SOUTH FLORIDA WADING BIRD REPORT

Volume 19 Mark I. Cook, Editor December 2013

SYSTEMWIDE SUMMARY

An estimated 48,291 wading bird nests were initiated throughout south Florida during the 2013 nesting season[a]. This is a moderate improvement in nesting effort after three relatively poor years and represents a relatively average year compared to the past decade. The 2013 estimate is 57% above average for the past 3 years (30,815.7 nests), similar to the average of the past 8 years[b] (42,093 nests), and about half (45%) the effort of 2009 (87,564 nests), which was the best nesting year on record in south Florida since the 1940s.

The improved nesting effort was largely due to increases in White Ibises (WHIB) and Wood Storks (WOST), with notable increases also for Great Egrets (GREG). The numbers of WOST and WHIB nests were up 50% and 23% respectively over the 8-year average, and 97% and 90% over the 3-year average. GREG had 34% and 46% more nests than the 8- and 3-year averages. By contrast, smaller herons and egrets, which exhibited a steep decline in nest numbers in recent years, had another relatively poor nesting season. Nesting effort was reduced 19% for the Snowy Egret (SNEG), 21% for the Tricolored Heron (TRHE), and 50% for the Little Blue Heron (LBHE) relative to the 8-year average.

Of particular interest are the recent nesting patterns of the Roseate Spoonbill (ROSP). This coastal species, which typically nests in the keys of Florida Bay, has for the past few years nested in relatively large numbers (>200 nests) at inland colonies in northern Water Conservation Area (WCA) 3A. This year, nest numbers were back down to normal for the WCAs (57 nests) but they increased by about 200 nests in mainland Everglades National Park (ENP) (360 nests). The displacement of wading birds (storks and ibises) from the coastal colonies was one of the first signs that the estuaries of the southern Everglades were degraded, and this pattern may now be being repeated for the spoonbill. In Florida Bay, ROSP nesting effort (367 nests) was similar to last year (348 nests), but remains much lower than historic averages.

[a] Nest counts for south Florida now include estimates from Lake Okeechobee, the Kissimmee River floodplain, and the Estero Bay Aquatic Preserve. In previous reports these were provided separately.

[b] An 8-year rather than a decadal comparison is provided as only 8 years of successive nest count data are available for Lake Okeechobee.

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SPATIAL DISTRIBUTION OF NESTS

South Florida

Most wading bird nesting in south Florida occurs in the Greater Everglades (the WCAs and mainland ENP, **Figure 1**). In 2013, wading birds initiated an estimated 35,580 nests in the Everglades, 74% of all nests in south Florida. This nesting effort was a moderate improvement from recent years (e.g., 24,191 nests in 2012), was similar to the decadal average (34,732.6 nests), but was 51% lower than the record high of 73,096 nests in the Everglades in 2009.

Lake Okeechobee is another important nesting area in south Florida. In 2013 it supported 8461 nests (17% of all nests in south Florida). This is an improvement on recent years (e.g., 3079 nests in 2012 and only 39 nests in 2008) and is the fourth largest nesting effort on the lake since 1954.

Figure 1. Locations of wading bird colonies with ≥50 nests in south Florida, 2013.

Not all traditional breeding areas in south Florida attracted nesting birds. Of particular note is the reduction in WOST nesting at Corkscrew Swamp Sanctuary. WOST have historically nested in Corkscrew in relatively large numbers, yet the 2013 nesting season was the sixth of the past seven years when storks failed to breed there. Such an unprecedented decline in nesting activity may reflect a serious reduction in the extent or quality of WOST foraging habitat in southwest Florida during recent years.

On the recently restored section of the Kissimmee River floodplain, wading birds are not yet nesting in significant numbers, and only 148 nests were recorded. However, nesting effort is not expected to improve until hydrologic conditions are restored in 2016.

Everglades

ENP historically supported the largest number of nests in the Greater Everglades, but in recent decades, most nesting has occurred inland in the WCAs. A goal of the Comprehensive Everglades Restoration Plan (CERP) is to restore hydrologic conditions that will reestablish prey production and availability across the landscape that will support the return of large successful wading bird colonies to the traditional estuarine rookeries downstream of Shark River Slough. In 2013, ENP supported a relatively large proportion of nests (35%), while WCA-3 and WCA-1 supported 46% and 19%, respectively. This spatial distribution of nests contrasts with the general pattern over the past decade when nesting was concentrated in WCA-1 and WCA-3A, while ENP was relatively unattractive for nesting (an average of 16% of nests over the past decade). ENP has become more attractive to nesting birds in recent years, with the proportion of nests increasing to 20% and 21% in 2006 and 2009, and then jumping to over 40% in 2010. However, 2013's increase remains below the 50% CERP target and may reflect declining nesting conditions in the WCAs rather than a marked improvement in habitat conditions along the marsh-mangrove ecotone.

TIMING OF WOOD STORK NESTING IN THE EVERGLADES

Because storks have a relatively long nesting period (≈120 days), it is critical that they start nesting relatively early in the dry season so that nestlings have time to fledge and gain independence prior to the onset of the rainy season in May–June. Once the rains arrive, the high densities of aquatic prey animals that formed during the dry season disperse with rising water levels, adults have difficulty finding suitable foraging habitat, and nesting often fails. Historically, nesting started around November–December, but in recent decades it has shifted to January–March. This year, storks nested in mid-late January, which is an improvement on last year when most storks delayed nesting until mid-March, but it falls short of the CERP target of December.

NEST SUCCESS IN THE EVERGLADES

While nesting effort was generally good this year, nest success was reduced for most species relative to previous years. This was certainly the case in the WCAs where overall nest success was at the low end of the range for most species studied (for more details see regional nest reports for WCAs and ENP). The exception was the WOST, which was largely successful in the WCAs and the Tamiami W colony in northern ENP, with most nests fledging young. However, stork nesting success was probably lower in the southern colonies of ENP, where observations of undernourished, dead, or missing young suggest that fledging success was relatively depressed. In Florida Bay, ROSP nests were relatively successful, fledging on average more than 1 chick per nest.

INFLUENCE OF HYDROLOGY ON NESTING IN THE EVERGLADES

Wading bird reproductive patterns in the Everglades are driven largely by hydrology through its influence on the production of aquatic prey and their vulnerability to predation (Frederick et al. 2009). During the wet season of 2012, most of the Everglades experienced greater than average rainfall and long periods of standing water, which generally promotes prey production (Trexler et al. 2005). High stages in October 2012 followed by rapid drying into March 2013, allowed prey to become concentrated and prompted relatively large nesting responses by WOST, GREG, and WHIB. However, several heavy rain events in February and April caused large-scale water-level reversal, which dispersed the concentrated prey. This led moderate numbers of WOST and GREG to abandon nesting shortly after the water level reversals, while WHIB, which started nesting in late March, suffered almost complete colony abandonment at many colonies (e.g., of approximately 8000 WHIB nests at Alley N colony in WCA-3A, 93% failed by May 2).

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ABBREVIATIONS

Species: Anhinga (ANHI, *Anhinga anhinga*), Black-crowned Night Heron (BCNH, *Nycticorax nycticorax*), Brown Pelican (BRPE, *Pelecanus occidentalis*), Cattle Egret (CAEG, *Bubulcus ibis*), Double-crested Cormorant (DCCO, *Phalacrocorax auritus*), Glossy Ibis (GLIB, *Plegadis falcinellus*), Great Blue Heron (GBHE, *Ardea herodias*), Great Egret (GREG, *Ardea alba*), Great White Heron (GWHE, *Ardea herodias occidentalis*), Green Heron (GRHE, *Butorides virescens*), Little Blue Heron (LBHE, *Egretta caerulea*), Osprey (OSPR, *Pandion haliaetus*), Reddish Egret (REEG, *Egretta rufescens*), Roseate Spoonbill (ROSP, *Ajaja ajaja*), Snowy Egret (SNEG, *Egretta thula*), Tricolored Heron (TRHE, *Egretta tricolor*), White Ibis (WHIB, *Eudocimus albus*), Wood Stork (WOST, *Mycteria americana*), Yellow-crowned Night Heron (YCNH, *Nyctanassa violacea*), small herons (SMHE), small dark herons (SML DRK), small white herons (SML WHT)

Regions, Agencies & Miscellaneous: Charlotte Harbor Aquatic Preserves (CHAP), Comprehensive Everglades Restoration Plan (CERP), Estero Bay Aquatic Preserve (EBAP), Everglades National Park (ENP), Everglades Protection Area (EPA), Florida Administrative Code (F.A.C.), Florida Atlantic University (FAU), Florida Department of Environmental Protection (FDEP), Kissimmee River Restoration Evaluation Program (KRREP), Northeast Shark River Slough (NE-SRS), Performance Measures (PM), Restoration Coordination and Verification (RECOVER), Solid Waste Authority (SWA), South Florida Environmental Report (SFER), South Florida Water Management District (SFWMD), Water Conservation Area (WCA), Water Year (WY)

EVERGLADES PROTECTION AREA HYDROLOGY

The amount of rain in the Everglades Protection Area (EPA) for Water Year 2013 (WY2013) (May 1, 2012–April 30, 2013) was substantially more than last year and much above average historical conditions (**Table 1**). In Everglades National Park (ENP), rainfall was 3.3 inches more (6.0%) than the historical average and 4.7 inches more (8.5%) than last year. Water Conservation Areas (WCAs) 1 and 2 experienced the most dramatic deviations from the historical average. Rainfall in these areas was 10.8 inches (20.9%) above the historic average and 8.9 inches (16.5%) more than last year. The rainfall in WCA-3 was 3.3 inches more (5.9%) than the historical average and was 4.7 inches more (8.7%) than last year.

Above-average rainfall translated into above-average stages throughout the Greater Everglades (**Table 1**), except in WCA-2A where WY2013 was 0.06 ft lower than the historic mean. Average WY2013 depth above the historic mean was 0.84 ft, 0.67 ft, and 0.53 ft for WCA-1, WCA-3, and the ENP, respectively, for an average depth of 1.4 ft, 2.04 ft, and 1.42 ft, respectively. For the entire Greater Everglades, this above-average stage was due to an above-average minimum, not an above-average maximum.

Last year, the analysis of ecohydrology was based on 4 water years to highlight a unique time-series pattern of two droughts and to discuss the ecological implications of a drought-wet-drought-wet sequence on the restoration of wading birds. This year, the analysis returns to an evaluation based upon the last 3 years. As described in last year's report, hydrologic conditions in WY2009 were highly conducive for nesting for many species of wading birds (prey density was high and no reversal during the dry season); WY2010 was terrible for most wading birds due to flooding; the WY2011 drought was too extreme and this was not a good year; and WY2012 started out looking good but low prey abundance and water levels that rose too soon and too quickly cut short the fledgling period.

The hydropattern figures (**Figure 2A-G**) highlight the average stage changes in each of the WCAs for the last 3 years in relation to the recent historic averages, flooding tolerances for tree islands, drought tolerances for wetland peat, and recession rates and depths that support both nesting initiation and foraging success by wading birds. These indices are used by the District to facilitate weekly operational discussions and decisions. Tree island flooding tolerances are considered exceeded when depths on the islands are greater than 1 ft for more than 120 days. Drought tolerances are considered exceeded when water levels are greater than 1 ft below ground for more than 30 days (i.e., the criteria for Minimum Flows and Levels in the Everglades).

The wading bird nesting period is divided into three simple categories (red, yellow, and green) in the hydropattern figures. These categories are based on foraging observations in the Everglades and are defined as follows:

- A red label indicates poor conditions due to recession rates that are too fast (greater than 0.6 ft/week) or too slow (less than 0.04 ft for more than two weeks). A red label is also given when the average depth change for the week is positive rather than negative.
- A yellow label indicates fair conditions and generally poor foraging depths (i.e., depths greater than 1.5 ft), a slow recession rate of 0.04 ft for a week, or rapid recessions (i.e., between 0.17 ft and 0.6 ft/week).
- A green/good label indicates water depth decreased between 0.05 and 0.16 ft/week and water depths were between 0.1 and 1.5 ft.

Table 1. Average, minimum, and maximum stage [feet National Geodetic Vertical Datum (ft NGVD)] and total annual rainfall (inches) for WY2013 in comparison to historic stage and rainfall. (Average depths calculated by subtracting elevation from stage.)

Area	WY2013 Rainfall	Historic Rainfall	WY2013 Stage Mean (min; max)	Historic Stage Mean (min; max)	Ground Elevation
WCA-1	62.80	51.96	16.49 (15.50; 17.35)	15.65 (10.0; 18.16)	15.1
WCA-2	62.80	51.96	12.45 (11.48; 14.43)	12.51 (9.33; 15.64)	11.2
WCA-3	56.15	51.37	10.24 (9.18; 11.64)	9.57 (4.78; 12.79)	8.2
ENP	58.49	55.22	6.52 (5.59; 7.38)	5.99 (2.01; 8.08)	5.1

Water Conservation Area 1

In WY2011, the dry season began at a below-average stage and got significantly worse. By July, water levels were on average some 1.7 ft below ground in WCA-1 (**Figure 2A**). This created a significant deficit entering WY2012. Water levels in WCA-1 took 6 months to return to average conditions; not much time for small fish to rebound and disperse. At the same time, the dry season recession rates in WY2012 were supportive of good foraging conditions for only a few months (January 2012–April 2012) before reversals and rising water levels brought the nesting season to an early end. Even if WY2012 foraging conditions had not ended early, nesting would have been poor because prey densities appeared insufficient (Joel Trexler, pers. comm.) to support substantial nesting success.

During the WY2013 wet season water stage rose quickly and was 1 ft above average by June. After the big summer drought of 2011, these high depths rejuvenated the aquatic prey base, and attracted large numbers of foraging birds during the start of the WY2013 dry season. A high nesting effort was expected for WCA-1A in WY2013 until a reversal occurred in March 2013. This reversal was followed by a return to good recession rates until April with water levels above average for May and June. These were poor hydrologic conditions for foraging, nesting, and fledgling young. Although WY2013 was not good for wading birds, it may be another year of rebound for small fish because the hydrology protected them from prying beaks.

Water Conservation Area 2A and 2B

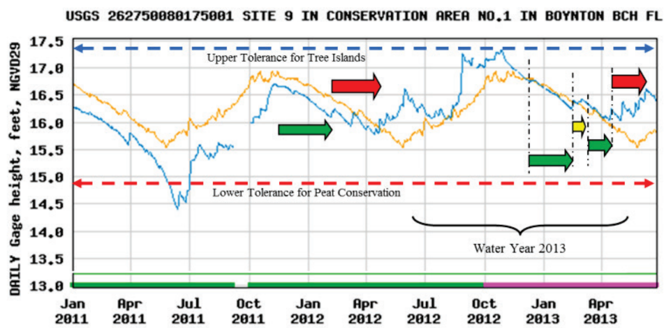
It is common for stage levels during the wet season to exceed the upper flood tolerance for tree islands for 1 to 2 months in WCA-2A as it did this year. Although 1 to 2 months is not considered enough to cause long-lasting tree island damage (Wu et al. 2002), it is believed that it is also good for tree islands to "dryout" occasionally (Heisler et al. 2002).

Last year, good recession rates in WCA-2A were long-lived followed by a rapid and early return of the wet season, making it a good foraging location. This year, rehydration rates during the wet season created a good environment for prey rebound, but recession rates during the dry season were "bumpy" (fair to good). Wading bird foraging was good, but short-lived in WCA-2A due to reversals in April and an early end to the dry season. No nesting was observed; lack of tree islands in WCA-2A and 2B makes these regions unsuitable for nesting. The 2011 to 2013 hydrograph (**Figure 2B**) for this section of the WCA continues to suggest a long-term trend of above-average foraging and poor nesting. For the last 2 water years, the hydrograph indicated relatively equal distributions of green and red arrows.

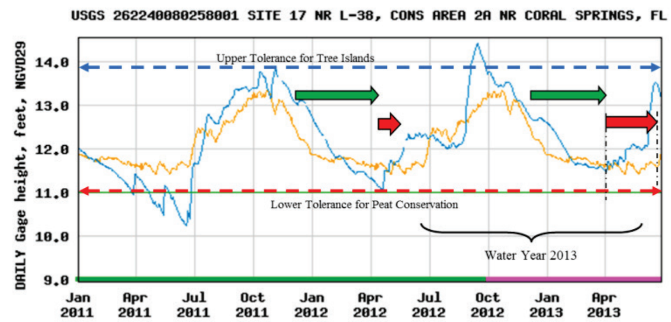
WCA-2B tends to be used by wading birds during droughts because it is often deeper longer than the rest of the EPA. This was true in WY2009 when dry season water levels went below ground for most of the EPA and the wading birds moved to WCA-2B. It was not true in WY2011 because dry season water levels went almost 2.5 ft below ground for an extended period. It was ecologically problematic for water levels to increase by some 4 ft over a few months as occurred in this region in WY2012. Young tree seedlings or marsh grass that established during the previous drought cannot keep their "heads" above water when water rises this quickly. The 2011–2013 hydrographs (**Figure 2C**) for this section of the WCA suggest a long-term trend of very poor foraging and nesting. For the last 2 years, the hydrograph indicated only yellow arrows.

Figure 2. Hydrology in the WCAs and ENP in relation to recent average water depths (A: 14-yr avg, B: 14-yr avg, C: 18-yr avg, D: 19-yr avg, E: 19-yr avg, F: 12-yr avg, G: 25-yr avg) and indices for tree islands, peat conservation, and wading bird foraging depths.

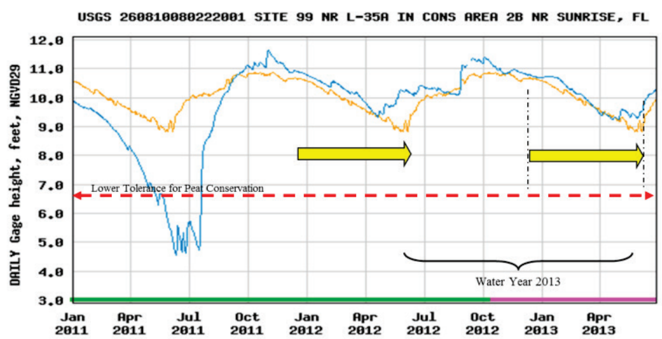
A. WCA-1 – Site 9



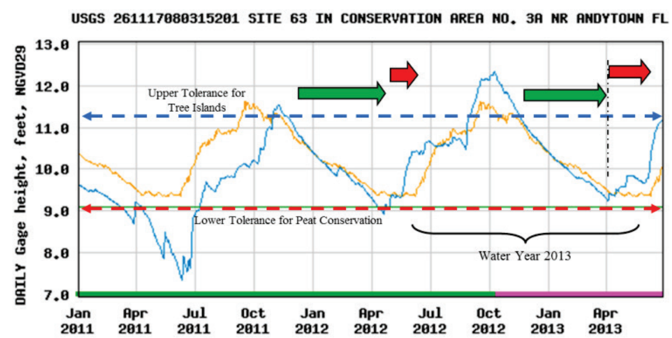
B. WCA-2A – Site 17



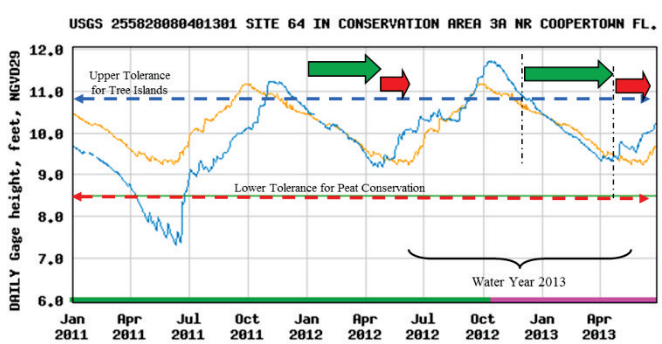
C. WCA-2B – Site 99



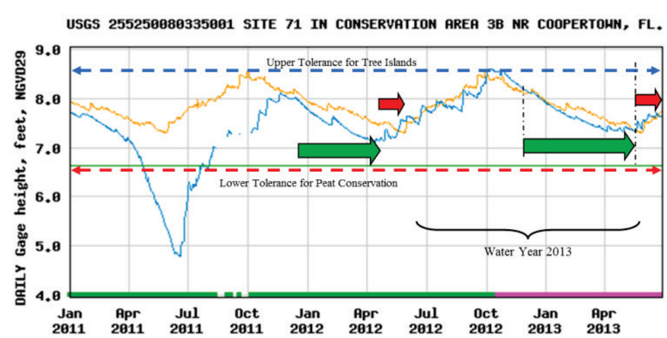
D. WCA-3A – Site 63



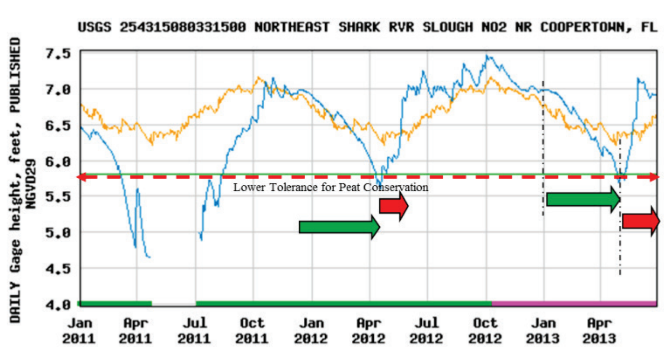
E. WCA-3A – Site 64

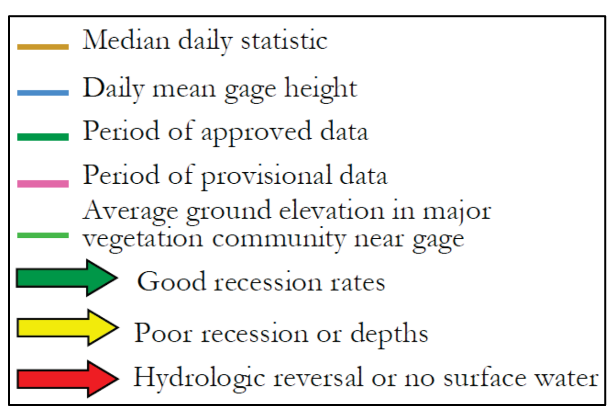


F. WCA-3B – Site 71



G. Northeast Shark River Slough





WATER CONSERVATION AREA 3A

In the northeastern part of WCA-3A, the WY2013 wet season water levels rose quickly and exceeded the flood tolerance of tree islands for some 100 days. These high water levels helped to keep the very large Alley North Colony free from predators for the entire dry season and created the hydraulic head for excellent recession rates for an extended period. However, despite excellent dry season hydrology in WY2013, foraging and nesting were only average. It appears that the drought of WY2011 and the pervasive shallow conditions of WY2012 may have prevented this region from replenishing aquatic prey stocks. Like last year, recession rates were excellent starting in December (good for Wood Storks) and optimum depths started to appear around January. However, like last year, water depths began to rise in April rather than June and the prey base, small that it may have been, began to disperse causing foraging to decline and nests to be abandoned. The 2011–2013 hydrograph (**Figure 2D**) suggests a long-term trend of average foraging and nesting. For the last 2 years, the hydrograph had large green arrows and equal distributions of green and red arrows.

