abundant in other regions. The number of species supported by the other geographic regions varied widely. The Bay region supported 19 species whereas the urban and western shore supported 12 and 8 respectively. It should be noted that the inland areas of the western shore and the southside were not surveyed for Great Blue Heron or Great Egret colonies. The Bay region supported 8 species in common with the Eastern Shore that were not found elsewhere. The Bay region was the dominant region for the Caspian Tern, Forster's Tern, Double-crested Cormorant and the Brown Pelican. Cities included in the urban region supported substantial populations of Common Terns, Least Terns, Laughing Gulls, Double-crested Cormorants, Great Egrets, Green Herons, and Yellow-crowned Night Herons. This was the dominant region for the Yellow-crowned Night Heron and Common Tern.

Population Changes

The colonial waterbird community in coastal Virginia that was assessed during this survey (all species except Great Blue Heron and Great Egret) declined by 28.9% during the 15 years between 1993 and 2004 (Table 3). There was no change in either the number or type of species breeding in the area. Population estimates for 14 of 22 species assessed declined since 1993 and 11

Table 1. Estimated number of breeding pairs for all geographic regions combined in 2008. The category “colonies” refers to the number of colonies that included each species. “%Nests” is the portion of the population estimate that was based on counts of nests rather than adults (see Methods).

Species	Colonies	Median	Range	%Nests	Pop. Est.
Waders					
White Ibis	3	24	16-79	0	119
Glossy Ibis	11	24	1-400	2.6	657
Great Egret	20	45	1-267	47.6	1588
Snowy Egret	16	27	3-300	8.6	895
Tricolored Heron	11	18	5-110	18.3	312
Little Blue Heron	8	9	4-98	0	173
Cattle Egret	4	25	8-70	0.7	120
Green Heron	7	2	1-13	87.9	33
Black-crowned Night Heron	14	27	2-175	11.8	654
Yellow-crowned Night Heron	28	6	2-21	97.3	212
Gulls					
Great Black-backed Gull	39	25	1-523	94.2	1519
Herring Gull	34	45	1-523	96.5	2685
Laughing Gull	73	70	1-3782	99.0	37064
Terns					
Gull-billed Tern	10	21	1-107	100	311
Caspian Tern	1	-----	-----	100	2
Royal Tern	6	200	6-2088	100	3244
Sandwich Tern	2	-----	16-84	0	100
Forster's Tern	50	27	1-594	99.0	3065
Common Tern	39	4	1-773	95.0	1442
Least Tern	39	15	1-214	89.9	1182
Others					
Black Skimmer	16	27	1-449	90.8	1364
Double-crested Cormorant	8	118	19-1316	100	1991
Brown Pelican	5	415	159-569	100	1924
Total	250	28	1-3782	93.1	60758

Table 2. Summary of species distributions across geographic areas. "Col" refers to the number of colonies within the respective regions. "Prs" indicates the estimated number of breeding pairs within each region. "%" indicates the percentage of the total population found within each region.

