Status and Distribution of Colonial Waterbirds in Coastal Virginia: 2023 Breeding Season

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Abstract

Colonial waterbirds are highly visible components of our coastal avifauna and represent important ecological sentinels. We surveyed 297 waterbird colonies during the breeding season of 2023. Colonies supported an estimated 40,944 breeding pairs of 23 species. Gulls were the most abundant group with more than 15,000 breeding pairs. Terns and wading birds (herons, egrets and ibis) accounted for 12,202 and 6,398 pairs respectively. Although they have declined dramatically, Laughing Gulls (*Larus atricilla*) continue to be the most abundant species. The Seaside Region which encompasses the barrier island/lagoon system of the Eastern Shore was the most important region for the majority of colonial species encountered. In 2023, this region supported 22 of the 23 species evaluated. The Eastern Shore seaside accounted for 61% and 43% of all breeding pairs and colonies respectively. For 15 of the 23 species, the region supported more than 50% of the known coastal population. Aside from the fact that the 2023 survey did not include Great Blue Herons (*Ardea herodias*) or all Great Egrets (*Casmerodius albus*), the colonial waterbird community as a whole in coastal Virginia has declined dramatically since 1993. Population estimates for 14 (64%) of the 22 species assessed declined between 1993 and 2018. Declines varied considerably between species with 11 species declining more than 40% and 9 species declining more than 60%. Eight species increased between 1993 and 2023. Two major forces appear to be shaping the colonial waterbird community in Virginia. These include: 1) regional shifts in population centers that are driving population increases in Virginia and 2) habitat degradation related to sea-level rise.

Introduction

In Virginia, colonial waterbirds include long-legged wading birds (herons, egrets and ibises) and seabirds (gulls, terns, skimmers, cormorants, and pelicans). These birds share the unusual characteristic of nesting in assemblages of varying densities. 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. Because of 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 degradation, and contaminants. The development, implementation, and evaluation of effective management actions for these sensitive species requires regular assessments of breeding population and distribution trends over time. Further, because some species of colonial waterbirds select different breeding locations from year to year both within and outside of Virginia, it is important for Atlantic coast states and provinces to conduct regular breeding surveys in a coordinated fashion. The survey results contained in this report will contribute to the 2023-2024 Atlantic Flyway Colonial Waterbird Survey that was planned and implemented by the Atlantic Flyway Nongame Migratory Bird Technical Section. Moreover, the results will be entered in the Avian Knowledge Network's Atlantic Flyway Colonial Waterbird Data Management System which will allow approved waterbird managers and researchers to access, query and analyze these data across multiple spatial scales.

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. In 1992, prior to the 1993 survey, a decision was made by the community of agencies and organizations concerned with waterbirds to repeat the survey on a regular schedule (initially 10 years but later reduced to 5) to monitor trends. In keeping with this agreement, the survey was repeated in 2003, 2013, and 2018 (Watts and Byrd 2006). This report provides a summary of the 2023 survey, the sixth in the series of benchmarks.

The purpose of this investigation was to generate population estimates for colonial waterbird species nesting in the Coastal Plain of Virginia in 2023 (Great Blue Herons were excluded from the 2023 survey and only a portion of the Great Egret breeding population was surveyed due to funding constraints). Information compiled is intended to be: (1) integrated into Virginia biological databases to be used in the environmental review process, inform waterbird management decisions in the Commonwealth, and contribute to long-term coastwide population trend assessments, and (2) entered in the Avian Knowledge Network's Atlantic Flyway Colonial Waterbird Data Management System which will allow approved waterbird managers and researchers to access, query and analyze data collected throughout the flyway.

Methods

Field Surveys

An extensive aerial survey was conducted using fixed-wing aircraft in 2023 that covered the western and eastern shorelines of the Chesapeake Bay, the upper Bay islands, and the Delmarva Peninsula seaside. All barrier islands, Bay islands, and marshlands were overflown and searched for waterbird colonies. Great Blue Heron (the most widely distributed colonial species in Virginia) colonies were not surveyed. As a result, the Delmarva mainland, Western Shore tributaries and the Chowan tributaries in the Southside Region were not covered by aerial surveys. The decision not to survey Great Blue Herons continues to have an impact on the coverage of Great Egrets since this species is increasingly nesting within Great Blue Heron colonies throughout the Western Shore tributaries and areas south of the James River. Aerial surveys 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 GPS-enabled laptops loaded with a recent set of aerial photographs. 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 or inaccessible colonies within the Seaside and Bay islands regions. These colonies were either in remote locations which presented challenging conditions for ground surveys or were difficult to survey on the ground due to their geographic extent. As such, 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. Active nest counts included counts of incubating adults conducted from the perimeter of colonies or walk-through transect counts of all active nests. We also acquired counts of nests and incubating birds using high resolution imagery obtained by an unmanned aerial vehicle (i.e., drone) or an observer from an aircraft. The number of breeding adults was used when nest counts were impractical or when deemed inappropriate due to colony disturbance. In some of these cases, a flush count was performed by having several observers encourage adults within the colony to take to the air while observers on the perimeter of the colony recorded the total number of flushed adults for each species present. Colony size was based on complete counts whenever possible. Because of the large size of several colonies, however, areas were subsampled to generate density estimates and density estimates were extrapolated to the full extent of the colony. All aerial survey estimates were obtained 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 adult counts of small colonies were reported without rounding.