Conditions during the WY2013 dry season were conducive for wading bird foraging in central WCA-3A. However, like most regions, this did not translate into high nesting success, probably again due to poor prey rejuvenation related to: 1) the extended WY2011 drought, 2) the shallowness of the WY2012 wet season (i.e., not protective), and 3) the good WY2012 dry season recession rates. Average to small flocks of wading birds were observed following the receding drydown fronts in the central WCA-3A during WY2013. As was observed last year, nesting birds abandoned their nest before most young birds could fledge due to an early onset of the WY2013 wet season. The 2011–2013 hydrograph (**Figure 2E**) for this area suggests a long-term trend of above average foraging and nesting. As in the northeastern part of WCA-3A, for the last 2 years, the hydrograph for the central area also had large green arrows and equal distributions of green and red arrows.

WATER CONSERVATION AREA 3B

For the last 2 years, water levels fell at an almost steady perfect 0.10 ft per week during the dry season in WCA-3B (**Figure 2F**). Last year foraging activity during the dry season was reported to be light, but this year there was a relatively large amount of foraging activity. We use the word "relatively" for WCA-3B because there are few sloughs in WCA-3B and as a result, the amount of foraging habitat is very limited. Last year, water depths and recession rates were good for foraging by wading birds, but foraging was limited due to: 1) the lack of sloughs, 2) the extensive WY2011 drydown, and 3) a lack of prey in WY2012. This year, it appears the prey stock had time and water to be rejuvenated. As prey density data are processed over the next year, it will be valuable to the restoration effort to evaluate the hydrological requirements of the aquatic prey populations in relation to the amount of good foraging habitat. Like everywhere else, the dry season in WCA-3B ended in April, thus limiting the foraging season and causing wading birds colonies just south of WCA-3B, in the ENP, to abandon their nests at above-average rates.

Mac Stone Photography

NORTHEAST SHARK RIVER SLOUGH

During WY2012, the wet season was relatively dry, especially June, July, August, and September, but the January–April dry season had good recession rates (**Figure 2G**). This year (WY2013), the wet season was relatively wet and dry season recession rates were very good until May. This hydrology suggests that Northeast Shark River Slough (NE-SRS) was the best place to be in the EPA for foraging wading birds because the aquatic prey had a year to return to pre-drought conditions and the nesting period was not cut short as it was in WCA-1, 2, and 3. Why large flocks of birds are not usually found in NE-SRS is not clear, but it may be due to the dense vegetation, the limited amount of slough, and a legacy of fires and very dry conditions. *South Florida Environmental Reports* (SFERs) on the hydrology of NE-SRS suggest a long-term trend of sub-optimum foraging and nesting. However, the 2011–2013 hydrograph for this section of ENP suggests a 3-year trend of greatly improved foraging and nesting hydrology.

SUMMARY

Above average rainfall for WY2012 came close to creating physiological stress for hardwoods on tree islands, especially in WCA-3A. Dry season recession rates were generally very good, except in WCA-1 where a hydrological reversal in March created a significant decline in wading bird foraging success. Nesting behavior was initially robust everywhere, but fledging success was below average due to an early onset of the 2013 wet season and possible low aquatic prey stock.

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REGIONAL NESTING REPORTS

WATER CONSERVATION AREAS 2 AND 3, AND A.R.M. LOXAHATCHEE NATIONAL WILDLIFE REFUGE

The University of Florida Wading Bird Project continued its long-term monitoring of wading bird reproduction throughout Water Conservation Areas (WCAs) 2 and 3 and A.R.M. Loxahatchee National Wildlife Refuge (NWR, which includes WCA-1) in 2013. We focused primarily on counts of Great Egrets (GREG), White Ibises (WHIB), Snowy Egrets (SNEG), and Wood Storks (WOST), the species that serve as bioindicators for the Comprehensive Everglades Restoration Plan (CERP) and are most readily located and identified through aerial searches. Estimates for these and other species were gleaned from both aerial and systematic ground surveys, as well as visits to nesting colonies and more intensive studies of nest success.

METHODS

We performed two types of systematic surveys to estimate nesting activity in 2013. The primary objective of both kinds of surveys is to locate and characterize nesting colonies. On or about the 15th of each month from February through June, we performed aerial surveys to find active colonies using observers on both sides of a Cessna 182. We surveyed at an altitude of 800 ft above ground level along east-west oriented flight transects spaced 1.6 nautical miles apart. These techniques have been used continuously since 1986 and result in overlapping coverage under various weather and visibility conditions. In addition to visual estimates of nesting birds, we took digital photos of all colonies and counted nesting birds observed in these photos. The reported numbers of nest starts are derived from a combination of information sources, including peak estimates of nests in any colony, information from monthly South Florida Water Management District (SFWMD) helicopter surveys of large colonies that were staggered in time by two weeks from ours, ground visits, and inference from observations across the season.

Since 2005, we have also performed systematic ground surveys in parts of WCA-3 that give an index of abundance for small colonies and dark-colored species not easily located during aerial surveys. In the case of ground surveys, all tree islands within 16 500 m-wide belt transects comprising a total of 336 km^2 were approached closely enough to flush nesting birds, and nests were either counted directly or estimated from flushed birds. These totals were added to the totals reported in the summary tables. Since ground surveys were conducted on only a subset of the total area, the figures should be used mainly for year-to-year comparisons and do not reflect the total number of nesting pairs for species like Little Blue (LBHE), Tricolored (TRHE), and Great Blue Herons (GBHE). In 2013, we also surveyed eight additional transects totaling 168 km^2 in areas adjacent to the regularly surveyed transects. TRHE and LBHE have been steadily declining in our ground survey transects over the years, and these additional surveys were to evaluate whether the birds had moved away from regularly surveyed areas because of local disturbance effects.

RESULTS

Nesting Effort: We estimated 23,007 wading bird nests were initiated at colonies within WCA-1, WCA-2, and WCA-3 in 2013 (**Table 2** and **Table 3**). This nesting effort was 81% of the average effort recorded during the last 10 years, and 95% of the average of the last 5 years. This is the largest total nesting effort recorded since 2009. Nesting effort for WHIB was 94% of the 10-year average and up 14% over the 5-year average. GREG nesting effort was consistent with past years at 92% of the 10-year average and was very close to the average for the past 5 years. WOST had a strong year for nest initiations with an effort 31% and 56% above average for the past 5 and 10 years respectively.

Roseate Spoonbills (ROSP) nested at 6th Bridge and Alley North (57 nests total). This nesting effort is down from the hundreds observed in 2011 and 2012. Spoonbills were also seen at a numerous other colonies during aerial surveys but did not appear to be nesting. This was the third year they have been recorded at 6th Bridge. All three of the nests monitored in nest checks at 6th Bridge had chicks reach 21 days old suggesting they were largely successful at most phases of nesting. However, following an early April reversal, dead ROSP chicks were observed near two of these three nests.

We also continued long-term monitoring of small colonies, primarily small dark herons, in WCA-3. Because of visibility problems these species are not detected well in the aerial surveys and our total counts in the summary table should be treated as bare minimums because they represent only those nests counted in selected ground survey transects. The recent trend towards much smaller numbers of TRHE and LBHE nests in the study area continued. The average number seen in 2005–2013 was reduced by 77% for LBHE and 62% for TRHE by comparison to 1996–2004 averages. In 2013, we saw only 56 nests of combined LBHE and TRHE in these transects. This pattern could be the result of a general reduction in nesting by these species throughout the Everglades or it could indicate that these species are nesting elsewhere in the system such as in larger colonies or in coastal areas. In 2013 we also surveyed areas adjacent to our regularly surveyed transects. We found 12 LBHE and TRHE combined in these areas in 2013 or 0.07 per km^2, suggesting that the decline is not specific to our regularly searched transects. This trend should serve as an alarm to evaluate evidence of more widespread declines of these two state-listed species.

Reproductive Success: We monitored nest success at three colonies: Tamiami West, Joule, and 6th Bridge. We monitored individual nests of GREG (n=18), WOST (n=36), WHIB (n=72), and small herons (SMHE) (n=14) at Tamiami West. GREG (n=42) were monitored at Joule and GREG (n=32) and SMHE (n=28) at 6th Bridge (n=32). Overall nest success for these colonies (P; probability of fledging at least one young, Mayfield method) was on the low end of the range: GREG (P=0.156; SD=0.039), SMHE (P=0.235; SD=0.06), WHIB (P=0.192; SD.039). Nest success appeared to vary widely among colonies in the WCAs.

One of the most obvious things about this season was the tendency for birds to abandon readily. We observed high early season abandonments at numerous colonies (Paurotis Pond, Joule, 6th Bridge, and Jupiter). These abandonments by WOST and GREG occurred during incubation. Since our methodology has not changed over the years, it seems likely that abandonment was a response to changing food availability and was associated with water level reversals in February and April.

In mid-April abandonments by WHIB occurred at three major colonies following early and mid-April reversals. Tamiami West had 67% of nests fail by April 17, Alley North had 93% fail by May 2, and Lox 99 had 91% fail by May 2. In mid-May, WHIB began nesting at several colonies (Tyger, Lox Ramp, and 186) in WCA-1. Though the evidence is circumstantial, this suggests movement of many of the same birds from failed colonies towards renesting attempts in WCA-1.

WOST appear to have been largely successful in the two WCA colonies and at Tamiami West despite water reversals with most nests surviving to fledging. In Tamiami West, nest success measures for WOST were relatively high (probability of producing 55-day old young=0.501; SD=0.114). However, success in the southern colonies (Paurotis Pond, Rodgers River, Broad River) appeared to be much lower, and decreased nest attendance by adults and undernourished-looking chicks late in the season throughout the Everglades system suggested that juvenile survival may be considerably lower than usual.

Python Camera Traps: Burmese Pythons (*Python molurus*) have become common in the southern Everglades, and telemetry work suggests that they are attracted to and inhabit wading bird colonies for long periods during the breeding season. It is unclear whether pythons typically prey on nest contents or adults in colonies, or even whether large adults can climb trees. In 2013, we used time-lapse trail cameras to monitor predation in WOST nests in Paurotis Pond and Tamiami West colonies, with photos every 5 minutes (infrared exposures were used at night). We monitored 16 nests over 500 trap nights and detected no python activity at nests. This information adds some quantitative weight to the idea that pythons are not currently preying on nest contents, though we consider this far from a definitive answer. We have yet to evaluate whether pythons may be taking adults and young when they forage and walk on the colony floor.

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Table 2. Number of nesting pairs found in Loxahatchee NWR during systematic surveys, February–June 2013.

Latitude	Longitude	Colony	GREG	WHIB	WOST	ROSP	SNEG	GBHE	LBHE	TRHE	GLIB	BCNH	Unid. Large Wht.	Unid. Small Wht.	Unid. Small Dark.	ANHI	Colony Total*
26.49511	-80.2253	Lox Ramp	116	800	0	0	0	0	0	0	0	0	0	0	0	0	**916**
26.49117	-80.26712	Weldon	74	0	0	0	0	0	0	0	0	0	0	0	0	0	**74**
26.45857	-80.24032	Newcol 2	268	0	0	0	0	0	0	0	0	0	0	0	0	0	**268**
26.43822	-80.39053	Lox 99	302	4000	0	0	0	0	0	***	0	0	0	119	0	0	**4421**
26.37197	-80.31035	Utu	50	0	0	0	0	0	0	0	0	0	0	0	0	0	**50**
26.37187	-80.26597	Tyger	140	561	0	0	0	0	***	***	0	0	0	35	0	0	**736**
26.55993	-80.24871	186	50	179	0	0	0	0	0	0	0	0	0	0	0	0	**229**
Air Surveys < 50			70	0	0	0	0	0	0	0	0	0	0	0	0	0	**70**
Totals By Species			1070	5540	0	0	0	0	0	0	0	0	0	154	0	0	**6764**

* Excludes ANHI
***Present but not counted

Table 3. Number of nesting pairs found in WCA-2 and WCA-3 during systematic surveys, February–June 2013.

Latitude	Longitude	WCA	Colony	GREG	WHIB	WOST	ROSP	SNEG	GBHE	LBHE	TRHE	GLIB	BCNH	Unid. Large Wht.	Unid. Small Wht.	Unid. Small Dark.	ANHI	Colony Total*
26.2371	-80.31016	2	New 1 18 May	183	0	0	0	0	0	0	0	0	0	0	0	0	0	**183**
26.20131667	-80.5287333	3	Alley North	1342	8000	0	20	0	0	***	***	0	0	0	497	0	0	**9859**
26.12428333	-80.5414833	3	6th Bridge	500	0	0	37	0	0	0	0	0	0	0	0	0	0	**537**
26.12408333	-80.5043833	3	Cypress City	131	0	0	0	0	0	0	0	0	0	0	0	0	0	**131**
26.10715	-80.4980167	3	Nanse	219	0	0	0	0	0	0	0	0	***	0	0	0	0	**219**
26.01556667	-80.5627167	3	Jupiter	141	0	0	0	0	0	0	0	0	0	0	0	0	0	**141**
26.0123	-80.6323333	3	Joule	180	0	0	0	0	0	0	0	0	0	0	0	0	0	**180**
26.00011667	-80.5951333	3	Jerrod	155	0	0	0	0	0	0	0	0	0	0	0	0	0	**155**
25.96051667	-80.5720667	3	L-67 (Horus)	300	0	0	0	0	0	0	0	0	0	0	0	0	0	**300**
25.91565	-80.6302167	3	Vacation	255	0	0	0	0	0	0	0	0	0	0	0	0	0	**255**
25.86302	-80.83874	3	Jetport	0	0	43	0	0	0	0	0	0	0	0	0	0	0	**43**
25.81913	-80.83983	3	Henry	50	0	0	0	0	0	0	0	0	0	0	0	0	0	**50**
25.8051	-80.84902	3	Jetport South	253	0	463	0	0	0	0	0	0	0	0	0	0	0	**716**
25.80133333	-80.49	3	3B Mud East	66	0	0	0	0	0	0	0	0	0	0	0	0	0	**66**
25.77353333	-80.8372167	3	Hidden	65	0	0	0	0	0	0	0	0	0	0	0	0	0	**65**
25.77328	-80.833385	3	163	0	2086	0	0	***	0	***	***	0	0	0	0	0	0	**2086**
Air and Ground < 50 **				378	0	0	0	8	176	41	15	0	639	0	0	0	621	**1327**
Totals by Species				4218	10,086	506	57	8	176	41	15	0	639	0	497	0	621	**16,864**

* Excludes ANHI
** Includes COUNT wading bird nesting pairs from ground surveys
***Present but not counted

EVERGLADES NATIONAL PARK – MAINLAND

This summary addresses colony monitoring within the slough and estuarine areas of Everglades National Park (ENP) during the 2013 wading bird breeding season[c].

METHODS

One or two observers flew monthly site checks of known colony locations. Altitude was maintained at 600–800 ft above ground level. During each flight, visual estimates of nest numbers by species were made and photos were taken of colonies using a digital camera with a 70–200 mm lens. Photos were later compared to visual estimates to assist with determining nest numbers, nesting stage, and species composition.

Due to a change in our aviation operations this year, we were unable to conduct colony surveys during March and May. We were also unable to conduct a reconnaissance survey this season. Nick Vitale with University of Florida (UF) and Jessica Klassen with Florida Atlantic University (FAU) assisted by checking colonies for us in March.

Species monitored include Great Egret (GREG), Wood Stork (WOST), White Ibis (WHIB), Snowy Egret (SNEG), Roseate Spoonbill (ROSP), Tricolored Heron (TRHE), Little Blue Heron (LBHE), Cattle Egret (CAEG), and Black-Crowned Night Heron (BCNH). Other birds found nesting in colonies such as the Great White Heron (GWHE), Great Blue Heron (GBHE), Anhinga (ANHI), Brown Pelican (BRPE), and Double-Crested Cormorant (DCCO) are noted as well.

[C] An aerial wading bird nesting survey was not conducted in Florida Bay this season.

RESULTS

Overall nesting effort in ENP was up by 31% compared to the 2012 nesting season. The total pooled species nest estimate was 12,505 (**Table 4**). WOST had an estimated 2005 nests, an increase of 145% compared to last season. GREG nest counts (N=2920) were up by 49% and SNEG nest counts (N=620) were down by 63%. WHIB (N=6600) were up by 31% this season compared to the previous season. Seventeen wading bird colonies were monitored (**Figure 3**).

WOST were first seen at colony sites on January 18. At Rodgers River Bay, storks were sitting on more than 100 nests and eggs were visible in several nests. At Paurotis Pond, some storks had started working on nest platforms but most birds were still roosting. When checked again on January 29 and 31, colonies where storks have nested in recent years had active nests with the exception of Cabbage Bay, Rookery Branch, and Grossman Ridge West. In March, storks were nesting at all known stork colony sites and nest numbers of other species had increased as well.

