



Colonial Nesting Birds in Biscayne National Park

2021–2022 Nesting Year Summary



Brown pelicans flying near Elliott Key in Biscayne National Park.
NPS / SOUTH FLORIDA/CARIBBEAN NETWORK

Colonial nesting birds in Biscayne National Park: 2021–2022 nesting year summary

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Abstract

The habitats within Biscayne National Park consist of rocky coast lines, Biscayne Bay (a shallow water bay), over 40 mangrove islands, and coral reefs. This ecosystem lies near the large metropolitan area of Miami, suburban development, a nuclear power plant, and has several canals that drain from the mainland into Biscayne National Park or close to park boundaries. As a result of the park's proximity to a large population, it endures heavy usage. The park is a popular destination for anglers and boaters. All the aforementioned factors put stressors on the park ecosystem.

The South Florida/Caribbean Network has developed a long-term monitoring program that focuses on the colonial nesting birds that use park resources for foraging, roosting, and nesting. The South Florida/Caribbean Network uses monthly helicopter flights to survey nine nesting colonies in or near the park. The nine colonies monitored are: Kings Road, Mangrove Key, West Arsenicker Key, Arsenicker Key, Jones Lagoon, Ragged Key 4, Ragged Key 5, Soldier Key, and Kings Bay. We focus on six species of birds: double-crested cormorants (*Phalacrocorax auritus*), great egrets (*Ardea alba*), great white herons (*Ardea herodias occidentalis*), great blue herons (*Ardea herodias*), white ibises (*Eudocimus albus*), and roseate spoonbills (*Platalea ajaja*).

Data collection for this vital sign began in 2009. This report presents data regarding peak nesting, nesting indices, species abundance, and the nine nesting colonies. No forecasts are presented from the data collected in this report.

Peak nest counts for five of the six focal species were lower in 2021–2022 than 2020–2021, except for white ibis, which increased relative to the previous nesting season. For the fourth consecutive season, peak nest counts for double-crested cormorants remain under 1,000 nests.

For the number of species actively nesting by colony, our data indicate that two colonies increased, four colonies decreased, and three colonies remained the same relative to the previous nesting season. At least one of the focal species nested at all nine colonies, which has been consistent since the start of surveys.

Introduction

Nesting colonies of wading birds and seabirds are important indicators of ecosystem health as they respond to changes in food abundance, food quality, contaminants, invasive species, and disturbances. The acts of selecting mates, building nests, laying eggs and rearing chicks are energy intensive. If the habitat is insufficient to support these activities, nesting success will suffer, and this may indicate a problem in the ecosystem. The South Florida/Caribbean Inventory and Monitoring Network (SFCN) of the National Park Service annually monitors colonial nesting birds in Biscayne National Park (BISC), and this report summarizes the results for the nesting year July 2021 through June 2022.

The specific objectives of this monitoring program are to determine status and long-term trends in:

- The number and locations of active colonies of colonial nesting birds with a special focus on double-crested cormorants (*Phalacrocorax auritus*), great egrets (*Ardea alba*), great white herons (*Ardea herodias occidentalis*), great blue herons (*Ardea herodias*), white ibises (*Eudocimus albus*), and roseate spoonbills (*Platalea ajaja*) referred to as focal species.
- The annual peak active nest counts (sum of the peak monthly nest counts for individual colonies/all colonies) of colonial nesting birds in Biscayne National Park for the focal species.
- An annual nesting index (sum of monthly nest counts for individual/all colonies) for the focal species.
- The timing of peak nest counts for the focal species.

Methods

The monitoring process in 2021–2022 consisted of an annual park-wide survey via helicopter to locate new nesting colonies of wading birds and seabirds, coupled with monthly surveys of previously located colonies. Two SFCN staff, a photographer and an observer, participated in each survey. As the helicopter circled each island colony, the colonies were photographed, and the observer recorded the number of visible nesting and non-nesting birds. Approximately 450 photographs were taken during each monthly survey. The photographs were uploaded to a computer and processed to identify active nests by species. The identified nests were circled on the photographs and then counted from the processed photographs.

Peak nest counts were identified for each colony and then summed across colonies to calculate the peak nesting year total across the park for each species. “Year” refers to nesting year defined as July through June in the subsequent year. In addition, an annual nesting index is calculated, which is the sum of monthly nest counts for the entire nesting year. The nesting estimates for months with no sampling are calculated as the average of the months before and after the missing month. The South Florida/Caribbean Network uses the annual nesting index as well as peak nest counts, as some species such as double-crested cormorants (*Phalacrocorax auritus*) nest in all months, and peak nest counts alone were considered insufficient to describe the nesting effort. The 2021–2022 peak nest counts and nesting index are compared to the previous nine nesting seasons’ mean, maximum and minimum. Complete methods are described in the protocol, Colonial Nesting Bird Monitoring Protocol in Biscayne National Park (Muxo et al. 2022).