Species	Seaside			Bay Islands			Urban			Western Shore		
	Col	Prs	%	Col	Prs	%	Col	Prs	%	Col	Prs	%
Waders												
White Ibis	3	119	100	-----	-----	-----	-----	-----	-----	-----	-----	-----
Glossy Ibis	7	521	79.3	4	136	20.7	-----	-----	-----	-----	-----	-----
Great Egret ¹	12	642	40.4	5	281	17.7	2	435	27.4	1	230	14.5
Snowy Egret	10	575	64.2	5	308	34.4	-----	-----	-----	1	12	1.4
Tricolored Heron	7	270	86.5	4	42	13.5	-----	-----	-----	-----	-----	-----
Little Blue Heron	5	137	79.2	3	36	20.8	-----	-----	-----	-----	-----	-----
Cattle Egret	3	95	79.2	1	25	20.8	-----	-----	-----	-----	-----	-----
Green Heron	-----	-----	-----	1	4	16.0	4	8	32.0	1	13	52.0
Black-crowned Night Heron	10	539	82.4	4	115	17.6	-----	-----	-----	-----	-----	-----
Yellow-crowned Night Heron	-----	-----	-----	2	27	12.7	26	185	87.3	-----	-----	-----
Gulls												
Great Black-backed Gull	19	1206	79.4	18	306	20.1	1	6	0.4	1	1	0.1
Herring Gull	18	2182	81.3	12	353	13.2	1	114	4.2	3	36	1.3
Laughing Gull	70	33152	89.4	1	130	0.4	1	3782	10.2	-----	-----	-----
Terns												
Gull-billed Tern	9	295	94.9	-----	-----	-----	1	16	5.1	-----	-----	-----
Caspian Tern	-----	-----	-----	1	2	100	-----	-----	-----	-----	-----	-----
Royal Tern	3	2259	69.6	1	152	4.7	2	833	25.7	-----	-----	-----
Sandwich Tern	2	100	100	-----	-----	-----	-----	-----	-----	-----	-----	-----
Forster's Tern	43	1527	49.8	7	1538	50.2	-----	-----	-----	-----	-----	-----
Common Tern	31	475	32.9	5	103	7.2	2	862	59.8	1	2	0.1
Least Tern	30	669	56.6	-----	-----	-----	4	204	17.3	5	446	37.7
Others												
Black Skimmer	13	1151	84.4	1	55	4.0	2	158	11.6	-----	-----	-----
Double-crested Cormorant	3	65	3.3	3	1636	82.2	1	128	6.4	1	162	8.1
Brown Pelican	2	728	37.8	3	1196	62.2	-----	-----	-----	-----	-----	-----
Total	176	45015	74.6	30	6492	10.7	34	7991	13.2	10	915	1.5

¹ Estimate reflects outer coastal plain only. Inland Great Blue Heron/Great Egret colonies were not surveyed.

Table 3. Comparison of colony numbers and estimated number of breeding pairs for 1993 and 2008. The category “colonies” refers to the number of colonies that included each species. Population estimates refer to breeding pairs.

Species	1993 Colonies	1993 Pop. Est.	2008 Colonies	2008 Pop. Est.	% Change
Waders					
White Ibis	1	3	3	119	+3966.7
Glossy Ibis	11	1008	11	657	-34.8
Great Egret ¹	45	2520	20	1588	-----
Snowy Egret	15	2329	16	895	-61.6
Tricolored Heron	11	767	11	312	-59.3
Little Blue Heron	10	374	8	173	-53.7
Cattle Egret	9	1459	4	120	-91.8
Green Heron	22	154	7	33	-78.6
Black-crowned Night Heron	13	526	14	654	+24.3
Yellow-crowned Night Heron	35	388	28	212	-45.4
Gulls					
Great Black-backed Gull	26	514	39	1519	+295.5
Herring Gull	34	8801	38	2685	-69.5
Laughing Gull	110	45387	73	37064	-18.3
Terns					
Gull-billed Tern	30	606	10	311	-48.7
Caspian Tern	5	8	1	2	-75.0
Royal Tern	3	6250	6	3244	-48.1
Sandwich Tern	2	30	2	100	+333.3
Forster's Tern	72	2939	50	3065	+4.3
Common Tern	40	6781	39	1442	-78.7
Least Tern	26	1171	41	1182	+0.9
Others					
Black Skimmer	25	3098	16	1364	-56.0
Double-crested Cormorant	4	354	8	1991	+562.4
Brown Pelican	2	368	5	1924	+522.8

¹In 2008, Great Egrets were only surveyed within the outer coastal plane. This species has moved inland and is now nesting within many Great Blue Heron colonies which were not surveyed in 2008.

of these have declined since the 2003 survey. Declines varied considerably between species with 10 species declining more than 40% and 4 species declining more than 70%. Cattle Egrets showed the highest loss rate, declining from an estimated 1,459 to only 120 pairs. Eight species increased between 1993 and 2008. Dramatic expansions were documented for White Ibis, Great Black-backed Gull, Double-crested Cormorant, and Brown Pelican.