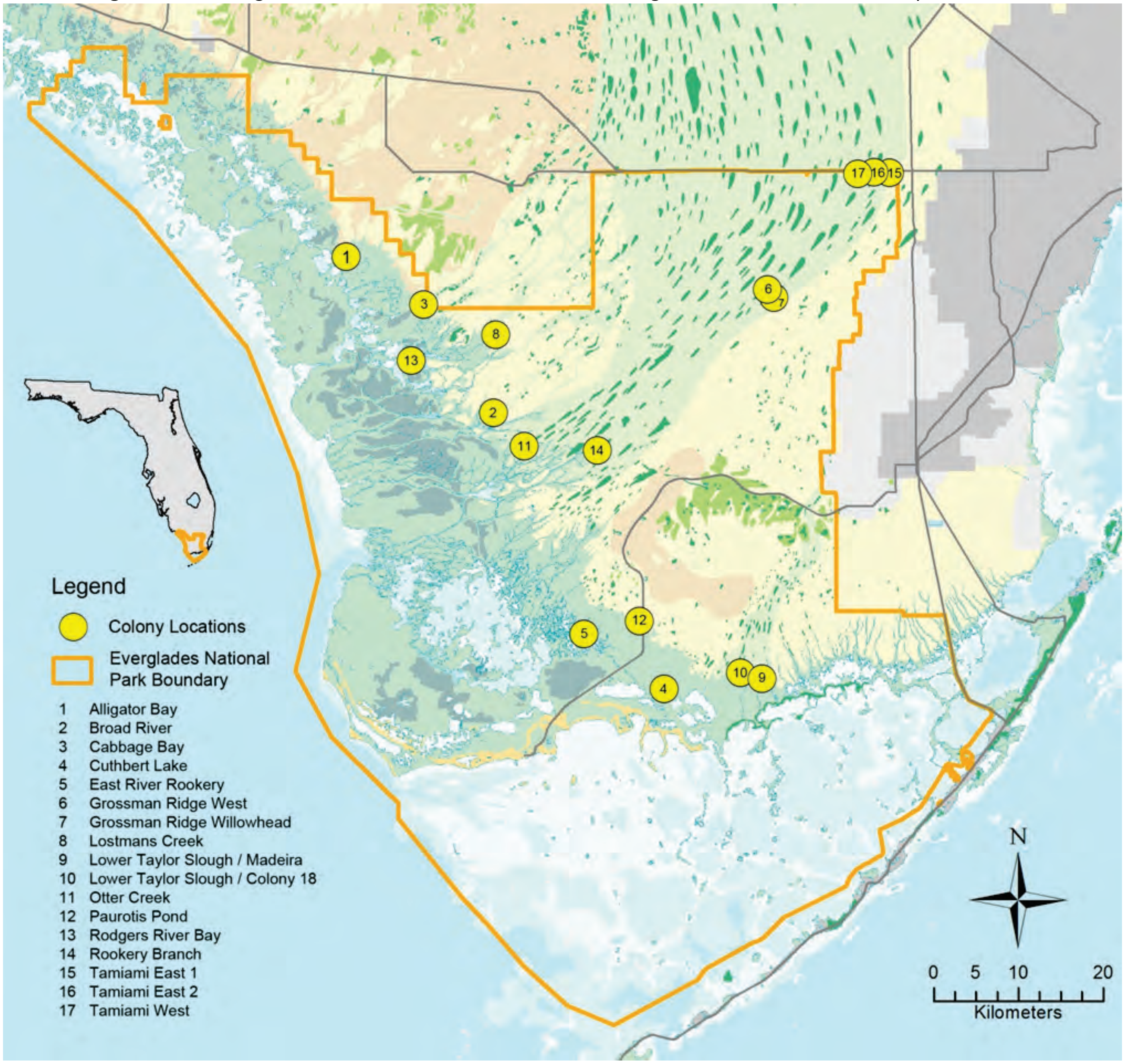
A significant rain event occurred the first week of April that resulted in an unknown number of WOST nest failures but not total abandonment. Some colonies appeared to weather the water level reversal better than others. During my April 17 flight, I noticed a complete lack of adult stork activity in all colonies except for Tamiami West. Stork chicks at that site were still alert and the larger young were standing up on nests. Ground checks of nests at Paurotis Pond by FAU on April 15 revealed that stork chicks were showing visible signs of malnourishment and few adults were seen in the colony. I drove to Paurotis Pond on April 20 and viewed nests from a distance in the parking lot. Adult birds were flying into the colony and feeding chicks again. I noted that most birds were flying in from south of the colony site.

Table 4. Peak numbers of wading bird nests found in Everglades National Park colonies through June 4, 2013.

Colony name	Latitude NAD83	Longitude NAD83	GREG	WOST	WHIB	SNEG	ROSP	TRHE	LBHE	BCNH	Total
Alligator Bay	25.67099	-81.14714	50	0	400	50	0	+	+	+	**500**
Broad River	25.50293	-80.97440	200	150	+	200	300	+	+	0	**850**
Cabbage Bay	25.62000	-81.05612	225	150	400	0	0	+	+	0	**775**
Cuthbert Lake	25.20933	-80.77500	75	150	0	0	+	+	+	0	**225**
East River Rookery	25.26860	-80.86785	20	0	0	0	0	0	0	0	**20**
Grossman Ridge West	25.63511	-80.65130	75	50	0	0	0	0	0	+	**125**
Grossman Ridge Willowhead	25.62613	-80.64582	100	0	0	+	0	+	+	0	**100**
Lostmans Creek	25.58723	-80.97204	200	200	800	150	+	+	+	+	**1350**
Lower Taylor Slough (Madeira)	25.22029	-80.65936	55	0	+	20	+	0	+	0	**75**
Lower Taylor Slough (Colony 18)	25.22697	-80.68428	0	50	0	0	0	0	0	0	**50**
Otter Creek	25.46781	-80.93772	320	0	200	50	25	+	+	+	**595**
Paurotis Pond	25.28150	-80.80300	300	500	400	50	35	0	0	0	**1285**
Rodgers River Bay	25.55975	-81.07026	300	200	0	0	0	0	0	0	**500**
Rookery Branch	25.46356	-80.85256	300	150	300	100	0	+	+	0	**850**
Tamiami East1	25.75762	-80.50801	0	5	0	0	0	0	0	0	**5**
Tamiami East2	25.75994	-80.52584	0	0	0	0	0	0	0	0	**0**
Tamiami West *	25.75784	-80.54484	700	400	4100	0	0	+	0	+	**5200**
Total			**2920**	**2005**	**6600**	**620**	**360**	**+**	**+**	**+**	**12,505**

+ Indicates species present and nesting, but unable to determine numbers
* data from University of Florida

Figure 3. Wading bird colonies checked this season in Everglades National Park, January–June 2013



On April 24, I conducted a short flight and checked the Broad River, Cabbage Bay, and Rodgers River Bay colonies. Stork chicks at Broad River were mostly all standing on nests. Most nests contained 2–3 young and several had 4 chicks. I also saw in photos that some nests also contained a dead nestling among the live young. At Cabbage Bay, many of the young appeared to be weak with larger young sitting down on nests instead of standing. Some dead chicks were seen in nests. This site had 2–4 chicks per nest. At Rodgers River Bay, almost a third of all large chicks were sitting down on nests. Only a few adults were seen flying to or roosting in the colony.

I checked all colony sites again on June 7. Most colonies were finished by this date. No storks remained in any colonies with the exception of a few chicks remaining on two nests at Tamiami West. At Rodgers River Bay, a quarter of the empty nests contained remains of dead young (visible feathers and bones). At Broad River, Paurotis Pond, Cuthbert Lake, and the Lostmans Creek, approximately one-third to one-half of empty nests contained remains of dead young. At Cabbage Bay, which started later than other colonies, more than half of the empty stork nests contained remains of dead young.

While it appears that storks in all colonies lost some young due to the water level reversal in early April, their initial nesting effort was the second highest recorded for ENP in the past 15 years. Nest numbers of WHIB and GREG were also the second highest recorded during the past 15 years in ENP. Although SNEG nest numbers have been slowly rising over the same period, a lower number was observed this season than during the past 3 years.

A notable increase in ROSP nesting numbers was observed at the Broad River colony this season with at least 300, and perhaps as many as 500, nesting in the colony. As this species nests mostly under the tree canopy, this reflects our best estimate from the number of visible nests and birds seen in the colony.

Finally, it is worth noting that a late nesting of both GREG and WHIB occurred in several colonies this season. While checking alligator nests on July 11, we discovered 50 WHIB and 20 GREG nesting on the interior of the center island at Paurotis Pond. Adult egrets and ibis were incubating on nests and eggs of both species were seen in photos. I flew a dedicated colony flight to check this and other colony sites on July 26. At Paurotis Pond, the ibis had abandoned, but 20 egrets were still sitting on nests. At Rodgers River Bay, approximately 50 GREG were on nests with eggs and newly hatched young are in the photos. At Alligator Bay, about 300 ibis were present with about 150–200 incubating on nests (**Figure 4**). At Otter Creek, another 100–150 ibis were incubating or brooding (**Figure 5**). At Tamiami West, approximately 50 ibis were sitting on nests and appeared to be incubating. All other colony sites were empty.

On August 19, I checked the active colony sites again. Paurotis Pond and Tamiami West were now empty. At Rodgers River Bay there were still approximately 40–50 GREG nesting on the small island. The nests now contained small- to medium-sized chicks. At Alligator Bay, most ibis had abandoned but 35 or more nests were still active. At Otter Creek, 25 ibis were either sitting on nests or standing at nests under the tree canopy.

On September 10, I flew one last flight to check on the remaining birds. Otter Creek was now empty. About half of the GREG nests at Rodgers River Bay appeared to be successful with large young standing on nests and some young seen flapping. A few adult birds flew in from the south while I was checking the site. At Alligator Bay, I photographed an adult WHIB roosting with at least 24 fledged young.

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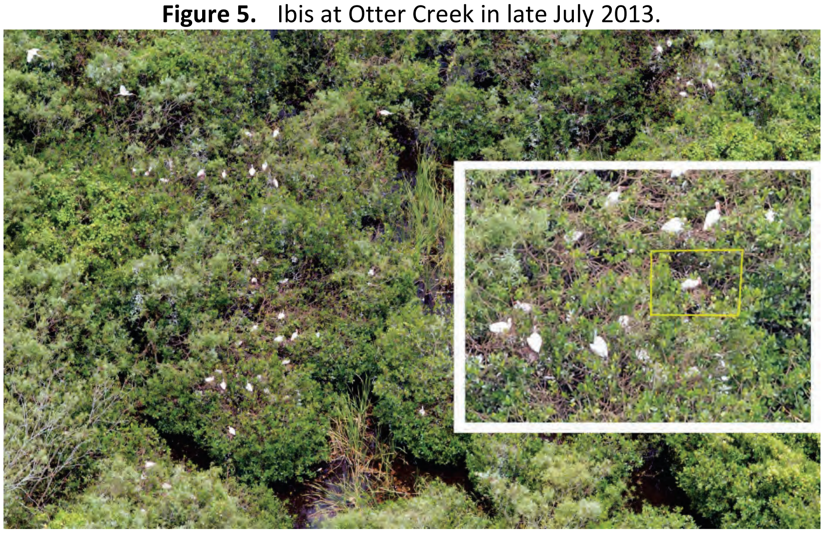
Figure 4. Ibis at Alligator Bay in late July 2013.

Figure 5. Ibis at Otter Creek in late July 2013.

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SOUTHWEST FLORIDA

The National Audubon Society gathered nesting data for five rookeries in 2013. While Wood Storks (WOST) were the primary focus of the monitoring effort, we were able to gather data on other wading birds at some of the colonies.

METHODS

Surveys were conducted March 27 and May 9, 2013 from a Cessna 172 flying at an altitude of 800–1000 ft above ground level. Nesting effort was recorded for later analysis using a Canon 30D equipped with a 70–300 mm zoom lens and image stabilizer. Images were examined to quantify the number of nest starts. In each survey set there were varying numbers of image features that we were unable to identify. While some of these features may have been active nests, they were not included in the analysis. Consequently, the results of our analysis are conservative, as only verifiable nests were counted.

HYDROLOGY

Rainfall during the July–December 2012 period preceding the 2013 nesting season totaled 34.10 inches (compared to 34.31 inches average), as recorded at the Corkscrew Swamp Sanctuary Visitor Center. During the January–May 2013 nesting season, rainfall totaled 12.06 inches, which was slightly less than the 13.36-inch average for these months. The B-staff gauge at Corkscrew's Lettuce Lakes declined from a high water mark of 30.96 inches in October 2012 to 0.00 inches by March 16, 2013. Monthly water levels during the 2013 nesting season were significantly below average.

CORKSCREW SWAMP SANCTUARY (N26 22.502, W081 36.985)

The Corkscrew colony is in the expanse of old growth bald cypress at National Audubon Society's Corkscrew Swamp Sanctuary. No nesting was recorded at Corkscrew throughout the duration of the nesting season. Below-normal water levels are the suspected reasons for the lack of nesting.

LENORE ISLAND (AKA CALOOSAHATCHEE WEST) (N26 41.332, W081 49.809)

This colony is on a mangrove island in the Caloosahatchee River. It has also been called Caloosahatchee West in past reports. WOST nesting is believed to have begun in January. It appeared that all 27 stork nests successfully fledged chicks, resulting in an estimated 80 chicks. The island also supported numerous Great Egrets (GREG), although most did not successfully nest and abandoned nest platforms by our second monitoring flight. A handful of small egrets (not present on early flight) had active nests by the time of our May flight.

CALOOSAHATCHEE EAST (N26 41.795, W081 47.697)

This colony is on a mangrove island in the Caloosahatchee River. No wading birds were observed nesting at this site; however, it appeared to be a roosting site for GREG and Cattle/Snowy Egrets (CAEG/SNEG).

COLLIER/HENDRY LINE (N26 22.223, W081 16.363)

This colony is located in a uniquely shaped cypress head along the border of Collier and Hendry counties. No wading bird nesting occurred in 2013.

BARRON COLLIER 29 (N26 16.383, W081 20.633)

The Barron Collier 29 colony is on a spoil island within a man-made lake in eastern Collier County. Nests are built on nonindigenous Brazilian Pepper trees. Nest initiation at this colony is thought to have occurred in late January through February, as evidenced by the age of observed WOST chicks. Of the 27 WOST nest attempts, 21 were successful, resulting in an estimated 46 fledged young. This colony also supported numerous GREG, but most were roosting birds and only 7 active nests were observed. Several smaller white egrets, likely CAEG, also had active nests.

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Table 5. 2013 wading bird nesting effort recorded in Southwest Florida.

Colony	WOST Nests	WOST Successful	WOST # Chicks Fledged	GBHE	GREG	SM WHT	SM DRK	Total
Corkscrew Swamp	0	0	0	0	0	0	0	**0**
Lenore Island	27	27	80	1	19	10	0	**57**
Caloosahatchee East	0	0	0	0	0	0	0	**0**
Collier-Hendry Line	0	0	0	0	0	0	0	**0**
Barron Collier 29	27	21	46	0	7	8	1	**43**
Total	**54**	**48**	**126**	**1**	**26**	**18**	**1**	**100**

SOLID WASTE AUTHORITY OF PALM BEACH COUNTY ROOKERY

METHODS

Typically, breeding bird censuses are conducted February–July in the Solid Waste Authority (SWA) roost by two observers every 8–10 weeks, representing approximately 12 man-hours of labor. During the census, all islands in three abandoned shell pits are systematically surveyed from a small boat, and the identified bird species and nest numbers are recorded. Surveys are conducted during the morning hours to minimize any burden caused by the presence of observers. The peak nest numbers are a compilation of early season boat counts and visual counts from observation towers.

LOCATION & STUDY AREA

The SWA roost is located on spoil islands in abandoned shell pits that were mined in the early 1960s in Palm Beach County (Lat. 26°46'42.22"N, Long. 80°08'31.15"W NAD83). The spoil islands consist of overburden material and are 5–367 m long, with an average width of 5 m. The distance between islands is 5–6.5 m with vegetation touching among close islands. The borrow pits are flooded with fresh water to a depth of 3 m. Dominant vegetation is Brazilian Pepper (*Schinus terebinthifolius*), Australian Pine (*Casurina* spp.), and Melaleuca (*Melaleuca quinquenervia*), all non-native species. Local features influencing the roost include: 1) the North County Resource Recovery Facility and Landfill, and 2) the City of West Palm Beach's Grassy Waters (=Water Catchment Area), a 44-km^2 remnant of the Loxahatchee Slough.

RESULTS

This report presents a partial data set for the 2013 breeding season. Because of engine malfunctions and adverse weather, the number of nest surveys conducted was limited. The estimated total number of wading bird nests for the SWA Colony (not including nests of unidentified species) was 1535 (**Table 6**). There were nests of Great Egrets (GREG), Cattle Egrets (CAEG), Little Blue Herons (LBHE), Wood Storks (WOST), White Ibis (WHIB), Tricolor Herons (TRHE), Roseate Spoonbills (ROSP), and Anhingas (ANHI). WOST peaked at 413 nests in March. Heavy rains during the season seemed to contribute to nest abandonment.

Table 6. Peak number of wading bird nests in SWA Rookery from February to July 2013.

GREG	SNEG	CAEG	GBHE	LBHE	WOST	WHIB	ANHI	TRHE	ROSP	Unident	Total Nests
34	0	283	0	3	413	465	310	25	2	403	**1535***

*Total nest count does not include nests of unidentified species

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ROSEATE SPOONBILL NESTING IN FLORIDA BAY, 2012–2013

METHODS

Roseate Spoonbills (ROSP) have used 44 keys in Florida Bay and one mainland site adjacent to the bay as nesting colonies. These colonies have been divided into five distinct nesting regions based on the primary foraging locations utilized by the birds (**Figure 6**, Lorenz et al. 2002). During the 2012–13 nesting season (November 2012–April 2013), nests were counted in all five regions by entering the colonies and thoroughly searching for nests. Nesting success was estimated for four of the five regions through mark and revisit surveys at the most active colony or colonies within each region. These surveys entailed marking as many nests as possible shortly after full clutches had been laid, and then revisiting the colonies on a 10- to 21-day cycle. Nests were monitored until failure or until all surviving chicks reached at least 21 days of age, the age at which chicks begin branching and can no longer be assigned to a nest. A colony was considered successful if it averaged at least one chick to 21 days per nesting attempt (c/n). Mean laying and hatching dates refer to the first egg laid and hatched in each clutch. We present our results in the context of spoonbill nesting activities in Florida Bay since 1984, the year that the South Dade Conveyance System, which has direct water management implications on Florida Bay, was completed (Lorenz et al. 2002, Lorenz 2013).

RESULTS

Northwest Region

Three of the six colonies in the Northwest Region were active, producing 127 nests, 37 more than last year; however, this is less than the mean of 201 nests for the previous 26 years (**Table 7**). Of the 74 nests with known fate, 68 produced chicks to at least 21 days (92% success rate), with a mean production of 1.76 c/n (**Table 8**), which is above the mean for the region (**Table 9**) and well above the level that is considered successful. Total production for the Northwest Region was estimated at 223 young to 21 days (**Table 8**). The mean lay date was December 22 and the mean hatch date was January 13 (**Table 8**).

Northeast Region

Everglades National Park's (ENP) annual surveys of the Madeira Hammock colony (**Figure 6**) indicate that the colony became active in 2009–10 for the first time since 1989 and that spoonbills nested at this colony in 2010–11 as well. Access to this colony is extraordinarily difficult so there are no nest counts for 2009–10 or 2010–11. In 2011–12, the colony was surveyed twice. The first (February 1) found an estimated 164 nests. The second (March 22), in tandem with ENP aerial surveys, indicated a moderate to high degree of success. This year there were three survey attempts made on the colony; however, the high levels of crow presence (which follow biologists to find unprotected nests) prevented thorough counts for fear of nest predation. Observations made during ground surveys along with aerial surveys indicated similar, if not higher, nest numbers and success as the previous year. Therefore we conservatively estimate 164 nests for this colony. It must be noted that the relatively high estimated number of nests at this colony in 2011–12 and 2012–13 casts doubts on the accuracy of total nest estimates for 2009–10 and 2010–11 (Northeast Region: 41 and 3; bay-wide: 233 and 69, respectively).

Four other colonies in the region were active, producing 24 nests for a regional total of 188. This is slightly above the average since 1984–85 (**Table 7**). The fate of 14 of these nests were known with an estimated production of 1.29 c/n (**Table 8**). These production numbers were notably higher than the long-term mean (**Table 9**). Applying the 1.29 c/n estimate regionwide, we estimate the total production for the region was 242 young (**Table 8**). This year, 8 nests and 5 fledglings that were ready to leave the colony were found on Eagle Key, an island in the region that previously had no recorded nesting because of the presence of raccoons (Lorenz et al. 2012). It is purely speculative but the recent documentation of Burmese Pythons in Florida Bay may have had an impact on raccoon populations. The presence of nests on Eagle Key suggests that other islands that had previously been uninhabited may now be in use.

Southeast Region

The Southeast Region produced 22 nests this year, well below the mean of 68 nests since 1984–85 (**Table 7**). Low Key had the most nests (n=9) of the 12 colonies, although its success is unknown due to most nests being found after the nesting period. For the region, the production rate was 0.67 c/n with 44% of the nests raising at least 1 chick to 21 days based on 9 nests with known fate (**Table 8**). This is the ninth time in the last 15 years that the southeastern colonies failed (**Table 9**). The estimated mean lay date was January 16.

Central Region

The Central Region yielded 30 nests; lower than the average 48 nests for this colony since 1984–85 (**Table 7**). Captain Key had spoonbill nests for the first time in 3 years, a total of 13 nests, which was the most for the region; however, this colony only had 18% success. Calusa Key had 6 nests and a 100% success rate, yielding an estimated 7 young. The regional 0.44 c/n is less than half of the long-term mean for the area (**Table 9**). In all, 36% of the nests raised chicks to 21 days and this was the eighth year of the last 15 that spoonbills were unsuccessful in this region (**Table 9**).

Southwest Region

All four colonies in the Southwest Region were surveyed in 2012–13, but none were active. Two adults were observed courting and one inactive nest was found.