Surveys occurred July through November of 2021, as well as March, April, and June of 2022. Surveys did not take place in December of 2021, or January, February, and May of 2022. The nine colonies surveyed during routine monthly flights were: Kings Road Island, Mangrove Key, West Arsenicker, Arsenicker Key, Jones Lagoon, Ragged Key 4, Ragged Key 5, Soldier Key, and Kings Bay (Figure 1). Although the Kings Bay colony is north of the park boundary, it is monitored because of its proximity to the park. The birds nesting at Kings Bay likely use the park for resources, so monitoring this colony provides a more complete picture of the colonial nesting birds using Biscayne National Park.



Figure 1. Locations of the nine nesting colony locations currently monitored. The black circles around the colonies show a 3-kilometer (1.9 mile) radius foraging area. Studies of double-crested cormorants in other states have shown their average foraging distance is within 3 kilometers of their colonies (Custer and Bunck 1992; Coleman et al. 2005; Seefelt and Gillingham 2006). The park boundary is shown in green.

Results and Discussion

The South Florida/Caribbean Network completed its 12th full nesting year of monitoring colonial nesting birds in Biscayne National Park (BISC) from 2021–2022. As shown in Table 1, double-crested cormorants tend to have more empty nests than the other focal species. Even when considering 19 unidentified nests into the totals of the five other focal species (Table 2), the percent of empty nests is relatively low. The double-crested cormorants (*Phalacrocorax auritus*) and roseate spoonbills (*Platalea ajaja*) have much lower percentages of nests with eggs compared to the white ibis (*Eudocimus albus*) and the stalk and strike feeders (e.g., great blue heron [*Ardea Herodias*], great egret [*Ardea alba*], and great white heron [*Ardea herodias occidentalis*]). This may be because of detectability of eggs when birds are positioned on their nests.

Table 1. Total counts and percentages of all occupied nests, nests with chicks, nests with eggs, and empty active nests and their percentages of the total active nests by species and nesting seasons. Species and their species codes are as follows, double-crested cormorant (DCCO), great blue heron (GBHE), great egret (GREG), great white heron (GWHE), roseate spoonbill (ROSP), and white ibis (WHIB).

Species Code	Nesting Season	Occupied Nests	Nests with Chicks	Nests with Eggs	Empty Nests	Total Active Nests	Percent of Occupied Nests	Percent of Nests with Chicks	Percent of Nest with Eggs	Percent of Empty Nests
DCCO	2012–2013	3708	258	97	448	4156	89 %	6 %	2 %	11 %
DCCO	2013–2014	5121	454	133	537	5658	91 %	8 %	2 %	9 %
DCCO	2014–2015	4274	446	172	653	4927	87 %	9 %	3 %	13 %
DCCO	2015–2016	4879	593	202	544	5423	90 %	11 %	4 %	10 %
DCCO	2016–2017	5671	601	189	1092	6763	84 %	9 %	3 %	16 %
DCCO	2017–2018	4676	574	147	451	5127	91 %	11 %	3 %	9 %
DCCO	2018–2019	4650	280	132	498	5148	90 %	5 %	3 %	10 %
DCCO	2019–2020	1431	131	51	297	1728	83 %	8 %	3 %	17 %
DCCO	2020–2021	2510	226	64	365	2875	87 %	8 %	2 %	13 %
DCCO	2021–2022	3575	331	81	194	3769	95 %	9 %	2 %	5 %
GBHE	2012–2013	35	8	3	1	36	97 %	22 %	8 %	3 %
GBHE	2013–2014	22	8	2	0	22	100 %	36 %	9 %	0 %
GBHE	2014–2015	23	10	5	0	23	100 %	43 %	22 %	0 %
GBHE	2015–2016	26	8	5	0	26	100 %	31 %	19 %	0 %
GBHE	2016–2017	33	6	4	0	33	100 %	18 %	12 %	0 %
GBHE	2017–2018	43	12	9	0	43	100 %	28 %	21 %	0 %
GBHE	2018–2019	35	9	3	0	35	100 %	26 %	9 %	0 %
GBHE	2019–2020	22	4	4	0	22	100 %	18 %	18 %	0 %
GBHE	2020–2021	40	11	7	0	40	100 %	28 %	17 %	0 %
GBHE	2021–2022	15	4	2	0	15	100 %	27 %	13 %	0 %
GREG	2012–2013	64	8	7	0	64	100 %	12 %	11 %	0 %
GREG	2013–2014	57	13	1	0	57	100 %	23 %	2 %	0 %

Table 1 (continued). Total counts and percentages of all occupied nests, nests with chicks, nests with eggs, and empty active nests and their percentages of the total active nests by species and nesting seasons. Species and their species codes are as follows, double-crested cormorant (DCCO), great blue heron (GBHE), great egret (GREG), great white heron (GWHE), roseate spoonbill (ROSP), and white ibis (WHIB).