Seaside Region

The barrier island/lagoon system along the seaward edge of the Delmarva Peninsula is the most important region for colonial waterbirds in Virginia. Since 1993, colonial waterbirds have been systematically surveyed for the geographic area in 1998, 2003, and 2008. In the majority of species, comparison of population estimates across these years (Table 4) show consistent trends. Snowy Egret, Tricolored Heron, Cattle Egret, Green Heron, Yellow-crowned Night Heron, Glossy Ibis, Herring Gull, Laughing Gull, Gull-billed Tern, Royal Tern, Forster's Tern, Common Tern, and Black Skimmer all showed a consistent decline across the four surveys. Only species that have colonized the area since 1970 including White Ibis, Great Black-backed Gull, Double-crested Cormorant, and Brown Pelican have exhibited consistent increases. Patterns for other species were stable or showed weak trends.

DISCUSSION

During the 2008 breeding season, coastal Virginia supported a substantial community of colonial waterbirds. The size of this community exceeded estimates from the late 1970s (Erwin and Korschgen 1979) but was less than the 1993 and 2003 estimates (Watts and Byrd 1998, 2006). The seaside of the Delmarva Peninsula continues to be the single most important region for colonial waterbirds in coastal Virginia. This small area supported more than 74% of all breeding pairs and was the dominant region for 15 of 23 species surveyed. The Bay region also supported a diverse community of species but much lower numbers of individuals compared to the seaside. Urban areas supported half of all species and significant populations of selected species. The western shore and southside regions were not adequately assessed during this effort.

Species Groups

Waders

Collectively, wader species that were assessed in 2008 declined 54.7% between 1993 and 2008 from an estimated 7,008 pairs to 3,175 pairs. Nearly 90% of this overall decline was due to the dramatic loss of waders on the seaside. These declines have been ongoing and represent a loss of some historic colonies during the decade and a reduction in birds within a couple of key colonies. Particularly notable were reductions in most mid-sized herons. Other more moderate reductions were documented in urban colonies.

Whit Ibis – Nesting of the White Ibis was first confirmed in Virginia in 1977 on Fisherman Island (Frohring and Beck 1978). Breeding has been restricted to the barrier islands. Breeding areas have been surveyed each year since 1975 (Williams et al. 1990). Until recent years, birds were associated with a mixed-species heronry on Fisherman Island exclusively with no indication of further expansion (Williams et al.

Table 4. Population estimates for colonial waterbirds within the barrier island/lagoon system of the Delmarva Peninsula. Values represent estimated number of breeding pairs. Data from 1993 are from Watts and Byrd 1998. Data from 1998 are from Truitt and Schwab 2001. Data from 2003 are from Watts and Byrd 2006.

Species	1993	1998	2003	2008
Waders				
White Ibis	3	18	77	119
Glossy Ibis	779	822	669	521
Great Blue Heron	8	10	0	0
Great Egret	885	976	467	642
Snowy Egret	1862	1212	624	575
Tricolored Heron	713	530	456	270
Little Blue Heron	330	195	249	137
Cattle Egret	854	540	146	95
Green Heron	47	3	0	0
Black-crowned Night Heron	442	359	590	539
Yellow-crowned Night Heron	63	36	2	0
Gulls				
Great Black-backed Gull	362	369	720	1206
Herring Gull	6106	4653	3417	2182
Laughing Gull	44387	43784	41692	33152
Terns				
Gull-billed Tern	604	478	304	295
Caspian Tern	7	4	1	0
Royal Tern	3250	3451	2058	2259
Sandwich Tern	30	54	7	100
Forster's Tern	2169	2426	1521	1527
Common Tern	3247	1727	843	475
Least Tern	747	709	703	669
Others				
Black Skimmer	2549	1766	1679	1151
Double-crested Cormorant	0	6	10	65
Brown Pelican	324	470	454	728
Total	69968	64608	56689	46707

1992). This heronry was abandoned in 2002 and has not been used since that time. In 2000, this pattern changed when birds appeared in the Cobb-Island heronry (Williams et al. unpublished data). This event was followed in 2001 when the Wreck-Island heronry was colonized. In recent years, White Ibis have colonized the heronry on Chimney Pole Marsh. The population has grown from 3 pairs in 1993 to 119 pairs in 2008. Further expansion is likely and colonization should be expected in the large heronries along the Chincoteague causeway and possibly within the upper Bay islands.