Baywide Synthesis

Overall spoonbill nest numbers this year were below the average since 1984 and well below historic numbers. This year's nesting effort and success was comparable to last year's, which was somewhat of an improvement considering the trends of the last decade. Both the Northeast Region and the Northwest Region had large successful colonies, indicating possible improvements in water management practices in regard to Florida Bay. It is possible that this increase may be attributed to relatively high reproductive rates over the last eight years (7 of 8 were successful in the Northeast, and 5 of 8 were successful in the Northwest). The birds that fledged during these successful years are now either sexually mature or will be soon. That we are seeing such high levels of success also leads to the conclusion that water management practices have become less detrimental to Florida Bay. This may be due, at least in part, to better communications between water managers and field scientists.

Table 7. Number of Roseate Spoonbill nests in Florida Bay (November 2012–April 2013).

			Summary since 1984-85		
	Colony	2012-13	Min	Mean	Max
Northwest	Clive	32	6	24	52
	Frank	0	0	43	125
	Han Van	0	15	15	15
	Oyster	0	0	5	45
	Palm	22	9	30	87
	Sandy	73	23	140	250
	Region Subtotal	**127**	**48**	**201**	**325**
Northeast	Deer	2	0	4	15
	Duck	12	0	11	100
	Little Betsy	0	0	5	21
	North Nest	0	0	1	8
	North Park	0	0	15	50
	Pass	0	0	1	7
	Porjoe	0	0	24	118
	South Nest	2	0	17	59
	Tern	0	0	89	184
	Eagle	8	0	?	0
	*Madeira Hammock**	*164*	*0*	*?*	*164*
	Region Subtotal	**188**	**3**	**153**	**333**
Southeast	Bottle	0	0	10	40
	Cotton	0	0	0	0
	Cowpens	0	0	5	15
	Crab	0	0	2	8
	Crane	0	0	10	27
	East	2	0	3	13
	East Butternut	4	0	5	27
	Low	9	0	0	0
	Middle Butternut	2	1	18	66
	Pigeon	5	0	9	56
	Stake	0	0	5	19
	West	0	0	2	9
	Region Subtotal	**22**	**5**	**67**	**117**
Central	Calusa	6	0	10	21
	Captain	13	0	2	9
	East Bob Allen	0	0	11	35
	First Mate	0	0	4	15
	Jimmie Channel	1	0	18	47
	Little Jimmie	0	0	2	12
	Manatee	0	0	0	3
	North Jimmie	0	0	1	2
	Pollock	0	0	2	13
	South Park	8	0	9	39
	West Bob Allen	0	5	5	5
	Central Bob Allen	2	12	12	12
	Region Subtotal	**30**	**3**	**48**	**96**
Southwest	Barnes	0	0	0	3
	East Buchanan	0	0	5	27
	Twin	0	0	2	8
	West Buchanan	0	0	3	9
	Region Subtotal	**0**	**0**	**8**	**35**
	Total	**367**	**87**	**476**	**880**

* Colony where nesting success surveys were conducted
Note: Second nesting attempts are not included.

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Figure 6. Roseate Spoonbill colony locations (solid red circles) and nesting regions (open circles) in Florida Bay. Arrows indicate the primary foraging area for each region. The dashed lines from the Central Region are speculative.

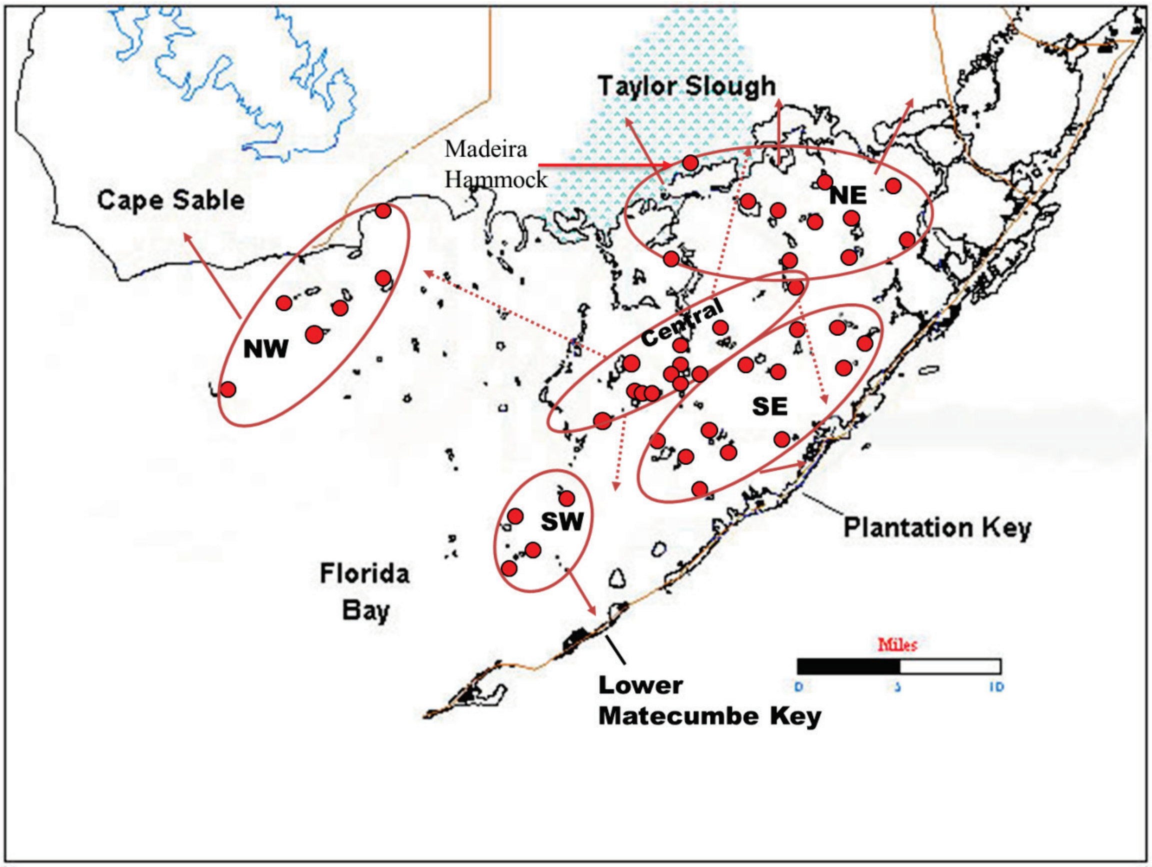

Table 8. Breakdown of colonies by region of all monitoring data collected.

Colony	Nests	Chicks to 21d	Nests with Known Fate	Est. Prod	Est. Chicks Fledged	Nests with at Least One Chick to 21d	% Success	Mean Lay Date	Mean Hatch Date
CBA	2	1	1	1.00	2	1	100%	1/12/13	2/3/13
Jimmie	1	0	1	0.00	0	0	0%		
Calusa	6	6	5	1.20	7	5	100%	12/19/12	1/10/13
S. Park	8	2	7	0.29	2	1	14%	1/9/13	1/31/13
Captain	13	2	11	0.18	2	2	18%	1/15/13	2/6/13
CENTRAL	**30**	**11**	**25**	**0.44**	**14**	**9**	**36%**	**1/7/13**	**1/29/13**
Sandy	73	89	47	1.89	138	44	94%	12/18/12	1/9/13
Clive	32	15	12	1.25	40	9	75%	12/26/12	1/17/13
Palm	22	26	15	1.73	38	15	100%	1/3/13	1/25/13
NORTHWEST	**127**	**130**	**74**	**1.76**	**223**	**68**	**92%**	**12/22/12**	**1/13/13**
S. Nest	2	4	2	2.00	4	2	100%	12/29/12	1/20/13
Duck	12	14	11	1.27	15	9	82%	1/18/13	2/9/13
Deer	2	0	1	0.00	0	0	0%		
*Madeira Hammock**	*164*	*?*	*0*	S	*>164*	*?*		*?*	
Eagle	8	0	0		0	0			
NORTHEAST	**188**	**18**	**14**	**1.29**	**242**	**11**	**79%**	**1/15/13**	**2/6/13**
Low	9	0	0		0	0			
Pigeon	5	2	3	0.67	3	2	67%	1/16/13	2/7/13
Mid Nut	2	4	2	2.00	4	2	100%	1/19/13	2/10/13
East	2	0	2	0.00	0	0	0%		
E. Nut	4	0	2	0.00	0	0	0%		
SOUTHEAST	**22**	**6**	**9**	**0.67**	**15**	**4**	**44%**	**1/16/13**	**2/7/13**
None									
SOUTHWEST	**0**	**0**	**0**		**0**	**0**			
Total	**367**	**165**	**122**	1.35	**496**	**92**	75%	**1/5/13**	**1/27/13**

Table 9. Mean number of spoonbill chicks to 21 days per nesting attempt and the percentage of nests that were successful. Summary data indicate the overall minimum, mean, and maximum production rates (c/n) to 21 days and the percent of years that the region has been successful since 1984–85. Numbers in parentheses indicate how many years each region has been surveyed since 1984–85. Success is defined as a mean of at least 1 chick to 21 days per nesting attempt. Summary figures refer to the focal colony or colonies surveyed in each year. Second nesting attempts are not included.

	2012–13 Nesting Season		Summary since 1984–85			
Region	Mean Production Per Nest	Percent Success Nests	Min	Mean	Max	% Years Successful
Northwest	1.76	92%	0	1.25	2.5	60% (n=26)
Northeast	1.29	79%	0	0.943	2.2	52% (n=26)
Southeast	0.67	44%	0	0.935	2.09	40% (n=15)
Central	0.44	36%	0	0.89	1.857	47% (n=15)

NESTING ACTIVITY OF WATER BIRDS ON SPOONBILL COLONY KEYS IN FLORIDA BAY, 2012–2013

While surveying known spoonbill colonies throughout Florida Bay, we noted other water bird nesting activity on the keys we investigated. We encountered 10 species of water bird nesting on these islands and did our best to enumerate nests (Error! Reference source not found.). These findings should not be treated as a thorough or exhaustive survey of water birds in the bay as many keys were not surveyed because spoonbills did not nest on them and also we did not search beyond areas where spoonbills nested on a given key.

That stated, we did our best to thoroughly find all Reddish Egret (REEG) nests. REEG have become as species of interest at both the state and local level in recent years and we are now trying to find all nests and document their productivity. The REEG estimates are likely an accurate representation of effort for this species in Florida Bay.

There was substantive numbers of Brown Pelican (BRPE) nests in northeastern Florida Bay at both Duck and South Park keys. From the mid-1990s until 2007, there was only one documented nesting colony in northeastern Florida Bay (45 nests at South Park Key in 2002; L. Oberhofer, pers. comm.). The activity noted this year marks the third time since 2007 that BPRE have nested in northeastern Florida Bay (30 nests in 2007 and 20 nests in 2008 at South Park; L. Oberhofer, pers. comm.). This, along with the documented increase in spoonbill nests and success and a perceived increase in Osprey (OSPR) nesting in the region may suggest some level of recovery in this part of Florida Bay.

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Table 10. Water bird nesting activity in Florida Bay.

COLONY	OSPR	GBHE	GWHE	GREG	REEG	BRPE	DCCO	TCHE	BAEA	WHIB
Clive	1	0	0	0	0	20+	60-100	0	1	0
Frank	1	0	0	0	0	0	0	0	0	0
Oyster	2	0	2	0	0	0	0	0	0	0
Palm	2	2	6	0	0	0	60-100	0	1	0
Sandy	2	0	0	0	9	0	60-120	0	0	0
Murray	1	0	0	0	0	0	0	0	0	0
Duck	0	0	0	0	5	20-30	0	0	0	0
Little Betsy	0	0	1	0	0	0	0	0	0	0
Porjoe	0	0	0	0	0	0	0	20	0	*
South Nest	0	0	1	0	0	0	0	1	0	0
Tern	1	0	0	0	0	0	0	29	0	0
Eagle	0	0	5	0	0	0	0	0	0	0
*Madeira Hammock**	0	0	0	*	0	0	0	*	0	*
Cowpens	0	0	0	1	0	0	*	0	0	0
Crab	0	0	0	0	3	0	0	0	0	0
East	0	0	0	1	0	0	0	0	0	0
Low	1	0	0	0	0	0	0	0	0	0
Pigeon	0	2	2	0	0	0	30+	0	0	0
West	1	0	0	1	0	0	0	0	0	0
Calusa	4	0	0	0	0	0	0	0	0	0
Captain	2	0	0	0	0	0	0	0	0	0
First Mate	1	0	0	0	0	0	0	0	0	0
Jimmie Channel	2	0	0	0	2	0	0	0	0	0
Little Jimmie	0	0	3	0	0	0	0	0	0	0
Manatee	1	0	0	0	0	0	0	0	0	0
North Jimmie	0	0	1	0	0	0	0	0	0	0
South Park	0	0	1	0	0	20-30	0	0	0	0
Central Bob Allen	1	0	0	0	0	0	0	0	0	0
Twin	2	0	0	0	0	0	0	0	0	0
Total	**25**	**4**	**22**	**3**	**19**	**60-100**	**210-350**	**50**	**2**	*****

*=nests present numbers unknown

Note: Han Van, Deer, North Nest, Lake, North Park, Pass, Bottle, Cotton, Crane, East Butternut, Middle Butternut, Stake, East Bob Allen, Pollock, West Bob Allen, Barnes, East Buchanan, and West Buchanan were surveyed, but no nests were found.

WADING BIRD NESTING COASTAL SOUTH-SOUTHWEST FLORIDA

As in the last several years the number of wading birds nesting is about the same; however, four things should be noted. First, the increase in wind, wave, and rain made getting out in a small boat difficult. Second, a large barge (part of a dredging project in Caxambas Pass) anchored next to the Smokehouse Colony inside the pass during the nesting season disrupted almost all the nesting (**Table 11**). Third, a fair number of fledglings were noted late in the season (e.g., in September, Great Egret [GREG] chicks were still screaming to be fed). Finally, in March I was unable to go on long runs down the coast; therefore, I did not do any censusing at the Chokoloskee Colony.

HYDROLOGY

This year's rainfall during the nesting season (January–July) was up 34% from the 27-year mean; this is the fourth highest rainfall year for the nesting season during this project. Although rainfall in the area has fluctuated considerably for the January–July nesting period for the last seven years, the number of small waders (Snowy Egret [SNEG], Little Blue Heron [LBHE], Tricolored Heron [TRHE], and Cattle Egret [CAEG]) has continued to decline. In all I do not feel that rainfall has much (if any) effect on wader nesting (so far).

LOCATION AND METHODS

Rookery Bay (RB): 26°01.721'N, 81°44.573'W. One Red Mangrove island, 0.14 ha. Nest census conducted April 16, May 20 and June 17, boat, 2 observers, 0.5 hour.

Marco Colony (ABC) (named ABC Islands by State of Florida): 25°57.389'N, 81°42.232'W. Three Red Mangrove islands, 2.08 ha. Nest census conducted April 13, May 27 and June 27, boat, 1 observer, 1.5 hours.

Smokehouse Key (SK): 25°54.562'N, 81°43.885'W. One island in Caxambas Pass, 0.8579 ha (Red Mangrove; a little terrestrial vegetation on sand ridge in center). April 22, May 14 and June 12, boat, 1 observer, 1 hour.

Chokoloskee Bay (CHOK): 25°50.834'N, 81°24.710'W. Four Red Mangrove islands, ≈0.2 ha. This year, waders used all four islands, March 30, April 28 and May 29, boat, 2 observers, 1 hour.

SUNDOWN CENSUSING

For two of the colonies, birds coming in to roost for the night are censused at sundown; the goal of this project is to get an index of the numbers and species in the area, year round. References below as to the use of the area by the different species are derived from these projects.

Marco Colony (ABCSD): Censused monthly with two boats and various numbers of volunteers (4–8). Boats are anchored in the two major flyways (north and east), species and numbers of birds flying in (and out during the nesting season) were recorded one hour before sunset to one half hour after sunset. This project is ongoing and started in 1979.

Rookery Bay (RBSD): Censused every two weeks with one boat and two observers (one a volunteer). The boat is anchored so that most of the birds can be observed flying in one hour before sunset to one-half hour after sunset. Species and numbers of birds flying in (and out during the nesting season) were recorded. This project is ongoing and started in 1977.

SPECIES ACCOUNTS (TABLE 11)

GREG: Started the nesting season with good numbers building up at the ABC Colony; they had a more spread out and productive season, fledging chicks well into September.

Small Waders (SNEG, LBHE, TRHE, CAEG): Started in small numbers and fledged some young.

Reddish Egret (REEG): Had a fair number of nests that all fledged young.

White Ibis (WHIB): Although no WHIB attempted to nest on the coast (again). The numbers of WHIB fledglings arriving from inland in September were low (10% of the total coming to roost in September; the 27-year mean is 12%); in my opinion they did not do badly.

Note: Two years ago, RB did not have any nesting; this year and last, after having moved the night roosting to a nearby island there were a few nests.

Table 11. Peak wader nests, coastal southwest Florida 2013.

Colony	GBHE	GREG	SNEG	LBHE	TRHE	REEG	CAEG	WHIB	GLIB	Total
Rookery Bay	0	5	1	0	1	0	0	0	0	7
Marco (ABC)	10	106	15	2	20	4	15	0	0	172
Smokehouse Key	0	1	7	0	0	0	0	0	0	8
Chokoloskee Bay	0	0	0	0	0	0	0	0	0	0
Total	10	112	23	2	21	4	15	0	0	187
Mean (30 years)	12	212	228	44	367	5	316	28	33	1245

Note: Although several censuses were conducted for some colonies, the numbers of nests in this table represent peak numbers.

No matter what: waders keep nesting and I keep trying to count and understand.

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CHARLOTTE HARBOR AQUATIC PRESERVES COLONIAL WADING AND DIVING BIRD NEST MONITORING

INTRODUCTION/BACKGROUND

For six consecutive years, staff at Charlotte Harbor Aquatic Preserves (CHAP) of the Florida Department of Environmental Protection (FDEP) has been conducting colonial nesting bird surveys within the Matlacha Pass, Pine Island Sound, Gasparilla Sound-Charlotte Harbor, Cape Haze, and Lemon Bay Aquatic Preserves (**Figure 7**). This year, 12 islands were monitored and 7 were identified as active wading and diving bird nesting sites within the CHAP complex. Goals of this study include documenting population trends, biodiversity on islands, and nesting shifts and efforts of wading and diving bird species.

METHODS

CHAP employs a direct count method with a primary observer, secondary observer, boat captain, and data recorder. Islands were circled by boat and individual nests were recorded according to species. Nests were recorded as *incubating*, *chicks*, or *unknown*. Nests were documented as *incubating* when an adult was sitting on the nest in a crouched position shading the nest. When juvenile birds were visible in or near the nest, nests were recorded as *chicks*. If the nesting stage could not be determined, the nest was recorded as *unknown*. Data collected during February–June 2013 were analyzed for this report. Peak numbers reflect the highest number per species throughout the survey period. The number of total peak nests for all species combined was calculated for each island as well. Monthly surveys continued through 2013.

RESULTS

The peak estimate for 14 species of colonial nesting birds from all islands combined was 654 nests (**Table 12**). Approximately a third (185) of the nests documented were wading bird nests while the remaining two-thirds (469) were diving bird nests. Most diving bird nests (449) were documented in Pine Island Sound on three islands: Broken Islands, Hemp Key, and Useppa Oyster Bar. Wading bird nests were distributed throughout the survey area.

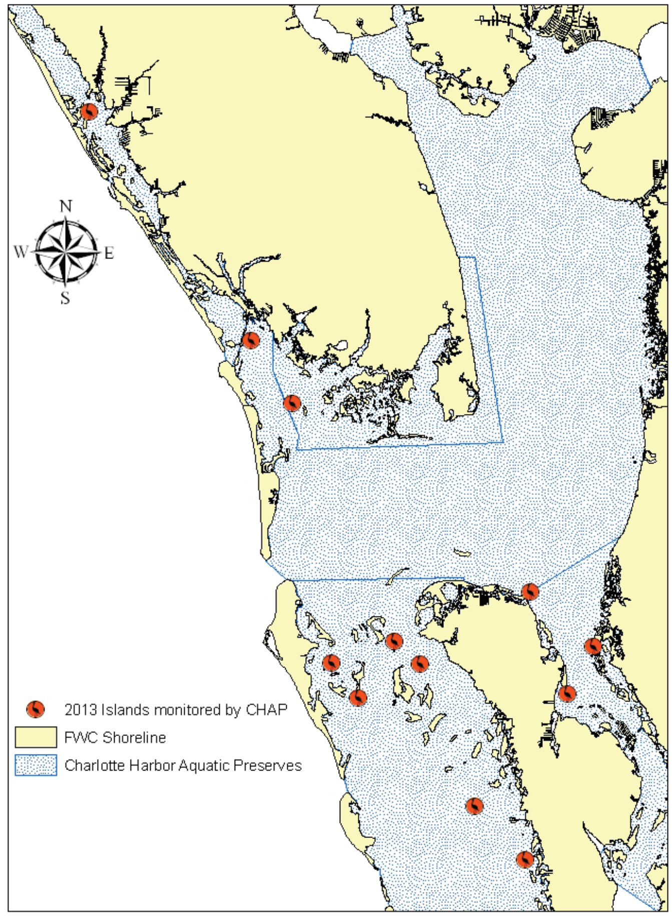

Figure 7. Charlotte Harbor Aquatic Preserve boundaries and locations of 2013 monitored colonial rookeries.