Breeding chronology was taken into account when designing the survey. Coastal marshes and islands supporting gulls, terns, and allies were overflown between mid-May and mid-June. Ground counts in urban areas were conducted during April, May, June, and July depending on the species involved. Most ground counts of colonies on the barrier islands, Bay islands, and marshlands were conducted in May and June and only a few colonies were surveyed in July.

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 the number of adults if so desired.

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) Seaside – barrier island/lagoon system along seaward margin of the Delmarva Peninsula northward to the Maryland/Virginia boundary line, 2) Bay Islands – western shoreline of the Delmarva Peninsula to the Maryland/Virginia border, and the 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), 2003 (Watts and Byrd 2006), and 2013 (Watts and Paxton 2014) surveys, the Southside Region was not surveyed in 2023. Similarly, inland areas of the Western Shore Region were not surveyed in 2023. These geographic areas support mixed Great Blue Heron and Great Egret colonies that were excluded from

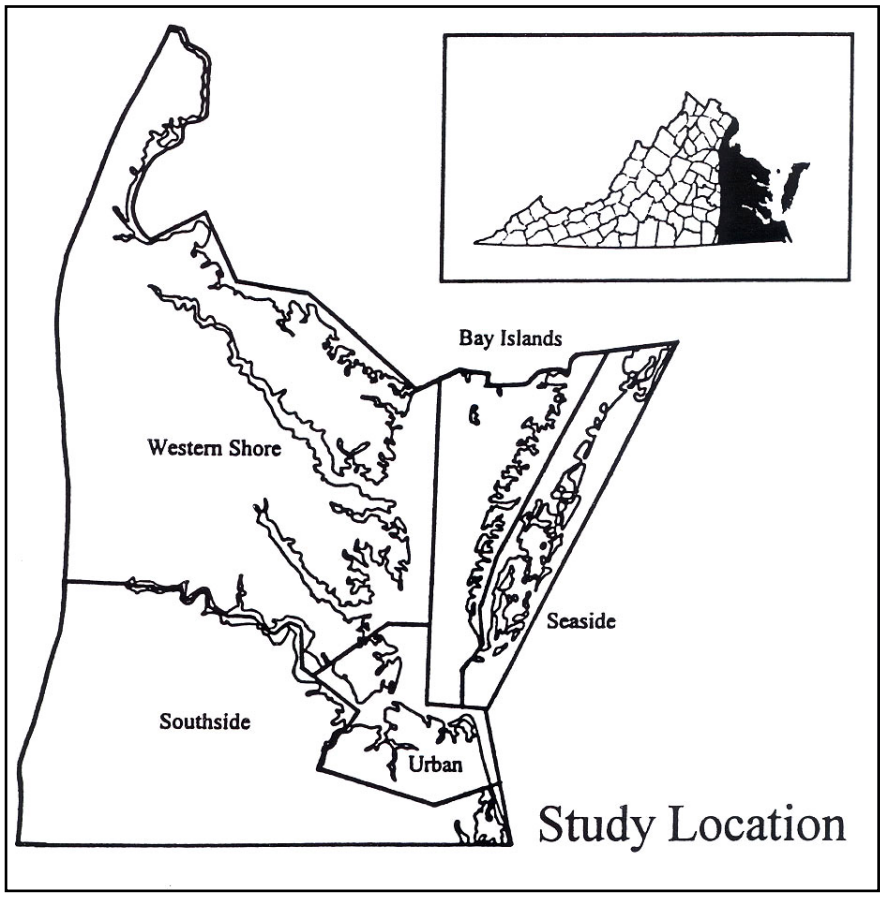

Figure 1. Map of study area. The Coastal Plain of Virginia was subdivided into geographic regions including Seaside, Bay Islands, Urban, Western Shore, and Southside.

the 2023 survey. For this reason, no population estimate for these species was generated that is comparable to the 1993, 2003 or 2013 estimates.

Results

Population Estimates

A total of 297 different waterbird colonies were mapped and surveyed during the 2023 breeding season. Colonies contained an estimated 49,944 breeding pairs of 22 species (Appendix I, Great Blue Herons were not included in the survey). Colony size varied from 2 to 7,007 pairs with 83% of colonies containing less than 100 pairs and 93% containing less than 500 pairs. The majority (76%) of colonies contained only one species and 94% contained three species or less. Eight mixed-species rookeries contained five species or more.

Abundance varied widely between species and species groups (Table 1). Gulls were the most abundant group with >15,000 breeding pairs. Terns and wading birds accounted for 12,202 and 6,398 pairs respectively. Although they have declined dramatically, Laughing Gulls continue to be the most abundant species. Other than Laughing Gulls, only Royal Terns (*Thalasseus maximus*) and Brown Pelicans (*Pelecanus occidentalis*) exceeded 3,000 breeding pairs. The remaining 20 species combined accounted for less than 43% of the total breeding pairs.

Geographic Distribution

The Seaside Region was the most important region for the majority of colonial species encountered (Table 2). In 2023, this region supported 22 of the 23 species evaluated. The only species not documented within this geographic area in 2023 was the Caspian Tern (*Hydroprogne caspia*) and this species was not detected anywhere during the survey. The Seaside Region accounted for 61% and 43% of all breeding

Table 1. Estimated number of breeding pairs for all geographic regions combined in 2023. 'Colonies' refers to the number of colonies that included each species. The variable '% Nests' is the portion of the population estimate ('Pop. Est.') that was based on counts of nests rather than adults (see Methods). 'NS' indicates 'not surveyed'.

