



NEW YORK CITY AUDUBON'S HARBOR HERONS PROJECT

2021 NESTING SURVEY REPORT

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Prepared for:

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Report Highlights

New York City Audubon's Harbor Herons Project Nesting Survey of the New York/New Jersey Harbor and surrounding waterways was conducted between 17 May and 2 June, 2021. This report principally summarizes long-legged wading bird, cormorant, gull, and tern nesting activity observed on selected harbor islands, and also includes surveys of aids to navigation and selected mainland sites. Principle outcomes of our 2021 survey include the following:

- Eight species of long-legged wading birds nested on seven of twenty islands surveyed in New York Harbor, as well as at several mainland sites.
- Observed wading bird species included (in order of decreasing abundance on island colonies) Black-crowned Night-Heron, Great Egret, Snowy Egret, Glossy Ibis, Little Blue Heron, Green Heron, Great Blue Heron, and Yellow-crowned Night-Heron.
- A total count of 1,195 island-nesting wader pairs indicates a stable population compared to the most recent previous survey, in 2019, when 1,186 pairs were observed.
- An apparent wader population decline over the last three decades seems primarily attributable to a long-term decline in Black-crowned Night Heron, with a smaller effect attributable to a decline in Glossy Ibis; other principal wader species populations appear to be stable or increasing in numbers over this time period.
- Notable species-specific findings compared to our 2019 survey included 15% increases in both Great Egret and Black-crowned Night-Heron nesting pairs; a 12% decrease in Snowy Egret pairs; and a 67% decline in Glossy Ibis pairs, resulting in the lowest count recorded for this species during the study period.
- 99.7% of island-nesting waders in the harbor were concentrated on six islands in 2021: South Brother Island in the East River/Long Island Sound, Hoffman Island in the lower harbor, and four islands in Jamaica Bay. Previously abandoned colonies that continued to exhibit little to no nesting activity included Mill Rock, North Brother, Goose, and Huckleberry Islands in the East River/Long Island Sound; Canarsie Pol in Jamaica Bay; and Isle of Meadows and Prall's and Shooters Islands in the Arthur Kill/Kill Van Kull.
- A total of 2,908 Double-crested Cormorant nests were observed, a 20% increase since 2019, continuing an increasing trend across the harbor exhibited since 2005.
- Short-term research goals for the project include analysis and summary of data from the NYC Audubon Harbor Herons Nesting Surveys (1986-present).
- Recommendations for the future include improvements to survey methodology, quantification of mammalian predator presence, and increased public outreach and posted signage to deter disturbance to the colonies during the breeding season.

Executive Summary

New York City Audubon's Harbor Herons Project Nesting Survey of the New York/New Jersey Harbor and surrounding waterways was conducted between 17 May and 2 June, 2021. This report principally summarizes long-legged wading bird, cormorant, gull, and tern nesting activity observed on selected harbor islands, and also includes surveys of aids to navigation and selected mainland sites.

Species summaries: Eight species of long-legged wading birds nested on seven of twenty islands surveyed in New York Harbor as well as at several mainland sites. Observed wading bird species, hereafter collectively referred to as waders, included (in order of decreasing abundance on island colonies) Black-crowned Night-Heron, Great Egret, Snowy Egret, Glossy Ibis, Little Blue Heron, Green Heron, Great Blue Heron, and Yellow-crowned Night-Heron. Overall, a total count of 1,195 island-nesting wader pairs indicates a stable population compared to the most recent previous survey in 2019, when 1,186 pairs were observed. (No survey was conducted in 2020, due to constraints imposed by the COVID-19 pandemic.)

The most significant species population changes observed since 2019 included an increase in the Great Egret population to 370 pairs (15%) and Black-crowned Night-Heron population to 537 pairs (15%), and a decrease in the Snowy Egret population to 238 pairs (-12%). Glossy Ibis numbers have fluctuated greatly over time, and decreased 67% to 37 pairs since 2019, one of the lowest counts for this species in the history of the survey. The number of Yellow-Crowned Night-Heron pairs on the nesting islands has remained in the single digits since 2016. (Though our mainland surveys are not methodically conducted, the mainland population of Yellow-crowned Night-Herons appears to have declined very slightly since 2019, from 119 to 107 pairs, after steadily increasing over the past decade. Our harbor-wide estimate of nesting pairs for this species decreased 14% to 108 pairs since 2019.) Little Blue Herons continued to nest in low numbers. Tricolored Heron, which has nested in very low numbers in most of the past 20 years, was not observed in either 2021 or 2019. Great Blue Heron, only observed nesting twice on the harbor islands in past years, was observed breeding on Hoffman Island in 2021. (Recovered camera trap footage also revealed a possibly breeding Great Blue Heron on South Brother Island in 2019, post-survey.) Three Green Heron pairs were estimated to be breeding on Subway Island in 2021; 8 pairs were reported at mainland sites, primarily on Staten Island. Cattle Egret, observed in 2019 for the first time since 2010, was not observed in 2021.

A total of 2,908 Double-crested Cormorant nests was observed on 6 of 18 islands surveyed for cormorant nesting activity in 2021, a 20% increase since 2019; this year's count continues an increasing trend across the harbor exhibited since 2005. Herring and Great Black-backed Gull nesting activity was observed on 11 of 15 islands surveyed for gull breeding; no nesting activity was observed on Isle of Meadows or on Shooters, Prall's, or North Brother Islands. Hart Island, Davids Island, Governors Island, Canarsie Pol, and Ruffle Bar were not methodically surveyed for gull nesting activity. Incidental observations of Common Tern nesting activity were recorded at several sites including Little Egg Marsh and Governors Islands, both of which also hosted colonies in 2019.

Island and selected mainland colony summaries: South Brother Island in Long Island Sound was the largest colony in the survey area in 2021, with 392 wader pairs, just surpassing the size of Hoffman Island in the lower harbor (372 pairs); prior to this year's count, Hoffman had been the largest colony in the survey since 2008. In Jamaica Bay, Subway Island and Elders Point East Marsh Island also hosted significant nesting wader populations (197 and 121 pairs, respectively). These four colonies together hosted 91% of the total island-nesting wader population in the harbor in 2021; when two additional Jamaica Bay Islands are included, these six islands hosted 99.7% of the harbor's nesting waders.

In the East River and Long Island Sound, South Brother and Mill Rock Islands are the only currently active wader colonies; South Brother exhibited a 26% increase over 2019, growing to 392 nesting pairs, while the colony on Mill Rock Island, which declined sharply five years ago, hosted just four wader pairs. All other colonies in this area have either declined or remained abandoned since 2016: North Brother Island exhibited no signs of wader nesting activity in 2021, it has appeared to be abandoned since 2008. In Long Island Sound, Huckleberry Island has shown little wader nesting activity since 2016, and its previously sizeable Double-crested Cormorant colony has also demonstrated no nesting activity since 2016. No wader nesting has been observed on Goose Island since its apparent predation and abandonment shortly before the 2013 survey.

In the lower harbor outside Jamaica Bay, Hoffman Island was the only productive wader colony in 2021. While it was the second largest colony in the survey area this year, this island was the most diverse, hosting six wader species. This island's nesting populations exhibited a 15% decrease in total nests since 2019, continuing a decline noted in that year compared to prior years; this year's count of 372 pairs was the lowest registered there since 2000. Double-crested Cormorant numbers continued to increase on this island, reaching a survey-period high of 1,407 pairs and exhibiting a 25% population increase since 2019. Nearby Swinburne Island's colony of Double-crested Cormorants increased 22% since 2019, reaching a survey-period high of 530 pairs. Isle of Meadows and Prall's Island, in the Arthur Kill, and Shooters Island, in the Kill Van Kull, together forming the core of the harbor's breeding wader population in first 15 to 20 years of this survey, have shown no evidence of wading bird nesting since the early 2000s.

In Jamaica Bay, waders nested on four out of six islands surveyed: Subway, Elders Point East Marsh, Elders Point West Marsh, and Little Egg Marsh Islands. Subway Island held the largest population in the Bay at 197 wader pairs; its populations declined 35% since 2019. Elders Point East Marsh Island, which had declined since 2016 and exhibited no wader or cormorant nesting activity in 2019, hosted 121 wader pairs this year, the largest number seen on this small island since 2015. The wader colony on Elders Point West Marsh Island, which grew rapidly after a few waders were found nesting there in 2016, declined 47% since 2019 to 63 pairs, while its cormorant colony increased 48% to 428 pairs. Little Egg Marsh Island, which has hosted a small, fluctuating population of waders since 2013, exhibited an increase of 156%, to 46 pairs, since 2019. No breeding waders were detected on Canarsie Pol, which was first found abandoned in 2013 after more than a decade of nesting activity. Ruffle Bar, which has not hosted breeding waders during the survey period, remains inactive.

The mainland nesting colony of Yellow-crowned Night-Herons at Redfern Houses in Far Rockaway, which had increased steadily over the past decade, declined 62% since 2019, to 23

pairs, while the Yellow-crowned Night-Heron colony in nearby Rockaway Beach, discovered in 2018, remained stable at 42 pairs. Several smaller Yellow-crowned Night-Heron colonies were reported in Queens, Staten Island, and Bayonne, NJ. Slightly increased numbers (21 pairs) over 2019 of this same species were reported from the Harmon Cove colony in the New Jersey Meadowlands.

Introduction

New York City Audubon’s 2021 Harbor Herons Nesting Survey marks the 37th year of this project since annual surveys were begun in 1985. (One earlier survey was conducted in 1982.) The primary objective of the surveys is to monitor the population status of wading birds (i.e., herons, egrets, and ibis) and other colonial waterbirds on select islands and mainland sites in New York/New Jersey (NY/NJ) Harbor and surrounding waterways, while also noting the presence of other nesting bird species and current nesting habitat.

In Fall 2004, NYC Audubon made a decision to shift the comprehensive Harbor Herons Nesting Survey from an annual to a triennial schedule, and in intervening years to conduct interim surveys on islands where nesting occurred in the prior year. The last comprehensive (or “full”) nesting survey previous to this year’s survey was conducted in 2019.

The U.S. Army Corps of Engineers and The Port Authority of New York & New Jersey “Comprehensive Restoration Plan for the Hudson-Raritan Estuary” and the Harbor Herons Subcommittee of the Harbor Estuary Program’s “Harbor Herons Conservation Plan” provide historical perspective on Harbor Herons and their breeding and foraging habitat, identify threats to the persistence of these species in the Harbor, and lay out a plan of action for protecting these birds in the future.

This report summarizes nesting activity of long-legged wading birds, cormorants, gulls, and terns observed on selected islands, aids to navigation, and at mainland colonies documented during the 2021 field season, between 17 May and 2 June. The objectives of the 2021 survey were to: (1) monitor the population status of long-legged wading birds (i.e., herons, egrets, and ibis), cormorants, and gulls on selected islands; (2) document nesting habitat used by long-legged wading birds and cormorants; and (3) record the presence of other important nesting or migratory bird species.

Monitoring long-term trends and short-term conditions in long-legged wading bird and other colonial waterbird nesting populations in NY/NJ Harbor provides both an estimate of the relative health and stability of local colonial waterbird populations, and a valuable indicator of the overall health of the region’s natural resources.

Methods

The 2021 survey followed field methods designed for previous Harbor Herons Project nesting surveys [Katherine Parsons (1986–1995), Paul Kerlinger (1996–2004), Andy Bernick (2004–2007), Liz Craig (2008–2013), Tod Winston (2014–2021)] and the standard protocol of the New York State Department of Environmental Conservation’s Long Island Colonial Waterbird and Piping Plover Survey (Litwin et al. 1993). All counts were conducted between 6:00AM and 4:00PM, and under clear conditions without rainfall, high winds (>8 knots), or temperatures above 80°F. Counts were conducted from 17 May to 2 June 2021.

Islands fully surveyed in 2021 (Table 1, Figure 1) using a combination of nest and adult counts included two in Lower New York Harbor (Hoffman and Swinburne Islands); three in the Arthur Kill and Kill Van Kull complex (Isle of Meadows and Prall's and Shooters Islands); three in the East River/Western Long Island Sound area (U Thant, Mill Rock, and South Brother Islands); two in the Hutchinson River/Long Island Sound area (Goose and Huckleberry Islands); and four in Jamaica Bay (Elders Point East Marsh, Elders Point West Marsh, Little Egg Marsh, and Subway Islands). North Brother Island in the East River/Long Island Sound and Canarsie Pol in Jamaica Bay, which have not hosted nesting waders since 2007 and 2012, respectively, and Ruffle Bar in Jamaica Bay and Davids and Hart Islands in the Hutchinson River/Long Island Sound area, which have not been known to host nesting waders in the past, were each partially surveyed by foot and/or scanned by boat for evidence of nesting waders. Also presented in this report are observations of (1) Yellow-crowned Night-Heron nesting at several mainland colonies, (2) Common Tern nesting on Governors Island, and (3) both Common and Least Terns nesting on Little Egg Marsh Island.

Each island was surveyed by a research team consisting of the author, NYC Audubon staff, and volunteers from NYC Audubon and other organizations. Double-crested Cormorant counts were conducted as part of an ongoing study of cormorant population dynamics, habitat use, and foraging ecology in New York Harbor. Surveys at Goose and Huckleberry islands were conducted with the support of New York City Department of Parks & Recreation, Van Cortlandt & Pelham Bay Parks Administrators' Office. Don Riepe of the American Littoral Society/Jamaica Bay Guardian/NYC Audubon provided additional information on colonial waterbird activity in Jamaica Bay. Hugh Carola and Ray Duffy of Hackensack Riverkeeper and Nellie Tsipoura of New Jersey Audubon coordinated surveys of New Jersey mainland colonies, while Hugh Carola conducted waterbird counts in Newark Bay. Jeff Kolodzinski of the Port Authority of New York & New Jersey provided information on roof-nesting gull populations on Rikers Island.

Surveys were conducted by one to three teams of researchers, led by the author, NYC Audubon staff, and/or trained volunteers. Groups quickly and systematically searched for nests and/or conducted adult counts on each island, initially focusing effort on areas occupied by nesting birds in previous years. Depending on the colony size, each team was composed of two counters (i.e., one person using a telescopic mirror pole to examine contents of nests up to five meters from the ground, and another to record data) and from one to three spotters, who moved slightly ahead to direct the counters to nests and keep multiple teams from re-sampling the same nests. Biodegradable flagging tape and spray paint were utilized in larger colonies to ensure accurate counts. A nest was deemed active if it contained eggs or young, if there was evidence of recent construction (e.g., fresh twigs or vegetation in nest) or use (e.g., a layer of fresh feces underneath a nest), or by direct observation of adults on or within one meter of a nest with the above characteristics. Whenever possible, nests were identified to species by the presence of young, eggs, and clearly discernible nest structure. Nests beyond the reach of the mirror pole were examined with binoculars. If nest contents and structure could not be discerned, but other evidence suggested recent activity (e.g., feces, new nest construction), nesting species was noted as "unknown." Old or unused nests were noted in the count as "inactive" and not included in the final tally of active nests. Nesting vegetation (i.e., tree, shrub, or vine species) was recorded for all species whenever possible by observers skilled in plant identification.

Double-crested Cormorant surveys were conducted by ground counts within colonies (as detailed above); biodegradable flagging tape was utilized to mark trees that had been surveyed for nests in larger colonies to avoid double-counting.

Adult and/or nest counts of Great Black-backed Gulls and Herring Gulls were conducted at all fully surveyed colonies, and are presented in this report. When adults were counted in the vicinity of selected colonies, a nest was assumed present for each adult observed, as one-half of adults are assumed to be foraging away from the nesting colony during daytime (see Litwin et al. 1993; Kerlinger 2004).

