SOUTH FLORIDA WADING BIRD REPORT

Volume 13 Mark I. Cook and Heidi K. Herring, Editors October 2007

SYSTEM-WIDE SUMMARY

Below average rainfall through the 2006 wet season resulted in the early onset of the 2007 dry season over much of South Florida. Continued below average precipitation led to good recession rates, only minor reversals in stage, but water levels that were generally lower on average than at any time since the drought of 2001. By the time of peak nesting activity in March/April, some areas were too dry for foraging or colony formation.

The estimated number of wading bird nests in South Florida in water year 2007 was 37,623 (excluding Cattle Egrets, which are not dependent on wetlands). This is a 31% decrease relative to last year's successful season, 46% less than the 68,750 nests of 2002, which was the best nesting year on record in South Florida since the 1940s, and 19% less than the average of the last six years. Note that this year's total count is a slightly conservative estimate. Surveys were not conducted this year at J. N. 'Ding' Darling National Wildlife Refuge Complex, which usually adds approx. 1000+ nests to the system-wide total. Also, ground survey coverage for the WCAs was relatively limited this year and may underestimate the total count (see Regional Nesting Reports section).

Systematic nest survey coverage has been expanded in recent years to include Lake Okeechobee and the recently restored section of the Kissimmee River floodplain. In 2007, nesting effort in these areas was relatively poor: 774 nests were counted at Lake Okeechobee and only one nest was found on the Kissimmee River floodplain. This is a marked decline from the 11,447 nests found at the two sites in 2006. As with other South Florida wetland systems, both areas were characterized by below average stage during the preceding wet season and below average winter rainfall. Note that the total for these areas is not included in the system-wide total.

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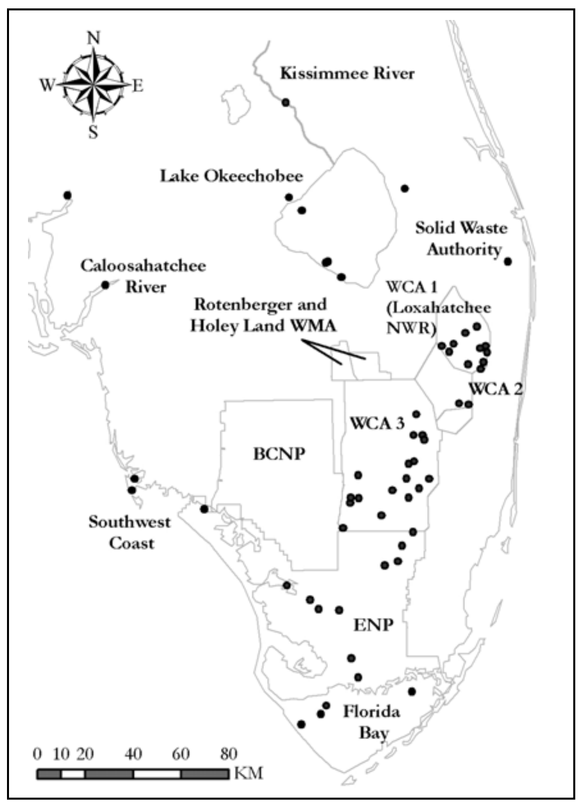
This year, all species of wading birds experienced reduced nesting effort relative to 2006 but the most extreme declines were for Wood Storks (79%), Tricolored Herons (69%) and Snowy Egrets (96%). Number of Spoonbill nests was 19% below the mean annual average since 1984, and number of White Ibis nests was 16% lower than 2006 but similar to the annual average of the past ten years. In general, 2007 was a poor wading bird breeding season in terms of nesting effort compared to the past ten years and pre-drainage years, but successful relative to the period 1960-1998.

As usual, nesting effort in the Everglades was not uniformly distributed among regions. WCA-3 and WCA-1 supported the most nests (47% and 44% respectively) whereas ENP supported only 9% of nests. This spatial distribution of nesting represents a change from recent years in that this year more nesting occurred in WCA-1 at the expense of nesting in WCA-3. ENP historically supported the largest number of nests in the system and a goal of CERP is to increase the proportion of birds nesting in the traditional estuarine "rookeries" downstream of Shark Slough.

Locations of wading bird colonies with ≥ 50 nests in South Florida, 2007.



Nesting effort in the estuaries has increased over recent years but this year the southern colonies supported only minimum nesting. Another pattern in recent years has been for a large proportion of nests in South Florida to be concentrated in a single large colony (Alley North) located in northeast WCA-3A. This year, Alley North and its adjacent marsh dried prior to breeding and nesting was not initiated at the colony. The loss of this important colony appeared to be offset slightly by increased nesting activity in WCA-1 and by the expansion of two extant colonies proximate to Alley North.

Generally, nesting was not successful for most species. Some of the nest failure can be attributed to the dry condition which led to poor foraging (see Cook and Herring, this issue) and possibly to increased mammalian predation when colonies dried completely. Despite the dry conditions, rain-driven reversal events in March and April also induced moderate nest failure particularly for nests containing eggs or very young chicks. Wood Stork nesting success was particularly poor in 2007. At Paurotis Pond all nests had failed by late May, and at Tamiami West only about 40 of 90 pairs appeared to fledge young. However, successful nesting was evident at large colonies of both Great Egrets (e.g., Vacation, Cypress City), and White Ibises (6th Bridge, Lox 73, New Colony 4). Given the nest failure in ENP and WCA 3, the number of nests in 2007 may be a liberal measure of overall reproductive success. The relationship between nest numbers and productivity was more direct in 2006 when high nest numbers were accompanied by good nesting success.

Two of four species-groups (White Ibis and Great Egrets) met the numeric nesting targets proposed by the South Florida Ecosystem Restoration Task Force. Two other targets for the Everglades restoration are an increase in the number of nesting wading birds in the coastal Everglades and a shift in the timing of Wood Stork nesting to earlier in the breeding season. The 2007 nesting year did not show an improvement in the timing of Wood Stork nesting or a general shift of colony locations.

Despite the reduced nesting effort and success, Systematic Reconnaissance Flight surveys (SRF) show that large numbers of birds foraged in the Everglades in 2007: the system-wide total abundance was 26% higher than last year and 48% higher than the average of the past five years. Also different from last year was the temporal distribution of foraging birds. In 2006, bird abundance was consistently high from January to June, whereas this year, numbers were elevated until April but declined dramatically thereafter, possibly due to the dry conditions. On the Kissimmee River floodplain the number of foraging wading birds has increased annually since restoration was completed in 2001 but this year it declined dramatically to pre-restoration levels. Extreme low stages on the Kissimmee floodplain and other wetlands precluded foraging for much of the 2007 dry season and birds from these systems were forced to migrate to longer hydroperiod marshes. This exodus may explain the marked increase in the Everglades population.