Glossy Ibis – The Glossy Ibis was first found breeding in Virginia on Hog Island in 1956 (Bock and Terborgh 1957). The breeding population increased dramatically throughout the 1960s reaching a high by the mid-1970s (Custer and Osborn 1977). Since this time the species has steadily declined on the barrier islands (Williams et al. 1990). By 1993, the coastal plain population had been reduced by more than 50% from historic highs (Watts and Byrd 1998). Between 1993 and 2008, the population has declined by nearly 35%.

Great Blue Heron – Due to funding constraints, this species was not assessed throughout the Coastal Plain. Anecdotal observations while flying other surveys throughout the region suggest that the population is continuing to increase both in terms of the number of colonies and the breeding population (Watts, pers. Obs.).

Great Egret – Due to funding constraints, this species was not assessed throughout the Coastal Plain. The population has increased dramatically over the past 30 years and this trend appears to be continuing to present. Great Egrets have continued to move inland and now breed beyond the fall line into the Piedmont (Watts, pers. Obs.). Between 2003 and 2008, the population has increased with both the seaside of the Delmarva and urban areas but has declined within the Bay island colonies.

Snowy Egret – Historically, Snowy Egrets bred as far north as New England. However, by the turn of the century, demand from the millinery trade had resulted in a contraction of the breeding range down to North Carolina (Ogden 1978). The first evidence of recolonization was in 1941 when birds were discovered breeding on the seaside of the Delmarva (Murray 1952). By the mid-1950s, this species was documented in all geographic areas of coastal Virginia except the southside region (e.g. Grey 1950, Abbott 1955). However, since the 1970s breeding has been restricted to the seaside of the Delmarva and the offshore islands of the upper Bay. Numbers have declined steadily on the barrier islands since the mid-1970s. The coastal plain-wide survey in 1993 was comparable to the surveys of the mid-1970s (Custer and Osborn 1977, Watts and Byrd 1998). Between 1993 and 2003 the population declined by more than 60%. The rate of decline has slowed between 2003 and 2008 as numbers have increased on the seaside. These advances have been mostly offset by declines on Watts Island. The colony surveyed on an islet of the Guinea Marshes of Gloucester County in 2003 was absent in 2008, possibly due to the loss of nesting substrate to storm erosion. However, the species has colonized the mixed heronry on Mumford Island further up the York River.

Tricolored Heron – The Tricolored Heron was first documented to nest in Virginia when breeding birds were discovered on the seaside of the Delmarva in 1941 (Murray 1952). Colonization of Virginia was part of a broader, northward range expansion that occurred between the 1940s and 1970s (Ogden 1978). In Virginia, the population apparently increased to a high that reached a plateau during the 1950s through the 1970s (Erwin and Korschgen 1979). The species has declined on the barrier islands since that time (Williams et al. 1990). The population estimate of 1993 (Watts and Byrd 1998) was more than 50% reduced from that of the mid-1970s (Custer and Osborn 1977). Between 1993 and 2008, the population declined by 59.3% or an additional 25% since 2003. The decline is widespread with reduced numbers in most of the historic colonies.

Little Blue Heron – Little Blue Herons were one of the most abundant waders along the Atlantic Coast from the 1930s to the 1950s (Ogden 1978). Historic breeding records for this species exist for all of the geographic regions of coastal Virginia (Grey 1950, Murray 1952, Abbott 1955). The species declined dramatically from the 1950s to the 1970s (Erwin and Korschgen 1979) and is now found only on the seaside of the Delmarva Peninsula and within 3 colonies on Chesapeake Bay islands. From 1993 to 2008, Little Blue Herons declined by an estimated 53.7% or an additional 35% since 2003. The decline continues to be widespread with very few species now on the Bay islands and reduced numbers in most of the seaside strongholds.