Species Code	Nesting Season	Occupied Nests	Nests with Chicks	Nests with Eggs	Empty Nests	Total Active Nests	Percent of Occupied Nests	Percent of Nests with Chicks	Percent of Nest with Eggs	Percent of Empty Nests
GREG	2014–2015	22	5	1	0	22	100 %	23 %	5 %	0 %
GREG	2015–2016	29	3	1	0	29	100 %	10 %	3 %	0 %
GREG	2016–2017	36	2	4	0	36	100 %	6 %	11 %	0 %
GREG	2017–2018	68	4	16	2	70	97 %	6 %	23 %	3 %
GREG	2018–2019	4	3	1	0	4	100 %	75 %	25 %	0 %
GREG	2019–2020	4	0	1	0	4	100 %	0 %	25 %	0 %
GREG	2020–2021	32	3	3	0	32	100 %	9 %	9 %	0 %
GREG	2021–2022	5	0	1	0	5	100 %	0 %	20 %	0 %
GWHE	2012–2013	74	21	4	4	78	95 %	27 %	5 %	5 %
GWHE	2013–2014	68	19	7	0	68	100 %	28 %	10 %	0 %
GWHE	2014–2015	58	15	5	1	59	98 %	25 %	8 %	2 %
GWHE	2015–2016	96	28	8	0	96	100 %	29 %	8 %	0 %
GWHE	2016–2017	130	28	7	1	131	99 %	21 %	5 %	1 %
GWHE	2017–2018	160	44	13	0	160	100 %	28 %	8 %	0 %
GWHE	2018–2019	135	44	22	2	137	99 %	32 %	16 %	1 %
GWHE	2019–2020	92	18	13	0	92	100 %	20 %	14 %	0 %
GWHE	2020–2021	166	33	33	0	166	100 %	20 %	20 %	0 %
GWHE	2021–2022	54	14	4	0	54	100 %	26 %	7 %	0 %
ROSP	2012–2013	8	3	0	0	8	100 %	38 %	0 %	0 %
ROSP	2013–2014	11	4	0	0	11	100 %	36 %	0 %	0 %
ROSP	2014–2015	0	0	0	0	0	–	–	–	–
ROSP	2015–2016	8	0	1	0	8	100 %	0 %	12 %	0 %
ROSP	2016–2017	7	0	1	0	7	100 %	0 %	14 %	0 %

Table 1 (continued). Total counts and percentages of all occupied nests, nests with chicks, nests with eggs, and empty active nests and their percentages of the total active nests by species and nesting seasons. Species and their species codes are as follows, double-crested cormorant (DCCO), great blue heron (GBHE), great egret (GREG), great white heron (GWHE), roseate spoonbill (ROSP), and white ibis (WHIB).

Species Code	Nesting Season	Occupied Nests	Nests with Chicks	Nests with Eggs	Empty Nests	Total Active Nests	Percent of Occupied Nests	Percent of Nests with Chicks	Percent of Nest with Eggs	Percent of Empty Nests
ROSP	2017–2018	18	3	0	0	18	100 %	17 %	0 %	0 %
ROSP	2018–2019	4	1	0	0	4	100 %	25 %	0 %	0 %
ROSP	2019–2020	3	0	0	0	3	100 %	0 %	0 %	0 %
ROSP	2020–2021	21	7	0	0	21	100 %	33 %	0 %	0 %
ROSP	2021–2022	3	1	0	0	3	100 %	33 %	0 %	0 %
WHIB	2012–2013	67	0	5	0	67	100 %	0 %	7 %	0 %
WHIB	2013–2014	82	11	6	0	82	100 %	13 %	7 %	0 %
WHIB	2014–2015	61	1	8	0	61	100 %	2 %	13 %	0 %
WHIB	2015–2016	24	2	3	1	25	96 %	8 %	12 %	4 %
WHIB	2016–2017	166	9	14	6	172	97 %	5 %	8 %	3 %
WHIB	2017–2018	136	12	14	1	137	99 %	9 %	10 %	1 %
WHIB	2018–2019	37	7	2	2	39	95 %	18 %	5 %	5 %
WHIB	2019–2020	18	0	1	0	18	100 %	0 %	6 %	0 %
WHIB	2020–2021	0	0	0	0	0	–	–	–	–
WHIB	2021–2022	31	0	2	0	31	100 %	0 %	6 %	0 %

We provide a list of species detected either through field observations or photographs of nests in Table 2. For the 2021–2022 nesting year, there were nine species photographed nesting and 17 species observed using the colonies. As previously seen, more species were observed than photographed nesting. This suggests colony locations function not only for reproduction but also for roosting and refugia for the additional species. Table 2 also provides the species codes used in all tables and graphs in this report.

Table 2. List of species detected in the 2021–2022 nesting year. Nest counts in this table should not be used as true abundance estimates as nests and birds were likely observed during more than one sample period. Common names with an asterisk (*) were not counted as species.