The annual nesting response of wading birds helps provide a better understanding of how the Everglades ecosystem functions. Recession rates in 2007 were generally classified as 'good' (see Hydrology section) but stages were generally below average and provided unsuitable foraging conditions over large areas of the system, particularly during the later stages of the breeding season. However, the magnitude of the drought and its effect on wading bird reproduction varied considerably by region. Nesting effort and success were greatest in areas where water levels were relatively high at the start of the breeding season, where it declined at appropriate rates, and where it did not dry completely during chick rearing. Little or no nesting occurred in areas that were too shallow prior to nesting. This year's poor nesting effort and reproductive success in the relatively dry marsh of WCA-3A and the switch in nesting effort to the wetter WCA-1 were almost certainly due to differences in hydrologic patterns. However, dry-season hydrologic conditions do not fully explain reproductive patterns. Water depths in WCA-2 and -3 were optimal for foraging early in the breeding season but compared to recent years these important feeding areas supported only limited numbers of wading birds (D Gawlik and M Cook, pers. obs.).

This disconnect between wading bird foraging and hydrology may be related to aquatic prey production. The annual monitoring of aquatic prey during the seasonal dry-down reveals that prey densities were relatively low in WCAs 2 and 3 in 2007 (D Gawlik pers. com.) and, adults that foraged in these areas had low body condition scores (G. Herring pers. com.). Prey production in WCAs 2 and 3 may have been reduced by the extended 2006 dry season during which surface waters fell below ground level for an extended period, potentially killing much of the prey stock for the 2007 breeding season. By contrast, water levels in WCA-1 remained above ground and subsequent prey densities and wading bird reproductive output were relatively high (M. Cook, unpublished data). Thus, wading bird reproduction is likely tied not only to appropriate dry-season hydrologic conditions (a strong recession and shallow water) which increases prey vulnerability but also to the hydrologic conditions of the preceding wet season which affects prey production. This is supported by the observation that the most successful breeding seasons since pre-drainage were associated with high stages during the preceding wet season and with appropriate dry season recession rates/water depths (i.e., 2002, 2004 and 2006). Years without this combination of conditions had much reduced nesting effort. Our long-term nesting data encompasses many years of variable reproductive effort over a range of hydrologic conditions. It may be large enough now that we can more effectively tease apart the ecological factors affecting the timing, distribution and magnitude of nesting.

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HYDROLOGY 2007

The amount of rain in the Everglades Protection Area for water-year 2007 (May 2006 - April 2007) was only 4-5 inches less than last year. However, this was enough to maintain water levels below regulation for all the WCAs for most of the year. The rainfall and associated stage readings for WY2007 are shown in Table 1 below. All three WCAs saw a 14% reduction in historic rainfall amounts. ENP saw only a 5% reduction in historic rainfall amounts.

In WY2007 most of the rain fell during July and August. July totals ranged between 8.1 inches (in WCA-1) and 11.5 inches (in ENP). August totals ranged between 7.7 inches (in ENP) and 8.7 inches (in WCA-1). For the rest of the year rainfall patterns were rather consistently lower than average and the dry season seemed to come a month or two early. October and November rainfall totaled a mere 1.8 inches across WCA-3A. As shown in the following hydrographs, and as might be expected from a below average rainfall water year, the 2006 hydrologic stage conditions were also below average throughout most of the system.

The following hydropattern figures highlight the average stage changes in each of the WCAs for the last two 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 were 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 foot for more than 120 days. Drought tolerances are considered exceeded when water levels are greater than 1 foot below ground for more than 30 days, i.e., the criteria for Minimum Flows and Levels in the Everglades. Figures 1A through 1G show the ground elevations in the WCAs as being essentially the same as the threshold for peat conservation. The wading bird nesting period is divided into three simple categories (red, yellow, and green) based upon foraging observations in the Everglades. A red label indicates poor conditions due to recession rates that are too fast (greater than 0.6 foot per week) or too slow (less than 0.04 foot 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 due to a slow recession rate of 0.04 foot for a week or a rapid recession between 0.17 foot and 0.6 foot per week. A green/good label is assigned when water depth decreased between 0.05 foot and 0.16 foot per week. Although these labels are not indicative of an appropriate depth for foraging, they have been useful during high water conditions to highlight recession rates that can lead to good foraging depths toward the end of the dry season (i.e., April and May).

WCA-1

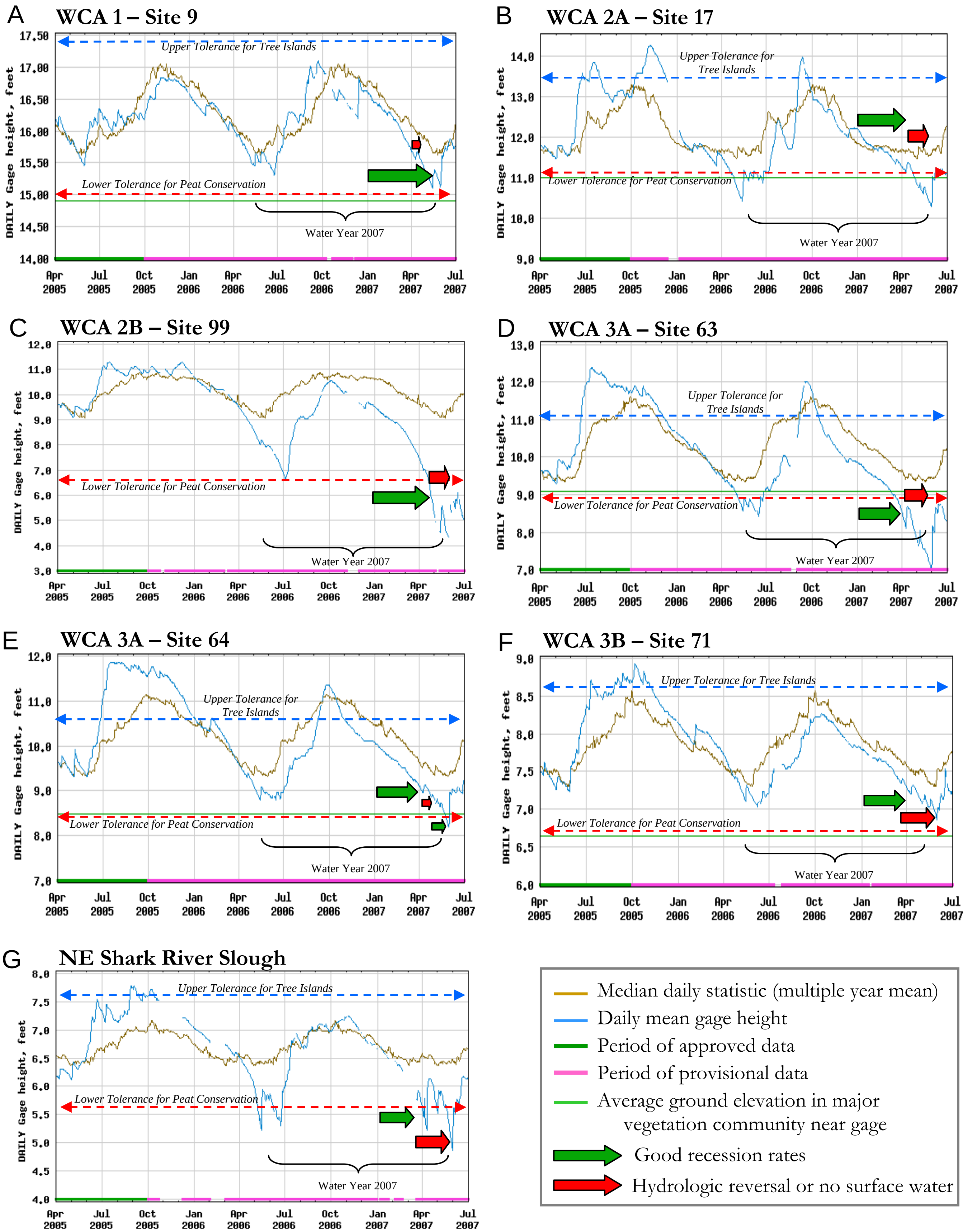
The 2007 water-year for WCA-1 started at a relatively low water condition, but then quickly rose to above average conditions and remained above average until October (Figure 1A). After September, rainfall rates declined significantly and stages quickly went below average and stayed below average for the rest of the water year. This was not necessarily bad for WCA-1 because the upper flooding tolerances for tree islands were never reached and recession rates were excellent for most of the dry season. Last water year (2006), there were a number of large-scale reversals in WCA-1 during March and April (Figure 1A), whereas this year, recession rates during the critical wading bird nesting season (January to June) were steady with only a minor reversal observed in April. Water depths became optimum for foraging in central and southern WCA-1 during April and May. Dry season foraging by wading birds in WCA-1 probably slowed significantly in mid-June when water levels increased by 0.5 ft. Just like last year, WCA-1 had the longest duration of good nesting and foraging periods of any region in the EPA. Just like last year, water levels in WCA-1 were below regulation most of the time, upper tolerances levels were never reached, and recession rates were steady.