Cattle Egret – The Cattle Egret was first found breeding in Virginia in 1961 (Scott and Cutler 1961). Colonization of Virginia was part of a rapid, broad-front range expansion that followed first establishment in North America in 1953 (Crosby 1972, Telfair 1994). The Virginia population increased rapidly during the 1960s. Although there has been considerable year to year variation on the barrier islands, numbers have declined since the mid-1970s and precipitously since the mid-1990s. Cattle Egrets experienced a dramatic decline between 1993 and 2008 within all breeding areas. Only 25 pairs were detected on islands within the Chesapeake Bay. Birds disappeared from the Hopewell colony on the James River in the mid-1990s and have never returned. Birds are now restricted to just 4 colonies in Virginia.

Green Heron – Green Herons nest widely throughout the Coastal Plain. Due to their broad distribution and cryptic coloration, none of the colonial waterbird surveys have adequately covered this species. Population estimates are inadequate to assess trends outside of the heronries that are surveyed regularly. Within the heronries that are surveyed regularly, Green Herons have declined dramatically within both the barrier island/lagoon system and the Chesapeake Bay islands. More moderate declines were documented in the traditional colonies within urban areas.

Black-crowned Night Heron – The breeding population of Black-crowned Night Herons in coastal Virginia declined by an estimated 80% between 1975 (Custer and Osborn 1977) and 1993 (Watts and Byrd 1998). Within the barrier island/lagoon system, this trend continued through the 1998 survey (Truitt and Schwab 2001). However, the species increased throughout the broader Coastal Plain between 1993 and 2003 and this trend has continued through the 2008 survey. Much of this increase may be

attributed to expansion of numbers within the Watts Island and Tangier Island colonies since 2003.

Yellow-crowned Night Heron – The Yellow-crowned Night Heron likely bred in Virginia in the 1800s but was apparently absent by the early 190's. The first modern breeding record for Virginia was in 1947 (Darden 1947). This event corresponds with a range expansion from the southeast northward to New England (Watts 1995). In Virginia, Yellow-crowns increased within urban areas of Norfolk, Hampton, Virginia Beach, and Portsmouth at least through the early 1990s (Watts unpublished data). Since 1993, the population has declined by more than 45%. This decline is evident within all regions that supported birds in 1993. Pairs are absent or much reduced within many of the urban neighborhoods where they were documented in the 1980s and early 1990s (Watts unpublished data). No birds were detected within the mixed heronries of the barrier islands in 2008. Bay islands have only supported a small number of pairs in recent years.

Gulls

As a group gulls declined by more than 23.9% over the 15-year period from an estimated 54,702 breeding pairs in 1993 to 41,616 in 2008. This decline was due primarily to Laughing Gulls but also to the continued decline of Herring Gulls. Great Black-backed Gulls increased dramatically over the period.

Great Black-backed Gull – In 1970, the Great Black-backed Gull was found breeding on Fisherman Island (Scott and Cutler 1970). This event was part of a broader range expansion that began in the early 1900s and has moved down the Atlantic Coast (Good 1998). Since the 1970s, this species has rapidly colonized other locations on both the seaside and Chesapeake Bay islands. Between 1993 and 2008, the population has more than tripled in size and continued to expand in distribution. Although the stronghold continues to be within the seaside, nearly 20 colonies now occur within the Virginia portion of the Chesapeake Bay. Colonization of the Hampton Roads Tunnel Island represents the first toe hold in the lower portion of the Bay. This was followed by colonization in 2008 of a small islet along the Guinea Marshes in Gloucester County.

Herring Gull – A single Herring Gull nest was found on the seaside near Cobb Island in 1948 (Murray 1952). By 1977, 9 colonies containing more than 2,900 pairs were reported (Erwin and Korschgen 1979). The 1993 survey located 35 colonies supporting an estimated 8,800 pairs. The breeding population on the barrier islands apparently reached a high in the late 1980s and has shown evidence of a decline since that time (Williams et al. unpublished data). Between 1993 and 2008 the Coastal Plain population declined by an estimated 66.9% or an additional 20% since 2003. Consistent declines were observed in both regions where breeding was documented in 1993. The 2003 survey adds further support to the documented decline within the barrier island/lagoon system between 1993 and 1998 (Truitt and Schwab 2001). In recent years, new colonies have been recorded on the Hampton Roads Tunnel Island

and near the mouth of the York River (Watts and Byrd 2006). Expansion of these colonies continued through 2008.