Transportation and Permits

Boat access to islands was provided by Don Riepe of the American Littoral Society/Jamaica Bay Guardian/NYC Audubon, Stan McGuigan and Chris Nagy of Mianus River Gorge/Gotham Coyote Project, BoatrideNYC, Brooklyn Marine Services, and Hackensack Riverkeeper.

Permits were issued by New York City Department of Parks & Recreation and National Park Service to conduct surveys on protected islands under city and federal jurisdiction, and permission to access the privately owned Huckleberry Island was provided by Huckleberry Indians, Inc.

Acknowledgements

We sincerely thank all volunteers (noted by name in the island accounts), organizations, and agencies that participated in the 2021 surveys.

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Port Authority of New York & New Jersey provided information on nesting gull populations at Rikers Island. Rita McMahon and staff of the Wild Bird Fund have provided skilled assistance in our survey work. Hugh Carola and Ray Duffy of Hackensack Riverkeeper and Nellie Tsipoura of New Jersey Audubon provided valuable expertise in surveying New Jersey areas. The New York Police Department Harbor Unit has generously supported this project through access to their facilities and expert staff. The author would like to particularly thank Elizabeth Craig (Shoals Marine Laboratory) and Susan Elbin (NYC Audubon) for their expertise and guidance.

Results

Overview:

In 2021, eight species of long-legged wading birds were confirmed as nesting on seven of twenty islands surveyed in New York Harbor. (See Table 2.) These eight species, hereafter collectively referred to as waders, included (in order of decreasing abundance in island colonies) Black-crowned Night-Heron, Great Egret, Snowy Egret, Glossy Ibis, Little Blue Heron, Green Heron, Great Blue Heron, and Yellow-crowned Night-Heron. 2021 was an interim survey year, but as all known colonies were surveyed, it is comparable to the full survey completed in 2019, and thus the majority of comparisons noted in this report are between the 2021 and 2019 surveys. (The 2020 survey was canceled because of constraints imposed by the COVID-19 pandemic.) Longer-term trends are noted where deemed relevant. Overall, our count of 1,195 total island wader pairs represents a stable population compared to 2019, when 1,186 pairs were found. (When mainland wader colonies are included in these totals, principally consisting of New York City and New Jersey mainland colonies of Yellow-Crowned Night-Herons, the trend remains stable, with counts of 1,304 and 1,310 pairs). Figure 2 illustrates the nesting activity of wader species on the NY/NJ harbor islands over the history of these surveys, with years of uncertain and/or missing data indicated with gray bars. Figure 3 illustrates the shifting patterns of nesting island use over the same time period. A total of 2,908 Double-crested Cormorant nests were observed on six of eighteen islands surveyed for cormorant nesting activity in 2021, a 20% increase since 2019; this year's count continues an increasing trend observed across the harbor exhibited since 2005. Herring and Great Black-backed Gull nesting activity was observed on 10 of 15 islands surveyed for gull breeding. Incidental observations of Common Tern nesting activity were recorded at several sites including Little Egg Marsh and Governors Islands, both of which also hosted colonies in 2019. Least Tern was also found nesting on Little Egg Island.

In 2021, waders nested primarily on Hoffman Island in the lower harbor, South Brother Island in the East River/Long Island Sound, and four Islands in Jamaica Bay. Six wader species nested on Hoffman Island, the second largest colony in the harbor this year—while the largest colony, South Brother Island, hosted just three species. The four active Jamaica Bay Islands together hosted seven species, while Mill Rock, in the East River, hosted very low numbers of two species. This concentration of nesting birds on six islands has coincided with colony abandonment or decline on Mill Rock and Huckleberry Islands in the East River/Long Island Sound. Goose Island, North Brother Island, and Canarsie Pol, which hosted colonies in the past two decades, and the islands in the Arthur Kill/Kill Van Kull complex (Isle of Meadows, Prall's Island, and Shooters Island), which were the core of NY/NJ Harbor's breeding wader community from the 1970s until the late 1990s, continued to exhibit no nesting activity in 2021. Principal mainland wader colonies were made up of Yellow-crowned Night-Herons, which appear to be nesting in increasing numbers at mainland sites including continuing colonies in Far Rockaway and Rockaway Beach, in Queens, and Harmon Cove in the New Jersey Meadowlands. Green Herons were also noted nesting this year in low numbers at eight mainland sites, including six sites on Staten Island.

Island Accounts:

Hutchinson River/Long Island Sound:

Huckleberry Island (10 acres)

21 May 2021, 9:40am-11:15am

By the author (NYC Audubon); Mike Feller, Opal Feller (NYC Audubon volunteers); Shannon Curley (Freshkills Park Alliance)

No nesting wader or cormorant activity was noted on Huckleberry Island, a colony first surveyed in 1986 (see Table 2 and Figure 4). Breeding activity was most recently observed here in 2016, when very low numbers of recently active Black-crowned Night-Heron and Double-crested Cormorant nests were observed, but no adults were seen in the vicinity of these nests during the survey. This colony abandonment follows a trend of increasingly low numbers of nesting waders on Huckleberry Island, since a 20-year high of 140 nests observed in 2001, and a survey-period maximum of 311 pairs in 1990. Continuing a decline over the past 20 years, no Herring Gull or Great Black-backed Gull nests have been observed since 2014, though for the third survey in a row, a Great Black-backed Gull pair was observed flying low over the island during the survey. Three American Oystercatcher adults were observed on the island, suggesting the presence of several nesting pairs. One Spotted Sandpiper was sighted, possibly representing a nesting pair. Five Canada Goose nests were observed, but no young, and remains of eggs were found, indicating possible predation. Two adult Mallards were observed in the water nearby. One Great Egret was observed foraging nearby, three Double-crested Cormorants were seen perched on offshore rocks, and Common Tern was sighted offshore. Possible nesting land bird species observed on or near the island included an unidentified *Empidonax* flycatcher species, Fish Crow, Tree Swallow, Barn Swallow, American Robin, Gray Catbird, Carolina Wren, House Wren, European Starling, Yellow Warbler, Song Sparrow, Red-winged Blackbird, Common Grackle, Boat-tailed Grackle, and Northern Cardinal. Wintering species Atlantic Brant was observed foraging nearby.

The wader and cormorant colonies on Huckleberry Island may have been abandoned due to the presence of predators (rats and raccoons); human activity on the island during breeding season may also play a role. Raccoon prints were found during this year's survey, and as noted above, it appeared that some Canada Goose nests had suffered predation. During the 2018 survey, an adult raccoon was found living in one of the island's buildings, and island management has been working to seal off potential living spaces and trap and remove raccoons. NYC Audubon and NYCDPR will continue to work closely with Huckleberry Indians, Inc. to ensure necessary researcher access to this island, and to understand and address any potential factors contributing to the colony abandonment. Huckleberry Island has been a critical nesting site for both waders and cormorants in the New York City area.

Dauids Island (78 acres)

21 May 2021, 11:25am-11:45am

By the author (NYC Audubon); Mike Feller, Opal Feller (NYC Audubon volunteers); Shannon Curley (Freshkills Park Alliance)

No evidence of nesting waders was observed during a pass-by of Davids Island by boat; this Island was partially surveyed by foot for the first time in 2016; no nesting activity was found at that time.

This island seems to present a potential wader nesting habitat, although it was reported to the author in 2016 that raccoons trapped on the mainland are often moved to this island. This account may also explain the presence of raccoons on nearby Huckleberry Island. Other waterbird species observed on or near the island included foraging Great Egret and Double-crested Cormorant, along with wintering Atlantic Brant. Possible nesting land birds observed at a distance included Osprey (a nest was observed near the island), Barn Swallow, possible Rough-winged Swallow (observed at a substantial distance), Northern Mockingbird, European Starling, and Common Grackle.

Hart Island (131 acres)

21 May 2021, 9:20-9:30am; 12-12:30pm

By the author (NYC Audubon); Mike Feller, Opal Feller (NYC Audubon volunteers); Shannon Curley (Freshkills Park Alliance)

Hart Island, the management of which has recently been transferred from the New York City Department of Corrections to NYCDPR, was observed during a pass-by by boat. No evidence of nesting waders was observed. Many loafing and/or foraging Double-crested Cormorants were observed along the shoreline, as were Canada Geese and wintering Atlantic Brant. Several Osprey were observed, along with an active nest. Other possible nesting land birds observed at a distance included Barn Swallow and Bank Swallow; several nesting burrows were observed in low bluffs along the northeastern edge of the island.

Goose Island (1 acre)

21 May 2021, 1:15pm-2:02pm

By the author (NYC Audubon); Mike Feller, Opal Feller (NYC Audubon volunteers); Shannon Curley (Freshkills Park Alliance)

Goose Island, abandoned shortly before our 2013 survey was conducted, continued to exhibit no active nesting wader activity in 2021. As has been the case in recent years, however, several species of ground-nesting waterbirds were found on or near the island this year, three of which appeared to be nesting: fifteen active Canada Goose nests were found, most containing eggs, though one nest appeared to have been predated. A female American Black Duck flushed from undergrowth during the survey and a male was observed offshore; a nest of 17 eggs was found, likely belonging to this species. A pair of Great Black-backed Gulls flew low over the island, calling, during the survey, indicating possible nesting, though no nest was located. One Mallard was observed in the water nearby, and a Laughing Gull was seen in the area. Other possible nesting land bird species observed on or near the island in 2021 included Osprey (three nests were observed nearby), Barn Swallow, Common Grackle, and House Sparrow.

The presence of successfully reproducing ground-nesting birds on Goose Island is encouraging, though the evidence of predated Canada Goose eggs points to the vulnerability of Goose Island to access by both predators and human visitors, due to its proximity to the mainland. Additional signage was posted on the shoreline in 2015 in an effort to reduce unwanted visitation, and this signage needs to be repaired and replaced. Outreach efforts to the local community to raise awareness may be helpful in enabling a healthy wader colony to reestablish itself here.

East River:

North Brother Island (19 acres):

24 May 2021, 10:45am-12:30pm

By Mike Feller (NYC Audubon volunteer); Novem Auyeung, Georgina Cullman, Evan Jordan (NYCDPR)

North Brother Island has not exhibited signs of nesting wader activity since 2007, and no evidence of wader or cormorant nesting activity was observed in 2021. Black-crowned Night-Herons observed flying over the Island were thought to be birds from the South Brother Island colony. Gull-nesting has been observed on building roofs on the island in recent years, but no nesting was confirmed this year. Mallard was observed in the vicinity of the island. An active Osprey nest was observed; this species was also found nesting here, post-survey, in 2019. Other possible nesting and/or migrating land bird species observed included Black Vulture, Eastern Wood Pewee, American Crow, Fish Crow, American Robin, Wood Thrush, Gray Catbird, House Wren, Yellow Warbler, Song Sparrow, American Goldfinch, and Northern Cardinal. NYCDPR concluded habitat restoration activities on North Brother Island in 2016. Continued monitoring during full survey years will help determine the effectiveness of this restoration in improving the island's habitat for nesting waders.

South Brother Island (12 acres)

24 May 2021, 8:35am-1:08pm

By the author, Kaitlyn Parkins, Emilio Tobón (NYC Audubon); Mike Feller, Ellen Pehek (NYC Audubon volunteers); Shannon Curley, José R. Ramírez-Garofalo (Freshkills Park Alliance); Novem Auyeung, Georgina Cullman, Evan Jordan (NYCDPR)

The South Brother Island colony was the largest wader colony in the NY/NJ Harbor in 2021. A total of 392 nests of three wader species was observed on the island (in order of decreasing frequency, Black-crowned Night-Heron, Great Egret, and Snowy Egret; see Table 2). This total represents a population increase of 26% since 2019. Though this island's overall wader population has remained relatively stable over the past five years, a decline has been observed over the past 15 years, from a high of 592 pairs in 2007. The majority of this longer-term decline is attributable to a reduction in observed Black-crowned Night-Heron nesting pairs. Numbers of this species nearly doubled since 2019 however, to 222 pairs from a survey low of 113 pairs. At 81 pairs, Snowy Egret numbers decreased 27% since 2019. Great Egret numbers increased 11% since 2019 to 89 pairs. No Yellow-crowned Night-Heron pairs were found this year; this species has nested here in fluctuating small numbers for the past decade. For the 10th year, no evidence of Glossy Ibis nesting activity was observed; this species had maintained a small breeding population over the previous 10 years. Double-crested Cormorant nests decreased 15% compared to 2019, to 394 nests, a trend counter to growth on other islands in the harbor. Cormorant numbers had rebounded steadily on South Brother in the last five years, marking a break in a declining trend observed on this island over the previous 20 years. Waders on South Brother Island primarily nested in box elder, mulberry sp., black cherry, multiflora rose, and oriental bittersweet; cormorants nested primarily in black locust, mulberry, and box elder.

Gull counts on the island tallied a total of 13 Great Black-backed Gull nests. Other confirmed or possible nesting waterbird species observed included Canada Goose (6 nests) and American Oystercatcher (1 nest). Confirmed or possible nesting land bird species included Fish Crow (1 nest), American Crow, Barn Swallow, Tree Swallow, Carolina Wren, House Wren, Gray Catbird, Yellow Warbler, and Song Sparrow.

Note: Herring and Great Black-backed Gulls regularly nest on roof tops on neighboring Rikers Island. Because of its close proximity to a major New York City airport (LaGuardia), the population is being controlled via egg addling. USDA/Aphis/Wildlife Services biologists counted 220 Herring Gull nests and 0 Great Black-backed Gull nests on Rikers Island this year.

Mill Rock Island (3 acres)

24 May 2021, 1:40pm-2:40pm

By the author, Kaitlyn Parkins (NYC Audubon); Ellen Pehek (NYC Audubon volunteer); Shannon Curley (Freshkills Park Alliance)

This colony, first established in 2004, reached a maximum of 203 wader pairs in 2012 but declined rapidly starting in 2016. Three recently occupied Black-crowned Night-Heron nests and one Great Egret nest were found this year, but no adults were observed. Double-crested Cormorants begin nesting on Mill Rock Island in 2011; our 2021 count of 103 nests represents a 94% increase over the 2019 survey, and the highest count of this species observed during the survey period. A total of 19 Great Black-backed Gull pairs were estimated, consistent with our 2019 count. No Herring Gulls were observed, continuing a decline of this species on this island from modest numbers a decade ago. Other confirmed or possible nesting waterbird species observed included Canada Goose (10 nests), Mallard (4 nests), Gadwall (1 nest) and American Black Duck (1 possible nest). Two Spotted Sandpipers were observed, possibly indicating a nesting pair. Confirmed or possible nesting land bird species included Mourning Dove, Fish Crow (1 nest), American Crow (1 possible nest), Barn Swallow, European Starling, and Song Sparrow.

Norway Rats have been a continuing presence on this island; 17 burrows were counted this year. Though human disturbance was not evident during the survey of Mill Rock Island this year, man-made structures including benches and tables have been found in recent few years, and human visitation may be at least partially responsible for the decline of this wader colony. Future efforts to discourage disturbance should include increased signage on the island, particularly at the north harbor. Kayaking clubs known to visit Mill Rock Island and other Harbor Herons nesting islands should be contacted and educated about the importance of maintaining zero human disturbance during the critical nesting period.

U Thant (1/4 acre)

24 May 2021, 3:20pm-3:40pm

By the author, Kaitlyn Parkins (NYC Audubon); Ellen Pehek (NYC Audubon volunteer); Shannon Curley (Freshkills Park Alliance)

This island was surveyed closely by boat in 2021. A total of 46 Double-crested Cormorant nests was observed on the collapsed metal arch sculpture, in trees, and on the ground. This total represents a stable cormorant population since 2019. A total of 10 Great Black-backed Gull adults

was counted; this species has been found nesting here in the single digits in each of the last four surveys. Six Herring Gull adults were observed. (In past surveys, observations of adult Herring Gulls on U Thant Island have been included in this report. Recent on-island surveys have only found Great Black-backed Gull nests, however, and it is not clear whether past adult counts of Herring Gulls taken from the mainland represented nesting birds.) Canada Goose was observed near the island.