Broken Islands

CHAP staff has been monitoring Broken Islands (in Pine Island Sound Aquatic Preserve) since 2008. Broken Islands had a peak nest count of 190 this year and also had the highest nesting effort for Tricolored Herons (TRHE), with a peak of 20. Broken Islands also had the greatest diversity with 10 species: Great Blue Heron (GBHE), TRHE, Little Blue Heron (LBHE), Snowy Egret (SNEG), Great Egret (GREG), Reddish Egret (REEG), Black-crowned Night Heron (BCNH), White Ibis (WHIB), Brown Pelican (BRPE), and Double-crested Cormorant (DCCO). Twenty-eight juvenile WHIB were observed in the June survey but were not included in the total nest counts because the nests were not visible.

Cork Island

Cork Island is in Pine Island Aquatic Preserve and monitoring efforts have been ongoing since 2009. Cork Island had a peak nest effort of 12, 9 of which were DCCO. This is a decrease from 2012, when the peak nesting effort was 53.

Dog Island

Dog Island is a spoil island in Gasparilla Sound-Charlotte Harbor Aquatic Preserve. Staff discovered GBHE nesting in tall Australian Pines in March 2011. The highest peak nesting effort since 2011 occurred in February 2012 with 9 GBHE. This year, only 1 active GBHE nest was observed.

Table 12. Colonial nesting bird peak counts for Charlotte Harbor Aquatic Preserves, March–July 2013.

Colony (Island)	Lat/ Long	GBHE	TRHE	LBHE	SNEG	GREG	REEG	CAEG	YCNH	BCNH	GRHE	WHIB	BRPE	DCCO	ANHI	Total
Bird Keys	26.6679, -82.2276	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Bird Rookery Keys	26.6742, -82.0897	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Broken Islands	26.6777, -82.1940	3	20	6	6	2	7	0	0	2	0	0	62	82	0	**190**
Cork Island	26.5742, -82.1273	1	0	0	0	0	0	0	1	0	1	0	0	9	0	**12**
Darling Keys	26.6669, -82.1811	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Dog Island	26.8205, -82.2671	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
E. of Chadwick Cove	26.9289, -82.3511	14	0	0	0	3	0	0	0	0	0	0	0	0	0	**17**
Hemp Key	26.5999, -82.1532	22	0	0	0	27	0	0	1	1	0	0	46	152	0	**249**
N. of Big Smokehouse	26.7001, -82.1225	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
S. of Indian Field	26.6518, -82.1035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Useppa Oyster Bar	26.6513, -82.2134	1	0	0	2	4	0	0	0	0	0	0	52	55	0	**114**
White Pelican Island	26.7905, -82.2463	14	0	0	29	13	2	0	0	2	0	0	0	11	0	**71**
Total		**56**	**20**	**6**	**37**	**49**	**9**	**0**	**2**	**5**	**1**	**0**	**160**	**309**	**0**	**654**

East of Chadwick Cove

This small mangrove island is in Lemon Bay Aquatic Preserve at the mouth of Chadwick Cove. The island has been a popular nesting site for GBHE. This year the peak nesting effort was 17, 14 of which were GBHE nests.

Hemp Key

Hemp Key, also known as Hemp Island, is in Pine Island Sound Aquatic Preserve. During the 2008–2013 survey periods, Hemp Key has had the highest peak nest counts consecutively and is rich in species diversity. Six species were documented nesting on Hemp Key, including GBHE, GREG, Yellow-crowned Night Heron (YCNH), BCNH, BRPE, and DCCO. This year, the peak nesting effort was 249. This was similar to 2012, when the peak nesting effort was 247.

Useppa Oyster Bar

Useppa Oyster Bar is a cluster of mangrove islands just south of the inhabited Useppa Island in Pine Island Sound Aquatic Preserve. Useppa Oyster Bar had the third largest peak nesting effort with 114. Nests consisted mostly of BRPE and DCCO with peak nest counts of 52 and 55, respectively.

White Pelican Island

White Pelican Island is in Cape Haze Aquatic Preserve. Throughout the survey period, White Pelican Island has had a high number of nesting SNEG. This year the peak nest count for SNEG was 29. The peak nesting effort for White Pelican Island was 71.

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ESTERO BAY AQUATIC PRESERVE COLONIAL WADING BIRD NEST MONITORING AND PROTECTION PROGRAM

INTRODUCTION

Estero Bay Aquatic Preserve (EBAP) consists of approximately 11,000 acres of sovereign submerged lands in southwest Florida extending from Fort Myers Beach to Bonita Springs. Estero Bay was designated as Florida's first aquatic preserve in 1966 with the intent to preserve it in an "essentially natural or existing condition so that [its] aesthetic, biological and scientific values may endure for the enjoyment of future generations" (Chapter 18-20.001(2) F.A.C.). Estero Bay and its tributaries are also designated as an Outstanding Florida Waterbody. The shallow estuary is fed by five freshwater tributaries and four passes connecting to the Gulf of Mexico. Estero Bay contains mangrove islands, 21 of which have been documented as breeding colonies for various bird species, including 10 species of wading birds and 3 species of diving birds. EBAP is managed under the Florida Department of Environmental Protection's Florida Coastal Office.

Bird nesting surveys in Estero Bay began in 1977, and the program has implemented a variety of survey techniques throughout its history. Since 2008, EBAP staff and volunteers have conducted monthly nest counts throughout the nesting season. This program provides peak estimates of nesting effort for each species of wading and diving bird, monitors population trends, maintains an atlas of historic and active colonies, documents human disturbance, documents the number of entanglements and fatalities due to fishing line and trash, documents the quantity of fishing line and trash removed from islands, and increases community involvement through volunteerism and by engaging and educating the public.

Mike Baranski

METHODS

Twenty-one islands within the aquatic preserve and state-owned islands bordering the aquatic preserve were monitored for nesting birds monthly throughout the year.

A 17-ft Boston Whaler or a 17-ft Carolina Skiff was used to conduct surveys. Each island was circled at a consistent speed, approximately 1.7 mph, while keeping a distance of approximately 100 ft from the island. Two observers conducted counts indicating the number of nests observed by species and nesting stage. Nests were recorded as *unknown* if an adult was present at the nest but no eggs or chicks were visible or if the pair was copulating; *incubating* if the adult was in an incubating posture or if eggs were visible; or *chick* if chicks were present in the nest or the vicinity of the nest and were still being cared for by an adult.

Survey data collected between January and June 2013 were analyzed for this report. Surveys were conducted on January 9 and 10, February 6, 7 and 18, March 18 and 19, April 10 and 18, May 9, 16 and 21, June 12, 13 and 17, and July 15, 16 and 22.

RESULTS

Of the 21 islands monitored in Estero Bay, 17 were active in 2013 with a peak nest count of 405 (**Table 13**). The nesting season peaked in June with 262 nests documented including 38 Double-crested Cormorant (DCCO), 61 Brown Pelican (BRPE), 20 Great Blue Heron (GBHE), 26 Great Egret (GREG), 24 Snowy Egret (SNEG), 16 Little Blue Heron (LBHE), 47 Tricolored Heron (TRHE), 8 Reddish Egret (REEG), 7 Black-crowned Night Heron (BCNH), and 15 Yellow-Crowned Night Heron (YCNH). Active nests were documented monthly from January to July.

Peak nest counts in EBAP decreased annually from 2008 to 2011: 2008 (N=534), 2009 (N=428), 2010 (N=424), 2011 (N=351). In 2012 (N=374) and 2013 (N=405) peak nest counts have increased. Active nests were documented monthly January through December of 2011 and 2012, which had not previously been seen in Estero Bay.

SPECIES SUMMARIES

DCCO nesting peaked in May with 44 active nests. Nests were documented on six islands with a peak count of 51 active nests.

BRPE nests were documented on three islands with 56% of the nesting activity on Matanzas Island. The peak nest count in April was 109 active nests; this was also the season peak for BRPE.

GBHE nests were documented on 14 islands with a peak nest count of 55. Forty-two active nests were recorded in January including two nests with white morphs; one nest with a white morph adult attending a fledged blue chick and no chicks were documented in the second nest.

GREG nest counts peaked at 48 active nests for the season on five islands. Nesting activity peaked in April with 41 active nests.

SNEG were documented on three islands with a peak nest count of 32 for the season. Nesting peaked in June with 23 of the 24 nests documented as *chick*.

LBHE nesting activity peaked in June with 16 nests, 15 of them were documented as *chick*.

TRHE were documented on three islands with 80% of the nesting activity on Matanzas Island. Nesting peaked in June; all 47 nests documented were recorded as *chick*.

REEG nesting peaked in June with five of eight nests documented as *chick* and three documented as *unknown*.

BCNH nesting peaked with 12 nests on five islands. The July nest count of eight was the highest recorded for the season.

YCNH nested on nine islands with a peak nest count of 21. Fifteen active nests were documented in June at the peak of the nesting season.

Green Heron (GRHE) nesting peaked in May with three nests. Active nests were documented on two islands and one inactive nest was documented on a third island but we are unable to confirm nesting activity at this location this season.

Cattle Egret (CAEG) nesting was not documented in Estero Bay from January through July 2013.

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This program would not be possible without our wonderful volunteers. They donated countless hours to this program and their knowledge, skills, and passion have made this program a success. Thank you to Lover's Key State Park and Lee County Parks and Recreation for providing launching and parking facilities.

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Table 13. Peak numbers of nests found in Estero Bay Aquatic Preserve colonies between January and July 2013.

Colony	Latitude	Longitude	DCCO	ANHI	BRPE	GBHE	GREG	SNEG	LBHE	TRHE	REEG	BCNH	YCNH	GRHE	CAEG	Total
619038c	26.36737	-81.84357	0	0	0	0	0	0	0	0	0	0	3	1	0	4
Big Bird Island	26.38286	-81.84995	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Big Carlos Pass M-43	26.43155	-81.90066	0	0	0	1	0	0	0	0	0	0	3	0	0	4
Big Carlos Pass M-48	26.42771	-81.90050	0	0	0	1	0	0	0	0	0	0	1	2	0	4
Big Carlos Pass M-50&52	26.42244	-81.89527	1	0	0	0	0	0	0	0	0	1	5	0	0	7
Big Carlos Pass S of M-48	26.42672	-81.89852	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Big Carlos Pass W of M-46	26.42926	-81.90137	0	0	0	1	0	0	0	0	0	0	1	0	0	2
Big Carlos Pass W of M-52	26.42469	-81.89359	9	0	20	5	16	9	2	9	4	6	0	0	0	80
Big Hickory E of M-85	26.35315	-81.84164	5	0	0	12	9	0	0	0	1	0	0	0	0	27
Big Hickory M-83	26.35057	-81.84388	0	0	0	1	0	0	0	0	0	0	1	0	0	2
Big Hickory M-49 2NW	26.36766	-81.84658	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Big Hickory M-49 3NW	26.36831	-81.84698	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coconut Point East	26.38411	-81.84905	18	0	28	7	7	0	0	0	0	0	0	0	0	60
Coconut Point West	26.38111	-81.84976	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hogue Channel M-78	26.34988	-81.84644	0	0	0	1	0	0	0	0	0	3	5		0	9
Matanzas Pass	26.46092	-81.95717	12	0	61	10	9	17	12	39	4	1	1	0	0	166
New Pass M-21	26.38865	-81.85925	0	0	0	1	0	0	0	0	0	0	0	0	0	1
New Pass M-9	26.40465	-81.86816	6	0	0	4	0	0	0	0	0	0	0	0	0	10
North Coconut E of M-3	26.41131	-81.85486	0	0	0	7	7	6	2	0	0	1	1	0	0	24
North Coconut M-4	26.40737	-81.85998	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Ruth's Island	26.40783	-81.85302	0	0	0	3	0	0	0	0	0	0	0	0	0	3
Total			**51**	**0**	**109**	**55**	**48**	**32**	**16**	**49**	**9**	**12**	**21**	**3**	**0**	**405**

J.N. "DING" DARLING NATIONAL WILDLIFE REFUGE COLONIAL WADING AND DIVING BIRD NEST MONITORING ANNUAL REPORT

INTRODUCTION

Since 2008, J.N. "Ding" Darling National Wildlife Refuge (Refuge) staff has been conducting colonial nesting bird surveys in cooperation with Charlotte Harbor Aquatic Preserve (CHAP) staff of the Florida Department of Environmental Protection. Each agency has split responsibility for colonial nesting surveys on assorted islands in Matlacha Pass, Pine Island Sound, and San Carlos Bay. Colonial wading and diving bird nest monitoring began in 2008 with 9 islands and was expanded to 34 islands in 2011. Goals of this study include documenting population trends, species diversity, spatial shifts in nesting, and nesting efforts of wading and diving bird species among islands.

METHODS

Refuge staff monitors islands in southern Matlacha Pass, San Carlos Bay, and southern Pine Island Sound. Surveys are conducted using a direct count method via a primary observer, secondary observer, boat captain, and data recorder. Islands are circled by boat and individual nests are recorded according to species. Nests are recorded as *incubating, chicks,* or *unknown* if the nesting stage could not be determined. Nests are documented as *incubating* when an adult is sitting on the nest in a crouched position shading the nest. Juvenile birds visible in or near the nest are recorded as a nest in the c*hicks* stage, and are not counted individually as a measure of productivity. Due to a slight change in protocol in previously surveyed years (2011–2013), individual chicks were counted as a measure of productivity and not nesting stage. Therefore, if a nest had chicks in it, the chicks were counted, but the nest was not, and as a result, the nest did not contribute to the peak nesting count. Survey protocols were corrected following a meeting between Refuge and CHAP staff in late June, and as of July 2013 Refuge staff began counting a nest with chicks as a single nest rather than individual chicks.

Data collected during March–June 2013 were analyzed for this report. The data reported here include the individual chick data. Individual chick data are presented in the total peak season nesting numbers by totaling the individual chicks observed and dividing by two to calculate the number of nests represented by the chick data. This calculation presumes that the nests produced an average of two chicks. The peak season nesting numbers, with chick data and without, were compared. Peak nest counts for individual species did not differ significantly when nest and chick tallies were comparatively analyzed. Peak numbers reflect the highest number per species throughout the survey period. The number of total peak nests for all species combined was calculated for each island. The same information from the 2012 nesting season was used to compare peak species abundance and species richness between the last two nesting seasons.

RESULTS

The total peak nesting effort for 2012 was 437 (**Table 14**) compared to 363 in 2013 (**Table 15**.) – a 17% decline in peak nesting effort. In 2013, 11 of 19 surveyed islands were active compared to 2012 when 14 of 19 islands were active. It is presumed that the birds from the non-active islands moved to new locations or possibly joined other active colonies. Individual islands ranged from having 1 nest to 78 nests in 2013 and 1 nest to 108 nests in 2012, respectively. The highest peak nesting effort occurred on Upper Bird Island in Matlacha Pass during both years with 78 nests recorded in 2013 and 108 recorded in 2012.

The most abundant nesting species for both years were Double-crested Cormorant (DCCO) and Brown Pelican (BRPE) with peak nest counts of 143 for DCCO and 133 for BRPE in 2013 and 172 for DCCO and 158 for BRPE in 2012; a 16.8% decrease in DCCO and a 15.8% decrease in BRPE. Survey results indicate a slight increase in peak nest counts for Tricolored Heron (TRHE) (25%) in 2013. There were no nests documented for Anhinga (ANHI), Cattle Egret (CAEG), Little Blue Heron (LBHE), and Reddish Egret (REEG) in 2012; however, a few were tallied in 2013: ANHI (5), CAEG (2), LBHE (1) and REEG (2). One of the limitations of the current survey protocol remains the difficulty of detecting the smaller, more secretive waders such as LBHE, TRHE, REEG, and Snowy Egret (SNEG) that nest deep within dense vegetation low to the ground. The difficulty lies with documenting and gathering needed information without significantly disturbing the colony with the potential of reducing productivity.

Decreases in peak nest counts for Great Blue Heron (GBHE) (38.3%), SNEG (15.4%), and Great Egret (GREG) (32.3%) were documented in 2013. There was 1 Black-crowned Night Heron (BCNH) nest documented in 2012, but none in 2013, although some adults were observed at several of the colonies. A total of 10 species were documented nesting in 2013 compared to only 7 in 2012. The greatest diversity of colonial nesters was found on North of York Island in Pine Island Sound with eight species recorded, including GBHE, TRHE, LBHE, GREG, REEG, BRPE, DCCO, and ANHI.

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Table 14. Colonial nesting bird survey peak estimates for Ding Darling NWR complex colonies between March and June 2012. Counts reflect the maximum number of pairs of adults with nests by species.

Colony (Island)	Lat	Long	GBHE	TRHE	LBHE	SNEG	GREG	REEG	CAEG	YCNH	BCNH	GRHE	WHIB	BRPE	DCCO	ANHI	Total
Bodiford Key	26.4980	-82.1125	0	0	0	0	2	0	0	0	0	0	0	0	10	0	**12**
Clam Key	26.5063	-82.1127	5	0	0	0	0	0	0	0	0	0	0	0	0	0	**5**
Crescent Island	26.5979	-82.0639	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Fish Hut Island	26.5466	-82.1244	5	0	0	1	0	0	0	0	0	0	0	1	20	0	**27**
Givney Key	26.5145	-82.0552	13	0	0	0	6	0	0	0	0	0	0	8	41	0	**68**
Lumpkin Key	26.6015	-82.0526	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lower Bird Island	26.5125	-82.0330	7	0	0	0	0	0	0	0	0	0	0	0	0	0	**7**
Master's Landing	26.5666	-82.0749	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
N. of Mason Island	26.5582	-82.1221	1	0	0	0	0	0	0	0	0	0	0	1	6	0	**8**
N. of Regla Island	26.5422	-82.1226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
N. of York Island	26.4946	-82.1043	4	1	0	2	2	0	0	0	0	0	0	43	28	0	**80**
NE of York	26.4938	-82.1020	2	0	0	2	1	0	0	0	0	0	0	5	22	0	**32**
NW of Mason Island	26.5543	-82.1251	2	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**
NW of Pumpkin Key	26.5660	-82.1279	3	0	0	0	0	0	0	0	0	0	0	0	0	0	**3**
Skimmer Key	26.5100	-82.0250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
SW of Mason Island	26.5532	-82.1251	4	0	0	0	0	0	0	0	0	0	0	0	0	0	**4**
SW of Pumpkin Key	26.5639	-82.1274	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
Tarpon Bay Keys	26.4573	-82.0747	5	1	0	7	18	0	0	0	1	0	0	31	17	0	**80**
Upper Bird Island	26.5592	-82.0714	8	0	0	1	2	0	0	0	0	0	0	69	28	0	**108**
Total			**60**	**2**	**0**	**13**	**31**	**0**	**0**	**0**	**1**	**0**	**0**	**158**	**172**	**0**	**437**

Table 15. Colonial nesting bird survey peak estimates for Ding Darling NWR complex colonies between March and June 2013. Counts reflect the maximum number of pairs of adults with nests by species.