Species	Colonies	Median	Range	% Nests	Pop. Est.
Wading Birds					
White Ibis	6	226	4-811	20.5	1602
Glossy Ibis	7	10	2-88	0	182
Great Blue Heron	NS	NS	NS	NS	NS
Great Egret	13	39	3-392	73.4	942[a]
Snowy Egret	11	48	5-194	8.8	751
Tricolored Heron	11	15	1-190	0	566
Little Blue Heron	7	10	3-38	0	104
Cattle Egret	3	2	1-22	0	25
Green Heron	12	3	1-5	96.8	31
Bl.-crown. Night Heron	11	12	3-914	0	1545
Ye.-crown. Night Heron	108	4	2-41	98.8	650
Gulls					
Gr. Blac-backed Gull	38	10	1-68	53.7	561
Herring Gull	37	40	1-487	49.4	2063
Laughing Gull	23	360	8-2400	100	12408
Terns					
Gull-billed Tern	7	18	9-211	100	325
Caspian Tern	0	-----	-----	-----	0
Royal Tern	10	146	1-5945	100	7974
Sandwich Tern	6	14	1-79	100	179
Forster's Tern	26	24	8-265	100	1099
Common Tern	18	58	2-324	74.1	1526
Least Tern	47	8	1-190	55.6	1099
Other Waterbirds					
Black Skimmer	12	41	3-915	100	1691
Dble-crest. Cormorant	19	22	2-1244	100	3012
Brown Pelican	6	272	16-1135	100	2609
Total	**297**	**12**	**2-7007**	**82.5**	**40944**[a]

[a]Great Blue Herons and Great Egrets were not surveyed along the tributaries of the Western Shore or throughout the swamps and Chowan watershed of Southside Virginia.

pairs and colonies, respectively. For 15 of the 23 species, this region supported more than 50% of the known coastal population. Many of these species were found almost exclusively in this region. The number of species supported by the other geographic regions varied widely. The Bay Islands Region supported 18 species whereas the Urban and Western Shore regions supported 15 and 3 species, respectively. The Bay Islands and Seaside regions had 7 species in common that were not found elsewhere. The Bay Islands Region was the dominant area for the Double-crested Cormorant (*Nannopterum auritum*) and Brown Pelican. The Urban Region supported the largest proportion of Green Herons (*Butorides striatus*), Yellow-crowned Night Herons (*Nyctanassa violacea*), Great Egrets and Royal Terns.

Population Changes

The colonial waterbird community as a whole in coastal Virginia has declined dramatically since 1993 (Table 3; 2023 survey did not include Great Blue Herons or all Great Egrets). There was no change in either the number or type of species breeding in the area. Population estimates for 14 (64%) of the 22 species assessed declined between 1993 and 2023. Declines varied considerably between species with 11 species declining more than 40% and 9 species declining more than 60%. Cattle Egrets (*Bubulcus ibis*) showed the highest loss rate (-98%), declining from an estimated 1,459 to only 25 pairs. Glossy Ibis (*Plegadis falcinellus*) declined by 82% from 1,008 to only 182 pairs. Eight species increased in number between 1993 and 2023. Dramatic expansions were documented for White Ibis (*Eudocimus albus*), Double-crested Cormorant, and Brown Pelican. Several species have shown signs of recovery including the Tricolored Heron (*Egretta tricolor*), Little Blue Heron (*Egretta caerulea*), Black-crowned Night Heron (*Nycticorax nycticorax*), Yellow-crowned Night Heron, Royal Tern, Least Tern (*Sternulla antillarum*), and Black Skimmer *(Rhynchops niger*) (Table 3).

Seaside Region

The Seaside Region is the most important region for colonial waterbirds in Virginia. Since 1993, colonial waterbirds have

Table 2. Summary of species distributions across geographic areas in 2023. 'Col' refers to the number of colonies within the respective regions. 'Pairs' indicates the estimated number of breeding pairs within each region. The variable '%' indicates the percentage of the total population found within each region. 'NS' indicates 'not surveyed'.