Upper New York Bay:

Governors Island (172 acres)

No Yellow-crowned Night-Heron nest was found on Governors Island in 2021, as reported by NYC Audubon volunteer Annie Barry. One or two pairs of this species had been observed nesting here since 2015.

The Common Tern colony on three piers along Governors Island's southeast end has fluctuated since first established in 2008, as has NYC Audubon's ability to observe it. (See below for an account of the colony and NYC Audubon's work to support it.). This year, though approximately 100 nesting pairs were observed in early June, the colony was abandoned in early July, prior to hatching. While no clues were found explaining the abandonment, possible causes include a nocturnal predator.

Colony History: Established in 2008 on three decommissioned piers on the southeast end of Governor's Island, extending into Buttermilk Channel, this colony was last officially surveyed in its entirety in 2013. In 2014, survey access was allowed to only one pier (Lima) due to structural instability of the other two piers. That year, the number of nesting pairs on Lima Pier was found to have increased by 200% over 2013; this increase may have been attributable to the addition of oyster shell nesting substrate to the pier by Elbin and Craig prior to the 2014 breeding season. In 2015, we were again only able to access Lima Pier, which hosted 24 nesting pairs, a slight decrease from 2014. No habitat enhancement was done in 2015 or 2016. Birds were observed nesting on the other two piers, Tango and Yankee, in 2014, 2015, and 2016, but we have not been able to get a reliable count due to lack of access. No terns nested on Lima in 2016. In 2017, the section of Yankee Pier used by nesting terns collapsed into Buttermilk Channel. In 2017 we enhanced the eastern end of Lima Pier by adding oyster shells, grasses, and gull excluders. A total of 35 successful nesting pairs were counted in 2017, 18 pairs in 2018, and 67 pairs in 2019. Plans were made to have NYS DEC Region 2 survey the remaining, inaccessible pier (Tango) by drone, but the flight was grounded and the count was cancelled. At the end of the nesting season, a webcam was also installed overlooking Tango Pier. Only portions of the pier are visible, so the webcam provides public outreach rather than survey information.

Note: Adult and nestling Herring and Great Black-backed Gulls have been observed on rooftops on Governors Island in recent years, but were not surveyed in 2021. A formal survey of this entire island would be worthwhile in the future.

Staten Island – Arthur Kill and Kill Van Kull:

Isle of Meadows (101 acres)

25 May 2021, 9:30am-11:36am

By the author (NYC Audubon); Ellen Pehek (NYC Audubon volunteer); Shannon Curley, José R. Ramírez-Garofalo (Freshkills Park Alliance)

This year no evidence of wader nesting activity was observed on Isle of Meadows, which has not been found to host breeding wading birds since 2001. No evidence of predators was noted on the island. Isle of Meadows contains habitat suitable for breeding wading birds and may be a good candidate for recolonization by colonial nesting birds in the future. Flyover Great and Snowy Egret were observed during the survey. Two Spotted Sandpipers may indicate one nesting pair. Other possible nesting waterbirds species observed on or near the island included Double-crested Cormorant and Mallard. Other possible nesting land bird species observed on or near the island included Mourning Dove, Red-tailed Hawk, Osprey, Downy Woodpecker, Northern Flicker, Eastern Kingbird, Willow Flycatcher, Warbling Vireo, Blue Jay, Barn Swallow, Tree Swallow, Black-capped Chickadee, Carolina Wren, House Wren, American Robin, Gray Catbird, Yellow Warbler, Common Yellowthroat, American Redstart, Northern Cardinal, Eastern Towhee, Song Sparrow, American Goldfinch, Northern Cardinal, Baltimore Oriole, Common Grackle, and Red-winged Blackbird.

Prall's Island (88 acres)

25 May 2021, 9:00am-9:15am; 12:05-1:45pm-

By the author (NYC Audubon); Ellen Pehek (NYC Audubon volunteer); Shannon Curley, José R. Ramírez-Garofalo (Freshkills Park Alliance)

No evidence of wader nesting activity was observed on Prall's Island in 2021; this island, continuously active from 1985 to 1997, last hosted a small number of Black-Crowned Night-Herons in 2005. Great and Snowy Egret were observed foraging nearby. Double-crested Cormorant and Herring and Great Black-backed Gull were observed, but no nesting activity was noted. Other possibly nesting waterbird species included Willet and Clapper Rail. Other confirmed or possible nesting land bird species observed on or near the island included Mourning Dove, Osprey, Red-tailed Hawk, Northern Flicker, Eastern Kingbird, Great Crested Flycatcher, Willow Flycatcher, Warbling Vireo, Crow sp. (1 nest), Blue Jay, Barn Swallow, Carolina Wren, House Wren, Marsh Wren (1 nest, many pairs), American Robin, Gray Catbird, European Starling, Cedar Waxwing, Yellow Warbler, Common Yellowthroat, American Redstart, Song Sparrow, Northern Cardinal, American Goldfinch, Baltimore Oriole, Brown-headed Cowbird, Common Grackle, and Red-winged Blackbird. White-tailed Deer (both adult and faun) and Red Fox were also observed.

See the 2019 Nesting Survey Report appendix for the Harbor Herons project for a more detailed ecological assessment of Prall's Island.

Shooters Island (48 acres)

25 May 2021, 2:50pm-4:00pm

By the author (NYC Audubon); Ellen Pehek (NYC Audubon volunteer); Shannon Curley, José R. Ramírez-Garofalo (Freshkills Park Alliance)

No evidence of wader nesting activity was observed on Shooters Island in 2021. With the exception of 2011, 2014, 2017, and 2020, this island has been surveyed every year since 1985; no wader nesting has been noted since 1999. No Double-crested Cormorant nesting activity was observed in 2021 or 2019; prior to these surveys, cormorants had nested here since 1987. This cormorant colony has exhibited a continuous decline over the past 20 years; the wooden structures upon which the birds have nested continue to collapse, offering fewer nesting sites than in the past. No Double-crested Cormorants were observed during this year's survey. One Canada Goose nest was observed. Three Killdeer were observed, one performing a "broken wing" distraction display, indicating possible nesting. Great Black-backed Gull and Gadwall were observed on or near the island, but no evidence of nesting was observed. Confirmed or possible nesting land bird species observed on or near the island included Turkey Vulture (fly-over), Red-tailed Hawk, Osprey (2 nests), Eastern Kingbird, Barn Swallow, Tree Swallow, Rough-winged Swallow, Blue Jay, House Wren, American Robin, Gray Catbird, Common Yellowthroat, Yellow Warbler, Song Sparrow, and Red-winged Blackbird.

Lower New York Harbor:

Hoffman Island (10 acres)

17 May 2021, 11:35am-1:55pm; 19 May 2021, 7:47am-11:25am

By the author, Kaitlyn Parkins, Emilio Tobón (NYC Audubon); Ellen Pehek (NYC Audubon volunteer); Don Riepe (American Littoral Society); Shannon Curley, José R. Ramírez-Garofalo (Freshkills Park Alliance); Carla García (NYCDPR)

Hoffman Island, where nesting waders were first detected in 1998, was the second-largest wader colony in the harbor in 2021 (surpassed by South Brother); this marks the first survey since 2009 that Hoffman has not been the largest colony in the harbor. Hoffman was the most diverse colony this year, hosting six wader species. A total of 372 nests was observed (in order of decreasing frequency, Great Egret, Black-crowned Night-Heron, Snowy Egret, Glossy Ibis, Little Blue Heron, and Great Blue Heron; see Table 2). This total represents a 15% decrease since 2019, is the lowest count recorded here since 2000, and seems to indicate a decline over the past three years. Wader numbers had fluctuated but remained relatively stable since the population reached an all-time high of 824 pairs in 2011. Great Egret numbers increased 26% since 2019, to 157 pairs, while Snowy Egret numbers fell just 4%, to 68 pairs (a total consistent with fluctuating counts over the past decade). Black-crowned Night-Heron numbers declined 37% to 129 pairs, while Glossy Ibis declined 66% since 2019, to 10 nests, the lowest count observed since 1999. The population of this latter species on Hoffman, while fluctuating widely, appears to have suffered a decline over the past decade, since a high of 115 nests recorded in 2011. Several dead adult Glossy Ibis were found during the survey, but the cause of death was unclear. Six pairs of Little Blue Heron were estimated in 2021; this species has nested in low numbers over the past 20 years. Two adult Great Blue Heron were observed on the colony, possibly indicating two breeding pairs—the first time this species has been observed breeding on this island, and one of the only records of island nesting in the history of this study. Neither Yellow-crowned Night-Heron, which has bred here in very low numbers, nor Cattle Egret, which was observed during the 2019 survey after an absence of 15 years, was observed in 2021. Waders primarily nested in mulberry sp., multiflora rose, box elder,

black locust, hackberry, oriental bittersweet, wild grape and/or porcelain-berry, and on the ground (Glossy Ibis).

A total of 1,407 Double-crested Cormorant nests was observed on Hoffman Island in 2021, a 25% increase over 2019, marking the highest cormorant population noted here and a continuing population increase since this island's cormorant colony first became established in 2002. Several former egret nesting areas at the southern end of the island appear to have converted to cormorant nesting since the 2019 survey.

Totals of 63 Herring and 71 Great Black-backed Gull nests were counted during the survey. Nesting populations of both species are substantially below the peaks they achieved in past decades. Other confirmed or probable nesting waterbirds included American Oystercatcher (7 adults), Spotted Sandpiper, and Canada Goose (4 nests); likely migrant or wintering Atlantic Brant and Ruddy Turnstone were also observed. Confirmed or possible nesting land bird species observed included Tree Swallow, Fish Crow (3 nests), Common Raven, Blue Jay, Common Yellowthroat, and Red-winged Blackbird.

Swinburne Island (4 acres)

17 May 2021, 9:42am-11:25am

By the author, Kaitlyn Parkins, Emilio Tobón (NYC Audubon); Don Riepe (American Littoral Society); Shannon Curley, José R. Ramírez-Garofalo (Freshkills Park Alliance); Carla García (NYCDPR)

No waders were found nesting on Swinburne Island in 2021. (While primarily a cormorant and gull colony, the island hosted one Black-crowned Night-Heron pair in 2016, as well as in the period of 2006-2011.) A total of 530 Double-crested Cormorant nests was observed this year, an increase of 22% over 2019 and the highest count recorded since this colony was first surveyed in 1998. Swinburne Island's cormorant populations has increased despite significant transformation of the habitat in 2012 by Hurricane Sandy, which removed topsoil and completely or partially felled all the standing buildings. Nests in 2021 were located on the remains of buildings, on the ground, and in several hackberry and black locust trees, though these trees have deteriorated in recent years. Totals of 79 Herring Gull and 62 Great Black-backed Gull nests were consistent with fluctuating numbers in recent years, but below peaks of 222 and 150 nests, respectively, observed in the late 1990s. No other nesting waterbirds were observed in 2021. Other possible nesting land bird species observed included Red-winged Blackbird.

Jamaica Bay:

Elders Point East Marsh Island (40 acres)

26 May 2021, 10:53am-11:23am

By the author (NYC Audubon); Don Riepe (American Littoral Society); Shannon Curley, José R. Ramírez-Garofalo (Freshkills Park Alliance); Georgina Cullman (NYCDPR); Ritamary McMahan (Wild Bird Fund)

Restoration of Elders Point East Marsh Island was begun eleven years ago as part of a marsh restoration project undertaken in Jamaica Bay by the U.S. Army Corps of Engineers (USACE). During the intervening decade, a wader and cormorant colony was established on this low-lying island, becoming one of the most diverse in the harbor, with up to five wader species. Over the last six years this colony declined and was abandoned by both waders and cormorants, but a resurgent population of nesting waders was found again this year. Though no nesting waders were observed in 2019, in 2021, 121 wader pairs of four species were estimated, making this island the fourth largest colony in the harbor. As in the most recent years, waders were found nesting in Phragmites and a broad expanse of high-tide bush on the southern part of the island, at a height of two feet or less. These species included, in order of decreasing abundance, Snowy Egret (52 pairs), Black-crowned Night-Heron (45 pairs), Glossy Ibis (21 pairs), and Great Egret (3 pairs). A decline in Great Egret on this island is notable. Neither Little Blue Heron nor Tricolored Heron, which have nested here in very low numbers, were observed in 2021. No nesting cormorants were found; they were also absent in 2019. At the northern end of the island, a small grove of dying trees upon which the cormorants nested has deteriorated considerably. Interestingly, the birds have not continued to nest on the ground here, as they have on other islands such as Swinburne and nearby Elders Point West Marsh Islands.

This colony continues to seem particularly vulnerable to disturbance by recreational boating activity in Jamaica Bay, as well as to storms and sea-level rise. (This vulnerability to flooding was evidenced during both the 2017 and 2018 surveys, when several dead Great Egret chicks were found, apparently drowned during recent high tides.)

Despite the recent fluctuations in breeding waders and cormorants on the island, counts of Herring Gull adults (194) and Great Black-backed Gull adults (23) in 2021 seem to indicate a stable population over the past decade. It is not clear what proportion of these birds are nesting, however. A total of 15 American Oystercatcher adults was observed on the island, indicating a continuing breeding presence of this species. Laughing Gull was observed foraging in the area; this species is known to nest in nearby Joco Marsh. Wintering species Atlantic Brant was also observed. Possible nesting land bird species observed included Common Grackle and Red-winged Blackbird.

Elders Point West Marsh Island (40 acres)

26 May 2021, 9:45am-10:26am

By the author (NYC Audubon); Don Riepe (American Littoral Society); Shannon Curley, José R. Ramírez-Garofalo (Freshkills Park Alliance); Georgina Cullman (NYCDPR); Ritamary McMahon (Wild Bird Fund)

Elders Point West Marsh Island, like its eastern counterpart, was restored as part of a marsh restoration project undertaken in Jamaica Bay by USACE. This colony has expanded since several Snowy Egret nests were observed here in 2016, but declined since 2019. (Low numbers of Great and Snowy Egret nests were also observed here from 2007 to 2009.) In 2021, 63 wader nests were estimated to be present on the island, approximately half of the 2019 total. These species included, in order of decreasing abundance, Snowy Egret (32 pairs), Great Egret (25 pairs), Black-crowned Night-Heron (5 pairs), and Little Blue Heron (1 pair). Notable since 2019 are sharp declines in Snowy Egret and Black-crowned Night-Heron (from 63 and 26 pairs, respectively).

In contrast to the wader colony, the island's Double-crested Cormorant colony has continued to expand, from 290 nests in 2019 to 428 nests in 2021, a 48% increase. (A few cormorants also nested here from 2007 to 2009.) Waders on this island nested in high-tide bush, while cormorants nested primarily on the ground. This island appears to be slightly higher in elevation than Elders Point East Marsh Island, so may afford more protection from high tides.

Totals of 98 Herring Gulls and 9 Great Black-backed Gulls were observed in 2021, indicating a 60% decline in Herring Gull numbers but a small but stable Great Black-backed Gull population since 2019. Three adult American Oystercatcher were observed, likely representing several nesting pairs. Gadwall was observed near the island. One occupied Osprey nest was observed.