Table 1. Average, minimum, and maximum stage (ft NGVD) and total annual rainfall (inches) for water-year 2007 in comparison to historic[1] stage and rainfall. Subtract elevation from stage to calculate average depths.

Area	WY2007 Rainfall	Historic Rainfall	WY2007 Stage Mean (min; max)	Historic Stage Mean (min; max)	Elevation
WCA-1	44.94	51.96	15.99 (14.07; 17.08)	15.58 (10.0;18.38)	15.1
WCA-2	44.94	51.96	11.91 (10.42; 13.97)	12.55 (9.33;15.64)	11.2
WCA-3	44.26	51.37	9.61 (8.4; 11.26)	9.54 (4.78;12.79)	8.2
ENP	52.76	55.22	6.15 (5.45; 6.67)	5.98 (2.01;8.08)	5.1

[1] See Chapter 2 of the 2008 South Florida Environmental Report for a more detailed description of rain, stage, inflows, outflows, and historic databases.

Figure 1. Hydrology in the WCAs and ENP in relation to recent average water depths (A: 9 yr ave, B: 12 yr ave, C: 11 yr ave, D: 12 yr ave, E: 13 yr ave, F: 12 yr ave, G: 24 yr ave) and indices for tree islands, peat conservation, and wading bird foraging depths.



WCA-2A and 2B

In WCA-2A, the differences between WY2006 and WY2007 were most obvious during the wet seasons (Figure 1B). In June 2005 the wet season began abruptly and was so intensive that it caused this region to exceed the upper flood tolerance for tree islands. In June 2006, WCA-2A was dry and wet season water depths were less than or equal to only 1 foot for most of July and August. For WY2007, only September stage heights were above average, the other 11 months were either average or some one foot below average.

In WCA-2A, the WY2006 and WY2007 dry seasons were very similar. Both had very good recession rates, both had minor recessions and both times the region completely dried out. The difference is that it dried out almost a month sooner in WY2007. The other difference is that in WY2006, WCA-2A exhibited excellent foraging conditions and many flocks of wading birds were observed. This year, although foraging conditions should have been similar, reports of large or many flocks were greatly reduced.

In WCA-2B, there was no hydrologic similarity between WY2006 and WY2007 (Figure 1C). Most of WY2006 was slightly above average, while all of WY2007 was significantly below average. In WY2006 when dry season water levels went below ground in WCA-2A, the wading birds moved to WCA-2B because fortunately, rainfall patterns and recession rates in WCA-2B created a suitable foraging habitat for the displaced wading birds in WCA-2A. This year, 2B and 2A dry season hydroperiods were much more synchronous, and both regions became too dry to support any foraging from May to July. WCA-2B has a history of being the wettest of the WCAs and it was unique to see depths drop some two feet below ground in this region. (Note: More than one foot below ground violates the guidance for Minimum Flows and Levels.)

WCA-3A

The hydrology in the northeastern region of WCA-3A (Gage-63) in WY2007 was very similar to that in WCA-2A (Figure 1D). They both had very much below average stage readings for most of the year, they had the same abrupt September peak, same late beginning of the wet season, good recession rates during the dry season, and an extended dry period when water levels were below ground. (Note: More than one foot below ground violates the guidance for Minimum Flows and Levels.) However, this region dried out to a much greater degree than it did last year, and the combination of a late wet season and extended dry season created an inhospitable environment for wading birds, especially those that frequent the popular Alley North Rookery. Last year this region had good recession rates for the entire nesting season and better foraging conditions (in terms of hydrology) than the previous water year (WY2005). This year, the birds were lucky that their rookery did not burn.

The hydrologic pattern in central WCA-3A (Gage-64) in WY2007 was almost identical to that just shown for the northeast WCA-3A (Figure 1E). However, the hydrograph is shown here in Figure 1E to illustrate the one most significant difference: good foraging hydrology and no violation of the MFL during the dry season. This does not mean, of course, that foraging was indeed good in this area. It is very possible that the shallow depths and short duration of the wet season was sufficient to cause widespread depletion of wading bird prey species.

WCA-3B

Last year, in WY2006, despite good recession rates during the entire nesting season, the water depths in WCA-3B did not go below 0.5 foot (optimum foraging depth) until May 2006, after most nesting behaviors had ceased. This year, in WY2007, reversals occurred in March, April, May and June, making this region marginal for foraging visits by wading birds (Figure 1F). What was said for WCA-3A may also be true here and that is the possibility that the shallow depths and short duration of the wet season was sufficient to cause widespread depletion of wading bird prey species.