	Seaside			Bay Islands			Urban			Western Shore			Southside		
Species	**Col**	**Pairs**	**%**	**Col**	**Pairs**	**%**	**Col**	**Pairs**	**%**	**Col**	**Pairs**	**%**	**Col**	**Pairs**	**%**
Wading Birds															
White Ibis	4	1593	99.4	2	9	0.6	-----	-----	-----	-----	-----	-----	-----	-----	-----
Glossy Ibis	5	120	65.9	2	62	34.1	-----	-----	-----	-----	-----	-----	-----	-----	-----
Great Blue Heron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	-----	-----	-----
Great Egret	6	230	24.4	3	47	5.0	4	665	70.6	NS	NS	NS	-----	-----	-----
Snowy Egret	7	508	67.6	3	177	23.6	1	66	8.8	-----	-----	-----	-----	-----	-----
Tricolored Heron	7	532	94.0	4	34	6.0	-----	-----	-----	-----	-----	-----	-----	-----	-----
Little Blue Heron	4	86	82.7	3	18	17.3	-----	-----	-----	-----	-----	-----	-----	-----	-----
Cattle Egret	2	23	92.0	1	2	8.0	-----	-----	-----	-----	-----	-----	-----	-----	-----
Green Heron	1	1	3.2	-----	-----	-----	9	25	80.6	2	5	16.2	-----	-----	-----
Bl.-cr. Night Heron	7	1408	91.1	4	137	8.9	-----	-----	-----	-----	-----	-----	-----	-----	-----
Ye.-cr. Night Heron	1	2	0.3	2	6	0.9	105	642	98.8	-----	-----	-----	-----	-----	-----
Gulls															
Great Bl.-back. Gull	20	353	62.9	17	197	35.1	1	11	2.0	-----	-----	-----	-----	-----	-----
Herring Gull	19	1641	79.5	17	392	19.0	1	30	1.5	-----	-----	-----	-----	-----	-----
Laughing Gull	20	11657	93.9	2	67	0.5	1	684	5.8	-----	-----	-----	-----	-----	-----
Terns															
Gull-billed Tern	6	305	93.8	-----	-----	-----	1	20	6.2	-----	-----	-----	-----	-----	-----
Caspian Tern	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Royal Tern	8	1472	18.5	1	557	7.0	1	5945	74.5	-----	-----	-----	-----	-----	-----
Sandwich Tern	5	110	61.5	-----	-----	-----	1	69	38.5	-----	-----	-----	-----	-----	-----
Forster's Tern	23	714	65.0	3	385	35.0	-----	-----	-----	-----	-----	-----	-----	-----	-----
Common Tern	11	658	43.1	5	581	38.1	2	287	18.8	-----	-----	-----	-----	-----	-----
Least Tern	35	945	86.0	-----	-----	-----	8	34	3.1	4	120	10.9	-----	-----	-----
Other Waterbirds															
Black Skimmer	8	1480	87.5	2	89	5.3	2	122	7.2	-----	-----	-----	-----	-----	-----
Dbl.-cr. Cormorant	7	154	5.2	4	2494	82.8	1	167	5.5	7	197	6.5	-----	-----	-----
Brown Pelican	1	1135	43.5	4	1272	48.8	1	202	7.7	-----	-----	-----	-----	-----	-----
Total	**129**	**25130**	**61.4**	**31**	**6522**	**15.9**	**123**	**8966**	**21.9**	**14**	**326**	**0.8**	**NS**	**NS**	**NS**

Table 3. Comparison of colony numbers and estimated number of breeding pairs for 1993, 2003, 2008, 2013, 2018, and 2023. Population estimates refer to numbers of breeding pairs.

Species	1993 Pop. Est.	2003 Pop. Est.	2008 Pop. Est.	2013 Pop. Est.	2018 Pop. Est.	2023 Pop. Est.
Waders						
White Ibis	3	77	119	369	1746	1602
Glossy Ibis	1008	818	657	484	366	182
Great Blue Heron	9112	9136	NS	7809	NS	NS
Great Egret	2520	2720	1588[a]	2894	1527[a]	942[a]
Snowy Egret	2329	882	895	903	893	751
Tricolored Heron	767	507	312	718	351	566
Little Blue Heron	374	310	173	178	64	104
Cattle Egret	1459	166	120	56	48	25
Green Heron	154	60	33	49	21	31
Bl.-cr. Night Heron	526	640	654	358	858	1545
Ye.-cr. Night Heron	388	241	212	299	602	650
Total Waders	**18640**	**15557**	**4763**	**14117**	**4949**	**6398**
Gulls						
Gr. Black-backed Gull	514	1084	1519	1172	1119	561
Herring Gull	8801	4521	2685	3326	1957	2063
Laughing Gull	45387	44953	37065	24160	16653	12408
Total Gulls	**54702**	**50558**	**39909**	**26658**	**19729**	**15032**
Terns						
Gull-billed Tern	606	322	311	294	349	325
Caspian Tern	8	1	2	9	1	0
Royal Tern	6250	2858	3244	5321	2874	7974
Sandwich Tern	30	7	100	28	102	179
Forster's Tern	2939	2477	3065	2431	1494	1099
Common Tern	6781	1891	1442	1985	1318	1526
Least Tern	1171	843	1182	925	991	1099
Total Terns	**17785**	**8399**	**9346**	**10993**	**7129**	**12202**
Other Waterbirds						
Black Skimmer	3098	1828	1364	1506	1567	1691
Dbl.-cr. Cormorant	354	1338	1991	2876	5012	3012
Brown Pelican	368	1661	1924	2454	3246	2609
Total Others	**3820**	**4827**	**5279**	**6836**	**9825**	**7312**
Grand Total	**94947**	**79343**	**59297[a]**	**60604**	**43159[a]**	**40944[a]**

[a]Great Blue Herons and Great Egrets were not surveyed along the tributaries of the Western Shore or throughout the swamps and Chowan watershed of Southside Virginia.

been systematically surveyed within this geographic area in 1993, 1998, 2003, 2008, 2013, 2018, and 2023. Among the majority of species, comparison of population estimates across these years (Table 4) shows consistent trends. Snowy Egret (*Egretta thula*), Cattle Egret, Green Heron, Yellow-crowned Night Heron, Glossy Ibis, Herring Gull (*Larus argentatus*), Laughing Gull, Gull-billed Tern (*Sterna nilotica*), Forster's Tern (*Sterna forsteri*), and Common Tern (*Sterna hirundo*) all showed a consistent decline across the seven surveys. Only species that have colonized the area since 1970 including White Ibis, Double-crested Cormorant, and Brown Pelican have exhibited consistent increases. Patterns for other species were stable or showed fluctuating patterns over time. Of particular note within this region was the

Table 4. Population estimates for colonial waterbirds within the barrier island/lagoon system of the Delmarva Peninsula in 2023. Values represent estimated number of breeding pairs.