Subway Island (40 acres)

26 May 2021, 7:33am-9:15am

By the author (NYC Audubon); Don Riepe (American Littoral Society); Shannon Curley, José R. Ramírez-Garofalo (Freshkills Park Alliance); Georgina Cullman (NYCDPR); Ritamary McMahon (Wild Bird Fund)

The Subway Island colony was the third-largest nesting colony in NY/NJ Harbor in 2021. This year was the 12th year in the history of these nesting surveys in which a large group of waders was found nesting on this island. A total of 197 wader nests was observed, representing five species of waders (in order of decreasing frequency, Great Egret, Black-crowned Night-Heron, Glossy Ibis, Snowy Egret, and Green Heron). This total represents a 35% decline since 2019. The total wader population on this island has fluctuated over the past decade, but is considerably below a peak of 373 pairs estimated in 2013. The count of Great Egrets was stable compared to 2019 at 92 pairs, while counts of Black-crowned Night-Heron and Snowy Egret decreased 13% and 80%, to 91 and 5 pairs, respectively. Glossy Ibis pairs declined by 93% since 2019 to 6 pairs, a low count for this species and consistent with low counts this year on other nesting islands. Three pairs of Green Heron were estimated to be nesting here in 2021; this species has been observed here only once before. Little Blue Heron and Yellow-crowned Night-Heron, recorded in small numbers in the past, were not observed in 2021. Great and Snowy Egrets nested primarily in Multiflora Rose and other low shrubs, while Black-crowned Night-Herons nested in somewhat taller shrubs and trees.

A total of 633 Herring Gull adults was observed, an increase over the 2019 count of 491 adults, and the highest count for this species on this island. A total of 42 Great Black-backed Gull adults was observed, indicating a stable population compared to recent years. Laughing Gull was observed near the island; this species is known to nest in nearby Joco Marsh. A total of 63 American Oystercatcher adults was observed, the highest count yet observed on this island; it was not clear how many of these birds were nesting on the island. A total of 9 Willet adults was observed, likely representing a number of nesting pairs. Other confirmed or possible nesting waterbirds observed included Canada Goose (27 adults), Mallard (5 flushed adults indicating 5 possible nests), Gadwall (1 nest), and American Black Duck (1 nest, 4 adults). Double-crested Cormorant, Laughing Gull, Common Tern, and Black Skimmer, which all are known to nest elsewhere in Jamaica Bay or in the Rockaways, were observed foraging off-shore, but no evidence of nesting by these species was observed on the island. Wintering and/or migrant waterbird species observed included Atlantic Brant, Ruddy Turnstone, Semipalmated Sandpiper, Least Sandpiper, and Short-billed Dowitcher. Possible nesting land bird species observed on or near the island

included Willow Flycatcher, Fish Crow, Barn Swallow, Tree Swallow, Gray Catbird, Yellow Warbler, Common Yellowthroat, Song Sparrow, Field Sparrow, Boat-tailed Grackle, and Red-winged Blackbird.

Little Egg Marsh Island (acreage unknown)

27 May 2021, 8:350am-9:40am

By the author, Kellye Rosenheim (NYC Audubon); Don Riepe (American Littoral Society); Shannon Curley, José R. Ramírez-Garofalo (Freshkills Park Alliance); Nooa Kuusisto (Wild Bird Fund)

The number of nesting waders observed in this small colony, first detected in 2013, has fluctuated, reaching a peak of 59 estimated nests in 2017 before declining for several years. In 2021, 46 pairs of three wader species were estimated to be nesting here, including Black-crowned Night-Heron (42 pairs), which has been the primary nesting wader species here, Great Egret (3 pairs), and Yellow-crowned Night-Heron (1 pair). Double-crested Cormorant was observed near the island but has not yet been observed nesting here. A total of 169 Herring Gull pairs was estimated, marking a decline from 352 pairs in 2019 and a low point for this species since 2013. A total of 233 Great Black-backed Gull pairs was estimated, an increase from 146 pairs in 2019; the number of this species has fluctuated over time. Laughing Gull was observed near the island; this species is known to nest in nearby Joco Marsh. A Common Tern colony has been observed on the island in recent years; 85 pairs were estimated in 2021, an increase over 30 pairs in 2019. Four Least Tern pairs were estimated in 2021; this species has not been found nesting here during previous surveys.

A total of 75 American Oystercatchers was observed, the highest total recorded for this island; it was not clear how many of these birds were nesting on the island. Other confirmed or possible nesting waterbirds observed included Willet (43 adults), Canada Goose (10 adults), Mallard (3 adults), and Gadwall (3 nests), and Clapper Rail. Confirmed or possible nesting land bird species observed included Osprey (1 nest in tree), Tree Swallow, Crow sp., Yellow Warbler, Song Sparrow, Red-winged Blackbird, Common Grackle, Boat-tailed Grackle, and House Sparrow. Wintering and/or migrant species observed included Atlantic Brant, Ruddy Turnstone, Semipalmated Plover, Dunlin, Semipalmated Sandpiper, Short-billed Dowitcher, and Rose-breasted Grosbeak.

Recreational boaters have been observed walking on the island during the Jamaica Bay surveys; increased signage and increased Park Service presence would be helpful to prevent disturbance of nesting colonies during the breeding season. Research being conducted by multiple organizations should also be coordinated to minimize human visitation to the island.

Canarsie Pol (220 acres)

2 June 2021, 2:00-2:30pm

By Don Riepe (American Littoral Society)

No nesting wader activity was evident on Canarsie Pol in 2021 during observation by boat. The wader population on this once productive nesting island collapsed to very low levels in 2012, and no breeding has been observed since that time. It is unclear why these declines occurred, but the

presence of mammals on the island, including raccoons, may have been a primary cause, as has occurred on other nesting islands in the harbor. From 2003 to 2010, this island was one of the largest and most diverse heron colonies within the New York Harbor system. No other observations of Canarsie Pol were recorded this year.

Ruffle Bar (143 acres)

27 May 2021, 9:50am-10:30am

By the author, Kellye Rosenheim (NYC Audubon); Don Riepe (American Littoral Society); Shannon Curley, José R. Ramírez-Garofalo (Freshkills Park Alliance); Nooa Kuusisto (Wild Bird Fund)

Ruffle bar is the second largest uninhabited island in Jamaica Bay, and has not been found to host nesting waders in the time period of this project. It was last surveyed in 2019. A partial survey by foot revealed no evidence of wader or Double-crested Cormorant nesting, though a large group of immature cormorants was observed resting and foraging along the shoreline. Gulls may be nesting on the island: one Herring Gull and two Great Black-backed Gulls were observed on the island during our partial survey. Other possible nesting waterbird species included Canada Goose (3 adults), Mallard (1 adult), and Spotted Sandpiper (1 adult). Laughing Gull and Forster's/Common Tern were observed foraging in the area, but are not believed to nest here.

Raccoon tracks were found; a Raccoon was also observed foraging on the shoreline during the 2019 survey.

Confirmed or possible nesting land bird species observed included Osprey (3 nests), Barn Owl (observed at nest box), Red-tailed Hawk, Mourning Dove, Willow Flycatcher, Tree Swallow, Rough-winged Swallow, House Wren, Yellow Warbler, Common Yellowthroat, Song Sparrow, Eastern Towhee, and Red-winged Blackbird. Wintering and/or migrant species observed included Atlantic Brant and Semipalmated Sandpiper.

Other Jamaica Bay islands

No evidence of nesting waders has been noted by Jamaica Bay Guardian Don Riepe on other islands in Jamaica Bay, such as White Island, which have not been known to host nesting waders in the time period of this project. Joco Marsh, an extensive, tidally flooded saltmarsh adjacent to the runways of John F. Kennedy International Airport, hosts a large waterbird colony that in recent years has included Laughing Gull, Common Tern, and Forster's Tern, but this colony is not known to have included breeding waders or cormorants, and has not traditionally been surveyed as part of this study. Joco Marsh is surveyed periodically by a collaborative group of agencies and organizations including NPS, NYCDPR, the American Littoral Society, the Port Authority of New York & New Jersey, USDA/APHIS, and NYC Audubon.

Mainland and Aid to Navigation (ATON)/Other Man-Made Structure Accounts:

New York City Audubon's Harbor Herons Project has traditionally reported nesting activity on island colonies only. Three species of waders are known to have nested in recent years in mainland areas: Yellow-crowned Night-Heron, Great Blue Heron, and Green Heron. These mainland colonies are included here to the extent they are known, but are not included in report island totals or in accompanying figures, unless noted. Several mainland colonies of non-wader waterbirds are also noted below, though they are not surveyed as part of the Harbor Herons Project. Double-crested Cormorants are known to nest on aids to navigation (ATONs) in the harbor, but our ATON survey is not comprehensive. As mainland and ATON nesting has not been consistently or comprehensively surveyed for the duration of the Harbor Herons Nesting Survey, valid comparisons between years cannot be made if these colonies are included in year-to-year analyses.

Mainland New York Accounts:

Redfern Houses, Far Rockaway

20 May 2021, 8:45am-10:25am

By the author (NYC Audubon); Shannon Curley (Freshkills Park Alliance)

A total of 23 Yellow-crowned Night-Heron nests was observed (Table 2), a sharp decline from the 61 nests found in 2019, and the lowest count recorded here since 2011 (following reported predation by Red-tailed Hawks). It is not clear what caused this recent decline, though some construction and tree removal was conducted in 2018 and 2019. NYC Audubon was given the opportunity by NYC Parks to review those plans; it appeared that the affected area and trees were not part of the principal nesting colony. This remarkable colony, located among the buildings of a New York City Housing Authority community, was first detected in 2006. Nests are located primarily in tall interior willow oak and honey locust trees, close to the community buildings.

Other waterbird species observed as fly-overs during the survey but not believed to nest on the Redfern grounds included Great Egret, Laughing Gull, and Glossy Ibis. Other possible nesting land bird species observed included Rock Pigeon, Chimney Swift, Warbling Vireo, Blue Jay, American Robin, Cedar Waxwing, European Starling, House Finch, Northern Cardinal, and House Sparrow.

Local residents and workers have proven to be a good source of information on the behavior and location of these local, distinctly urban colonies. During the 2018 Redfern Houses survey, maintenance workers alerted the survey team to another nearby nesting colony, in the Hammel Houses community in Rockaway Beach, summarized below.

Hammel Houses, Rockaway Beach

20 May 2021, 11:00am-11:50am

By the author (NYC Audubon); Shannon Curley (Freshkills Park Alliance)

A total of 42 Yellow-crowned Night-Heron nests was observed in this colony in New York City House Authority's Hammel Houses community; 35 nests were found when the colony was first

discovered in 2018. Nests were located primarily in Willow Oak trees, also the preferred nesting tree species in the nearby Redfern Houses colony. Almost all nests were concentrated directly over community pathways, which likely causes conflict with residents; several individuals complained about the birds' droppings and smell during the survey, though others expressed interest and support. Other waterbird species observed during the survey but not believed to nest on the Hammel Houses grounds included Herring Gull and Double-crested Cormorant. Other possible nesting land bird species observed included Chimney Swift, Red-bellied Woodpecker, Barn Swallow, European Starling, and House Finch.

Other Mainland New York City Yellow-crowned Night-Heron Colonies

Several other mainland Yellow-crowned Night-Heron Colonies were reported in New York City in 2021: Brookville Park, Queens (12 pairs estimated from eBird accounts); Lindenwood, Queens (4 pairs); and Great Kills, Staten Island (2 pairs) are all continuing colonies. No reports were received in 2021 about several other small colonies observed in recent years at New York City sites, including Bushwick Housing Project, Brooklyn; Sheepshead Bay, Brooklyn; and Throggs Neck, Bronx.

Mainland Green Heron Nesting Sites

Green Heron pairs were reported nesting at eight different New York City sites in 2021: Prospect Park, Brooklyn; Bronx Zoo, Bronx; and six sites on Staten Island: Clove Lakes Park, Freshkills Park, the Great Kills neighborhood, the Huguenot neighborhood, Mount Loretto Unique Area, and River Road Marshes. We are grateful to José R. Ramírez Garofalo for reports from Staten Island. We hope to continue a more regular tally of Green Herons in New York City.

Mainland Great Blue Heron Nesting Sites

A pair of Great Blue Herons nested for a six consecutive year in Staten Island's Clove Lakes Park, from 2013 to 2018, but nesting was not confirmed at this site in 2019 or 2021.

Other Mainland New York Non-Wader Waterbird Colonies

Several mainland waterbird colonies within the NJ/NJ harbor are not surveyed by NYC Audubon as part of the Harbor Herons project:

Beach Colonies: Colonies of several non-wader waterbird species including Common Tern, Least Tern, Black Skimmer, American Oystercatcher, and Piping Plover are known to exist, or to have recently existed, on New York City beaches including those on the Rockaway Peninsula. While NYC Audubon conducts research on nesting American Oystercatchers at some of these sites, these waterbird colonies are monitored primarily by NYCDPR.

Rooftop Colonies: Herring and Great-blacked Gulls are known to nest on mainland rooftops in New York City, but these colonies are not regularly surveyed by NYC Audubon. (For detail on the Rikers Island gull colony, see the account of South Brother Island.)

Mainland New Jersey Accounts:

Hugh Carola of Hackensack Riverkeeper and Nellie Tsipoura of New Jersey Audubon have regularly presented information on nesting activity of Yellow-crowned Night-Herons in the Meadowlands and northern New Jersey at Harbor Estuary Program Harbor Herons Subcommittee meetings. Known nesting sites for this species have included Laurel Hill County Park, Schmidt's Woods Park, and Harmon Cove in Secaucus. Details on the Harmon Cove colony are reported below. Three Yellow-crowned Night-Heron nests were also reported this year from Bayonne, NJ. A more methodical survey of local New Jersey colonies is being considered for future surveys.

Harmon Cove, Secaucus

1 June 2021

By Ray Duffy (Hackensack Riverkeeper)

A total of 21 active nests were found at Harmon Cove, a 30% increase over recent survey counts.

Aids to Navigation (ATONs) and Other Man-Made Structures:

Newark Bay and the Kill Van Kull

15 May 2021, 12:30pm-1:30pm

By Hugh Carola (Hackensack Riverkeeper)

A total of 41 nesting pairs of Double-crested Cormorants were observed on aids to navigation in Newark Bay and in the Kill Van Kull adjacent to the Bayonne Bridge. This total is a decline from 50 nests observed at these sites in 2019 (and a decline from a reported 43 pairs observed in 2020, when NYC Audubon did not conduct this survey). No nests were observed on wooden structures off of Shooters Island (3 pairs were observed there in 2020). This colony declined over the past decade, likely due to deterioration of the nesting structures. Great Black-backed Gull nests were observed: 2 on the bridge support of former NY Central RR Bridge and 2 on ATONs, during the survey. An Osprey nest was also found on an ATON.

Survey Details:

1. Concrete bridge supports of former NY Central RR Bridge
 - 1 pr, GBBG Jersey City side (40.718491 / -74.103084)
 - 1 pr, GBBG Kearny side (40.719054 / -74.105493)
2. ATON #9 - 10 pr. DCCO
3. ATON #5 - 5 pr. DCCO
4. ATON NB - 1 pr. OSPR*
5. ATON #22 - 11 pr. DCCO and 1 pr. GBBG
6. ATON #19 - 5 pr. DCCO
7. ATON #15 - 4 pr. DCCO
8. ATON BB - 6 pr. DCCO and 1 pr. GBBG
9. Shooters Island - 0

*Site showed evidence of 2-3 DCCO nest attempts.

Species Accounts:

The species trends discussed below are based primarily on comparisons of nesting numbers between surveys conducted in 2021 and 2019, though longer-term comparisons are made when considered relevant.