Common Name	Species Code	Photographed Nests	Field Observed Birds
Anhinga	ANHI	1	20
Black vulture	BLVU	–	41
Brown pelican	BRPE	–	169
Double-crested cormorant	DCCO	3,769	3,734
Great blue heron	GBHE	15	22
Great egret	GREG	5	83
Great white heron	GWHE	54	109
Gulls and Terns * (LARIDAE)	LARI	–	37
Little blue heron	LBHE	–	5
Magnificent frigatebird	MAFR	–	157
Osprey	OSPR	1	4
Reddish egret	REEG	1	–
Roseate spoonbill	ROSP	3	15
Snowy egret	SNEG	–	8
Tricolored heron	TRHE	–	10
Turkey vulture	TUVU	–	24
Unidentified *	UNID	19	16
Unidentified Dark Bird *	UNDA	1	–
Unidentified White Bird *	UNWH	11	8
White ibis	WHIB	31	53
White-crowned pigeon	WCPI	–	6
Yellow-crowned night-heron	YCNH	–	3
Grand Total	–	3,911	4,524

Focal Species Results

Our monitoring results document species-specific nesting patterns and trends, and are grouped by feeding method: diver, stalk and strike, and tactile feeders (Figures 2–4). Species-specific information is presented with a focus on six species: double-crested cormorants, great blue herons, great egrets, great white herons, roseate spoonbills, and white ibises.

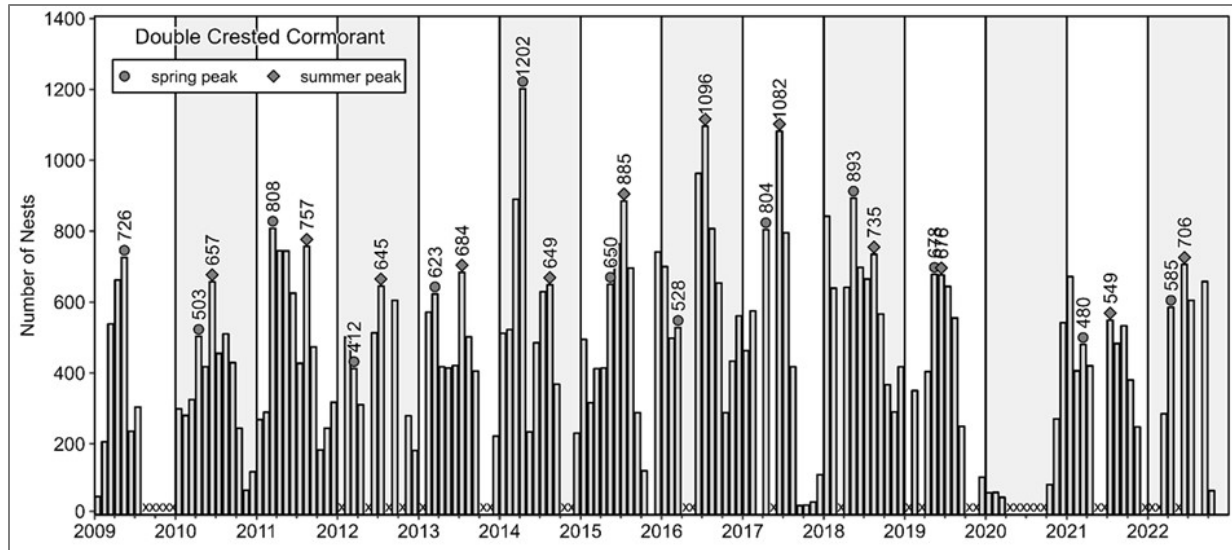


Figure 2. The number of double-crested cormorant nests by month since monitoring began in 2009. Months not sampled are indicated by an "X." Note the spring and summer seasonal peaks. Hurricanes that affected the area were: Isaac (August 26, 2012), Matthew (October 6, 2016), and Irma (September 10, 2017).