Northeast Shark River Slough

The uniqueness of the hydrology and drought in the Everglades during WY2007 is captured by the Northeast Shark River Slough hydrograph (Figure 1G). ENP, like most of southeast Florida did not experience below average rainfall for most of the year. Dry season recession rates were good, for the most part, until April when depths became too low and a series of large reversals caused foraging to probably cease. This trend was similar to that from last year. It was made worse, in all likelihood, by the short duration of the WY2007 wet season.

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REGIONAL NESTING REPORTS

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

In 2007, the University of Florida team monitored WCAs 2 and 3 and Loxahatchee for nesting by long-legged wading birds. We concentrated effort on documenting numbers of Great Egrets, White Ibises, and Wood Storks, and continued our studies of juvenile stork movements and survival.

Methods

We performed 2 types of systematic surveys in 2007: aerial and ground surveys. The primary objective of both kinds of surveys is to systematically encounter and document nesting colonies. On or about the 15th of each month between February and June we performed systematic aerial surveys for colonies, with observers on both sides of a Cessna 172, flight altitude at 800 feet AGL, and east-west oriented flight transects spaced 1.6 nautical miles apart. These conditions have been demonstrated to result in overlapping coverage on successive transects under a variety of weather and visibility conditions, and have been used continuously since 1986. We took aerial photos of larger colonies from directly overhead and from multiple angles, and made detailed counts of the apparently nesting birds showing in these slides via projection. The reported numbers of nest starts are usually "peak" counts, in which the highest count for the season is used as the estimate of nests. The only exceptions to this rule were colonies in which clearly different cohorts were noted in the same colony, in which case the peak counts of the cohorts was summed. In most cases we also modified total aerial counts with information from ground checks.

ABBREVIATIONS

Species: Great Egret (GREG), Snowy Egret (SNEG), Reddish Egret (REEG), Cattle Egret (CAEG), Great Blue Heron (GBHE), Great White Heron (GWHE), Little Blue Heron (LBHE), Tricolored Heron (TRHE), Green Heron (GRHE), Black-crowned Night-Heron (BCNH), Yellow-crowned Night-Heron (YCNH), Roseate Spoonbill (ROSP), Wood Stork (WOST), White Ibis (WHIB), Glossy Ibis (GLIB), Anhinga (ANHI), Double-crested Cormorant (DCCO), Brown Pelican (BRPE), Osprey (OSPR), Bald Eagle (BAEA), small dark herons (SML DRK), and small white herons (SML WHT).

Regions, Agencies, and Miscellaneous: Water Conservation Area (WCA), Everglades National Park (ENP), Wildlife Management Area (WMA), A.R.M. Loxahatchee National Wildlife Refuge (LNWR), Lake Worth Drainage District (LWDD), Solid Waste Authority (SWA), South Florida Water Management District (SFWMD), U.S. Army Corp of Engineers (USACOE), Systematic Reconnaissance Flights (SRF), Comprehensive Everglades Restoration Plan (CERP), and Natural Systems Model (NSM).

In the past, we have performed systematic, 100% coverage ground surveys of colonies by airboat in WCAs 1, 2 and 3 once between early April and late May, and were designed to document small colonies or those of dark-colored species that are difficult to detect from aerial surveys. Since 2004, 100% coverage ground surveys were discontinued due to a change in MAP guidelines for monitoring. However, we did perform some systematic ground surveys in WCA-3 that allow for a direct comparison of densities of colonies in certain areas. This was designed to give an index of abundance for small colonies and dark colored species that might be sustainable. In the case of all ground surveys, all tree islands were approached closely enough to flush nesting birds, and nests were either counted directly, or estimated from flushed birds.

As part of an effort to measure nest turnover in colonies, we also estimated nest success in several colonies, by repeatedly recording the contents and fates of marked nests.

Results

Total counts in the WCAs and Loxahatchee NWR

Combining all species at all colonies in LNWR, WCA-2, and WCA-3, we estimated a grand total of 32,032 nests of wading birds (Cattle Egrets, Anhingas and cormorants excluded) were initiated between February and July of 2007. Note that this figure does not include birds nesting at the Tamiami West colony, which we also monitored intensively in ENP.

Table 1. Numbers of nests of aquatic birds found in WCAs 2, 3, and Loxahatchee NWR during systematic surveys, January through June of 2007.

Latitude	Longitude	WCA	Colony	GREG	WHIB	WOST	ANHI	GBHE	TRHE	BCNH	SNEG	LBHE	ROSP	SML WT	SML DRK	Colony Total*
N26 31.968	W80 16.572	Lox	New Col 4		7,207			9						1,917	11	9,144
N26 22.330	W80 15.612	Lox	Lox 73	95	1,064		165							882	37	2,078
N26 26.293	W80 23.432	Lox	Lox99	202			7					11		1,540		1,753
N26 27.514	W80 14.419	Lox	New Col 2	505			1					40		355		900
N26 28.103	W80 22.337	Lox		288										54		342
N26 23.937	W80 14.995	Lox		280			26					5		10	18	313
N26 26.129	W80 14.037	Lox										307				307
N26 27.022	W80 15.720	Lox		77			16					111		2		190
N26 27.548	W80 25.401	Lox										159				159
N26 23.532	W80 18.736	Lox		118			36					5		15		138
N26 30.591	W80 19.425	Lox		1								85		2		88
N26 14.601	W80 21.043	2		37			4	3			5			443		488
N26 14.269	W80 18.768	2		31			1	19								50
N26 07.457	W80 32.489	3	6th Bridge	42	10,661			5								10,708
N26 07.445	W80 30.263	3	Cypress City**	652	200		4	19	100		150	100	22	544	125	1,912
N26 00.934	W80 33.763	3		380				14						52		446
N25 57.631	W80 34.324	3		197			4	55			2			37	10	301
N25 52.105	W80 48.398	3		17			4		3		1	41		145	46	253
N25 54.939	W80 37.813	3	Vacation	98				23						78	1	200
N25 53.240	W80 46.255	3									18	102		19		139
N25 46.412	W80 50.233	3	Hidden	15	46						1			72	1	135
N26 01.538	W80 32.350	3	Vulture	82			3	27								109
N25 49.239	W80 40.616	3		79			1	2						17	7	105
N26 12.079	W80 31.724	3	Alley North	36	8			1	10		29		17			101
N26 06.429	W80 29.881	3		91				8								99
N25 55.408	W80 31.115	3		51										21		72
N25 58.456	W80 46.340	3								60		2				62
N25 53.318	W80 48.272	3							1		17	11		30		59
N25 53.362	W80 33.758	3		32			8	10						13		55
N25 57.541	W80 28.739	3		39			13	9							2	50
Total Nests for Colonies > 50				3,445	19,186	0	293	204	114	60	223	979	39	6,248	258	30,756*
Total Nests for Colonies < 50				489	17	0	575	276	29	349	24	35	0	41	16	1,276*
Grand Total				**3,934**	**19,203**	**0**	**868**	**480**	**143**	**409**	**247**	**1,014**	**39**	**6,289**	**274**	**32,032***