Colony (Island)	Lat	Long	GBHE	TRHE	LBHE	SNEG	GREG	REEG	CAEG	YCNH	BCNH	GRHE	WHIB	BRPE	DCCO	ANHI	Total
Bodiford Key	26.4980	-82.1125	0	4	0	0	3	0	0	0	0	0	0	0	16	0	**23**
Clam Key	26.5063	-82.1127	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
Crescent Island	26.5979	-82.0639	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Fish Hut Island	26.5466	-82.1244	2	0	0	0	3	0	0	0	0	0	0	5	32	0	**42**
Givney Key	26.5145	-82.0552	13	0	0	0	0	0	1	0	0	0	0	6	14	1	**35**
Lumpkin Key	26.6015	-82.0526	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lower Bird Island	26.5125	-82.0330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Master's Landing	26.5666	-82.0749	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
N. of Mason Island	26.5582	-82.1221	1	0	0	0	0	0	0	0	0	0	0	0	18	2	**21**
N. of Regla Island	26.5422	-82.1226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
N. of York Island	26.4946	-82.1043	3	2	1	0	1	1	0	0	0	0	0	30	13	1	**52**
NE of York	26.4938	-82.1020	2	0	0	0	0	0	0	0	0	0	0	33	2	1	**38**
NW of Mason Island	26.5543	-82.1251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
NW of Pumpkin Key	26.5660	-82.1279	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**
Skimmer Key	26.5100	-82.0250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
SW of Mason Island	26.5532	-82.1251	6	0	0	0	0	0	0	0	0	0	0	0	4	0	**10**
SW of Pumpkin Key	26.5639	-82.1274	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Tarpon Bay Keys	26.4573	-82.0747	4	2	0	10	11	1	0	0	0	0	0	14	20	0	**62**
Upper Bird Island	26.5592	-82.0714	4	0	0	1	3	0	1	0	0	0	0	45	24	0	**78**
Total			**37**	**8**	**1**	**11**	**21**	**2**	**2**	**0**	**0**	**0**	**0**	**133**	**143**	**5**	**363**

WADING BIRD NESTING AT LAKE OKEECHOBEE

INTRODUCTION

In 2005, Florida Atlantic University (FAU) began wading bird nesting surveys on Lake Okeechobee to determine location and size of colonies as part of the Comprehensive Everglades Restoration Plan (CERP) Monitoring and Assessment Plan. We reported the highest nesting effort on record in 2006 with 11,310 nests, and the lowest nesting effort on record in 2008, with 38 nests. Herein we report our findings for 2013.

METHODS

From February through June 2013, FAU conducted wading bird nesting surveys to determine timing and location of breeding populations as a part of the CERP Monitoring and Assessment Plan. Detailed methods are described in previous editions of the *South Florida Wading Bird Report*.

We obtained rainfall and hydrology data from the South Florida Water Management District's DBHYDRO database. We calculated lake stage as the mean of four principle gauges in the pelagic zone of Lake Okeechobee (L001, L005, L006, and LZ40). All elevation data are presented in National Geodetic Vertical Datum 1929 (NGVD 1929) and locations are in North American Datum 1983 (NAD 1983). Historical stage data are from 1977 to the present, which corresponds to the period of systematic aerial surveys.

HYDROLOGY

In 2013, lake levels were normal at approximately 4.6 m (15 ft) in January with an extended dry-down throughout the season (**Figure 8**). On February 14, a substantial weather system moved across south and central Florida causing a rise in water levels that peaked at 4.4 m (14.5 ft) on February 15. Thereafter water levels receded in typical fashion through April. Despite several storms in early May that produced a second reversal (peaked on May 4 at 4.13 m [13.6 ft]), the official start of the wet season was May 18, two days earlier than the average historical start date. Water levels reached the lowest point on May 28 at 4.04 m (13.3 ft).

RESULTS AND DISCUSSION

Colony Location and Size

We detected 12 colonies (**Figure 9**), 10 on-lake and 2 off-lake (Gator Farm and Lakeport Marina), with an estimated 8461 nests. We derived this number by summing the peak nesting month for each species except for Anhingas (ANHI) and Cattle Egrets (CAEG) (**Table 16**). For historical comparisons, the cumulative total for Great Egrets (GREG), Great Blue Herons (GBHE), White Ibises (WHIB), and Snowy Egrets (SNEG) was 6919 nests, making 2013 the fourth highest nest effort on record of the 33 years monitored since 1957 (**Figure 10**). This is the first year since 2010 that the Moore Haven marsh and several other traditional marsh colonies were active (Botta and Gawlik 2010). Colony placement and nesting substrate seem to be related to nest effort. Willow head colonies in the marsh are characteristically large, usually more than 1000 nesting birds, whereas spoil island colonies typically can only accommodate a few hundred nesting birds. This year, the three Clewiston spoil island colonies and Little Bear Beach (also a spoil island) produced only 6% of the total nesting effort (**Table 17**).

Timing and Success

The advanced stages of GBHE nesting we observed in February indicated that this species was the first to initiate nesting (**Table 16**). The next species to initiate nesting was GREG, with a median initiation date of February 15. Small herons were next to initiate with a median date of March 2. WHIB initiated last with a median date of April 2. Nest success was generally high, with many nests fledging 2–3 young.

Figure 8. Hydrograph of 2013 Lake Okeechobee stage (m) and daily precipitation totals (cm) with the mean daily stage from 1977 to the present.

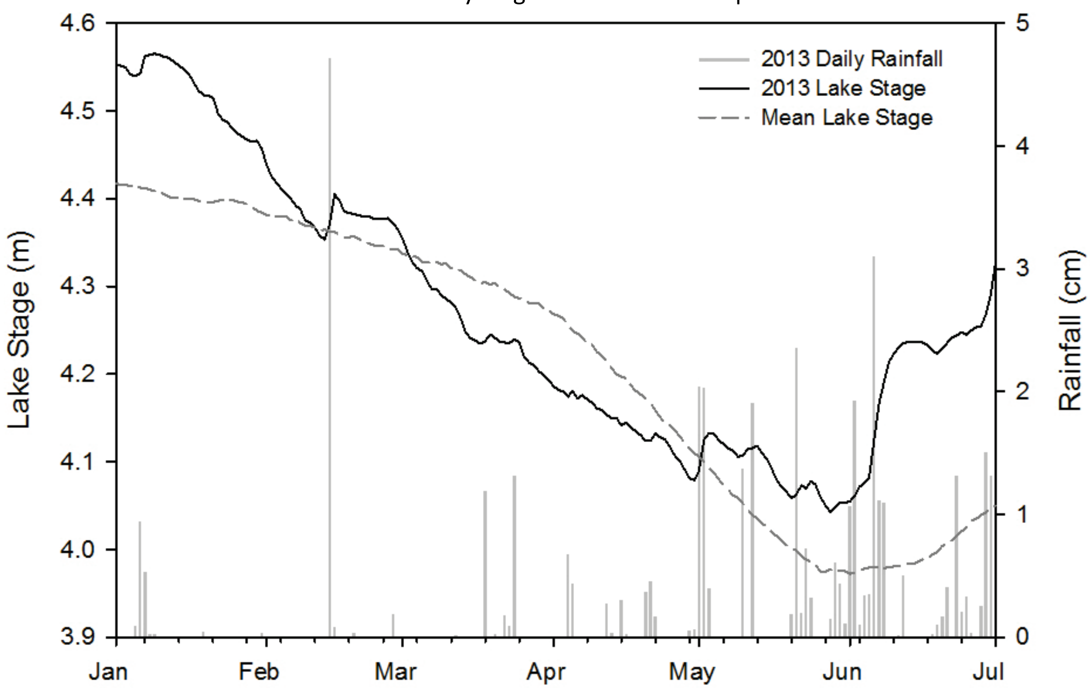

Figure 9. Wading bird colonies observed at Lake Okeechobee from February to June 2013.

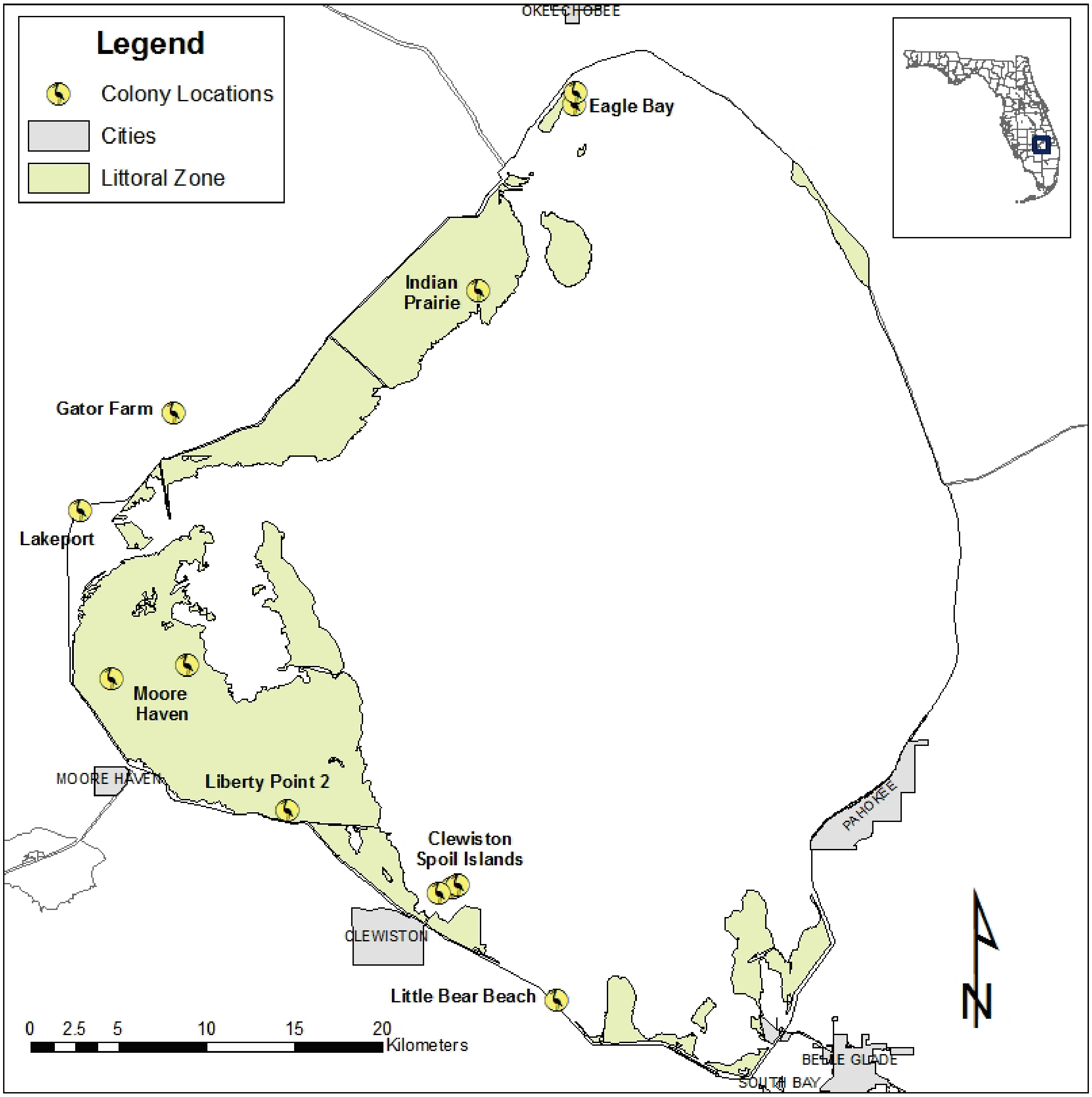

Table 16. Timing and nest effort for species breeding in wading bird colonies during 2013 at Lake Okeechobee. Bold denotes peak nest effort for species included in grand total.

Month	GREG	GBHE	WHIB	SNEG	LBHE	TRHE	WOST	GLIB	ROSP	CAEG	ANHI	Peak Nest Effort[1]
January	---	4	---	---	---	---	---	---	---	---	---	4
February	650	**16**	---	---	---	---	---	---	---	---	15	666
March	**1592**	13	---	**2911**	100	500	---	---	---[2]	---	58	5116
April	920	10	**2400**	2000	**401**	**739**	---[2]	**400**	---[2]	---	45	6870
May	350	---	1550	750	200	320	---	250	**2**	1000	10	3422
June	70	---	300	250	70	100	---	---	---	1850	---	790

[1] Does not include CAEG or ANHI.
[2] Species detected during monthly survey effort but never seen nesting.

Figure 10. Historic record of wading bird nesting on Lake Okeechobee (four species include GBHE, GREG, SNEG, WHIB). Thick horizontal line represents the mean, thin horizontal line represents one standard deviation. Data for 1961-1970, 1973, 1976, and 1993–2004 are not available.

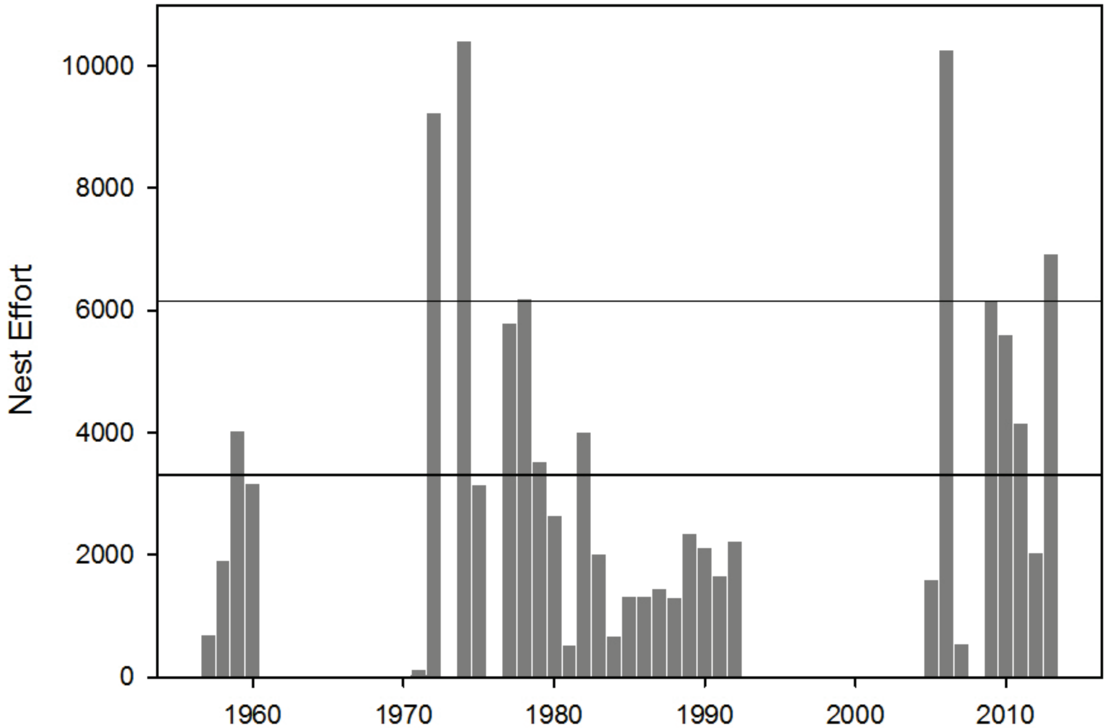

Table 17. Geographic coordinates (NAD 83) and species-specific peak nest efforts in detected colonies during the 2013 breeding season at Lake Okeechobee

Colony	Peak Month[1]	Lat	Long	GREG	GBHE	WHIB	SNEG	LBHE	TRHE	WOST	GLIB	ROSP	CAEG	ANHI	Total[1]
Clewiston Mid	MAR	26.77965	-80.90157	---	---	---	25	---	---	---	---	---	---	---	**25**
Clewiston Out	APR	26.78091	-80.89850	17	---	---	26	---	39	---	---	---	---	---	**82**
Clewiston Spit	MAR	26.77658	-80.90914	50	1	---	50	---	---	---	---	---	---	---	**101**
Eagle Bay East	APR	27.17987	-80.83080	25	10	400	300	---	100	---	200	---	800	---	**1035**
Eagle Bay Trail	MAR	27.18659	-80.83056	---	1	---[2]	25	---	20	---	---	---	200	---	**46**
Gator Farm	APR	27.02278	-81.06084	150	---	---	350	---	---	---[2]	---	---[2]	350	---	**500**
Indian Prairie 1	MAY	27.08526	-80.88613	---	---	---	---	---	---	---	---	---[2]	---	10	**---**
Lakeport Marina	MAR	26.97260	-81.11440	200	1	---	200	1	5	---	---	---	500	3	**407**
Liberty Point 2	APR	26.81906	-80.99579	750	3	1050	925	400	200	---	100	---[2]	---	20	**3428**
Little Bear Beach	APR	26.72139	-80.84222	50	---	---	200	---	75	---	---	---	---	---	**325**
Moore Haven	MAR	26.88641	-81.09644	50	---	50	10	---	---	---	---	---	---	---	**110**
Moore Haven East 4	APR	26.89336	-81.05337	300	---	900	800	---	300	---	100	2	---	25	**2402**

[1] Does not include CAEG or ANHI

[2] Species detected during monthly survey effort but never seen nesting

Wood Storks and Roseate Spoonbills

Wood Storks (WOST) have nested in a mixed species colony at an alligator farm about 4 km north of Harney Pond along County Road 721 from 2007–2010. Although the colony has developed each successive year since, storks did not initiate nesting in 2011–2013. Roseate Spoonbills (ROSP) initiated nesting on the lake in 2009 and 2012, but they failed before fledging young. Large flocks of foraging and roosting ROSP were seen in 2010 and 2011, but there was no nesting reported in those years. This year, we consistently observed a flock of about 50 ROSP roosting in the Moore Haven East 4 colony. In late May, two spoonbill nests were confirmed; however, a week later and for unknown reasons, the nests were destroyed and the eggs were gone.

Wading Bird Nesting and Prey Availability

The 2011 dry season had low lake levels similar to three of the five worst nest effort years on record (1971, 1981, and 2007), yet nest effort was within the top ten on record. We suspect fish populations in 2011 were high because the marsh was flooded as early as April of the previous year. In a separate study on the lake, throw-trap samples (see Kushlan 1976 for basic throw-trap methodology) of aquatic prey during the dry season showed that mean prey density in 2011 was 165±168 prey/m^2 with a maximum prey density of 936 prey/m^2 (**Figure 11**) (Chastant and Gawlik, unpub. data). In contrast, nest effort was poor in 2012 and throw-trap samples showed that mean prey density was merely 87±55 prey/m^2 with a maximum prey density of 267 prey/m^2. Reduced fish density during the 2012 nesting season was probably the result of the low water levels during the 2010 wet season and 2011 dry season, which did not allow for much reproduction of marsh fishes (**Figure 11**). Wading bird nest effort was considerably greater in 2013 even though prey density was only up slightly (mean = 104±61 prey/m^2 with a maximum prey density of 260 prey/m^2). Food availability over the entire season may have been higher than the small-scale measure of prey density would indicate because the extended drydown in 2013 transformed a large amount of marsh into suitable foraging habitat (**Figure 11**). As in the Everglades, it may be that there is more than one mechanism that produces high prey availability for wading birds. CERP monitoring in conjunction with focused companion studies offer an effective way to identify the mechanisms and pathways by which hydrology acts to influence wading bird nesting patterns. Understanding these relationships will significantly increase our ability to predict how wading birds will respond to specific water management regimes.

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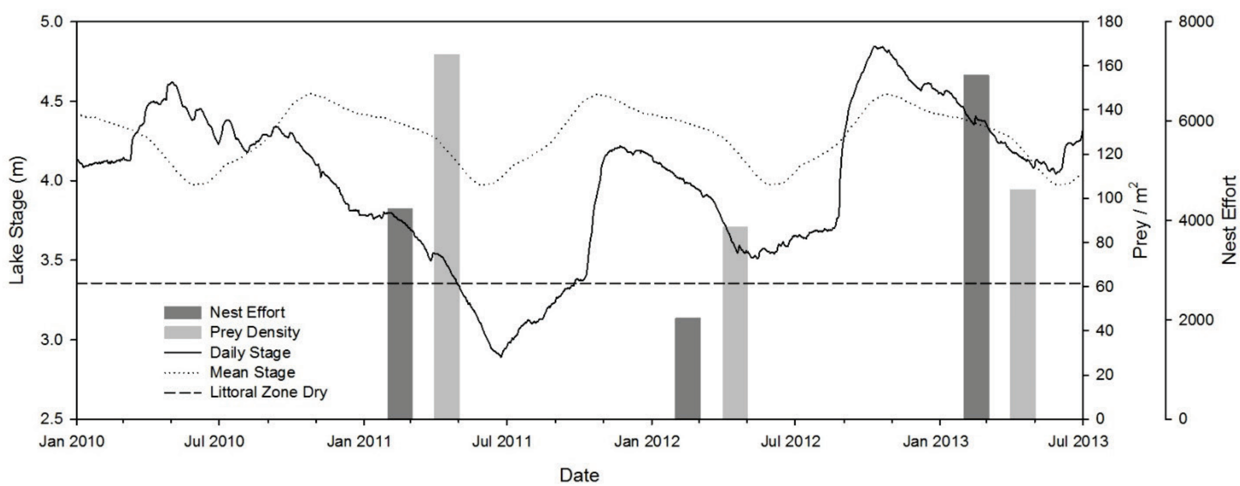

Figure 11. Lake Okeechobee hydrograph for the 2010 dry season–2013 dry season with the mean daily lake stage from 1977 to the present. When lake levels fall below 3.35 m (11 ft), the majority of the littoral zone marsh is dry.