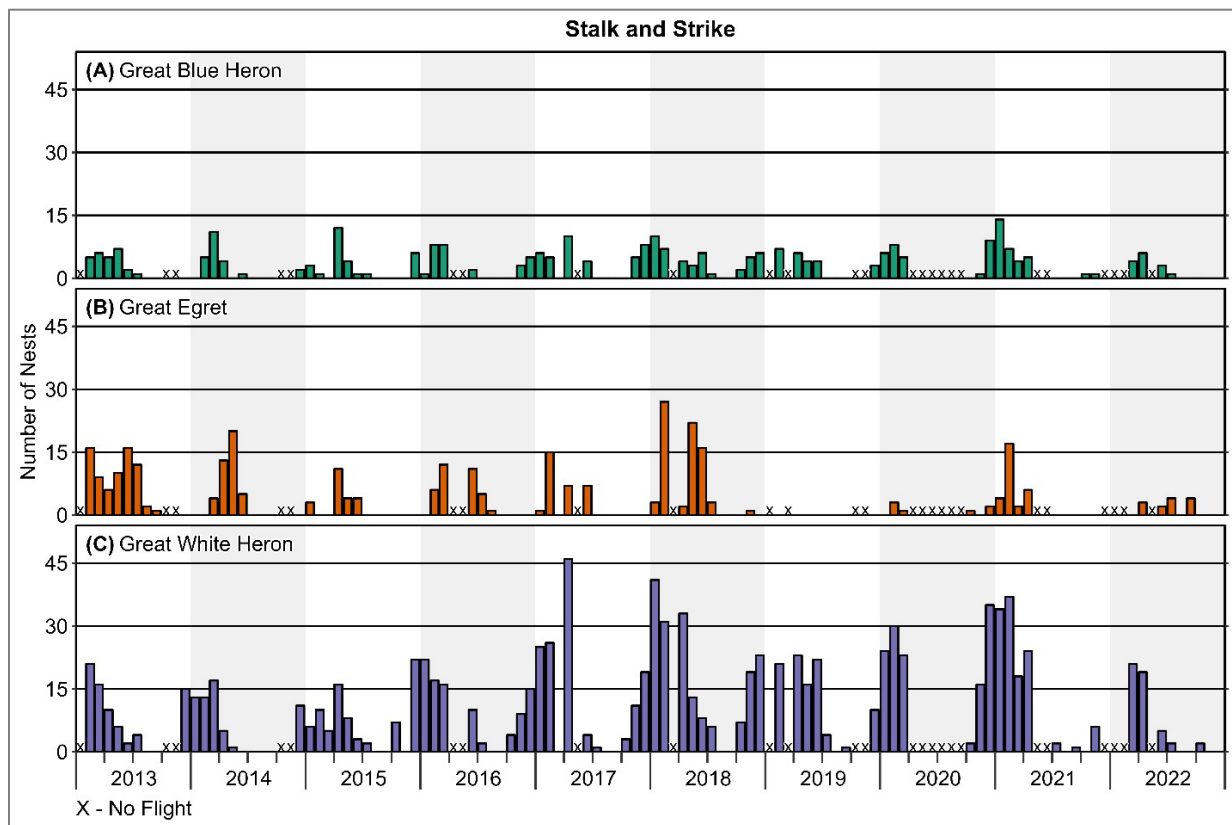


Figure 3. The number of nests by month for the selected stalk and strike species (great blue heron, great egret, and great white heron) over the last 10 nesting seasons. An "X" indicates months not sampled.

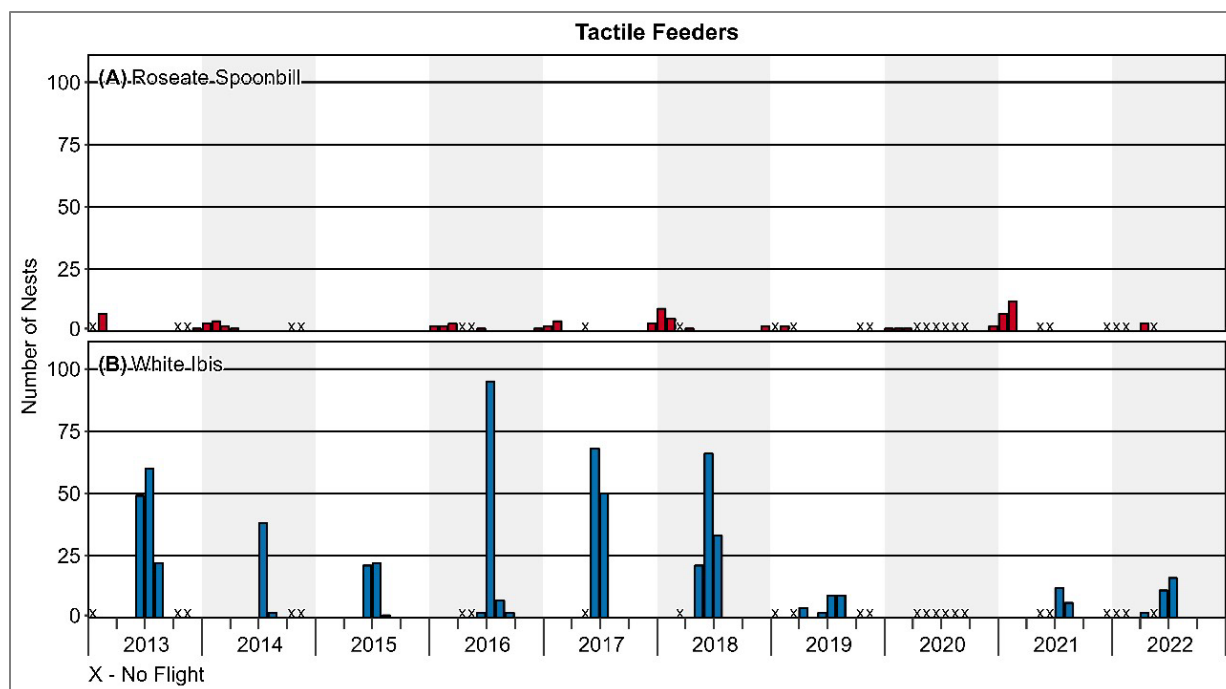


Figure 4. The number of nests by month for the two tactile feeder species (roseate spoonbills and white ibises) over the last 10 nesting seasons. This graph shows that roseate spoonbills nest in the dry season and white ibises nest in the wet season. An “X” indicates months not sampled.