Species	1993[a]	1998[b]	2003[c]	2008[d]	2013[e]	2018[f]	2023
Wading Birds							
White Ibis	3	18	77	119	369	1746	1593
Glossy Ibis	779	822	669	521	384	224	120
Great Blue Heron	8	10	0	0	52	NS	NS
Great Egret	885	976	467	642	692	789	230
Snowy Egret	1862	1212	624	575	755	704	508
Tricolored Heron	713	530	456	270	688	301	532
Little Blue Heron	330	195	249	137	150	55	86
Cattle Egret	854	540	146	95	48	33	23
Green Heron	47	3	0	0	0	0	1
Bl.-cr. Night Heron	442	359	590	539	277	758	1408
Ye.-cr. Night Heron	63	36	2	0	2	28	2
Gulls							
Gr. Black-backed Gull	362	369	720	1206	868	820	353
Herring Gull	6106	4653	3417	2182	2945	1560	1641
Laughing Gull	44387	43784	41692	33152	21414	12716	11657
Terns							
Gull-billed Tern	604	478	304	295	255	325	305
Caspian Tern	7	4	1	0	9	1	0
Royal Tern	3250	3451	2058	2259	62	658	1472
Sandwich Tern	30	54	7	100	5	2	110
Forster's Tern	2169	2426	1521	1527	1137	1358	714
Common Tern	3247	1727	843	475	694	683	658
Least Tern	747	709	703	669	533	815	945
Other Waterbirds							
Black Skimmer	2549	1766	1679	1151	1135	965	1480
Dbl.-cr. Cormorant	0	6	10	65	67	47	154
Brown Pelican	324	470	454	728	597	1493	1135
Total	**69968**	**64608**	**56689**	**46707**	**33138**	**26119**	**25130**

[a]from Watts and Byrd 1998; [b]from Truitt and Schwab 2001; [c]from Watts and Byrd 2006; [d]from Watts and Paxton 2009; [e]from Watts and Paxton 2014; [f]from Watts et al. 2023

catastrophic decline in marsh-nesting species such as Laughing Gull, Herring Gull, and Forster's Tern since 1993 and particularly since the 2000s. Declines have been most pronounced within the southern reaches of the Seaside Region (i.e., Northampton County).

Discussion

During the 2023 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 region continues to be the single most important area for colonial waterbirds in coastal Virginia; however, most populations are experiencing declines within this region. There is a clear need to investigate how sea-level rise is contributing to these declines and identify potential management options to help restore these populations to more sustainable levels.

The Bay Islands Region also supported a diverse community of species but with lower numbers of individuals compared to the Seaside Region. The Urban Region supported half of the species that breed in Virginia and the residential areas within this region continued to harbor significant populations of Yellow-crowned Night Herons, Great Egrets, and Green Herons. From 2007-2019, the Hampton Roads Bridge-Tunnel (HRBT), which is part of the I-64 corridor that spans the mouth of the James River, supported the Commonwealth's largest seabird colony. The colony was located on South Island, one of two artificial islands that served as tunnel ingress and egress points.

Immediately following the approval of the HRBT expansion project in 2017, the Virginia Department of Transportation mandated the permanent removal of the colony from South Island to avoid bird-related project delays and because there would be no space for birds to nest during and after construction. In 2020, the governor issued a directive to the

Virginia Department of Wildlife Resources (DWR) that it (1) create temporary nesting habitat for the displaced colony on Fort Wool, an artificial island and historic military landmark located adjacent to South Island, and (2) provide additional nesting habitat on industrial barges anchored in the embayment between South Island and Fort Wool (hereafter referred to as the Fort Wool/Barge Complex). This habitat will be maintained by the DWR until a new seabird nesting island is constructed in the vicinity of the HRBT which is expected to be completed in 2026. 2023 marked the 4th year seabirds and other waterbirds nested successfully on the Fort Wool/Barge Complex. Royal Terns were the predominant species followed by Laughing Gulls, Common Terns, Black Skimmers, Brown Pelicans, Gull-billed Terns, Herring Gulls, and a small colony of Snowy Egrets.

Wading Birds

Collectively, wading birds (excluding Great Blue Herons and Great Egrets that were not fully assessed in 2023) declined 22% between 1993 and 2023 from an estimated 7,008 pairs to 5,456 pairs. This decline is despite the exponential increase in White Ibis over the past ten years and the recent increase in Black-crowned and Yellow-crowned Night Herons. Most of this overall decline was due to the continued degradation of mixed heronries both in the Seaside and Bay Islands regions. These declines have been ongoing and represent a loss of some historic colonies during the past two decades. Other sites may be lost in the next decade. Particularly notable was the continued declines in Cattle Egrets, Little Blue Herons, Tricolored Herons, Snowy Egrets and Glossy Ibis. Collectively, these species have declined by 67% (Table 3).