Black-crowned Night-Heron (537 pairs): Breeding Black-crowned Night-Herons were observed on seven islands in 2021 (in order of decreasing colony size, South Brother, Hoffman, Subway, Elders Point East Marsh, Little Egg Marsh, Elders Point West Marsh, and Mill Rock Islands; see Table 2) and were the numerically dominant species harbor-wide and on South Brother Island. Total observed island nesting activity increased 15% compared to 2019. This recent increase is in the context of a longer-term decline evident in our data over the past 25 years, from a survey-period high of 1,343 pairs in 1993 to 537 pairs in 2021. (See figure 5.)

Yellow-crowned Night-Heron (108 total pairs comprising 1 pair on islands; 83 New York City mainland pairs; 21 Secaucus, NJ, pairs, and 3 Bayonne, NJ pairs): Yellow-crowned Night-Heron was observed on just one island this year: Little Egg Island (1 pair). Numbers of island-nesting Yellow-crowned Night-Herons have increased and declined several times over the past 30 years. As island populations of this species have decreased over the past decade, numbers have increased at mainland colonies in both New York City and New Jersey, resulting in a possible slow increase in the total surveyed nesting population. (See figure 6.) The largest colony in the survey area in 2021 was the mainland colony at Hammel Houses in the Rockaways (42 nests), which remained stable since 2019. The older, nearby colony at Redfern Houses declined sharply this year compared to 2019, from 61 to 23 nests. The colony located in the Harmon Cove housing development near Secaucus, NJ, increased from 15 to 21 pairs. Additional small colonies have been reported and not consistently surveyed in recent years in Brooklyn, the Bronx, and Queens. This year, these locations included Brookville Park, Queens (12 pairs estimated from eBird accounts); Lindenwood, Queens (4 pairs); and Great Kills, Staten Island (2 pairs), all continuing colonies. No reports were received in 2021 about several other small colonies observed in recent years, including Bushwick Housing Project, Brooklyn; Sheepshead Bay, Brooklyn; and Throggs Neck, Bronx. Yellow-crowned Night-Herons did not nest in 2019 or 2021 on Governors Island, where one or two pairs had nested for the previous five years. See the description of these colonies as well as the New York City mainland colonies above in the mainland accounts section.

Great Egret (370 pairs): Great Egrets were observed on seven islands in NY/NJ Harbor this year (in order of decreasing colony size, Hoffman, Subway, South Brother, Elders Point West Marsh, Elders Point East, Little Egg, and Mill Rock Islands; see Table 2). This species' measured population increased 15% compared to 2019, countering a slight decline over the past decade. This decline however is in the context of a longer-term increase in population over the entire survey period (see Figure 7). Over the past 35 years, Great Egrets have shifted their breeding locations around the harbor, and their current distribution on seven islands represents a concentration on four primary islands (Hoffman, Subway, South Brother, Elders Point West Marsh), with very low activity on two islands that have been considerably more productive in the past: Elders Point East Marsh and Mill Rock Islands—as well as on Little Egg Island. No nesting activity was observed this year on the previously productive Huckleberry or Goose Islands. The Great Egret population

rebounded since 2019 on Hoffman Island, but remained stable compared to 2019 on Subway, South Brother, and Elders Point West Marsh Islands.

Snowy Egret (238 pairs): Snowy Egrets nested on five islands in NY/NJ Harbor in 2021 (in order of decreasing colony size, South Brother, Hoffman, Elders Point East Marsh, Elders Point West Marsh, and Subway Islands; see Table 2). This year's count of 238 pairs represents a 12% decrease from the 2019 count of 270 pairs. Despite year-to-year fluctuations, the population of this species has remained fairly stable over the history of this survey. (See Figure 8.) The Snowy Egret, like the Great Egret, has continued to move its centers of nesting activity throughout the harbor, and has recently abandoned several nesting islands: formerly productive colonies (Huckleberry, Goose, and Mill Rock Islands) remained inactive in 2021. The pair count on South Brother Island decreased 27% since 2019, while the Hoffman Island population declined just very slightly during the same period. In Jamaica Bay, Snowy Egrets continue to shift their concentrations, declining on Subway and Elders Point West Marsh Islands since 2019, while the Elders Point East Marsh Island colony, abandoned in 2019, rebounded to an estimated 52 pairs in 2021. No Snowy Egret pairs were observed on Little Egg Marsh Island in 2019.

Little Blue Heron (7 pairs): Little Blue Herons were observed on Hoffman and Elders Point West Marsh Islands in 2021, a repeat of their distribution in 2019, and a slight increase in numbers. The small Jamaica Bay population appears to have shifted from Subway Island to the Elders Point complex since 2014. This species approaches the northern extent of its range in the NY/NJ Harbor area, and it maintains a consistent, low-level presence in the NY/NJ Harbor breeding community.

Cattle Egret (0 pairs): While one breeding-plumaged Cattle Egret was observed during the 2019 survey of Hoffman Island, the species was not found this year during the survey. Its appearance in 2019 was the first time this species had been observed during the nesting survey since 2010, when one pair was estimated on Canarsie Pol. (Cattle Egrets previously bred in low numbers on Hoffman Island from 2001 to 2005.) The harbor-wide breeding Cattle Egret population declined to 0 in 2011 from a high of 266 nests on two islands (Prall's and Shooters islands) in 1985. A possible cause of this decline was closure of local landfills that were a foraging source.

Tricolored Heron (0 pairs): No Tricolored Herons were observed this year during the Jamaica Bay surveys; this species has been consistently found in the Bay in very low numbers in recent years. This is a species more typical of southern colonies, and no increasing trends in NY Harbor have been observed since the first nesting recorded here during this study period, in 1999. The first record of Tricolored Herons nesting in NY/NJ Harbor occurred in 1955 on Ruler's Bar Hassock in Jamaica Bay. Nesting for this species has also been observed in colonies in Long Island's Great South Bay (McGowan and Corwin 2008).

Green Heron (11 total pairs comprising 3 pairs on Subway Island and 8 New York City mainland pairs): Green Heron pairs were observed on the island colonies for the first time since 2010: three pairs were estimated on Subway Island in Jamaica Bay. On the mainland, eight additional pairs were reported, between three boroughs, one pair at each site: Prospect Park, Brooklyn; Bronx Zoo, Bronx; and six sites on Staten Island: Clove Lakes Park, Freshkills Park, the Great Kills neighborhood, the Huguenot neighborhood, Mount Loretto Unique Area, and River Road Marshes. We are grateful to José R. Ramírez Garofalo for reports from Staten Island, and hope to continue

a more regular tally of Green Herons in New York City. An effort to assess the population in NY/NJ Harbor would be a worthwhile endeavor.

Great Blue Heron (2 pairs): Two Great Blue Heron adults were observed on Hoffman Island this year, possibly representing two pairs. This is only the third confirmed nesting of this species on the islands during the entire period of the survey; one pair was found nesting on Goose Island in 2011 and 2012. (It is also possible that a Great Blue Heron pair nested on South Brother Island in 2019, post-survey; a photo of a bird was captured on a “camera trap” on the island in July 2019.) A Great Blue Heron pair nested for a six consecutive year in Staten Island’s Clove Lakes Park, from 2013 to 2018, but nesting was not confirmed at this site in 2019 or 2021.

Glossy Ibis (37 pairs): Glossy Ibis nests were found in low numbers on three islands in 2018 (in order of decreasing colony size, Elders Point East Marsh, Hoffman, and Subway Islands). The total of 37 nests represents a 67% decrease since 2019, due to observed declines on both Hoffman and Subway Islands. The population of this species has remained fairly consistent over the past decade despite some sharp fluctuations, but this year’s total is the lowest record since the first years of the study. In the past seven years this species has nested exclusively on Hoffman, Subway, Elders Point East Marsh, and Elders Point West Marsh Islands, though it could historically be found nesting on other islands in Jamaica Bay, as well as on South Brother and Goose Islands in small numbers. (See Figure 9.)

Double-crested Cormorant (2,908 pairs): Double-crested Cormorant nests were observed on six of eighteen islands surveyed for cormorant nesting activity in 2021 (in order of decreasing colony size, Hoffman, Swinburne, Elders Point West Marsh, South Brother, Mill Rock, and U Thant Islands; see Table 2). This year’s count represents a 20% increase since 2019, continuing an increasing trend across the harbor exhibited since 2005. This increase has continued despite recent abandonment of longtime colonies Huckleberry and Shooters Islands. The decline and desertion of Elders Point East Marsh Island since 2016 was accompanied by rapid growth on Elders Point West Marsh Island, which currently hosts 428 pairs, while the colony on Hoffman Island grew by 25% since 2019, to 1,407 pairs. An additional 41 cormorant nests were observed on aids to navigation in Newark Bay and the Kill Van Kull in 2021. Other aids to navigation and man-made structures off the coast of Staten Island, which have hosted nesting colonies in recent years, were not surveyed in 2021.

As pertains to island cormorant colonies, this year’s island-nesting total of 2,908 pairs is the highest count registered during the period of this survey. Double-crested Cormorant colonies must continue to be carefully monitored to determine the potential impact of cormorant nesting activity on wader nesting populations. (See Figure 10.) An analysis of Double-crested cormorant population trends in the NY/NJ Harbor and northeast region is pending.

Herring and Great Black-backed Gulls: Gulls were monitored using adult counts, nest counts, or both whenever possible. Excluding Jamaica Bay and Rikers Island nesting populations, island surveys of gull nests found a 34% decline in Herring Gulls and a 40% increase in Great Black-backed Gulls harbor-wide since 2019. Adult gull counts in Jamaica Bay yielded a 15% decrease in Herring Gulls and a 47% increase in Great Black-backed Gulls. (For detail on the Rikers Island gull colony, see the account of South Brother Island.)

Common Tern: Common Terns nested at three known island locations in 2021: Governors Island, Little Egg Marsh Island, and Joco Marsh in Jamaica Bay, in addition to several mainland sites on the Rockaway Peninsula. All of these locations have been active in recent years, but none has been consistently or formally surveyed as a part of the Harbor Herons survey effort. (NPS and NYCDPR conduct surveys of the colonies located at Joco Marsh and on the Rockaway Peninsula.) The colony on Little Egg Marsh Island was estimated at 85 pairs during the 2021 survey, an increase over the 30 pairs found in 2019. This colony was not detected during the 2017 survey but consisted of 110 pairs in 2016, and is reported to have been established post-survey in 2015. (For details on the Governors Island colony, see the island accounts.) The Common Tern is a threatened species in New York State. NYC Audubon has submitted to the New York State Department of Environmental Conservation a plan for all tern species nesting in New York City, to either monitor nesting populations directly or coordinate with others who are monitoring. We recommend continued monitoring and habitat enhancement at Governors Island and increased conservation efforts to protect and improve the NY Harbor colonies.

Least Tern: A total of four pairs was estimated to be nesting on Little Egg Island this year, a first nesting record on the islands for this survey.

Conclusions and Recommendations

In 2021, eight species of long-legged wading birds were confirmed as nesting on seven of twenty islands surveyed in New York Harbor as well as at several mainland sites. (See Table 2.) These eight wader species included (in order of decreasing abundance in island colonies) Black-crowned Night-Heron, Great Egret, Snowy Egret, Glossy Ibis, Little Blue Heron, Green Heron, Great Blue Heron, and Yellow-crowned Night-Heron. Our total of 1,195 island-nesting pairs of wading birds indicates a stable population since 2019, when 1,186 wader pairs were observed. Compared to our 2019 survey, Great Egret and Black-crowned Night-Heron populations each increased 15%, while the Snowy Egret population decreased 12%. Glossy Ibis numbers have fluctuated greatly over the past decades, and decreased 67% since 2019, resulting in the lowest count recorded for this species since the beginning of the study. Yellow-crowned Night-Heron numbers appear to have increased harbor-wide, though this species has shifted its population from island to mainland colonies in recent years, and those mainland colonies are not methodically surveyed.

This year's total of 1,195 nesting wader pairs is the second lowest survey count (the lowest count being 2019) recorded since 1987, when years with substantial uncertainty or gaps in the data (1998, 2006, 2012, 2020) are excluded. While the total nesting wader population has ostensibly declined over the past few years and over the last decade, the apparent wader population decline over the last three decades seems primarily attributable to a long-term decline in the population of Black-crowned Night Herons, with a smaller effect attributable to a decline in Glossy Ibis; other principal wader species populations appear to be stable or increasing in numbers over this time period. (See Figure 2.) A comprehensive trend analysis (1986-2017) suggests the harbor's wader population is stable over the entire survey period (Tobón unpublished report).

The preferred nesting areas of the majority of breeding waders have been stable since 2019, and indeed since 2013. The three largest wader nesting colonies in 2021—South Brother Island in the East River/Long Island Sound, Hoffman Island in the lower harbor, and Subway Island in Jamaica Bay, have held that position since 2013, and hosted 80% of the total island-nesting wader population in 2021. These three colonies plus three island in Jamaica Bay (Little Egg and the Elders Point Marsh Islands) constitute 99.7% of island-nesting waders in the harbor. This concentration of nesting birds on six islands has coincided with the declines on Mill Rock and Huckleberry Islands in the East River/Long Island Sound. Goose Island, North Brother Island, and Canarsie Pol, which hosted colonies in the past two decades. The islands in the Arthur Kill/Kill Van Kull complex (Isle of Meadows, Prall's Island, and Shooters Island), which were the core of NY/NJ Harbor's breeding wader community from the 1970s until the late 1990s, also continued to exhibit no nesting activity in 2021.

It is normal for waterbird colonies to move from island to island over time. However, it is imperative that a large number of suitable nesting islands remain available for these birds to continue to colonize and recolonize, and that when islands are abandoned, other suitable nesting islands continue to remain available. NYC Audubon is currently conducting an in-depth nesting population trend analysis to determine statistical significance and environmental correlates of trends. Continued monitoring of wader populations through nesting surveys and banding is a necessary step to comprehend species status, population trends, and overall health and persistence of the system.

At least three areas of the Harbor Herons Project survey protocol need improvement:

1. A repeatable method to survey islands with dense vegetation is required. Many researchers face the somewhat intractable problem of surveying islands heavily colonized by invasive species and/or dense undergrowth. NYC Audubon has received a NPS permit for implementation of a grid system of directionally marked posts on Hoffman Island, and has been in discussion with NYC Parks to implement a similar system on South Brother Island. This system should improve the qualitative and quantitative data collected in these surveys by allowing surveyors to more accurately describe changes in the nesting community and vegetation of a specific colony segment from one year to the next, and add a valuable spatial component to the dataset.
2. A method of quantifying productivity is necessary and should be implemented. Although some reproductive data are collected (e.g., nest counts and contents), repeat visits to the colony by researchers has been discouraged. These data represent only a snapshot of time. The correlation between nest number and number of fledglings is the true measure of productivity. The most effective technique would likely be to mark and monitor a subset of nests within selected colonies over the breeding season.
3. An improved habitat assessment protocol should be developed, including a rapid assessment technique, collaborating with additional botanists during breeding season vegetation surveys, and conducting a non-breeding season vegetation survey.

An additional relevant conservation issue is the presence of mammalian predators, particularly raccoons, on current and former nesting islands. Mammalian predators can have severe impacts on nesting colonial waterbird populations, and evidence of predation on waders, gulls, and other waterbirds has been observed on Ruffle Bar, Canarsie Pol, and Goose, South Brother, Huckleberry, and Mill Rock Islands. Efforts to quantify mammalian presence throughout the year using camera trapping should be conducted on all nesting islands, and methods to control the impacts on colonial waterbirds should be considered for island colonies found to support mammalian predators. For nesting islands at a considerable distance from the mainland, appropriate control methods could include live capture and relocation of mammals. For islands that mammals can reach more readily, control methods such as exclosures around nesting trees may be more appropriate.

Human disturbance on island colonies is difficult to manage in a highly urban setting. As mentioned in Bernick (2007), articles and websites that document unauthorized visitation of colonial waterbird nesting island have appeared in recent years. While an increase in waterfront activities by the public is a positive sign of a growing interest in the urban environment, any unauthorized visitation of nesting colonies requires attention and thoughtful solutions.