Divers — Double-crested Cormorants

Double-crested cormorants nested in all nine colonies from 2021–2022 (Figures 5 and 6). This species remains the most prominent nesting bird species in our survey, as cormorant nests comprised 96% of the photographed nests of focal species (Table 2) and 93% of the peak nest counts for the last 10 nesting seasons (Table 3). The 2021–2022 peak nest count of 736 for double-crested cormorants was lower than the 10-year average of 966 nests per year (Table 4). Double-crested cormorants were the only species detected nesting on the Kings Bay and Kings Road colonies (Figure 6).

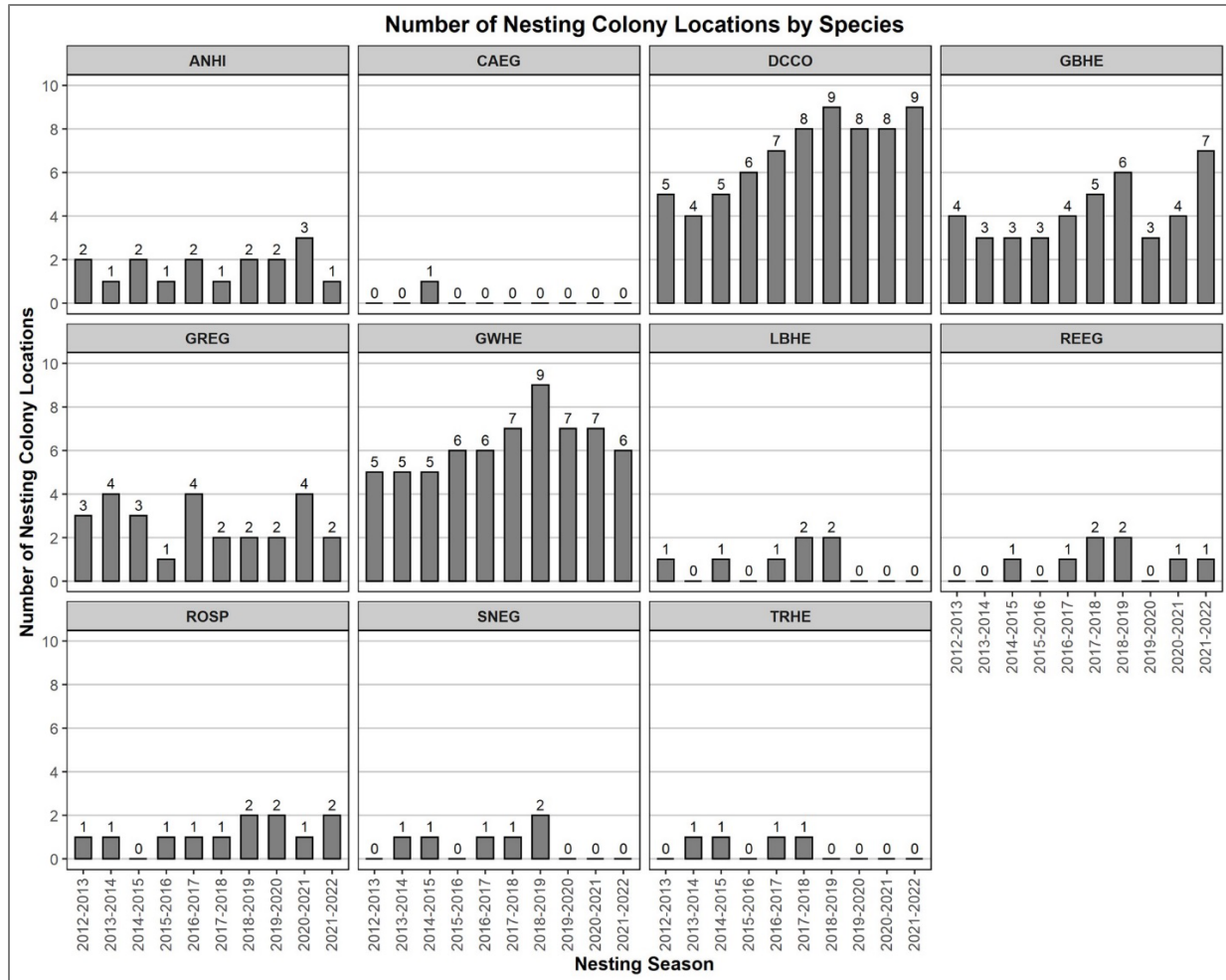


Figure 5. Number of nesting colony locations by species in Biscayne National Park. Includes all egrets, ibises, spoonbills, and herons. ANHI=anhinga; CAEG=cattle egret; DCCO=double-crested cormorant; GBHE=great blue heron; GREG=great egret; GWHE=great white heron; LBHE=little blue heron; REEG=reddish egret; ROSP=roseate spoonbill; SNEG=snowy egret; TRHE=tricolored heron.