* Does not include ANHI

** Small Dark (GLIB) estimated from ground visits; ROSP probably from Alley N.

The size of the nesting aggregation in 2007 in the WCAs and LNWR combined was approximately 80% of the average of similar counts during the past five years, 98% of the average of the past ten years, and 52% of the banner year of 2002. Numbers of Great Egret nests were only 54% the average of the last five years, and 66% of the average of the last ten. In 2007, Wood Stork nests were very much reduced, with no pairs attempting to nest in the WCAs. White Ibis nests were 87% of the average of the last five and 106% the average of the last ten years. Compared with the banner year of 2002, only 60% of the ibis pairs nested in 2007. Snowy Egrets appeared to be nesting in very small numbers according to Table 1, but we believe a large proportion of the unidentified white herons were actually Snowy Egrets.

Generally, nesting was not very successful for most species, with a lot of nest disappearances following water level reversals in late March, and some colonies drying out completely during the nesting period (which we suspect would have led to high predation rates by mammals). In the places that Wood Storks did attempt to nest (Tamiami West, Paurotis Pond) they did not nest successfully. At Paurotis Pond, all nests had failed by late May.

At Tamiami West, approximately 90 pairs did form nests by the end of March, of which approximately 40 appeared to fledge young. Counts of young per nest suggest that approximately 1.37 chicks were brought to a large fledgling stage per successful nest, which would translate into approximately 0.57 young per nest start. Both figures are far below the suggested replacement rates for this species. However, we did see successful nesting at large colonies of both Great Egrets (eg, Vacation, Cypress City), and White Ibises (6th Bridge, Lox 73, New Colony 4), and large numbers of young ibises were evident in late May at 6th Bridge and Tamiami West.

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EVERGLADES NATIONAL PARK

Mainland Areas February – July 2007

Methods

Aerial colony surveys were conducted monthly (February through July) by 1 or 2 observers using a Cessna 182 fixed-wing aircraft (~22 person hours). Survey dates were: 21, 22 and 23 February, 19, 21 and 23 March, 4 and 23 April, 11, 21, 30 May, 26 June and 20 July. (Note: not all colonies were flown on each date and several colonies were checked via helicopter during other project flights.)

Results

Numbers of colonies and nest numbers within colonies were well below the exceptional 2006 nesting season totals and more in line with the lower counts from previous years. The reduced nesting observed this season was probably due to low water conditions throughout the region. Most colony sites and surrounding areas were already quite dry when checked during other project flights in January as well as during the first colony flight in February. By March, there was little to no surface water seen around most colonies and within many areas of the park. Birds were finally seen incubating on nests in March, however several rain events in April coincided with subsequent colony abandonment. Immediately after the rain events, much of the park appeared to be completely inundated. By the 23 April flight, birds had already abandoned nests and vultures were observed in several colonies.

Overall, nest numbers of all species combined decreased by 68% compared to the 2006 season. A total of 3281 nests within 55 active mainland colonies were surveyed in Everglades National Park. White Ibis were the most abundant of the species surveyed but their nest numbers were down 67% from 2006 numbers. Great Egrets were the second most abundant nesting species but their nest numbers were down 52% compared to the 2006 season. Snowy Egrets and Wood Storks seemed to be the most sensitive to the poor water conditions. Few Snowy Egret nests were seen this season, down 96%, and stork nests were down 70% from 2006 numbers.

Two colonies were still active as of 20 July. White Ibis along with a few Great Egrets were attempting a second nesting at Paurotis Pond. Both ibis and egrets were seen incubating on nests. At Rodgers River Bay, Great Egrets were brooding on approximately 125 new nests. Some small young could be seen. However, now that summer rains have started, it is doubtful that these second nest attempts will be successful. We will continue to monitor the status and outcome of these colonies.

Note: For our final tally of colonies, we combined our counts with additional colonies found during systematic colony searches conducted by University of Florida researchers: Peter Frederick and John Simon.

Table 1. Peak numbers of wading bird nests found in Everglades National Park colonies from February through July 2007.

Mainland colonies only COLONY NAME	Latitude WGS 84	Longitude WGS 84	GREG	WOST	WHIB	SNEG	CAEG	ROSP	TRHE	LBHE	BCNH	LRG WHT	SML WHT	SML DRK	TOTAL
Broad River	25 30.176	-80 58.464	50			30		15							95
Lower Taylor Slough	25 13.618	-80 41.057	10												10
Cuthbert Lake	25 12.560	-80 46.500	100	75											175
East River Rookery	25 16.116	-80 52.071	12												12
Grossmans Ridge West	25 38.176	80 39.166	40							+					40
Madeira Ditches	25 19.390	-80 38.740			20		20								40
NE Grossman A	25 38.810	-80 36.550					60								60
Otter Creek	25 28.068	-80 56.263	120		200			+	+	+					320
Paurotis Pond*	25 16.890	-80 48.180	185	150	410			15	+	+					760
Rodgers River Bay Peninsula*	25 33.400	-81 04.190	105	40											145
Rookery Branch	25 27.814	-80 51.153	125		400	+		+	+	+					525
Tamiami East-2	25 45.561	-80 31.474	8												8
Tamiami West	25 45.447	-80 32.701	60	75	400										535

Table 1. Cont.