Laughing Gull – Virginia has apparently been a stronghold for breeding Laughing Gulls for centuries. This species has been the numerically dominant colonial waterbird during all comprehensive surveys conducted of the Coastal Plain. Between 1977 and 1993 there was a considerable increase in population estimates. Between 1993 and 1998, there was a very small decline in numbers on the seaside of the Delmarva Peninsula (Truitt and Schwab 2001). The barrier island population has exhibited considerable variation since the mid-1970s but estimates over the past 20 years have consistently represented only 20-30% of those during the late 1980s. The population decline between 2003 and 2008 is consistent with trends observed over the past 15 years. Historic colony sites within the southern portion of the Delmarva seaside continue to go unused or are much reduced. The strongholds for the population continue to be supported within patches of high marsh but these habitats may be experiencing changes in tidal influence.

Terns

As a group, terns declined over the 15-year period by 46.8% from an estimated 17,785 to 9,455 breeding pairs. This was the greatest decline of all the broad taxonomic groups with most species showing substantial declines. Exceptions were Forster's and Least Terns that were stable and Sandwich Terns that increased dramatically.

Gull-billed Tern – The Gull-billed Tern has experienced extreme population swings in coastal Virginia over the past 200 years (Parnell et al. 1995). In the mid-1800s this species was considered to be abundant along the barrier islands. By the late 1800s and early 1900s they had been reduced to very low numbers by hunters supplying the millinery trade (Bailey 1913). Throughout the early 1900s numbers remained very low (Austin 1932). By the mid-1970s numbers appear to have recovered to those comparable with the 1800s. By 1993, the population had declined once again to approximately 20% of 1970s levels (Watts and Byrd 1998). Between 1993 and 2008 the number of occupied colonies declined from 30 to 10 and the number of breeding pairs declined by 48.7%. The species is now restricted to shell piles within the barrier island/lagoon system and to a single colony on the Hampton Roads Bridge Tunnel.

Caspian Tern – There is some evidence that Caspian Terns once bred in greater numbers along the Virginia barrier islands than they have from 1900 to present (reviewed by Weske et al. 1977). Egging and hunting apparently reduced their numbers in the 1880s to a low from which they have never fully recovered. Since 1900, Caspians have been documented in very low numbers breeding in scattered locations along the seaside and occasionally on Chesapeake Bay islands. They appear to be present consistently since the mid-1970s. In 1993 only 7 pairs were documented in 5 locations. During the 2003 survey, only a single pair was documented. In 2008, 2 pairs were documented on Clump Island in the upper Bay. Although the Virginia population

of Caspians appears to be very small in recent decades, it is also likely that this species is not well surveyed. Unlike Royal and Sandwich Terns that nest in large conspicuous colonies, Caspians often nest as single pairs on shell piles in the lagoon system or within small colonies of other smaller terns.

Royal Tern – In Virginia, Royal Terns have apparently always been the most abundant of the large terns. Like many of the other terns, their numbers have fluctuated widely through the years due to natural and human perturbations. This species also appears to move over a larger spatial scale such that local population patterns may reflect movements rather than population changes. This possibility is supported by wide fluctuations in adjacent states (D. Brinker, S. Cameron unpublished data). Royal Terns have declined on the barrier islands since the early 1980s (Williams et al., unpublished data). The population estimate for the broader Coastal Plain in 1993 was comparable to estimates from the mid-1970s (Erwin and Korschgen 1979). Since 1993, the number of breeding pairs has declined 48.1%. Since 2003, numbers have increased slightly on the seaside, have declined dramatically on the Bay islands, and have colonized urban areas. The expanding colonies on the Hampton Roads Bridge Tunnel Island and Grandview Beach now represent more than 25% of the state population.

Sandwich Tern – Virginia and occasionally Maryland represent the northern range limit for breeding Sandwich Terns. There is no evidence that this species was ever a common breeder in Virginia. Scattered records in the late 1800s and early 1900s imply that this species was an uncommon nester associated with Royal Tern colonies on the barrier islands (records reviewed by Weske et al. 1977). There is a paucity of reports throughout the middle 1900s until the late 1960s when the species was discovered nesting again on the barrier islands (Buckley and Buckley 1968). Breeding has been consistent on the barrier islands since the mid-1970s but has involved relatively few individuals. Numbers documented during the annual barrier island survey have fluctuated widely since the mid-1970s (Williams et al. unpublished data). The change from 30 pairs in 1993 to 7 pairs in 2003 and back to 100 pairs in 2008 reflect the dynamics of their occurrence in Virginia.