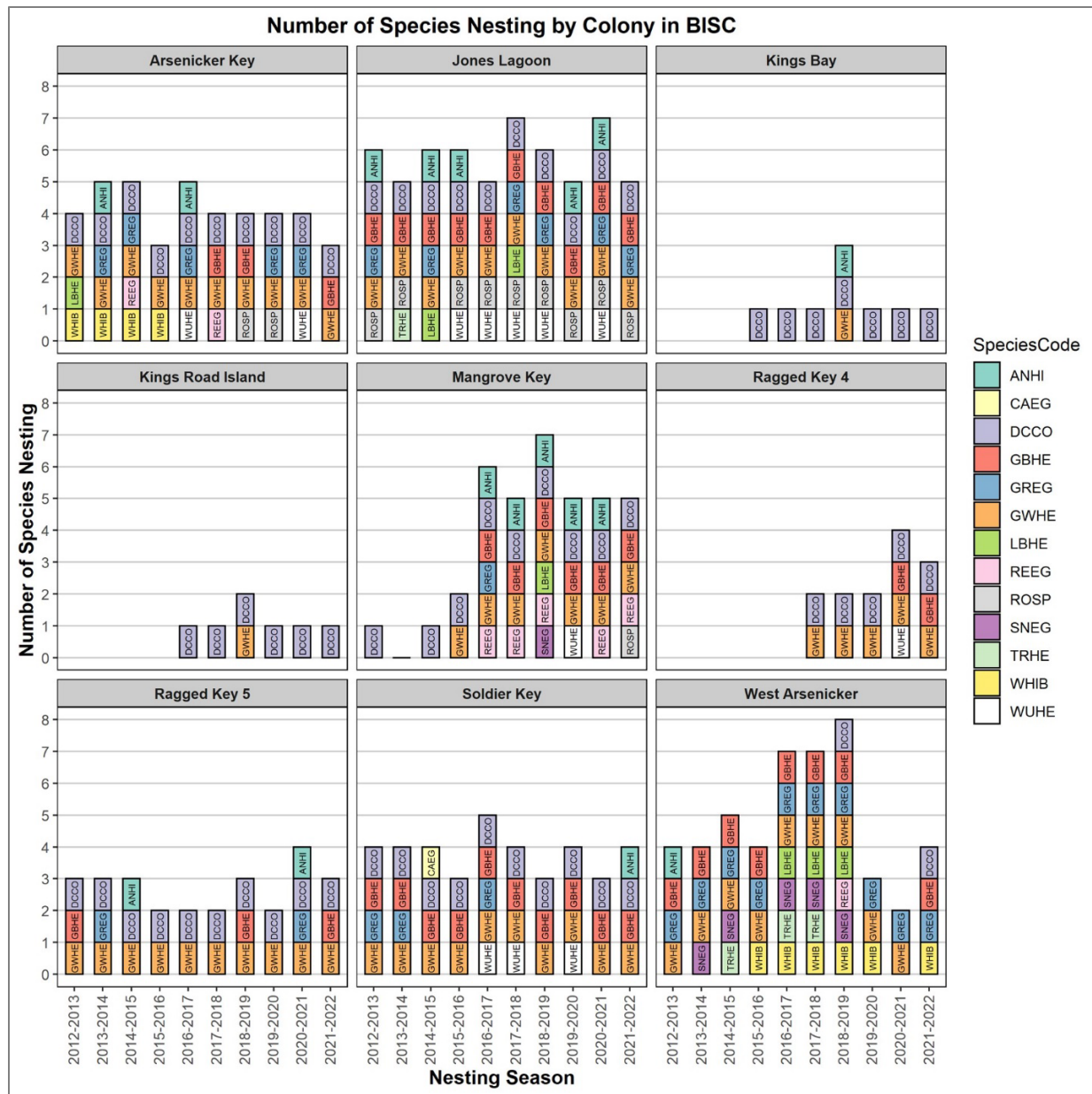


Figure 6. Number of species nesting by colony in BISC. For the 2021–2022 season Jones Lagoon and Mangrove Key had the highest number of species nesting. To allow for legibility, results are displayed for the last 10 nesting seasons. ANHI=anhinga; CAEG=cattle egret; DCCO=double-crested cormorant; GBHE=great blue heron; GREG=great egret; GWHE=great white heron; LBHE=little blue heron; REEG=reddish egret; ROSP=roseate spoonbill; SNEG=snowy egret; TRHE=tricolored heron.

Table 3. Peak nest counts for all colonies over the last 10 nesting seasons. Species and their species codes are as follows, double-crested cormorant (DCCO), great blue heron (GBHE), great egret (GREG), great white heron (GWHE), roseate spoonbill (ROSP), and white ibis (WHIB).