Mainland colonies only COLONY NAME	Latitude WGS 84	Longitude WGS 84	GREG	WOST	WHIB	SNEG	CAEG	ROSP	TRHE	LBHE	BCNH	LRG WHT	SML WHT	SML DRK	TOTAL
UF - L	25 38.000	-80 39.860	69			36									105
UF - COL 1	25 42.451	-80 35.452	38		23										61
UF - T	25 37.850	-80 59.350	30			1									31
UF - COL 12	25 32.718	-80 46.807	13										12	1	26
UF - COL 5	25 31.197	-80 50.678	17										5		22
UF - WP 498	25 29.958	-80 53.977	20										2		22
UF - E	25 40.250	-80 54.620	20										1		21
UF - WP 440	25 37.928	-80 59.342	15		5										20
UF - COL 4	25 32.012	-80 46.773	17										1		18
UF - N	25 37.950	-80 44.440	16												16
UF - WP 497	25 30.677	-80 52.384	16												16
UF - AA	25 36.400	-80 56.060	16												16
UF - W	25 38.000	-81 00.090	14			1									15
UF - M	25 38.170	-80 43.630	11			3									14
UF - COL 10	25 31.290	-80 48.305	9										3		12
UF - COL 11	25 30.100	-80 47.180	7										4		11
UF - WP 438	25 40.492	-80 55.902	5										6		11
UF - Z	25 36.360	-80 56.970	11												11
UF - BB	25 35.550	-80 42.200	9			1									10
UF - Q	25 37.480	-80 55.640	7										3		10
UF - J	25 38.120	-80 56.610	10												10
UF - U	25 38.000	-80 59.380	8			1									9
UF - V	25 37.910	-81 00.060	7												7
UF - Y	25 37.100	-81 01.800	7												7
UF - X	25 37.870	-81 02.550	7												7
UF - K	25 38.350	-80 37.120	7												7
UF - S	25 37.680	-80 58.000	6												6
UF - G	25 38.350	-81 00.200	5												5
UF - WP 496	25 32.274	-80 45.261	4												4
UF - UF1	25 28.793	-80 48.211	2										2		4
UF - I	25 38.720	-80 57.150	3												3
UF - H	25 38.720	-81 00.150	3												3
UF - B	25 41.190	-80 41.540	3												3
UF - R	25 37.350	-80 56.750	3												3
UF - P	25 37.700	-80 47.100	1			1									2
UF - UF4	25 28.793	-80 48.211	2												2
UF - WP 403	25 37.902	-80 46.326	1												1
UF - UF1	25 28.793	-80 48.211	1												1
UF - COL 2	25 34.237	-80 48.865	1												1
UF - WP 408	25 29.532	-80 51.183	1												1
UF - D	25 40.900	-80 52.510	1												1
UF - WP 437	25 40.399	-80 54.837	1												1
TOTAL			1259	340	1458	74	80	30	0	0	0	0	39	1	3281

+ Indicates species present but unable to determine numbers

* includes 2nd nesting attempt

EVERGLADES NATIONAL PARK

Florida Bay January – July 2007

A formal wading bird aerial nesting survey was not conducted in Florida Bay, however we continue to monitor nesting activity at the large Frank Key colony.

Frank Key
Birds were not seen in February but were already nesting when checked during the 21 March survey. The highest nest numbers were also recorded on that flight date. The colony consisted of about 105 pairs of Great Egrets, 150 pairs of Brown Pelicans and approximately 125 pairs of Double-crested Cormorants. Most birds were already incubating on nests. When checked again on 4 April, many Great Egrets were brooding small young. White Ibis were also seen in the colony but were not nesting. There were also about 5-10 Great White Herons nesting on the island, not all nests were within the central colony.

After several rain events occurred in April, most Great Egrets abandoned their nests with only 20 pairs remaining when checked on 23 April. Approximately 400 White Ibis were seen roosting in the colony but had not set up nests. The pelican and cormorant nest numbers did not change and young were seen in their nests. On 11 May, it appeared that 125 pairs of White Ibis were setting up new nests and some appeared to be incubating. The remaining Great Egret nests were still active, but with very few young seen in nests, most birds seen were adults. When checked again on 30 May, the ibis had abandoned all nests and no adult ibis were seen in the colony. Only a few adult Great Egrets remained. In June, Snowy Egrets were seen roosting within the colony, but didn't attempt to nest at Frank Key this season. Pelicans and cormorants were the only birds that appeared to have a successful nesting season within the Frank Key colony.

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WOOD STORK NESTING AT CORKSCREW SWAMP SANCTUARY

Location: N26° 22.5024 W081° 36.9859

Methods
Corkscrew Sanctuary Staff conducted aerial reconnaissance throughout Southwest Florida from early November through May to record Wood Stork foraging and nesting effort. Flights were conducted two times per week on average using fixed wing aircraft. Initial surveys were conducted at 1000', when foraging and nesting efforts were identified; digital photographs were taken from 1000' and 500'. An 8.2 megapixel Canon EOS 30D body was used in combination with a 70-300mm lens for close-ups and an 18-55mm wide angle lens for landscape images. The close-up lens was equipped with an image stabilizer.

Results
No nesting was initiated. Wood Storks arrived in the Corkscrew watershed as early as October of 2006. Courtship behavior was observed off and on for approximately one week in December, yet no nesting occurred. In April, Wood Storks constructed some nest platforms in the bald cypress areas where nesting typically occurs at Corkscrew, yet no eggs were laid. Research staff documented wood storks foraging in 433 distinct wetlands across Southwest Florida from October 15th through May 17th.

Hydrology
Water levels at the Corkscrew staff gage peaked at 43.56" in mid-September. This is approximately 6.5" above the average wet-season high. A very pronounced dry season followed these high water levels where Corkscrew recorded only 6.54" of rainfall from October 2006 through March 2007, when the mean rainfall is 15 inches.

Table 1. Wood Stork nesting in Southwest Florida. Nest initiations are nests in which eggs have been laid.

Colony Name	Latitude	Longitude	Date	Stork Nests Initiated	Estimated Number Fledged
Lenore Island (Caloosahatchee West)	26 41.332	-81 49.809	4/10/2007	220	100-150
Peace River	27 01.629	-81 59.478	4/13/2007	63	NA
Morganton	27 02.014	-81 59.241	4/13/2007	18	NA
North Port Charlotte -Myakka River	27 01.962	-82 16.594	4/13/2007	0	0
Corkscrew Swamp	26 22.502	-81 36.985	4/10/2007	0	0
Caloosahatchee East	26 41.795	-81 47.697	3/5/2007	0	0
Collier/Hendry Line	26 22.223	-81 16.363	3/23/2007	0	0
Totals				301	NA

Other 2007 Wood Stork Nesting Colonies in Southwest Florida

An effort was made to document other nesting efforts throughout Southwest Florida monitored by Audubon staff in 2006-07. All sites monitored supported some wading bird nesting of a variety of species, however nesting across all species was clearly well below last year's levels. Only three of the sites monitored had some Wood Stork nesting. These were Lenore Island, (f.k.a. Caloosahatchee West colony), Peace River and Morganton.

Methods
Digital photos of the aerial survey for each colony were projected on a whiteboard and all nests that could be confirmed as Wood Storks were documented as such. At the time this report was compiled other wader species had not been tallied.

Results
Lenore Island was the most productive wood stork nesting site this season. It was monitored and photographed on nine occasions between February and May of 2007. Considerable nest abandonment occurred in April and the total nesting effort at Lenore Island produced an estimated 100-150 fledglings. Wading bird nest abandonment was evident at the Peace River, Morganton and Myakka River sites as numerous large nest structures were guano covered and vultures were observed on the nest platforms at the Myakka River location. For the seven locations monitored during the 2006-07 nesting season there were approximately 301 nest initiations documented. The same seven locations had an estimated 1,540 nest initiations last season.