White Ibis – Nesting of the White Ibis was first confirmed in Virginia in 1977 on Fisherman Island (Frohring and Beck 1978). Breeding was restricted to the barrier islands until 2013. The barrier islands were surveyed annually from 1975 – 2005 (Williams et al. 2005). Initially, birds were associated with a mixed-species heronry on Fisherman Island exclusively with no indication of further expansion (Williams et al. 1992). This heronry was abandoned in 2002 and has not reformed since. 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 and then the colony on Wire Narrows Marsh in Chincoteague Bay. The 2023 survey was the first to document White Ibis breeding on Ship Shoal Island in the Seaside Region and in the Bay Islands Region with pairs found within Watts Island and Tangier Island mixed species heronries. The population has grown from 3 pairs in 1993 to 369 pairs in 2013 to 1,746 pairs in 2018. The population declined slightly in 2023 to 1,602 pairs. The decline was likely due to a combination of vegetation damage caused by the large numbers of wading birds nesting in the Wire Narrows colony for well over a decade along with marsh subsidence.

Glossy Ibis – The Glossy Ibis was first found breeding in Virginia on Hog Island (a barrier island in the Seaside Region) in 1956 (Bock and Terborgh 1957). The breeding population increased dramatically throughout the 1960s reaching a high of 4,178 pairs by the mid-1970s (Custer and Osborn 1977). Since this time the species has steadily declined on the barrier islands (Williams et al. 2005, Watts et al. 2023). By 1993, the Coastal Plain population had been reduced by more than 50% from historic highs (Watts and Byrd 1998). Between 1993 and 2023, the population has declined by 82%. Of particular importance moving forward is the ongoing erosion of sites supporting mixed heronries in the Bay Islands Region. Losses in this region have accounted for most of the decline. Losses have also been documented within the Seaside Region due to tidal flooding and habitat loss.

Great Blue Heron – Due to funding constraints, this species was not assessed throughout the Coastal Plain in 2023. Anecdotal observations while flying other surveys throughout the region suggest that colonies have continued to fragment and the species is becoming more widespread with more small colonies forming compared to the historic pattern of a few large colonies supporting the majority of Virginia's 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 although trends vary between regions. Great Egrets have continued to move inland and now breed beyond the fall line into the Piedmont (Watts, per. obs.). Between 2013 and 2023, the population has declined within the Seaside and Urban regions where Great Egret ground counts across all survey years (Table 3). That being said, anecdotal observations suggest the population appears to have continued to increase along tributaries of the Western Shore Region and in the Southside Region.

Snowy Egret – Historically, Snowy Egrets bred as far north as New England. By the turn of the century, however, 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 Peninsula (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). Since the 1970s, however, breeding has been almost entirely restricted to the Seaside and Bay Islands regions. The colony on Fort Wool represents a new toehold in the lower 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 2023 the population has declined by nearly 68% (Table 3). Loss

of nesting substrate in the Seaside and Bay Islands regions continues to be a concern. The colony on Mumford Island in the York River has been lost since the 2013 survey due to sea-level rise. Population strongholds continue to be Watts Island in the Bay Islands Region and Wreck Island and the Wires Narrow Marsh located in the Seaside Region. Newly established mixed- species heronries on Little Cobb and Ship Shoal Islands also supported Snowy Egrets in 2023.

Tricolored Heron – The Tricolored Heron was first documented to nest in Virginia when breeding birds were discovered on the seaside of the Delmarva Peninsula 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, Watts et al. 2023). The 1993 population estimate (Watts and Byrd 1998) was reduced by more than 50% from that of the mid-1970s (Custer and Osborn 1977). The population has fluctuated since 1993 having alternating periods of decline and recovery. Newly established mixed-species heronries on Little Cobb and Ship Shoal Islands collectively supported 40% of the estimated population in 2023. Ongoing erosion of the Chesapeake Bay islands and the loss of topographic highs in the Seaside Region continue to threaten suitable nesting substrate.

Little Blue Heron – Little Blue Herons were one of the most abundant wading birds 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 in the Seaside Region and on Watts and Tangier islands in the Bay Islands Region. From 1993 to 2023, Little Blue Herons declined by an estimated 72% (Table 3). However, the population estimate has increased from 64 to 104 pairs over the past 5 years. Nearly 83% of the population in 2023 was nesting within the Seaside Region on Wreck Island and in Chincoteague Bay marshes.

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 this species' 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 even more precipitously since the mid-1990s. Cattle Egrets experienced a dramatic decline between 1993 and 2023 within all breeding areas (Tables 2 and 3). Only 2 pairs were detected in the Bay Islands Region. Birds disappeared from the Hopewell colony on the James River in the mid-1990s and have never returned. The stronghold in 2023 was the Wire Narrows Marsh colony in the Seaside Region.

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 Seaside and Bay Islands regions. More moderate declines have been documented in the traditional colonies within the Urban Region.

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). However, the species increased throughout the broader Coastal Plain between 1993 and 2003 and this trend continued through the 2008 survey (Table 3). Much of this increase may be attributed to expansion of numbers within the Watts Island and Tangier Island colonies since 2003. Between 2003 and 2013, Black-crowned Night Herons declined by 44% resulting in a 32% decline since 1993. Black-crowned Night Herons increased in 2018 with the highest number of pairs documented since 1993. This trend continued with a dramatic jump between 2018 and 2023 from 858 to 1545 pairs. Recent gains have been driven entirely by colonies on the southern barrier islands in the Seaside Region, including Wreck Island and newly established colonies on Little Cobb and Ship Shoal islands.