KISSIMMEE RIVER

The South Florida Water Management District (SFWMD) surveys wading bird nesting colonies and foraging wading bird abundance along the Kissimmee River as part of the Kissimmee River Restoration Evaluation Program (KRREP)(Williams and Melvin 2005a, 2005b). To date, approximately 7710 acres of wetland habitat (about half of project total) has been restored and the interim response by foraging wading birds has exceeded expectations (Bousquin et al. 2010). While there is no formal expectation for wading bird nesting effort, the number and size of colonies that have formed along the river since restoration began in 2001 has been below the historical average (Williams and Melvin 2005a). All construction is scheduled for completion by the end of 2016, when new water regulation schedules for headwater lakes and the river will also be implemented, further improving wading bird habitat. Wading bird responses to the river restoration project will be monitored through 2021.

NESTING COLONIES

Methods

As part of the KRREP, the SFWMD performed systematic aerial surveys on March 1, April 23, and May 15, 2013, to search for wading bird nesting colonies within the Kissimmee River floodplain and the surrounding wetland-upland complex approximately 3 km east and west of the 100-year flood line (**Figure 12**). One aerial survey was also conducted in the Upper Kissimmee Chain of Lakes Basin on May 15 and ground surveys of Bird Island (Lake Mary Jane) and Rabbit Island (Lake Kissimmee) were conducted on May 15 and May 23, respectively (**Figure 13**). Nesting colonies were also monitored, when encountered, during separate aerial surveys of foraging wading birds on January 15, February 12, March 12, April 16, and May 7, 2013. Observers were placed on both sides of a helicopter flying at an altitude of 244 m along east-west transects spaced 2 km apart. Once a colony was located, nesting species and the number of active nests were visually estimated by the principal observer while photographs were taken by another observer. Nest counts were also obtained from the digital photos to improve the accuracy of initial counts made from the air. The number of nests reported here represent the maximum number of nests for each species observed. It is likely the nests for a relatively small number of dark-colored birds, such as Little Blue Heron (LBHE), Glossy Ibis (GLIB), Tricolored Heron (TRHE), Yellow-crowned Night Heron (YCNH), and Black-crowned Night Heron (BCNH), were undercounted during the aerial surveys because of their lower visibility from above (Frederick et al., 1996). Thus, the colony totals presented in **Table 18** and **Table 19** are considered conservative. Nest fate and nesting success were not monitored, but ground surveys were conducted at Bird Island and Rabbit Island to obtain a more accurate nest count and determine the presence of less visible dark-colored species.

Results

Four small colonies were active within the Kissimmee River 100-year floodline (**Table 18**, **Table 19**, and **Figure 12**): S-65C Boat Ramp, S-65C Structure, River Ranch, and Chandler Slough. The largest, S-65C Boat Ramp colony, was dominated by the terrestrial Cattle Egret (CAEG) (599 nests under construction). Aquatic wading bird species had only 43 nests at all four colonies within the floodplain. All 599 CAEG nests at the S-65C Boat Ramp were abandoned sometime between the April 23 and May 15 survey flights. Although the cause of abandonment is uncertain, one likely reason is the fragile condition of the nesting substrate. Many of the nests were being built in dead and dying shrubs, mostly Wax Myrtle (*Myrica cerifera*), with some Red Bay (*Persea borbonia*) and Red Maple (*Acer rubrum*), that were decomposing and collapsing as the result of an aerial herbicide treatment conducted during 2011. As the nests were being built, the substrate may have been collapsing and the birds abandoned the site or, even one small wind event, such as a downdraft from a thunderstorm, could have collapsed most, if not all, of the nests under construction. One small historical colony (Chandler Slough) was observed this year for the first time since 2006, although it contained only 7 Great Blue Heron (GBHE) nests and 16 Great Egret (GREG) nests.

Two other small colonies (Melaleuca Island and Orange Grove) formed in the vicinity of the Kissimmee River, but outside of the 100-year floodline. Together these colonies had 22 GBHE and 3 GREG nests. Although the colony locations are considered to be just outside the restoration project area, birds feeding young at the colony are within foraging flight distance of the project area.

A previously unknown colony on the northeastern shore of Lake Conlin was surveyed during one flight when 40 Wood Stork (WOST) nests and 1 GBHE nest were observed in large cypress trees. As was the case last season, the colonies on Lakes Mary Jane and Istokpoga were dominated by aquatic species, while nesters on Lake Kissimmee were mostly CAEG. The largest colony to form this year was the rookery island in Lake Mary Jane (1224 nests), which was dominated by White Ibis (WHIB) and GREG (**Table 19**). The number of aquatic species nesting on Lake Mary Jane was up by 607 nests (113%), largely due to an increase in WHIB and GREG. CAEG nesting on Mary Jane was down by 135 nests (-57%). Aquatic species nesting on Rabbit Island in Lake Kissimmee were down by approximately 214 nests (-40%) due to a decrease in the number of GREG, GBHE, WHIB, and Snowy Egrets (SNEG). CAEG nests on Rabbit Island were up by approximately 30 nests (4%). Bumblebee Island in Lake Istokpoga had an increase in both CAEG (175 nests, 233%) and GREG (168 nests, 96%) nests, while GBHE nests declined by 20 nests (-26%) (**Table 19**). No WHIB nests were observed during the March and April surveys.

Compared to 2012, the number of aquatic bird nests in all observed colonies was up by 634 nests (46%), while the number of CAEG nests was up by 521 (30%). Most nesting of both aquatic wading bird species and CAEG continues to occur outside of the Kissimmee River Restoration area on islands in the Kissimmee Upper Chain of Lakes and Lake Istokpoga. To date, no significant colonies of aquatic species have formed near the restoration project area. The continued small numbers of aquatic species nesting along the restored portion of the river suggests that prey availability on the floodplain is not yet sufficient to support the completion of breeding for these wetland dependent birds. While conditions on the floodplain can become optimal for foraging wading birds during certain times of the year (see *Foraging Abundance* below), the timing and magnitude of floodplain inundation and recession is not yet optimal for rookery formation due to operational constraints. Implementation of the regulation schedule for the Headwaters Revitalization Project in 2016 will allow water managers to more closely mimic the historical stage and discharge characteristics of the river, presumably leading to suitable hydrologic conditions for wading bird nesting colonies.

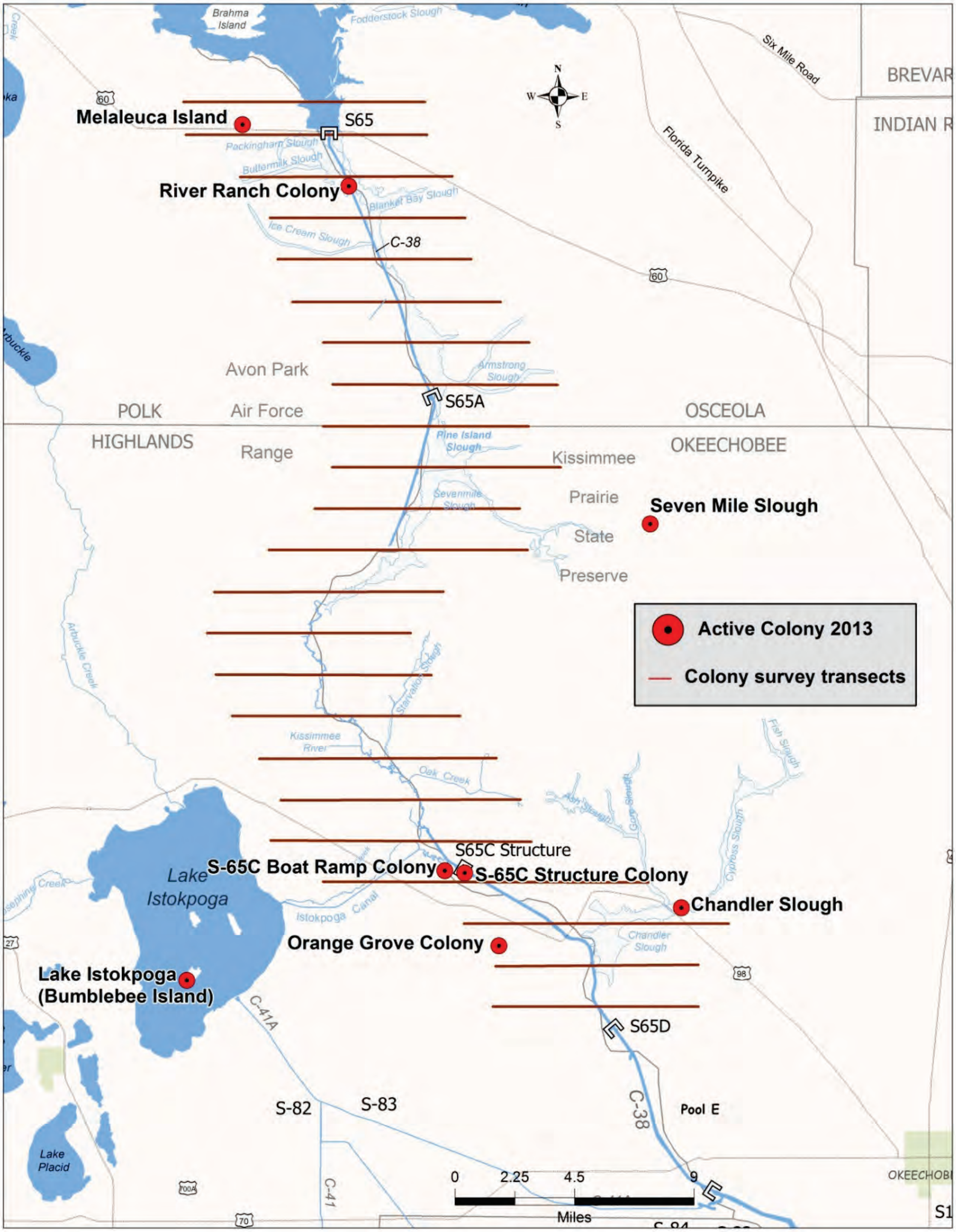

Figure 12. Aerial survey transect routes and locations of nesting colonies within the Kissimmee River floodplain and surrounding wetland/upland complex during 2013.

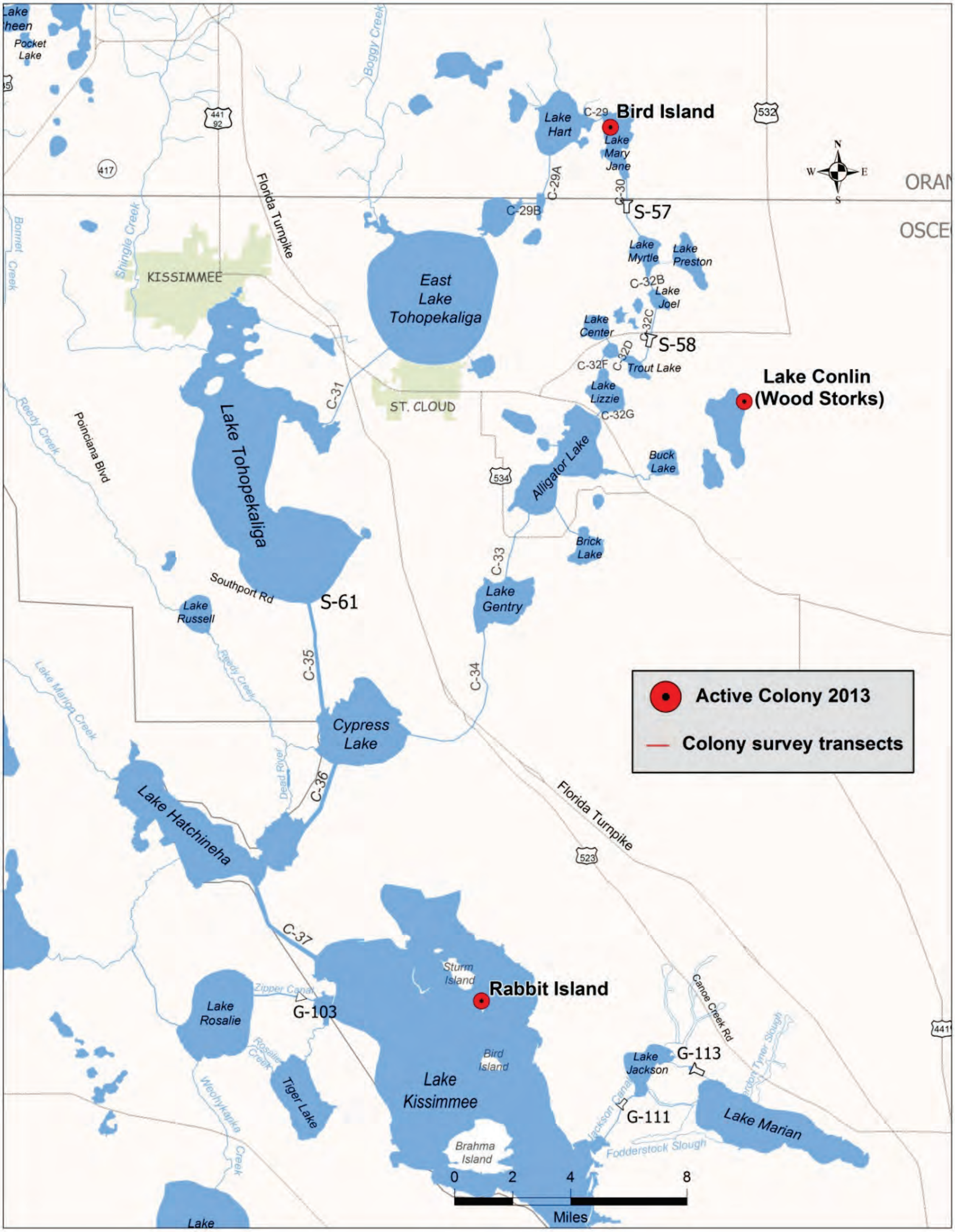

Figure 13. Observed nesting colony sites within the Upper Kissimmee Chain of Lakes Basin during 2013.

Table 18. Peak numbers of wading bird nests within the Kissimmee Chain of Lakes and Kissimmee River Basins during 2013 (March, April, and June).

Colony Name (Location)	Lat, Long	CAEG	GREG	WHIB	SNEG	GBHE	SMDH	GLIB	BCNH	WOST	Total
Bird Island (Lake Mary Jane)	28.3785, -81.1842	100	376	566	-	-	50	-	-	132	**1,224**
Lake Conlin	28.2410, -81.1073	-	-	-	-	1	-	-	-	40	**41**
Rabbit Island (Lake Kissimmee)	27.9395, -81.2543	675	135	95	7	35	36	5	5	-	**993**
Melaleuca Island	27.8078, -81.2512	-	2	-	-	4	-	-	-	-	**6**
River Ranch Island (Island in C-38 canal; east of River Ranch Resort)	27.7747, -81.1857	-	15	-	-	1	-	-	-		**16**
Seven Mile Slough (Kissimmee Prairie Preserve State Park)	27.5900, -81.0013	-	12	-	-	12	-	-	-	-	**24**
S-65C boat ramp (Approx. 0.6 mile SW of ramp)	27.3176, -81.0305	599	-	-	-	-	-	-	-	-	**599**
S-65C structure	27.3993, -81.1136	-	4	-	-	-	-	-	-	-	**4**
Chandler Slough	27.3803, -80.9812		16			7					**23**
Orange Grove (1.0 mile SW of Pool D floodplain)	27.3595, -81.093	-	1	-	-	18	-	-	-	-	**19**
Bumblebee Island (Lake Istokpoga)	27.3993, -81.1136	250	343	-	-	55	-	-	-	-	**648**

Table 19. Peak numbers of wading bird nests inside or within 3 km of the Kissimmee River 100–yr floodline between S-65 and S65-D structures and within Lakes Mary Jane, Conlin, Kissimmee, and Istokpoga.

Kissimmee River

Year	CAEG	GREG	WHIB	SNEG	GBHE	LBHE	TRHE	SMDH	BCNH	Total
2004	-	-	-	-	-	-	-	-	-	-
2005	400	81	-	-	5	-	-	-	-	486
2006	500	133	-	-	4	-	-	-	-	637
2007	226	-	-	-	-	-	1	-	-	227
2008	-	2	-	-	4	-	-	-	-	6
2009	240	126	-	-	27	11	3	-	-	407
2010	891	35	-	-	31	22	15	-	-	994
2011	751	14	-	8	35	26	9	-	-	843
2012	1,202	2	-	18	20	-	-	108	-	1350
2013	599	38			30					667
Total	**4,809**	**431**	**-**	**26**	**168**	**59**	**28**	**108**	**-**	**5629**

Lake Conlin

Year	CAEG	GREG	WHIB	SNEG	GBHE	LBHE	TRHE	WOST	BCNH	Total
2013	-	-	-	-	1	-	-	40	-	**41**
Total	-	-	-	-	1	-	-	**40**	**-**	**41**

Bird Island (Lake Mary Jane)

Year	CAEG	GREG	WHIB	SNEG	SMDH	LBHE	TRHE	WOST	BCNH	Total
2010	-	250	-	-	-	-	-	100	1	**351**
2011	-	200	-	-	-	-	-	200	-	**400**
2012	235	176	119	25	-	-	-	172	-	**727**
2013	100	376	566	-	50	-	-	132	**-**	**1224**
Total	**335**	**1002**	**685**	**25**	**50**	**-**	**-**	**604**	**1**	**2702**

Rabbit Island (Lake Kissimmee)

Year	CAEG	GREG	WHIB	SNEG	GBHE	LBHE	TRHE	GLIB	BCNH	Total
2009	740	150	75	-	50	42	87	10	3	**1157**
2010	200	249	1,156	-	59	-	-	-	-	**1664**
2011	350	250	540	75	75	-	-	-	-	**1290**
2012	645	250	156	39	87	-	-	-	-	**1177**
2013	675	135	95	7	35	11	25	5	5	**993**
Total	**2,610**	**1,034**	**2,022**	**121**	**306**	**53**	**112**	**15**	**8**	**6281**

Bumblebee Island (Lake Istokpoga)

Year	CAEG	GREG	WHIB	SNEG	GBHE	LBHE	TRHE	WOST	BCNH	Total
2010	103	325	110	-	75	-	-	-	-	**613**
2011	381	200	50	-	45	-	-	-	-	**676**
2012	75	175	-	-	75	-	-	-	-	**325**
2013	250	343	-	-	55	-	-	-	-	**648**
Total	**809**	**1,043**	**160**	**-**	**250**	**-**	**-**	**-**	**-**	**2262**

Note: Surveys were performed approximately monthly from January to June.

FORAGING ABUNDANCE

As part of the KRREP, a restoration expectation was developed for the abundance of foraging wading birds on the post-construction floodplain. It is expected that the mean annual dry season density of long-legged wading birds (excluding cattle egrets) will be 30.6 or more birds per square kilometer (birds/km^2) on the restored floodplain (Williams and Melvin, 2005a).

Methods

East-west aerial transects (n=218) were established at 200 m intervals beginning at the S-65 structure and ending at the S-65D structure (see **Figure 12** for structure locations). Each month, a minimum of 20% of the 100-year floodplain was surveyed in both the restored and unrestored portions of the river/floodplain. Surveys were conducted via helicopter at an altitude of 30.5 m and a speed of 80 km/hr. A single observer counted all wading birds and waterfowl within 200 m of one side of the transect line. Because it is not always possible to distinguish Tricolored Herons (TRHE) from adult Little Blue Herons (LBHE) during aerial surveys (Bancroft et al. 1990), the two are lumped into the category, Small Dark Herons (SML DRK). Likewise, Snowy Egrets (SNEG) and immature LBHE were classified as small white herons (SML WHT) (Bancroft et al. 1990).

Results

Prior to the restoration project, dry season abundance of long-legged wading birds in the Phase I restoration area averaged ± SE 3.6±0.9 birds/km^2 in 1997 and 14.3±3.4 birds/km^2 in 1998. Since completion of Phases I, IVA, and IVB of restoration construction in 2001, 2007, and 2009, respectively, abundance has exceeded the restoration expectation of 30.6 birds/km^2 (evaluated as a three-year running average), except during 2007–2009 and 2009–2011 (**Table 20**, **Figure 14**).

Mean monthly wading bird abundance within the restored portions of the river during the 2012–2013 season (28.8±6.6 birds/km^2) was just over half of last year's estimate of 44.4 birds/km^2, although the three-year running average (31.0±7.2) remains just above the restoration target of 30.6 birds/km^2. Wading bird numbers were below average in December, likely due to the approximate 0.22-ft reversal of water levels on the floodplain following a rain event just prior to the survey flight. Numbers increased in January to slightly above the monthly mean before dropping again in February to slightly below the monthly mean. The decrease in February also occurred sometime after a reversal in water levels of approximately 0.8 ft on the floodplain. Abundance estimates came back up in March to slightly below the monthly mean and subsequently declined to below average each month through May as water levels receded and the floodplain became completely dry by May, with the exception of a few remaining drying pools.