Estimates of colony nesting effort and productivity can be found in Table 1 above.

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SOLID WASTE AUTHORITY OF PALM BEACH COUNTY ROOKERY

Methods
Typically, Breeding Bird Censuses (BBCs) are conducted from February – July in the SWA Roost by two observers every 8-10 weeks, representing approximately 12 man-hours. During the BBC, all islands from 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 so as to minimize any burden caused by the presence of observers. However, this year's severe drought restricted boat access into the colony. The peak nest numbers are a compilation of early season boat counts and visual counts from the observation towers.

Location & Study Area
The SWA roost is located on spoil islands in abandoned shell pits that were mined in the early 1960's in Palm Beach County, Florida (N26 46.683 W080 08.533, NAD27). The spoil islands consist of overburden material and range from 5 to 367 m in length, with an average width of 5 m. Islands are separated by 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 preliminary data for the 2007 breeding season. Typically, nesting activities have been observed at this colony through September, and these surveys being reported are only through the end of July. Only the peak nest numbers are being reported for each of the bird species (Table 1, next page).

Table 1. Peak number of wading bird nests in SWA Rookery from February to July 2007*

GREG	SNEG	CAEG	GBHE	LBHE	WOST	WHIB	ANHI	TRHE	Total Nests
53	11	87	0	2	124	676	127	40	1167

*Severe drought restricted boat access; nest numbers are a compilation of boat surveys and tower observations.

The estimated peak number of wading bird nests for the SWA Colony is 1167 which represents about a 19% decrease from the previous 2006 season. Despite the severe drought, there were nests of the following bird species: Great Egrets, Snowy Egrets, Cattle Egrets, Wood Storks, White Ibis, Little Blue Herons, Tricolored Herons, and Anhinga. The Wood Stork nest numbers were less than last year but were yielding 1-2 fledglings (visual observations). It is difficult to draw any real conclusions because of the incomplete data set. It should also be mentioned that there was at least one Roseate Spoonbill nest with fledglings observed from the observation tower.

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ROSEATE SPOONBILL NESTING IN FLORIDA BAY ANNUAL REPORT 2006-2007

Methods

Spoonbill Colony Surveys

Thirty-eight of Florida Bay's keys have been used by Roseate Spoonbills as nesting colonies. These colonies have been divided into five distinct nesting regions (Table 1) based on each colony's primary foraging location (Figure 1, Lorenz et al. 2002). During the 2006-2007 nesting cycle (Nov-May), complete nest counts were performed in all five regions by entering the active colony and thoroughly searching for nests. Nesting success was estimated for the four active regions through mark and re-visit surveys of the most active colony within the region. These surveys entailed marking up to 50 nests shortly after full clutches had been laid and re-visiting the nests on an approximate 7-10d cycle to monitor chick development. Prey fish availability was estimated at six sites (TR, EC and WJ in the Taylor Slough Basin and JB, SB and HC in the C-111 Basin) in the coastal wetlands of northeastern Florida Bay (Figure 1) known to be spoonbill foraging locations for the Northeastern and Central regions. Prey abundance was also estimated at a site located in southern Bear Lake (BL) on Cape Sable where large numbers of spoonbills nesting in the Northwestern region regularly feed. Prey fish were collected monthly from Nov through Apr with a $9m^2$ drop trap using the techniques of Lorenz et al. 1997. Prey availability data have not been fully analyzed and the qualitative information presented should be considered preliminary.

Banding Program

The purpose of this banding program is to better understand the movements and dynamics of the state's spoonbill population. We are interested in the location of post breeding dispersers, the possibility of breeder exchanges between Florida Bay and Tampa Bay and state-wide regional movements of the general population. We are hoping to see trends in spoonbills' movements with future banding and resighting efforts. Please refer anyone with information on resighting banded spoonbills to the author or our website (http://www.audubonofflorida.org/who_tavernier_reportspoonbills.html).

In Florida Bay, spoonbill nestlings were banded at 19 of the 24 colonies where spoonbills nested. In Tampa Bay, we banded spoonbills at the largest colony in the region, Richard T. Paul Alafia Bank Bird Sanctuary (Alafia Bank) (Hillsborough Bay), as well as the smaller colony of Washburn Junior (Terra Ceia Bay). Both are mixed colonial waterbird colonies. The 19 colonies in Florida Bay were distributed among five regions: 1 colony in the Northwest, 5 colonies in the Northeast, 6 colonies in the Central, 6 colonies in the Southeast, and 1 colony in Southwest Florida Bay. The northwestern region had 4 active colonies, 3 of which were patrolled heavily by American Crows. In an effort to minimize our impact, banding activities in these colonies were discontinued based on prior observation of intense nest predation by this species.

Table 1. Number of ROSP nests in Florida Bay Nov 2006-May 2007. An asterisk (*) indicates colony with nesting success surveys (see Table 2).