The first step in addressing unauthorized visitation of islands is the placement of clear signage. Additional signs must be posted on city-owned and federally owned islands, clearly stating the restricted status of the islands and the protected status of colonial waterbirds. (Additional signage is included in the previously mentioned plans for grid systems on Hoffman and South Brother Islands.) In addition to signage, managing agencies and stakeholders should establish a dialogue with law enforcement entities that patrol NY/NJ Harbor waters (US Park Police, New York City Police Department's Harbor Unit, and the US Coast Guard) and inform them of the security and safety threats that this type of activity poses, in addition to the ecological impacts.

Any communication concerning press coverage of NY/NJ Harbor islands should stress that these issues be thoughtfully considered and incorporated in the press coverage. This would reinforce to the public that these islands are unique, wild places that often support large bird populations, and that these birds are sensitive to human disturbance.

Not only does the conservation community need to effectively and publicly express the conservation issues that unauthorized visitation to nesting islands can create for bird populations; we also need to offer programs for the public to learn about, appreciate, and participate in the study of these interesting islands and their birds. NYC Audubon's programming and collaboration with community organizations create opportunities for community and educational outreach through participation in birding events as well as observational wader studies and other conservation projects. Additionally, direct contact with individuals or organizations that have made unauthorized visits to nesting colonies may often be productive and the danger to colonies easily remedied, without resorting to regulatory enforcement.

The Harbor Herons Conservation Plan was published in 2010 (Elbin and Tsipoura, Eds. 2010). Efforts are under way to prioritize and implement recommended actions outlined in this plan. In particular, emphasis needs to be placed on the protection of important foraging areas in addition to nesting habitats.

The New York City Audubon Harbor Herons Project Nesting Surveys are complemented by a suite of research programs, many of which include banding initiatives of multiple species at nesting islands throughout the NY/NJ Harbor. In recent years, color bands have been affixed to young-of-the-year Double-crested Cormorants, Great Egrets, Snowy Egrets, Glossy Ibis, and Herring Gulls. Wing tags (yellow) were used as a means of Great Egret identification in 2012-2015. USGS metal bands without color have been used on Herring Gulls, Great Black-backed Gulls, and Black-crowned Night-Herons. Color band re-sightings of any of these species should be communicated to NYC Audubon (bands@nycaudubon.org), giving leg band or wing tag code, color, location, date, and name of observed. All band sightings should be reported to the Bird Banding Laboratory by visiting www.reportband.gov or calling 1-800-327-2263.

Additional recommendations and goals are as follows:

- Complete the analysis and summary of data from the New York City Audubon Harbor Herons Nesting Surveys (1986-present).
- Continue dialogue with all agencies responsible for colonial waterbird surveys in New York, New Jersey, and Connecticut, in order to establish a working regional perspective on colonial wader and cormorant populations. Coordinating standardized methods to allow for regional comparisons and data analysis will be critical to the success of this effort.
- For privately owned Huckleberry Island, continued communication and collaboration with the current owners should be pursued by parties interested in the persistence of wader and cormorant populations.
- Encourage the development of wader and cormorant research projects in the NY/NJ Harbor area at high school, undergraduate, and graduate levels.

- Examine relationships between or among metropolitan NY/NJ area colonies and colonies in southern New Jersey, Long Island, and Connecticut, including gene flow, post-fledging dispersal, and natal philopatry.
- Design a photographic guide of nests, eggs, and young to aid volunteers in identification during nesting surveys. A reference guide to identify nest trees, shrubs, and vines should also be developed. Guides should be available in PDF format for all volunteers.
- Outreach to the local birding community would be helpful to learn about the location of mainland wader colonies (principally Green Heron and Yellow-crowned Night-Heron) in the NY/NJ Harbor area.
- Provide guidance for continued tern habitat enhancement on Governors Island.

New York City Audubon's Harbor Herons Project has included additional programs in recent years (i.e., the Harbor Herons Foraging Study) that allow for greater public participation and awareness of the "Harbor Herons," and have strengthened NYC Audubon's role as an advocate for conserving NY/NJ Harbor's wader populations. New and vital collaborations between NYC Audubon and other organizations (i.e., New Jersey Audubon) have formed, and the open forum of NY/NJ Harbor Estuary Program's Harbor Herons Subcommittee has brought organizations and agencies from New York, New Jersey, and Connecticut to discuss issues of regional importance.

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TABLES, FIGURES, AND APPENDICES

Table 1. Survey schedule for principal wader, cormorant, and gull counts, 17 May-2 June 2021

Location Surveyed	Date	# of Observers	Ownership
<u>Long Island Sound</u>			
1) Goose Island	21 May	4	NYC DPR
2) Huckleberry Island	21 May	4	Huckleberry Indians, Inc.
3) Davids Island	21 May	4	City of New Rochelle
4) Hart Island	21 May	4	NYC DPR
<u>East River</u>			
5) North Brother Island	24 May	4	NYC DPR
6) South Brother Island	24 May	9	NYC DPR
7) Mill Rock	24 May	4	NYC DPR
8) U Thant	24 May	4	NYC DPR
<u>Arthur Kill/Kill Van Kull</u>			
9) Shooters Island	25 May	4	NYC DPR
10) Prall's Island	25 May	4	NYC DPR
11) Isle of Meadows	25 May	4	NYC DPR
<u>Lower New York Bay</u>			
12) Swinburne Island	17 May	6	NPS
13) Hoffman Island	17 May	6	NPS
	19 May	6	NPS
<u>Jamaica Bay</u>			
14) Elders Point East Marsh Island	26 May	6	NPS
15) Elders Point West Marsh Island	26 May	6	NPS
14) Canarsie Pol	2 June	1	NPS
15) Subway Island	26 May	6	NPS
16) Little Egg Marsh Island	27 May	6	NPS
17) Ruffle Bar	27May	6	NPS
<u>Mainland – Far Rockaway</u>			
18) Redfern Houses	20 May	2	NYC Housing Authority
19) Hammel Houses	20 May	2	NYC Housing Authority
<u>Mainland – New Jersey</u>			
20) Harmon Cove	1 June	1	Harmon Cove

Island and Mainland Nesting Locations



Figure 1:

- (●) Current and former island waterbird nesting sites surveyed for waders, cormorants, and gulls
- (●) Primary mainland colonies of Yellow-crowned Night-Heron
- (●) Mainland nesting sites of Green Heron

Table 2. 2021 Wader, cormorant, and gull nesting activity (number of nesting pairs, as estimated from nest and/or adult counts) on selected islands and mainland colonies in NY/NJ Harbor and surrounding waterways. Surveyed species below are Great Egret (GREG), Cattle Egret (CAEG), Snowy Egret (SNEG), Black-crowned Night-Heron (BCNH), Yellow-crowned Night-Heron (YCNH), Little Blue Heron (LBHE), Glossy Ibis (GLIB), Green Heron (GRHE), Tricolored Heron (TRHE), Great Blue Heron (GBHE), Double-crested Cormorant (DCCO), Herring Gull (HERG), and Great Black-backed Gull (GBBG).

	Hoffman Island	North Brother Island	South Brother Island	Mill Rock Island	Goose Island	Huckleberry Island	Hart Island	David's Island	Elders Point East Marsh Island	Elders Point West Marsh Island	Subway Island	Little Egg Marsh Island	Ruffle Bar	Canarsie Pol	Swinburne Island	Shooters Island	Pral's Island	Isle of Meadows	U Thant Island	Governors Island	Redfern Houses	Hammel Houses	Other Mainland Colonies	Total Islands	Total Islands and Mainland	
Waders																										
GREG	157	0	89	1	0	0	0	0	3	25	92	3	0	0	0	0	0	0	0	0	0	0	0	0	370	370
CAEG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SNEG	68	0	81	0	0	0	0	0	52	32	5	0	0	0	0	0	0	0	0	0	0	0	0	0	238	238
BCNH	129	0	222	3	0	0	0	0	45	5	91	42	0	0	0	0	0	0	0	0	0	0	0	0	537	537
YCNH	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	23	42	42	1	108	
LBHE	6	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	7
GLIB	10	0	0	0	0	0	0	0	21	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	37	37
GRHE	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	8	3	11	
TRHE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GBHE	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	
Unidentified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Active Wader Nests	372	0	392	4	0	0	0	0	121	63	197	46	0	0	0	0	0	0	0	0	23	42	50	1,195	1,310	
Cormorants																							0			
DCCO	1,407	0	394	103	0	0	0	0	0	428	0	0	0	0	530	0	0	0	46	0	0	0	0	0	2,908	
Gulls																										
HERG Nests	63	0	0	0	0	0									79	0	0	0			0		0			
HERG Adults	*					0		4	194	98	633	169	1					6			0					
GBBG Nests	71	0	13	19	1	0									62	0	0	0			0		0			
GBBG Adults					2	2		7	23	9	42	233	2					10								

Note: Blank items indicate that no data were collected.

Wading Bird Nesting Activity, 1982-2021

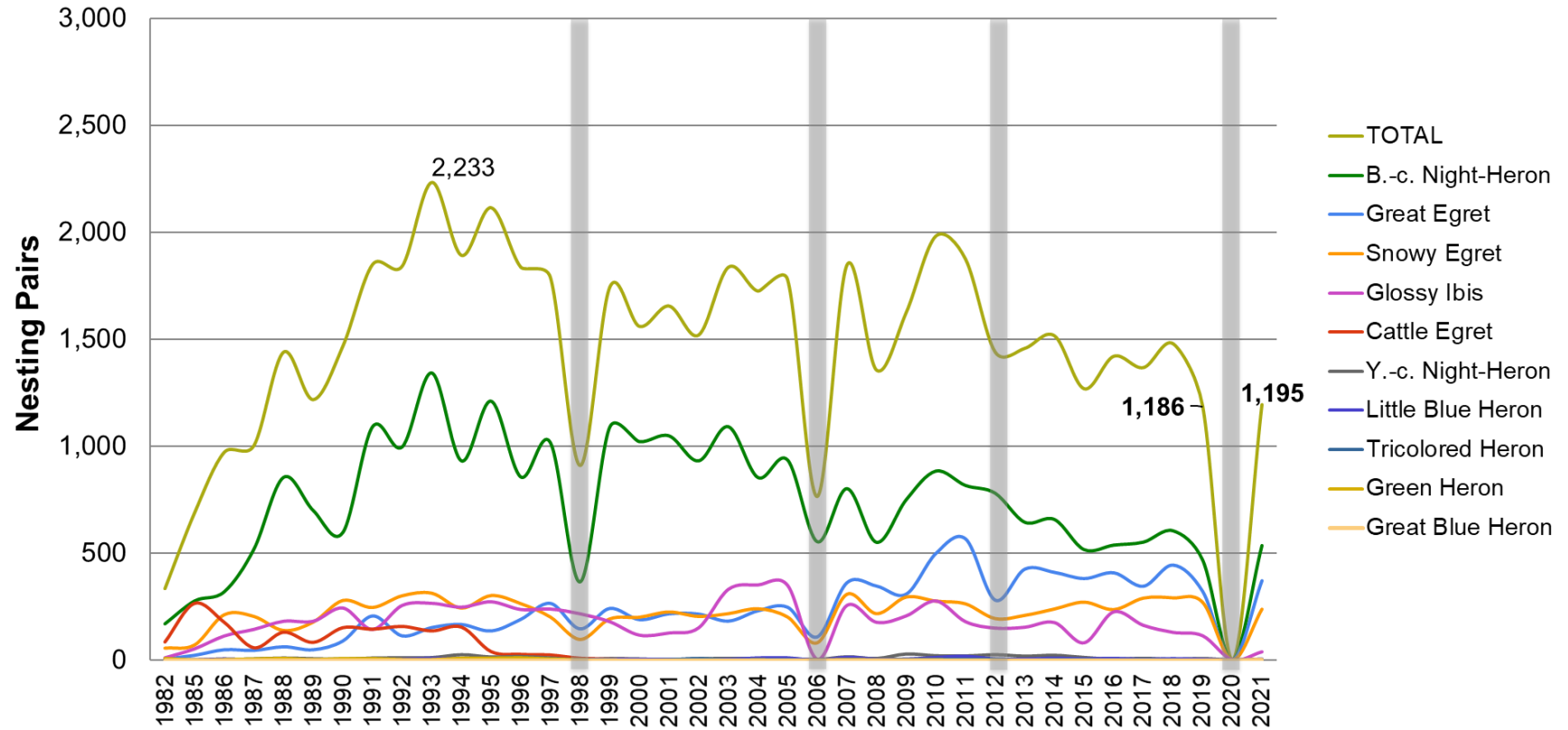


Figure 2: Total number of island-nesting pairs of wader species estimated from nest and/or adult counts during the New York City Audubon Harbor Herons nesting surveys from 1982 to 2021. Years with substantial uncertain or missing data (survey years that did not capture one or more of the major breeding colonies) are indicated with gray bars (1998, 2006, 2012, 2020).

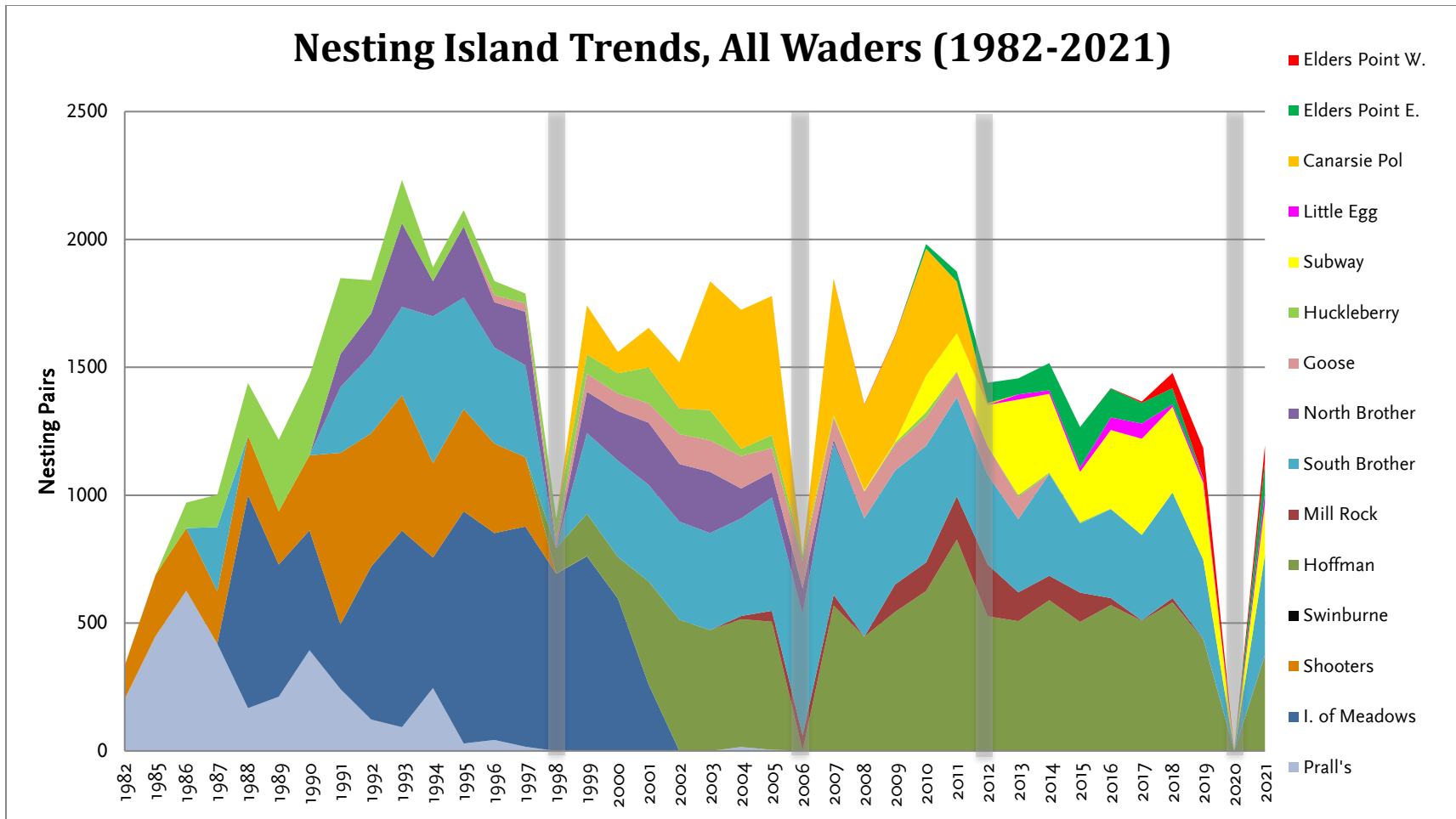


Figure 3: Total number of wader nesting pairs estimated from nest and/or adult counts during the New York City Audubon Harbor Herons nesting surveys from 1982 to 2021, by nesting Island. Years with substantial uncertain or missing data (survey years that did not capture one or more of the major breeding colonies) are indicated with gray bars (1998, 2006, 2012, 2020).