WHIB and CAEG dominated numerically, followed in order of abundance by GREG, SML WHT, GLIB, GBHE, SML DRK, WOST, BCNH, ROSP, and YCNH.

Table 20. Post-restoration abundance (3-year running averages [± SE]) of long-legged wading birds excluding cattle egrets during the dry season (December–May) within Phase I, IVA, and IVB restoration areas of the Kissimmee River.

Period	Three-year Running Average ± SE
2002–2004	65.4 ± 5.1
2003–2005	74.3 ± 3.5
2004–2006	76.4 ± 4.8
2005–2007	58.9 ± 8.8
2006–2008	49.3 ± 27.4
2007–2009	21.4 ± 7.0
2008–2010	33.9 ± 8.6
2009–2011	29.0 ± 9.8
2010-2012	37.6 ± 9.0
2011-2013	31.0 ± 7.2

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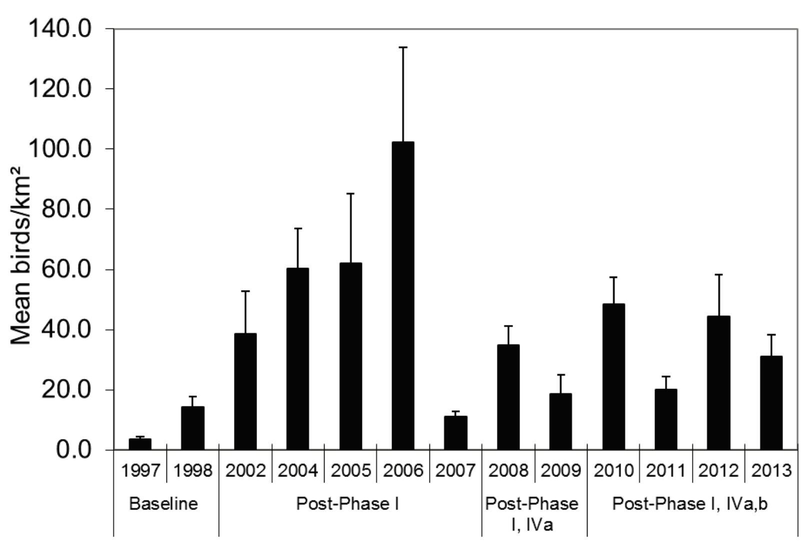

Figure 14. Baseline and post-Phases I, IVa, and IVb mean abundance (± SE) of long-legged wading birds (excluding cattle egrets) per square kilometer (birds/km^2) during the dry season (December–May) within the 100-year flood line of the Kissimmee River. Baseline abundance was measured in the Phase I area prior to restoration. Post-restoration abundance was measured beginning approximately 10 months following completion of Phase I.

STATUS OF WADING BIRD RECOVERY

The sustainability of healthy wading bird populations is a primary goal of the Comprehensive Everglades Restoration Plan (CERP) and other Everglades restoration programs in south Florida. A central prediction of CERP is that a return to natural flows and hydropatterns will result in the recovery of large, sustainable breeding wading bird populations, a return to natural timing of nesting, and restoration of large nesting colonies in the coastal zone (Frederick et al. 2009). There are at least two overlapping sets of measures of attaining these conditions, all based on historical conditions and thought to represent key ecological features of the bird-prey-hydrology relationship. RECOVER established Performance Measures (PM)[d], which include the 3-year running average of the numbers of nesting pairs of key avian species in the mainland Everglades, the timing of Wood Stork (WOST) nesting, and the proportion of the population that nests in the coastal ecotone (Ogden et al. 1997). In addition, the annual Stoplight Reports have added two other measures: the ratio of visual to tactile wading bird species breeding in the Everglades, and the frequency of exceptionally large White Ibis (WHIB) breeding events. These additional measures were added to further capture key ecological relationships found in the historical ecosystem (Frederick et al. 2009).

In this section, I report on the long-term trends and status of these measures. When thinking about progress towards these restoration measures, it should be remembered that the hydrological system is not yet restored to provide anything like the ecological functions expected in a completed comprehensive Everglades restoration. Based on the status of the hydrological system, we would not have predicted restored or even partially restored wading bird population indicators.

The main indicator species are Great Egret (GREG), Snowy Egret (SNEG), WHIB, and WOST. Although the Tricolored Heron (TRHE) was originally included in these species (Ogden et al. 1997), this species has proven extremely difficult to consistently monitor due to the inability to see their dark plumage in colonies during aerial surveys. Ogden et al. (1997) lumped TRHE and SNEG population targets (e.g., 10,000 breeding pairs), and it is difficult to derive an expected number for SNEG alone (Ogden 1994). Based on relative abundances in coastal colonies, roughly equal support can be derived for 1:1 ratios as for 2:1 ratios (Snowy:Tricolored) (Ogden 1994). In practice, the distinction is unimportant since both species appear to be declining and are nowhere near any of the population restoration targets. Here, I summarize data for the three Water Conservation Areas (WCAs) and mainland Everglades National Park (ENP).

[d]http://www.evergladesplan.org/pm/recover

RESULTS

Numbers of Nesting Pairs

The 3-year running averages for nesting pairs (2011–2013) are 7940 pairs for GREG, 1299 for SNEG, 16,282 for WHIB, and 1686 pairs for WOST. Trends for GREG (**Figure 15**, **Table 21**) increased markedly from 1988 to 2004 and have been stable or slightly declining since, with the 3-year running average meeting or exceeding restoration criteria (see target minima in **Table 21**) for 18 consecutive sampling periods since 1996. Trends for SNEG also increased markedly from 1986 to 2004, but have dropped dramatically since 2005, with the 2013 season showing continued declines compared with the previous 3 years. Three-year running averages of breeding SNEG have been consistently well below the target restoration goal since 1986. The 3-year running average has increased markedly for WHIB during 1986–2001, and then remained variable but arguably stable for 2002–2011. The final period in this record (2010–2013) showed substantial decreases in ibis nesting (approximate 50% reduction), with 3 of the 4 years being well below the average of the previous decade. WHIB nesting populations have met or exceeded the breeding population criterion during the past 13 years. WOST showed a marked increase from averages in the 2–300 pair range (1986–1992) to averages above 1000 after 1999. WOST have equaled or exceeded the restoration population criterion during 5 of the last 12 years. Together, these statistics illustrate that there has been a very substantial increase in numbers of GREG, WOST, and WHIB since 1986, followed by a period of relative stability during which each of these species has met restoration targets most years. SNEG, however, continue to nest in declining numbers and have never met restoration targets. In addition, there is evidence from systematic ground surveys in WCA-3 (see earlier in this report) that breeding populations of the Tricolored Heron (TRHE) and Little Blue Heron (LBHE) are also declining sharply in the Everglades.

Figure 15. Trends in 3-year running average of nesting pairs of the five target species since 1986.

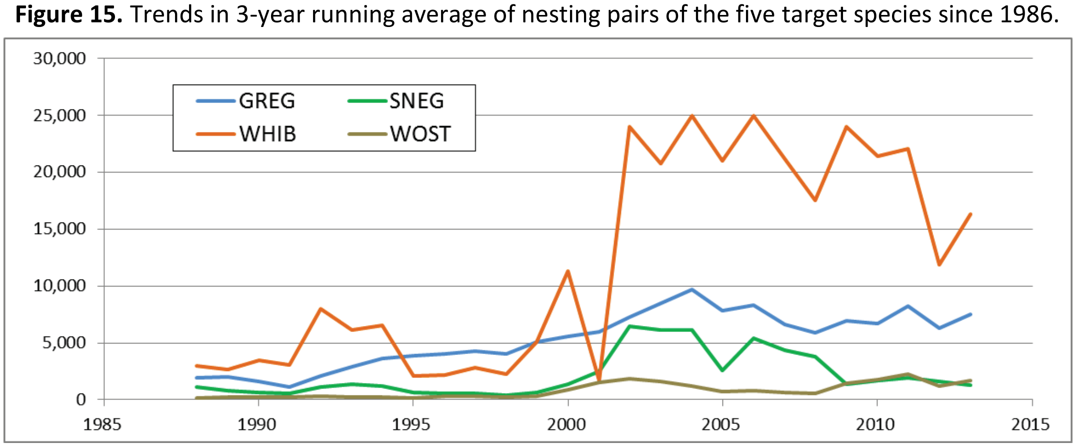

Table 21. Three-year running averages of the number of nesting pairs for the four indicator species in the Everglades. Bold numbers are years in which the target minima were met.

Year Range	Year	GREG	SNEG	WHIB	WOST
1986-88	1988	1946	1089	2974	175
1987-89	1989	1980	810	2676	255
1988-90	1990	1640	679	3433	276
1989-91	1991	1163	521	3066	276
1990-92	1992	2112	1124	8020	294
1991-93	1993	2924	1391	6162	250
1992-94	1994	3667	1233	6511	277
1993-95	1995	3843	658	2107	130
1994-96	1996	**4043**	570	2172	343
1995-97	1997	**4302**	544	2850	283
1996-98	1998	**4017**	435	2270	228
1997-99	1999	**5084**	616	5100	279
1998-00	2000	**5544**	1354	**11,270**	863
1999-01	2001	**5996**	2483	1655	**1538**
2000-02	2002	**7276**	6455	**23,983**	**1868**
2001-03	2003	**8460**	6131	**20,758**	**1596**
2002-04	2004	**9656**	6118	**24,947**	**1191**
2003-05	2005	**7829**	2618	**20,993**	742
2004-06	2006	**8296**	5423	**24,926**	800
2005-07	2007	**6600**	4344	**21,133**	633
2006-08	2008	**5869**	3767	**17,541**	552
2007-09	2009	**6956**	1330	**23,953**	**1468**
2008-10	2010	**6715**	1723	**21,415**	**1736**
2009-11	2011	**8270**	1947	**22,020**	**2263**
2010-12	2012	**6296**	1599	**11,889**	1182
2011-13	2013	**7490**	1299	**16,282**	**1686**
Target minima		4000	10,000–20,000	10,000–25,000	1,500–2,500

Colony Location

It is estimated that more than 90% of the nesting of the indicator species occurred in the southern ecotone region during the 1930s and early 1940s, in all likelihood because this was the most productive area. A major restoration hypothesis holds that the reduction of freshwater flows to this coastal region has reduced secondary productivity and resulted in the abandonment of the area by nesting wading birds. The proportion of the entire mainland Everglades nesting population that nests in the coastal zone is one of the restoration indicators, with at least 50% of nesting as the restoration target (Ogden et al. 1997). This measure has shown considerable improvement since the lows of the mid-1990s and early 2000s (2–10%, **Figure 16**), and during the last several years has ranged between 15 and 46%. In 2013 the proportion was 36%.

Ratio of Visual to Tactile Foragers

This measure recognizes that the breeding wading bird community has shifted from being numerically dominated by tactile foragers (storks and ibises) during the predrainage period to one in which visual foragers such as GREG are numerically dominant. This shift is thought to have occurred as a result of impounded, stabilized, or overdrained marsh, which leads to the declining availability both of larger forage fishes (for WOST) and crayfishes (for ibises). These conditions also seem to favor species like GREG that are less reliant on the entrapment of prey and can forage both in groups and solitarily under various circumstances. Restoration targets are set at 32 breeding tactile foragers to each breeding visual forager, characteristic of the 1930s breeding assemblages. While this measure has shown some improvement since the mid-1990s (movement from 0.66 to 3.5), the ratio is still an order of magnitude less than the restoration target. The 5-year running average for this measure in 2012 was 2.55.

Timing of Nesting

This parameter applies only to the initiation of nesting for WOST, which has shifted from November–December (1930s–1960s) to January–March (1980s–present). Later nesting increases the risk of mortality of nestlings that have not fledged prior to the onset of the wet season and can make the difference between the south Florida stork population being a source or sink population. This measure has shown a consistent trend towards later nesting between the 1930s and the 1980s (**Figure 17**), with variation around a February mean initiation date since the 1980s. Although some years in the mid-2000s stimulated earlier nesting, there has been no lasting improvement. The 2013 season was early by comparison with recent years (mid-January) but late by comparison with the November–December benchmark.

Exceptionally Large Ibis Aggregations

Exceptionally large breeding aggregations of ibises were characteristic of the predrainage system, and are thought to be indicators of the ability of the wetland system to produce very large pulses of prey resulting in part from typical cycles of drought and flood. Large breeding aggregations during the recent period are defined as being above 16,977 nests each year, defined as the 70th percentile of the entire period of record of annual nestings. The interval between large ibis nestings in the predrainage period was 1.6 years and this serves as the target for restoration. This measure has improved very markedly since the 1970s, with the target achieved in 9 of the last 10 years (**Figure 18**). The 2013 ibis nesting did reach the criterion, and the interval averaged over the last 5 years is 1.6 years, almost exactly the same as in the 1930s.

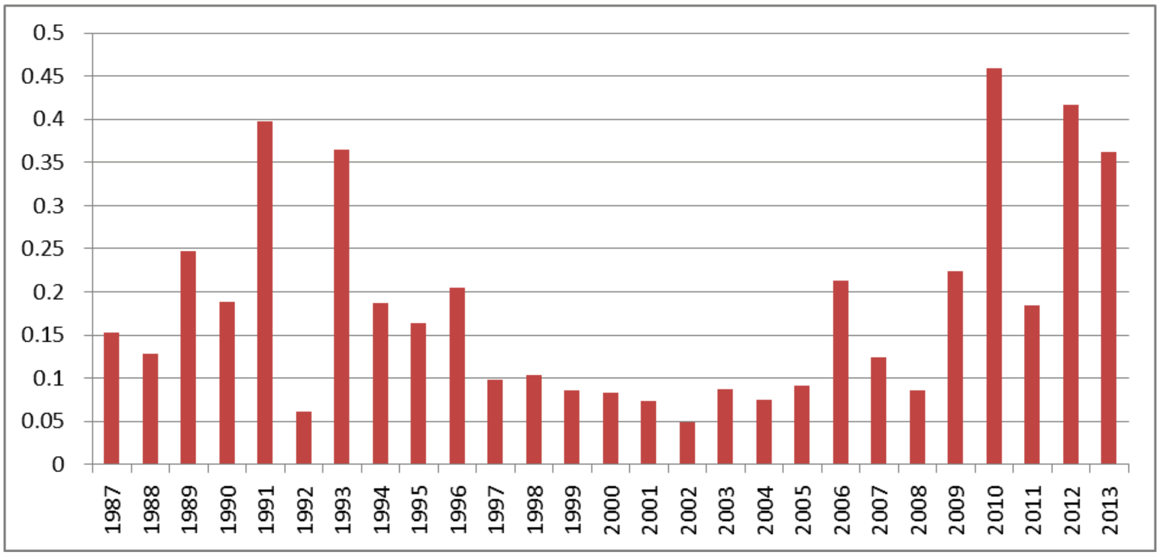

Figure 16. Proportion of all mainland Everglades nesting within the coastal estuarine zone, 1986–2013.

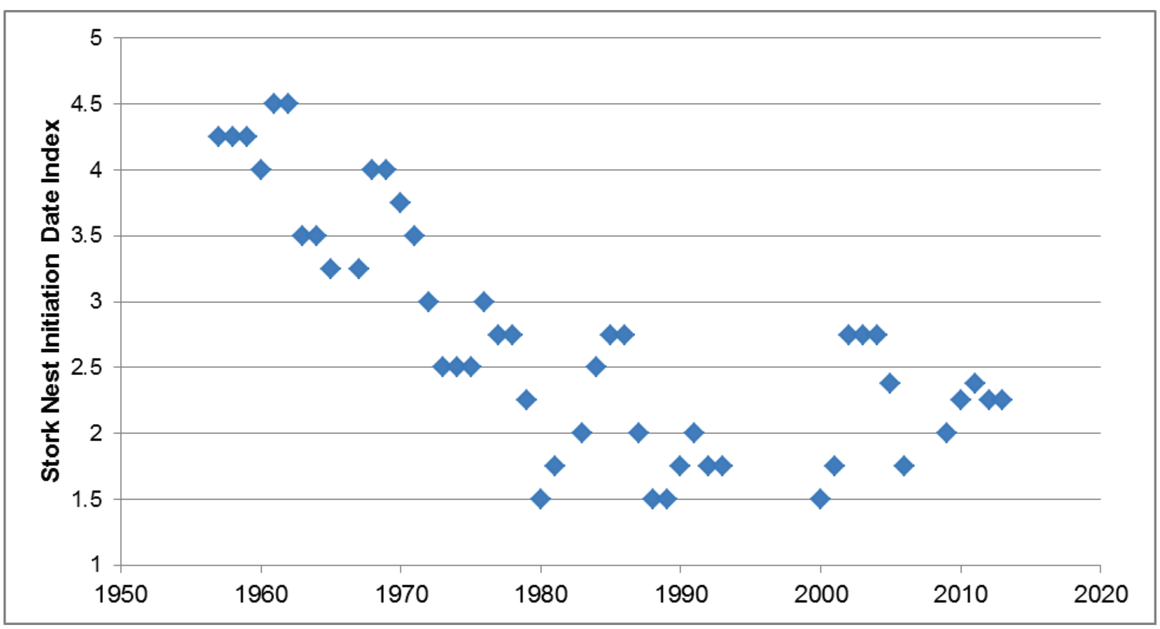

Figure 17. Four-year running average Wood Stork nest initiation date, 1960–2013 (1=March, 5=November). Target nest dates for restored conditions are November–December.

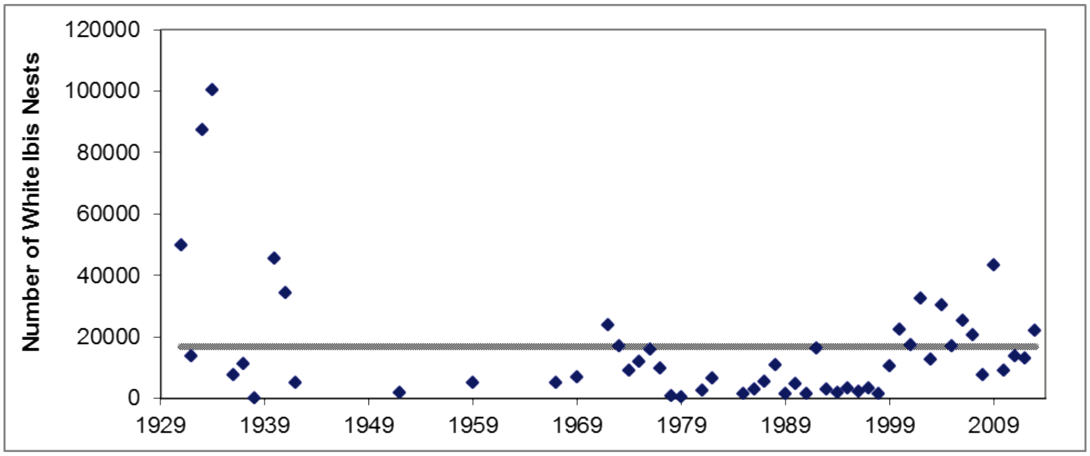

Figure 18. WHIB nests in the mainland Everglades, 1930–2013. The gray line illustrates the 70th percentile of the period of record, which is used as the criterion for exceptional ibis nesting events.

DISCUSSION

Taken together, these measures of wading bird nesting suggest that while there have been real improvements in several of the measures during the past 20 years, several key measures are stalled and not showing further improvement. Two measures are genuinely hopeful: numbers of nesting pairs of ibises, WOST, and GREG in the system seem to be regularly achieving the restoration targets, and the interval between exceptional ibis nesting years has consistently met the restoration target for 8 of the past 10 years. There has been real progress in the location of nesting, but the proportion of nesting in the coastal zone remains low (5-year running average of 32.9% compared to 50% target), and there is much room for improvement. Several measures are not improving. The numbers of SNEG are declining and remain far from restoration targets. There is little evidence that the timing of nesting for WOST is improving, and this measure may actually be getting worse. The ratio of tactile to visual foragers has improved since the mid-2000s, but remains an order of magnitude below the restoration target.

These results illustrate clearly that the birds probably have responded in the last two decades to a combination of altered water management regimes, good weather, and beneficial hydropattern by nesting more consistently in the coastal zone, and by increasing populations of ibises and storks. While some of the population increases may be attributable to forces outside the Everglades system, the fact that these species have been attracted to nest in the Everglades in larger numbers remains a solid indicator. The lack of movement of the other measures suggests that the current management regimes are not powerful enough to nudge the timing of nesting, ratio of tactile foragers, or numbers of nesting SNEG further. While this illustrates an apparent statis, it should be remembered that full restoration of wading bird populations is predicted only as a result of full restoration of key historical hydropatterns, which has not yet occurred.

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Mac Stone Photography

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