Yellow-crowned Night Heron – The Yellow-crowned Night Heron likely bred in Virginia in the 1800s but was apparently absent by the early 1900s. 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-crowned Night Herons increased throughout the Urban Region at least through the early 1990s (Watts unpublished data). Between 1993 and 2003 the population declined primarily because of losses within mixed species heronries located in the Bay Island and Seaside regions. This pattern has continued to the present and in 2023 both regions combined only harbored 1% of the population (Table 3). Virtually the entire population currently occurs in the Urban Region where it continues to expand (Table 2).

Gulls

As a group, gulls declined by 72% over the 30-year period from an estimated 54,702 breeding pairs in 1993 to 15,032 in 2023 (Table 3). This decline was due to the catastrophic decline in Laughing Gulls between 2003 and 2023 but also

to the long-term decline in Herring Gulls and the recent decline in Great Black-backed Gulls (*Larus marinus*).

Great Black-backed Gull – In 1970, the Great Black-backed Gull was first found breeding in Virginia 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 in both the Seaside and Bay Islands regions. Between 1993 and 2003, the population more than doubled in size (Table 3). Between 2003 and 2018 the population was relatively stable. The population declined by nearly 50% over the past five years. This decline appears to reflect the overall degradation of topographic highs in the Bay Islands and Seaside regions.

Herring Gull – A single Herring Gull nest was found on the seaside near Cobb Island in 1948 (Murray 1952). By 1977, nine 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. 2005, Watts et al. 2023). Between 1993 and 2023, the Coastal Plain population declined by an estimated 77% (Table 3) with a 5% increase occurring between 2018 and 2023. The current stronghold for the population is in Chincoteague Bay marshes, which supported nearly 50% of pairs in 2023. Halfmoon Island supported the largest colony in the Bay Islands Region with an estimated 210 pairs.

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 on the Coastal Plain. Between 1977 and 1993 there was a considerable increase in population estimates (Table 3). Between 1993 and 1998, there was a very small decline in numbers in the Seaside Region (Truitt and Schwab 2001). The barrier island population exhibited considerable variation after 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 2013 was catastrophic and was the most significant result of the 2013 survey (Table 3; Watts and Paxton 2014). Historic colony sites within the southern portion of the Seaside Region have now been abandoned for several years. Evidence of stress is ongoing and now being seen within the topographically higher saltmarsh colonies along the Chincoteague Causeway, which historically supported several thousand pairs. To compensate, an increasing number of Laughing Gulls are nesting in dunes on several barrier islands in the Seaside Region and at the Fort Wool/Barge Complex in the Urban Region. Collectively, the patterns of decline and shifts in distribution strongly suggest tidal flooding is the predominant threat to this species.

Terns

As a group, terns declined 30% over the 30-year period from an estimated 17,785 pairs in 1993 to 12,202 breeding pairs in 2023. Steeper declines for most species are being masked by the recent increase in Royal Terns, but the remaining species collectively have declined by more than 60%.

Gull-billed Tern – The Gull-billed Tern (*Gelochelidon nilotica*) 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 2023 the number of occupied colonies declined from 30 to 7 (Watts and Byrd 1998, Table 1) and the number of breeding pairs declined by 46% (Table 3). Despite earlier declines, the population has remained relatively stable since 2003. In 2023, nearly 94% of the state's breeding population nested in the Seaside Region on Cedar and Cobb islands.

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). Egg collecting and hunting apparently reduced their numbers in the 1880s to a low from which they have never fully recovered. Since 1900, Caspian Terns have been documented in very low numbers breeding in scattered locations in the Seaside Region and occasionally in the Bay Islands region. They appear to be present consistently since the mid-1970s. In 1993 only 7 pairs were documented in 5 locations (Table 3). During the 2003 survey, only a single pair was documented. In 2008, 2 pairs were documented on Clump Island just south of the Maryland/Virginia border in the Bay Islands Region. In 2018, a single pair was found within the Royal Tern colony on Wire Narrows marsh in Chincoteague Bay in the Seaside Region. The species has nested on this shell pile consistently since at least 1993. No Caspian Terns were detected during the 2023 survey (Table 1).

Royal Tern – In Virginia, Royal Terns have apparently always been the most abundant of the large terns. Like many of the other tern species, 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) and recent large-scale banding efforts in Virginia. Royal Terns have declined on the barrier islands since the early 1980s (Williams et al. 2005, Watts et al. 2023). 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 increased 28% (Table 3). The increase is recent and reflects a 177% increase since 2018. This increase reflects the growing colony on Fort Wool that is approaching 6,000 pairs. This colony has become a center of Royal Tern nesting activity and is likely drawing birds from throughout the region. Beyond Fort Wool, a large Royal Tern colony has recently formed on the north end of Cobb Island in the Seaside Region and the Clump Island colony in the Bay Islands Region continues to persist despite significant erosion and elevation loss.

Sandwich Tern – Virginia, and occasionally Maryland, represent the northern range limit for breeding Sandwich Terns (*Thalasseus sandvicensis*). 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 to 100 pairs in 2008 to 28 pairs in 2013 and back to 102 pairs in 2018 reflect the dynamics of their occurrence in Virginia. The increase to 179 pairs in 2023 represents the highest number in modern times. This increase is coincident with the spike in Royal Terns and all pairs were recorded within the hotspots of Fort Wool/Barge Complex in the Urban Region and Cobb Island in the Seaside Region.