Forster's Tern – Like many of the other colonial species that nested historically in coastal Virginia, Forster's Terns were greatly impacted by market hunting from the 1870s through approximately 1910 (Howell 1911, Austin 1932). Due to their nesting habits, the status of Forster's Terns was less known compared to other tern species. Forster's nest in scattered colonies within the lagoon system on wrack deposited in the marshes or on other topographic highs. Their distributions are subject to change depending on the availability of nesting substrate. This makes them difficult to survey effectively. The first comprehensive survey of Forster's was in 1977 (Erwin and Korschgen 1977). By 1993, numbers appeared to have doubled (Watts and Byrd 1998). Between 1993 and 2003 estimated population size declined by more than 15%. However, by 2008 the population had increased to above the numbers recorded in 1993.

Common Tern - Historically, the Common Tern nested throughout coastal Virginia wherever there was suitable substrate away from predators. Like many of the other species, Common Terns were hunted to very low numbers by the turn of the 20th century but there were signs of recovery by the early 1930s (Austin 1932). Since the 1960s Common Tern colonies have been documented in many areas of the Coastal Plain. However, over the past 20 years colonies have disappeared from the western shore and lower tidewater. Since the 1980s, Common Terns have shown consistent declines on the barrier islands (Williams et al. unpublished data). However declines on the islands were compensated for by the formation of the largest colony in the state on the Hampton Roads Tunnel Island such that estimates from 1977 (Erwin and Korschgen 1979) and 1993 (Watts and Byrd 1998) were comparable. Between 1993 and 2008, Common Terns declined by 78.2% in coastal Virginia. Considerable declines have been documented in all 3 geographic regions that supported colonies in 1993. Much of the overall decline was accounted for by the recent losses within the tunnel island colony. The invasion Laughing Gulls prior to the 2003 survey reduced the Common Tern population by more than 75%. As of 2008, this loss has not been absorbed in other regions.

Least Tern – Historically, Least Tern colonies have been documented throughout many areas of coastal Virginia including up major tributaries to near tidal fresh waters. Abundant on the barrier islands this species was hunted relentlessly during the late 1800s to near extirpation. After release from hunting pressures, Least Terns rebounded rapidly. Numbers appear to have reached a high in the early 1980s and then declined steadily over the next 20 years (Beck et al. 1990). Between 1993 and 2003 the population declined 28% from 1171 to 843 breeding pairs. However, between 2003 and 2008 the population increased 42% to 1258. For the first time in Virginia, colonies were located on roof tops in urban areas. Colonies were located on both Lynnhaven and Patrick Henry Malls. The formation of roof top colonies has been reported throughout the southeast and has been anticipated for many years in Virginia. It is possible that additional colonies exist within lower tidewater or elsewhere that have not been discovered. Such colonies are subject to severe heat stress and active management is required to improve productivity.

Others

As a group, the three remaining waterbird species have increased more than 26% from 3,820 to 5,330 breeding pairs. This overall increase reflects the fact that both Double-crested Cormorants and Brown Pelicans are recent colonizers that are rapidly expanding. This increase masks the substantial decline in Black Skimmers.

Black Skimmer – The Black Skimmer appears to have been a common nester on the barrier islands for as far back as records are available. Due to their coloration, skimmers were not valued in the millinery trade and so were not hunted as actively as many of the other beach-nesting species. They also were favored by the locals and so did not experience the same degree of pressure from eggers. From most accounts, Black Skimmers were one of the numerically dominant species on the barrier islands

throughout most of the 20th century. However, between the mid-1970s and the 1990s numbers on the barrier islands were reduced by 70%. This decline continued between 1993 and 2003 as the coastal population declined 41% from an estimated 3,098 to 1,828 breeding pairs. In 2008, the population declined further to 1,415 pairs or an additional 22.6%. In 2008, numbers had still not recovered on the Hampton Roads Tunnel Island but the formation of a colony on Grandview Beach did offset some of the losses.