Nesting Season	DCCO	GBHE	GREG	GWHE	ROSP	WHIB
2012–2013	792	15	18	24	7	49
2013–2014	1336	11	24	18	4	60
2014–2015	802	13	14	18	0	38
2015–2016	1213	11	12	28	3	24
2016–2017	1245	11	16	40	4	95
2017–2018	1147	16	29	46	9	66
2018–2019	940	13	4	40	3	33
2019–2020	657	11	3	38	2	9
2020–2021	796	19	19	51	12	0
2021–2022	736	12	3	25	3	12

Table 4. The mean, maximum (Max) and minimum (Min) peak nest counts calculated using data from the last 10 nesting seasons. Species and their species codes are as follows, double-crested cormorant (DCCO), great blue heron (GBHE), great egret (GREG), great white heron (GWHE), roseate spoonbill (ROSP), and white ibis (WHIB).

Species Code	Mean	Max	Min
DCCO	966.4	1336	657
GBHE	13.2	19	11
GREG	14.2	29	3
GWHE	32.8	51	18
ROSP	4.7	12	0
WHIB	38.6	95	0

As shown in Table 5, the 2021–2022 nesting season nesting index is lower for all six focal species compared to the 10-year average (Table 6). This may not be significant because of the missed surveys.

Table 5. Nesting index values for all colonies over the last 10 nesting seasons. Species and their species codes are as follows, double-crested cormorant (DCCO), great blue heron (GBHE), great egret (GREG), great white heron (GWHE), roseate spoonbill (ROSP), and white ibis (WHIB).

Nesting Season	DCCO	GBHE	GREG	GWHE	ROSP	WHIB
2012–2013	5744.5	44	89	112	13	76
2013–2014	6285	27.5	58	80.5	11	82
2014–2015	5525	23	33	72.5	0	61
2015–2016	7113.5	32	52	138.5	12	27
2016–2017	8472.5	46	54	198.5	9	172
2017–2018	5782.5	50	88.5	195	21	137
2018–2019	5908.5	52.5	5	192.5	6	42
2019–2020	2083	22	4	103.5	3	18
2020–2021	3844	43	40.5	182	21	0
2021–2022	4414.5	19	7	69.5	3.5	37.5

Table 6. Mean, maximum (Max) and minimum (Min) nesting index values calculated over the last 10 nesting seasons. Species and their species codes are as follows, double-crested cormorant (DCCO), great blue heron (GBHE), great egret (GREG), great white heron (GWHE), roseate spoonbill (ROSP), and white ibis (WHIB).

Species Code	Mean	Max	Min
DCCO	5517.3	8472.5	2083
GBHE	35.9	52.5	19
GREG	43.1	89	4
GWHE	134.45	198.5	69.5
ROSP	9.95	21	0
WHIB	65.25	172	0

Stalk and Strike — Great Blue Heron, Great Egret, and Great White Heron

The 2021–2022 peak nest count for great blue heron was 12 and 25 for the great white heron (Table 3), both fell within their respective minimums and maximums (Table 4). For the great egret, the peak nest count of three, equals the lowest in the last 10 seasons (Table 3). The nesting index values of 35.9 for great blue herons, 43.1 for great egrets, and 134.45 for great white herons all fell within their respective minimums and maximums and the nesting index values for all three species were lower than last year’s values (Tables 5 and 6).

Great blue herons were detected nesting on seven colonies, great whites on six colonies, and great egrets on two colonies (Figure 5). Great blue herons were detected nesting on all colonies except Kings Road and Kings Bay colonies. Great egrets were only detected on Jones Lagoon and West Arsenicker Key. The great white herons were not detected on Kings Bay, Kings Road, and West Arsenicker (Figure 6) but were detected at the other six sites.

Tactile Feeders — Roseate Spoonbill and White Ibis

Roseate spoonbills were detected nesting on Jones Lagoon and Mangrove Key, while the white ibis was only detected nesting on West Arsenicker (Figure 6). Although both species are tactile feeders, their nesting times are different. Roseate spoonbills nest in the dry period, while the white ibis nest in the wet season (Figure 4).

Colony Results

There were no new colonies detected on our census flight and all surveyed colonies maintained some level of nesting. Only Soldier Key and West Arsenicker showed increases in the number of species. Arsenicker Key, Jones Lagoon Ragged Key 4, and Ragged Key 5 showed reductions in species while Kings Bay, Kings Road, and Mangrove Key remained the same. This 2021–2022 nesting season showed the double-crested cormorants as the only species detected nesting on all nine colonies. Great blue herons nested on seven colonies and great white herons on six colonies (Figure 5). On two colonies, Kings Bay and Kings Road, only double-crested cormorants were detected nesting (Figure 6).

Conclusion

Because of a helicopter problem and an administrative shutdown, we were unable to survey from December 2021 through February 2022. The May 2022 survey also did not take place because of personnel and helicopter unavailability. The lack of data makes it difficult to compare annual trends.

Peak nest counts for five of the six focal species were lower in 2021–2022 than 2020–2021, except for white ibis, which increased relative to the previous nesting season. For the fourth consecutive season, peak nest counts for double-crested cormorants remain under 1,000 nests.

For the number of species actively nesting by colony, our data indicate that two colonies increased, four colonies decreased, and three colonies remained the same relative to the previous nesting season. At least one of the focal species nested at all nine colonies, which has been consistent since the start of surveys (Figure 6).

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