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). Because of their nesting habits, the status of Forster's Terns was less known compared to other tern species. Forster's nest in scattered colonies throughout the Seaside and Bay Islands regions on wrack deposited in the marshes or on other topographic highs. Their distributions are subject to change depending on the availability of suitable wrack. This makes them difficult to survey effectively. The first comprehensive survey of Forster's Terns was in 1977 (Erwin and Korschgen 1977). By 1993, numbers appeared to have doubled (Watts and Byrd 1998) likely due to better coverage. Between 1993 and 2023 estimated population size declined by 63% (Table 3). More significant is that most (56%) of this decline has occurred since 2013. Forster's Terns are vulnerable to sea-level rise to the same degree as marsh-nesting Laughing Gulls, which also nest in low marsh habitats. It remains to be seen if Forster's Terns will shift to higher elevation habitats as marsh subsidence coupled with sea-level rise continues to threaten their breeding success.

Common Tern - Historically, the Common Tern nested throughout coastal Virginia wherever there was suitable substrate devoid of 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 Region and the lower Tidewater area. 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 HRBT South Island in the early 1980s such that estimates from 1977 (Erwin and Korschgen 1979) and 1993 (Watts and Byrd 1998) were comparable. Despite the relocation of the South Island colony to the Fort Wool/Barge Complex, Common Tern numbers have not recovered to previous levels. Between 1993 and 2023, Common Terns declined by 78% in coastal Virginia (Table 3) with numbers between 2003 and 2023 fluctuating between about 1,300 and 2,000 pairs. The northern end of Cobb Island supported the largest colony in 2023 with 324 breeding pairs.

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 in the Seaside Region, 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% (Table 3). Since 2003 the population has steadily recovered to 1,099 breeding pairs. Roof-nesting Least Terns were first documented in Virginia in 2008 in the Urban Region. Colonies have been located on store rooftops at Lynnhaven Mall and Patrick Henry Mall, and on a building at the Langley Air Force Base. Neither of the mall sites were active in 2023 and the colony on the Langley Air Force Base rooftop was abandoned before it was surveyed. The birds subsequently moved to a fighter jet parking area and a nearby runway. Nests were removed from both areas to prevent impacts to operations. The formation of rooftop colonies has been reported throughout the southeast and has been anticipated for many years in Virginia. It is possible that

additional colonies exist within the Urban Region that have not been discovered. Such colonies are subject to severe heat stress, flooding and exposure to avian predators. Many flat-topped buildings are switching from pea gravel to a white polyvinyl substrate to reduce cooling costs in the summer. This is an effective way to keep Least Terns from nesting on commercial rooftops which are almost exclusively located in highly disturbed areas.

Other Waterbirds

As a group, the three remaining waterbird species have increased 191% from 3,820 to 7,312 breeding pairs between 1993 and 2023 (Table 3). This overall increase reflects the fact that both Double-crested Cormorants and Brown Pelicans are rapidly expanding within the Commonwealth. This increase masks the substantial decline in Black Skimmers over the same period of time and does not reflect the fact that both Double-crested Cormorants and Brown Pelicans have declined substantially in the state since 2018 (Table 3).

Black Skimmer – The Black Skimmer appears to have been a common nesting species on the barrier islands 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 so did not experience the same degree of pressure from egg harvesters. According to 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 2013 as the coastal population declined 51% (Table 3). Since 2013 the population has steadily increased. Current strongholds are Cobb and Cedar Islands in the Seaside Region. Despite the successful relocation of Black Skimmers from the HRBT South Island to the Fort Wool/Barge Complex, the number of breeding pairs at the relocation site continue to remain below those documented on South Island prior to the relocation.

Double-crested Cormorant – Breeding of the Double-crested Cormorant in Virginia was first confirmed in the Western Region 1978 on a small, vegetated island in the James River near Hopewell (Scott 1978). Cormorants have experienced range-wide fluctuations in numbers and distribution throughout the 20th century (Hatch 1984). The colonization of Virginia represents an expansion beyond the historic range following a low during the DDT era which began in the 1940s and ended in 1972 (Hatch and Weseloh 1999). After 1984, the Virginia population expanded rapidly and by 1995 there were five colonies containing more than 400 pairs (Watts and Bradshaw 1996). The Seaside Region was not colonized until 1995. Between 1993 and 2018 the population increased by 1,416% (Table 3). Most of this increase reflects the rapid expansion of the Shanks Island colony located in the northern reach of the Bay Islands Region. The colony has expanded from 6 pairs in 1993 to 5,012 in 2018 (Table 3). The colony declined dramatically between 2018 and 2023 resulting in an overall 40% decrease in the Virginia population. This significant drop has been largely driven by erosion of the Shanks Island site due to sea-level rise. Several new smaller colonies have formed in the Seaside and Bay Islands regions but none have made up for the significant loss observed on Shanks Island.

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, another barrier island in the Seaside Region (Williams 1989). In 1992, an additional colony formed on Shanks Island in the Bay Islands Region (Brinker, pers. comm.). In recent years, colonies on the Seaside have come and gone. Between 1993 and 2018 the population increased from 368 to 3,246 and then declined to 2,609 in 2023 (Table 3), reflecting the erosion of the Shanks Island site. The 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). The colony reached a peak of 1,857 pairs in 2013. The colony declined by roughly 100 pairs in 2018 and dropped to 1,256 pairs in 2023. A new colony formed at the Fort Wool/Barges Complex in 2022 with just over 100 pairs. In 2023, the colony increased to 202 pairs (Table 2).

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APPENDIX I: List of colonial waterbird species surveyed in coastal Virginia, including American Society of Ornithology alpha codes.

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