Double-crested Cormorant – Breeding of the Double-crested Cormorant in Virginia was first confirmed in 1978 on a small vegetated island in the James River near Hopewell (Scott 1978). Range wide cormorants have experienced wide fluctuations in numbers and distribution throughout the 20th century (Hatch 1984). Colonization of Virginia represents an expansion beyond the historic range following a low during the DDT era (1940s-1972) (Hatch and Weseloh 1999). After 1984, the Virginia population expanded rapidly to 5 colonies by 1995 containing more than 400 pairs (Watts and Bradshaw 1996). The seaside of the Delmarva was not colonized until 1995. Between 1993 and 2008 the population increased by 562% from 354 to 1,991 pairs. Most of this increase is accounted for by the rapid expansion of the Shanks Island colony. The colony has expanded from 6 pairs in 1993 to 907 pairs in 2003 to 1,636 in 2008. Three colonies now exist on the seaside including 2 on duck blinds in Chincoteague Bay.

Brown Pelican – The Brown Pelican was first found breeding in Virginia on Fisherman Island in 1987 (Williams 1989). During this same year, birds were also found nesting on Metompkin Island (Williams 1989). Since that year, breeding on the barrier islands has been restricted to Fisherman Island. In 1992, an additional colony was formed in the upper Chesapeake Bay on Shanks Island north of Tangier (Brinker, pers. Comm.). In recent years, a colony has formed on Sandy Island near the north end of Hog Island on the seaside. Colonization of Virginia represents a northward range expansion from North Carolina that extends beyond the historic range and follows recovery of southeastern populations from contaminants. Since its discovery, the Shanks Island colony has grown exponentially apparently fueled by continued immigration. In 1993, there were only 53 pairs documented in this colony (Watts and Byrd 1998). By 1999, the colony supported 913 breeding pairs (Watts 1999). Between 1993 and 2008 the Virginia population increased 522% from an estimated 368 to 1,924 breeding pairs. The Fisherman Island colony has increased and then declined over this time period. Growth in the Shank's Island colony has slowed in the past few years suggesting that it may be reaching capacity.

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APPENDIX I: List of colonial waterbird species surveyed in coastal Virginia along with A.O.U. alpha codes.

Species	Alpha Code	Scientific Name
Great Black-backed Gull	GBBG	<i>Larus marinus</i>
Herring Gull	HERG	<i>Larus argentatus</i>
Laughing Gull	LAGU	<i>Larus atricilla</i>
Gull-billed Tern	GBTE	<i>Sterna nilotica</i>
Caspian Tern	CATE	<i>Sterna caspia</i>
Royal Tern	ROYT	<i>Sterna maxima</i>
Sandwich Tern	SATE	<i>Sterna sandvicensis</i>
Forster's Tern	FOTE	<i>Sterna forsteri</i>
Common Tern	COTE	<i>Sterna hirundo</i>
Least Tern	LETE	<i>Sterna antillarum</i>
Black Skimmer	BLSK	<i>Rynchops niger</i>
Double-crested Cormorant	DCCO	<i>Phalacrocorax auritus</i>
Brown Pelican	BRPE	<i>Pelecanus occidentalis</i>
White Ibis	WHIB	<i>Eudocimus albus</i>
Glossy Ibis	GLIB	<i>Plegadis falcinellus</i>
Great Blue Heron	GBHE	<i>Ardea herodias</i>
Great Egret	GREG	<i>Ardea alba</i>
Snowy Egret	SNEG	<i>Egretta thula</i>
Tricolored Heron	TRHE	<i>Egretta tricolor</i>
Little Blue Heron	LBHE	<i>Egretta caerulea</i>
Cattle Egret	CAEG	<i>Bubulcus ibis</i>
Green Heron	GRHE	<i>Butorides virescens</i>
Black-crowned Night Heron	BCNH	<i>Nycticorax nycticorax</i>
Yellow-crowned Night Heron	YCNH	<i>Nyctanassa violacea</i>