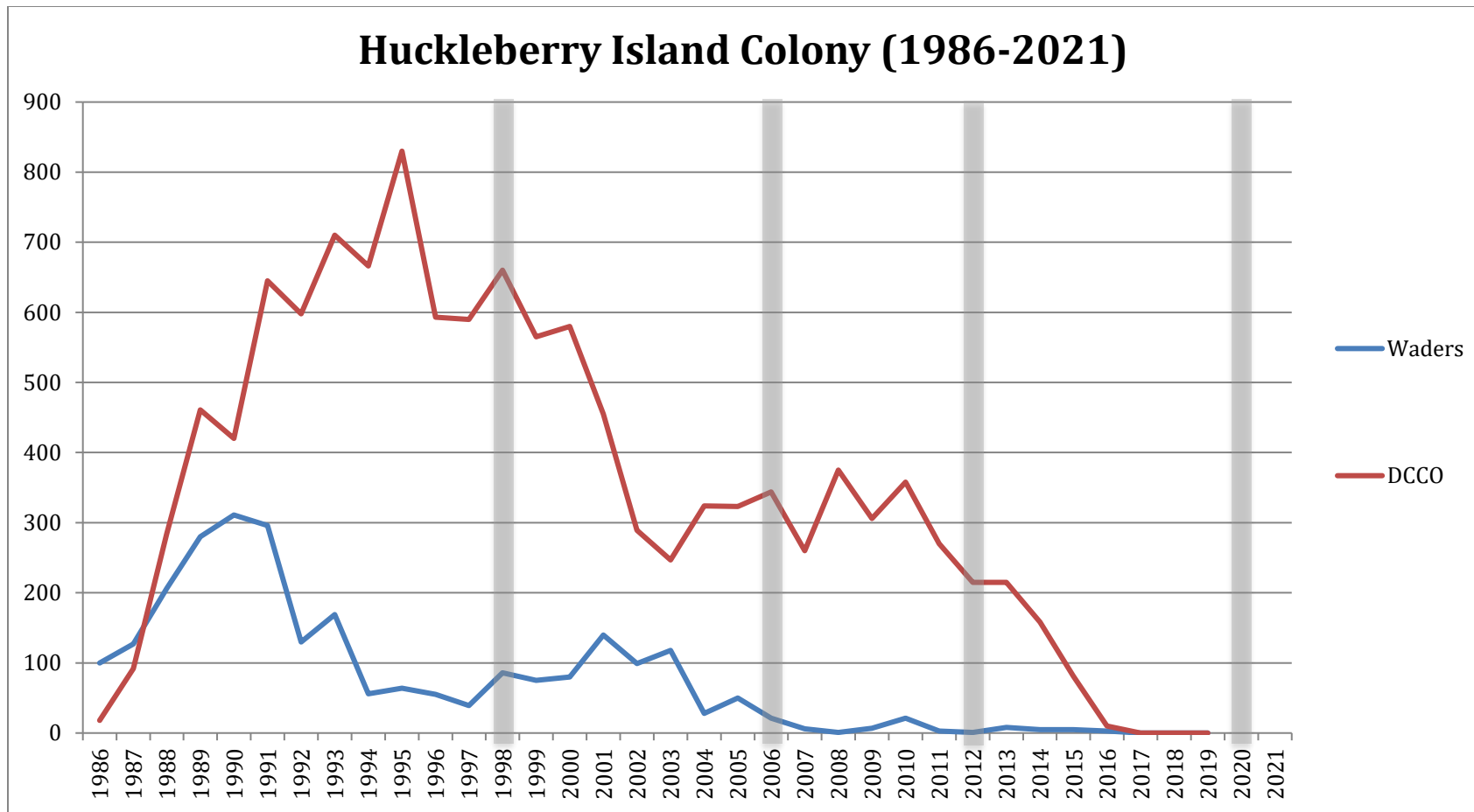


Figure 4: Total number of wader and Double-crested Cormorant (DCCO) nesting pairs estimated from nest and/or adult counts during surveys of Huckleberry Island, 1986-2021. (Note: Huckleberry Island was first surveyed as part of this project in 1986.) Years with substantial uncertain or missing data (survey years that did not capture one or more of the major breeding colonies) are indicated with gray bars (1998, 2006, 2012, 2020).

Nesting Island Trends, Black-crowned Night-Herons (1982-2021)

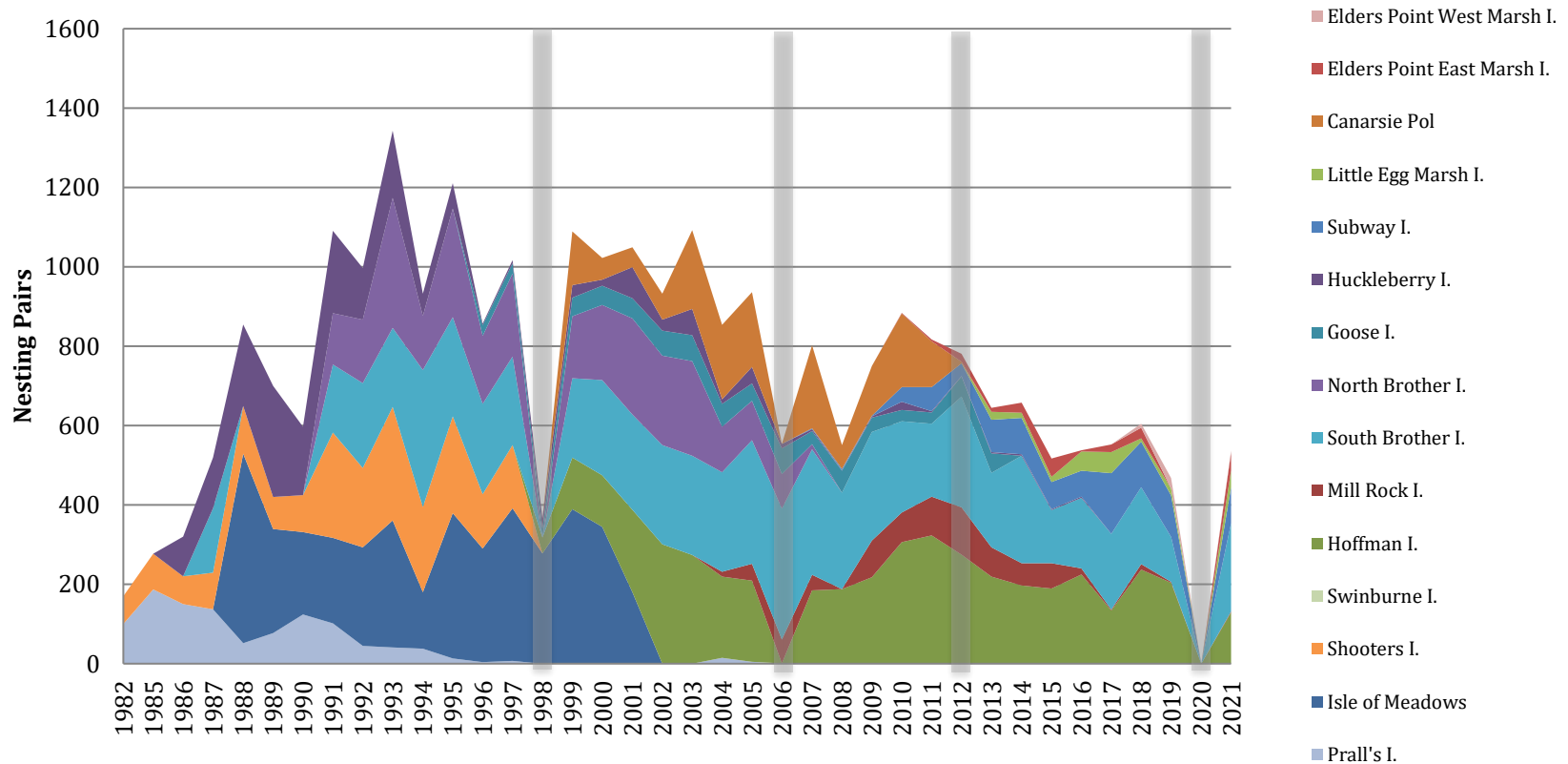


Figure 5: Total number of Black-crowned Night-Heron nesting pairs estimated from nest and/or adult counts during the New York City Audubon Harbor Herons nesting surveys from 1982-2021, by nesting island. Years with substantial uncertain or missing data (survey years that did not capture one or more of the major breeding colonies) are indicated with gray bars (1998, 2006, 2012, 2020).

Nesting Trends, Yellow-crowned Night-Herons (1982-2021)

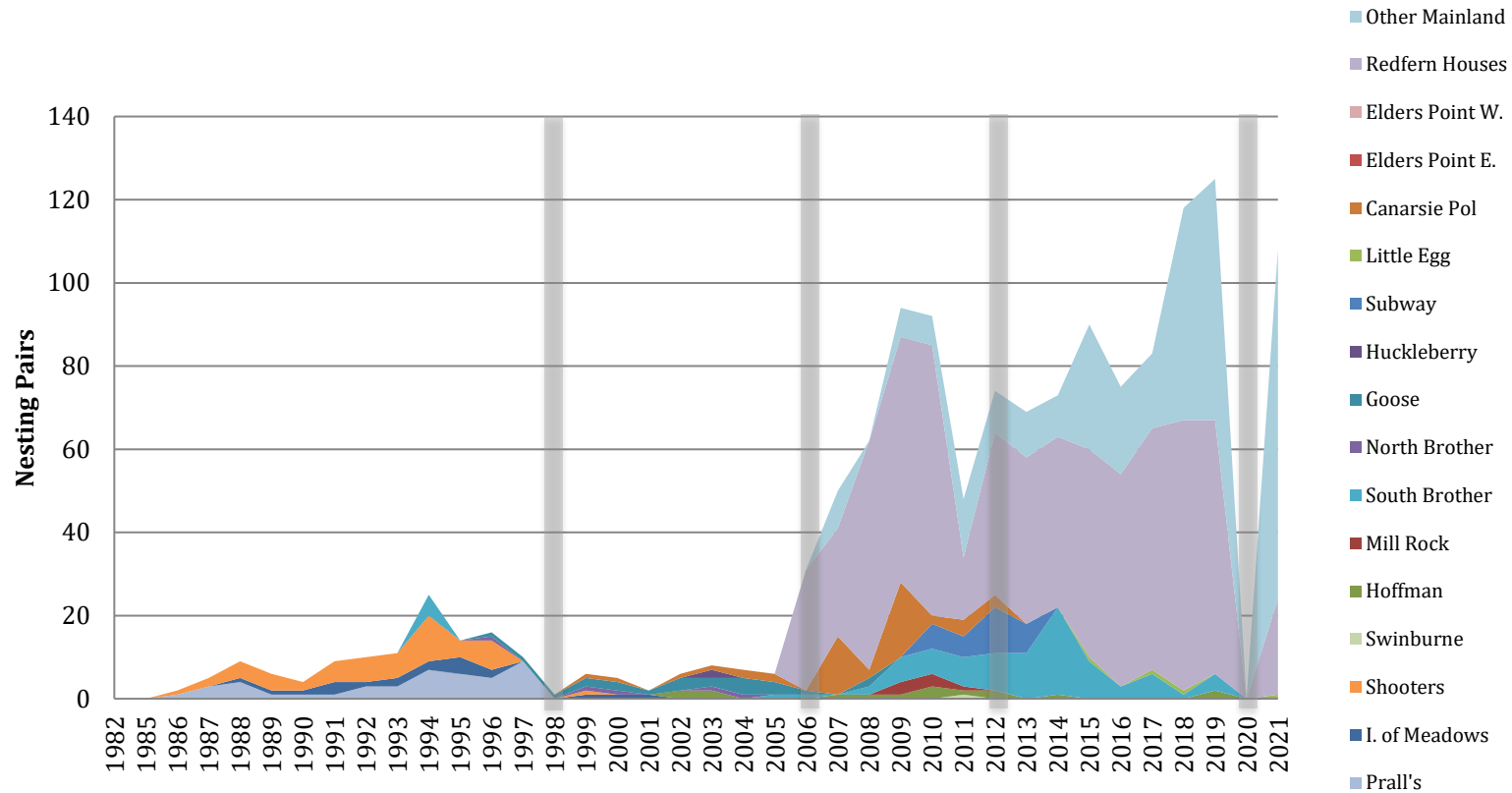


Figure 6: Total number of Yellow-crowned Night-Heron nesting pairs estimated from nest and/or adult counts during the New York City Audubon Harbor Herons nesting surveys from 1982 to 2021, by nesting island and regularly surveyed mainland colony. Years with substantial uncertainty or missing data (survey years that did not capture one or more of the major breeding colonies) are indicated with gray bars (1998, 2006, 2012, 2020). Note: Mainland colony data from the New York City and local New Jersey areas (“Other Mainland” and “Redfern Houses”) is included as available. It is unclear whether mainland nesting has actually increased since 2005 as much as is indicated appear above, or if the apparent increase is simply the result of a lack of earlier data and/or failure to detect earlier mainland colonies. A survey of historical records of mainland nesting prior to 2006 would be a worthwhile endeavor.

Nesting Island Trends, Great Egrets (1982-2021)

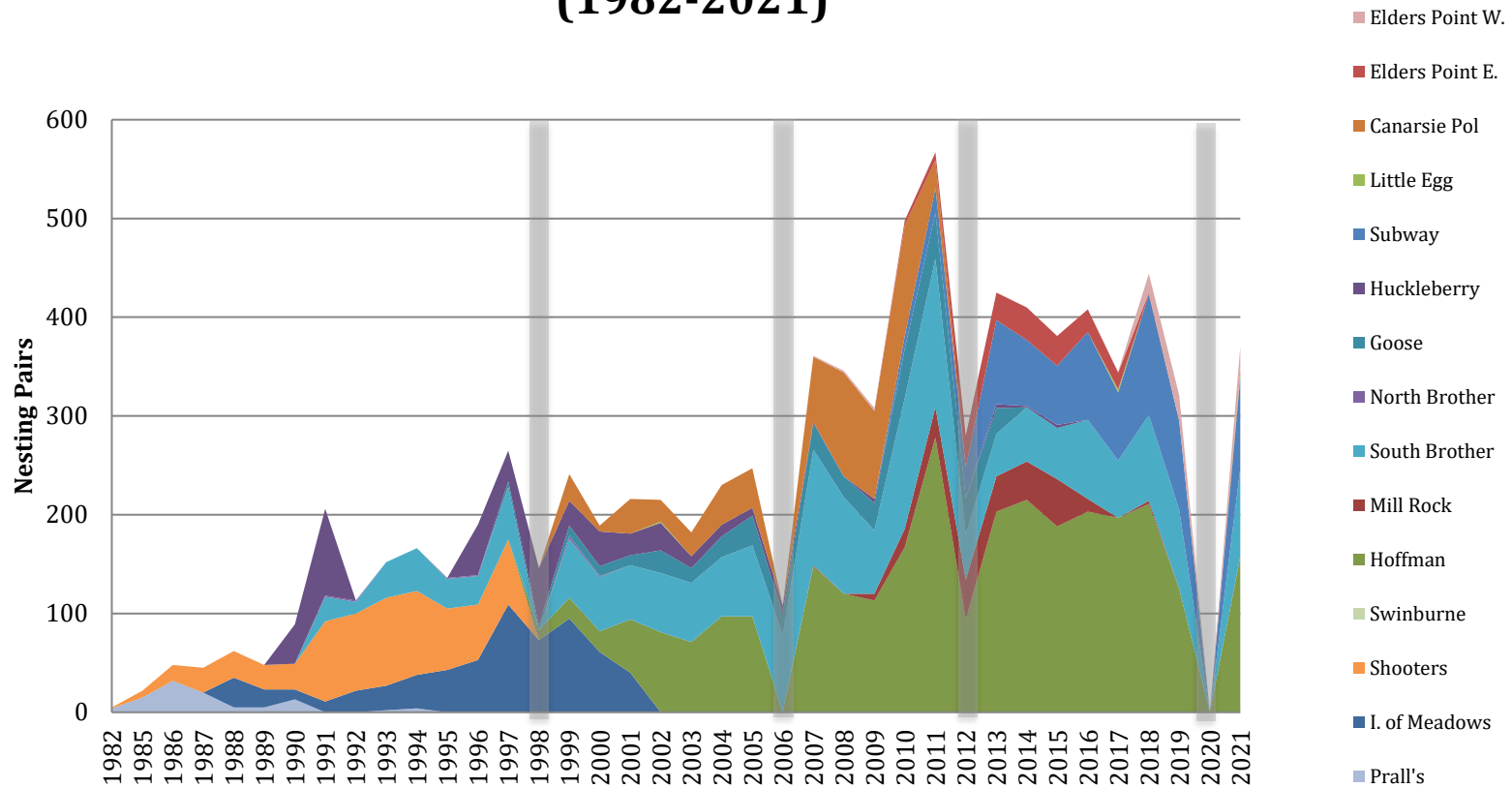


Figure 7: Total number of Great Egret nesting pairs estimated from nest and/or adult counts during the New York City Audubon Harbor Herons nesting surveys from 1982-2021, by nesting island. Years with substantial uncertain or missing data (survey years that did not capture one or more of the major breeding colonies) are indicated with gray bars (1998, 2006, 2012, 2020).

Nesting Island Trends, Snowy Egrets (1982-2021)

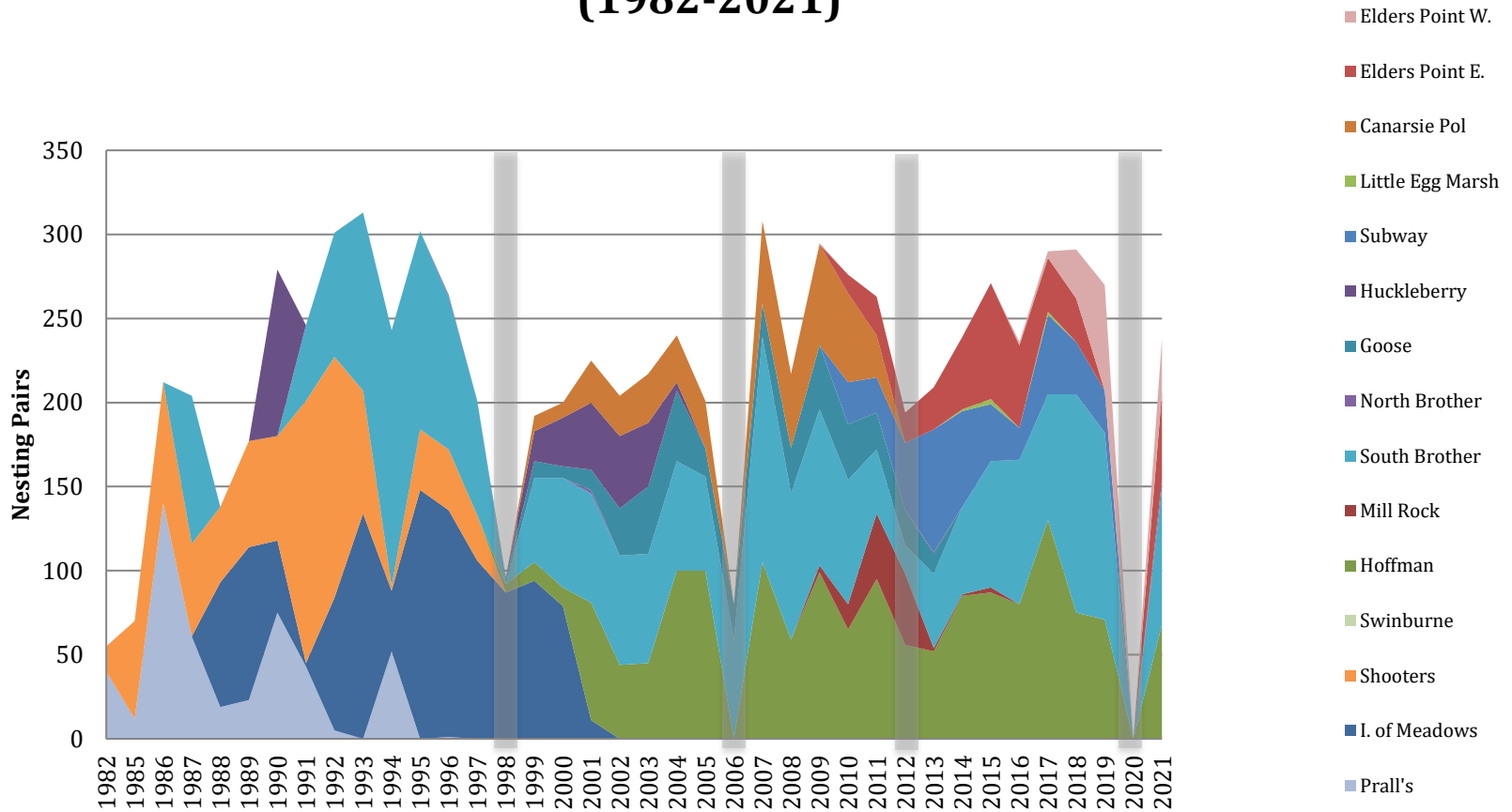


Figure 8: Total number of Snowy Egret nesting pairs estimated from nest and/or adult counts during the New York City Audubon Harbor Herons nesting surveys from 1982-2021, by nesting island. Years with substantial uncertain or missing data (survey years that did not capture one or more of the major breeding colonies) are indicated with gray bars (1998, 2006, 2012, 2020).

Nesting Island Trends, Glossy Ibis (1982-2021)

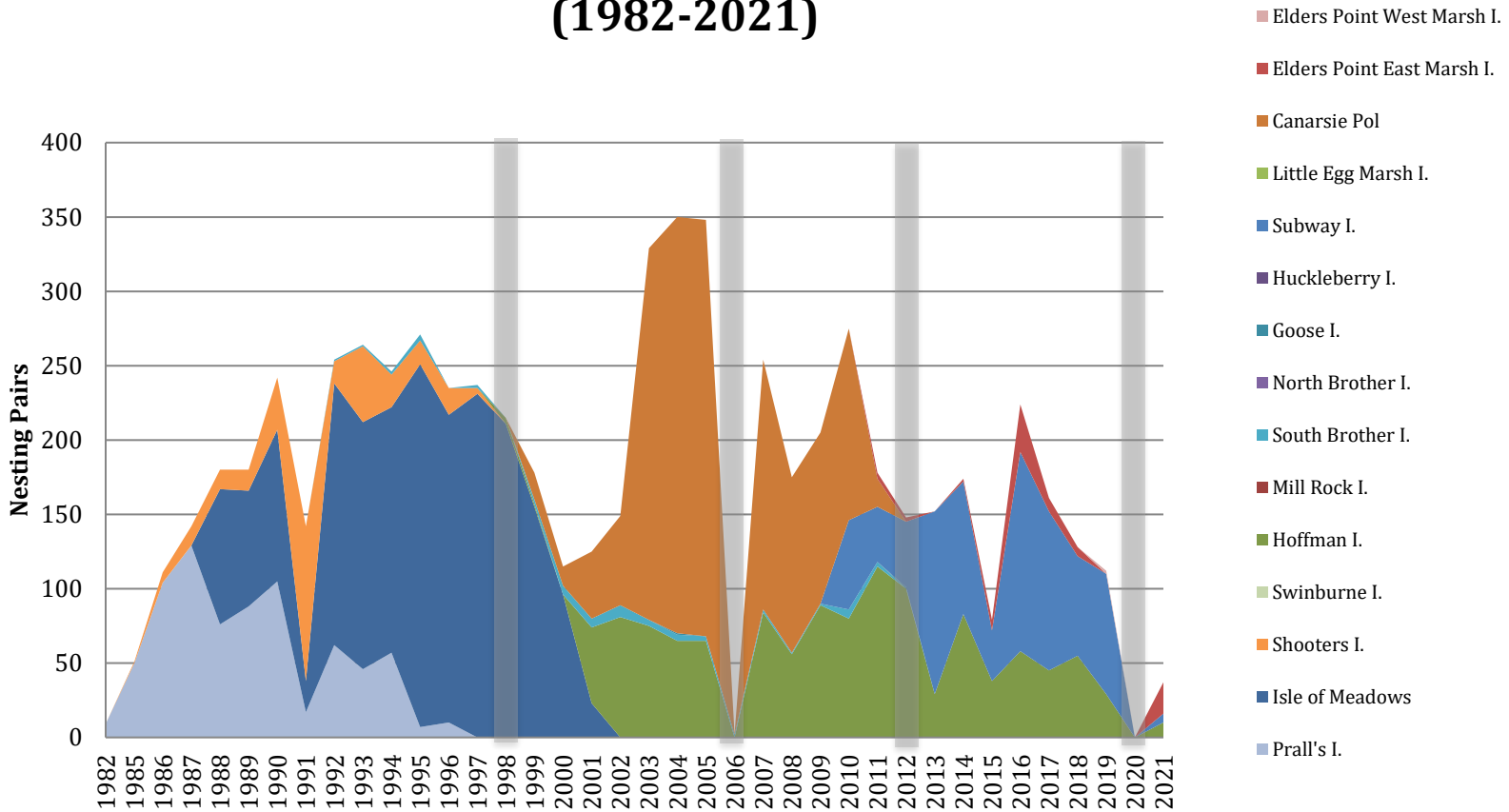


Figure 9: Total number of Glossy Ibis nesting pairs estimated from nest and/or adult counts during the New York City Audubon Harbor Herons nesting surveys from 1982-2021, by nesting island. Years with substantial uncertain or missing data (survey years that did not capture one or more of the major breeding colonies) are indicated with gray bars (1998, 2006, 2012, 2020).

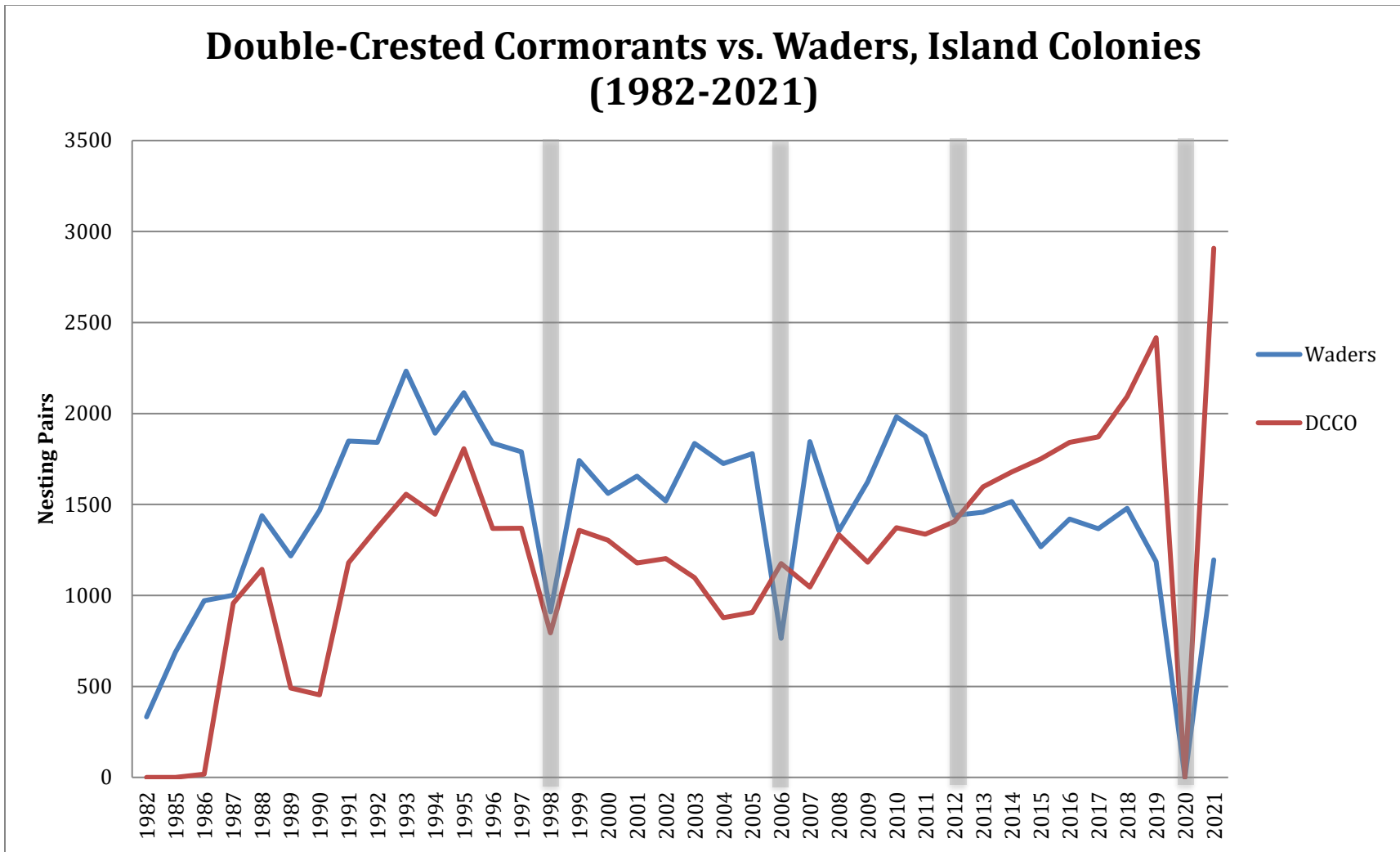


Figure 10: Total number of Double-crested Cormorant and wader nesting pairs estimated from nest and/or adult counts during the New York City Audubon Harbor Herons nesting surveys from 1982 to 2021. Years with substantial uncertain or missing data (survey years that did not capture one or more of the major breeding colonies) are indicated with gray bars (1998, 2006, 2012, 2020)