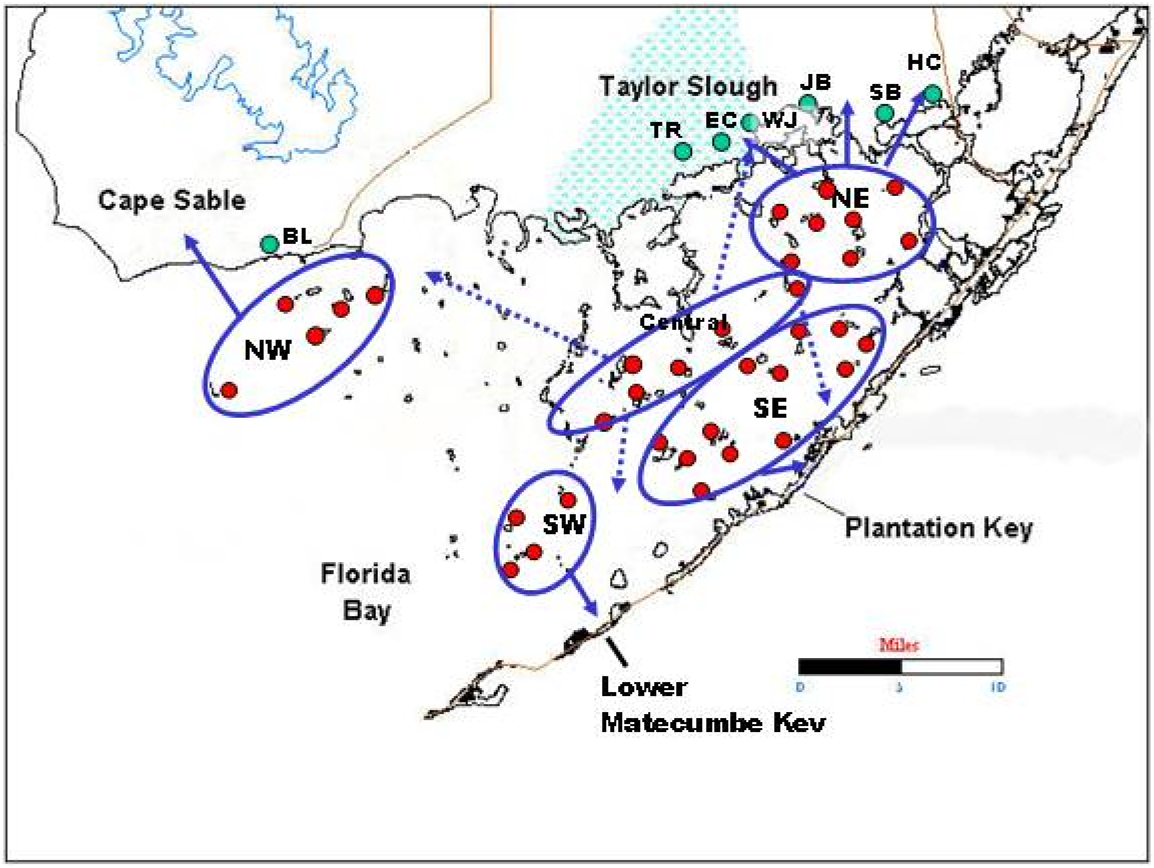
Sub-region	Colony	2006-07	Summary since 1984		
			Min	Mean	Max
Northwest	Sandy*	100	62	157	250
	Frank	51	0	54	125
	Clive	52	11	27	52
	Palm	15	9	16.25	21
	Oyster	0	0	6.44	45
	Subtotal	218	65	211.55	325
Northeast	Tern*	64	60	109.31	184
	N. Nest	0	0	0.13	1
	S. Nest	26	0	18.59	59
	Porjoe	0	0	29.53	118
	N Park	13	0	19.06	50
	Duck	0	0	2.00	13
	Pass	0	0	0.53	4
	Deer	3	2	2.50	3
	Subtotal	106	101	185.88	333
Cental	Calusa*	21	0	12.43	21
	E. Bob Allen	2	0	14.71	35
	Manatee	0	0	0.00	0
	Jimmie Channel	8	6	20.18	47
	Little Pollock	0	0	2.75	13
	S. Park	3	0	11.24	39
	Little Jimmie	12	12	12	12
	First Mate	1	1	1	1
	Captain	9	9	9	9
	Subtotal	56	15	54.00	96
Southwest	E. Buchanon	0	0	6.53	27
	W. Buchanon	0	0	3.64	9
	Barnes	3	0	0.29	3
	Twin	0	0	1.71	8
	Subtotal	3	0	11.38	35
Southeast	Stake*	13	0	5.07	19
	M. Butternut	1	1	21.71	66
	Bottle	15	0	11.44	40
	Cowpens	0	0	6.13	15
	Cotton	0	0	0.00	0
	West	0	0	3.07	9
	Low	0	0	0.00	0
	Pigeon	1	0	8.87	56
	Crab	8	0	2.29	8
	East	0	0	3.56	13
	Crane	4	2	13.60	27
	E. Butternut	27	4	5.64	27
	Subtotal	69	39	81.57	117
Florida Bay Total		452	429	557.47	880

Nestlings were banded anywhere between 5-20 days of age. We found that a 5 day-old chick was the youngest age we could band due to the small size of their legs. On the youngest chicks, we placed clay on the inner surface of the band to reduce its diameter and thereby stop the band from sliding over the joint. As the chicks age and their legs grow, this soft clay is then displaced, allowing the band to move freely. After approximately 20 days of age, we no longer attempted to band the nestlings due to their extreme mobility. We found that attempting to capture these highly mobile chicks caused unacceptable levels of stress to the chicks and disturbance to the colony. We retrieved nestlings from their nests by climbing the nest trees, or by extending a ladder up to the nest. We then transported the nestlings in five-gallon buckets to a banding station. To keep the birds warm and calm, we lined and covered the buckets with towels.

In Florida Bay, a total of 3 bands were placed on each nestling. A USGS band was placed on the tarsus, and a 2-digit alphanumeric band was placed on the opposite tibia. Florida Bay spoonbills received an additional colored celluloid band, placed above the alphanumeric band, to designate the region in which the bird was banded (blue for NW, white for NE, red for Central, and yellow for SE). Tampa Bay birds were banded with a USGS band and a red alphanumeric band. The Alafia Bank birds were not banded with an additional celluloid band, and the Washburn Junior birds were banded with an additional white celluloid band above the alphanumeric band. At the time of banding, we recorded the age and sibling rank of each chick and the number of siblings or eggs still in the nest.

Frequent visits to the colonies of Florida Bay and Tampa Bay were required in order to band as many nestlings as possible. During these visits, some nestlings were not banded due to the disturbance it caused to neighboring nests with large, mobile chicks. Although it was our goal to band every nestling in Florida Bay, many nests were not banded because they failed before the eggs hatched, the nestlings died before reaching banding age, or it was physically impossible (or too unstable) to reach the nests to retrieve the chicks. In Tampa Bay, we banded large enough chicks during the main nesting cycle, and did not band chicks during the later asynchronous nesting cycle to avoid disturbing the co-nesting White Ibis.

Figure 1. Map of Florida Bay indicating spoonbill colony locations (red circles) and nesting regions (blue circles). Arrows indicate the primary foraging area for each region. The dashed lines from the central region are speculative. Approximate locations of fish sampling sites are represented by green circles.



Spoonbill Monitoring Results

Northwestern Region: Sandy Key

All five colonies in the Northwestern region were surveyed for nesting activity in 2006-07 (Table 1). A total of 218 nests were counted in this region, which is slightly above average for this region compared to the last twenty-three years of survey data. Nesting success surveys were conducted at Sandy Key on Nov 1, 10, 15, 20, Dec 1, 8, 22, 14, 24, Jan 8, Feb 1, and Feb 15. Individual nest attempts were asynchronous compared to this colony's historical nesting record; however, in the last few years, nest attempts have been typically asynchronous. We estimate that the first nest to lay eggs was on Oct 23 while the last nest did not lay eggs until Nov 16. Usually, all nests are initiated within 14 to 21 days of each other. The mean egg laying date was Nov 2, and the mean hatch date was Nov 22. This was, by far, the earliest nesting that has occurred at Sandy Key since hatch records began in 1987. This date is two weeks earlier than the next closest mean hatch date of Dec 5 (1999) and more than 5 weeks earlier than the 1987 to 2006 mean hatch date of Dec 29. The 100 nests counted on Sandy Key were below average (157 nests since 1984). Sixty-one nests were marked for revisitation. Of these, 69% were successful at raising chicks to at least 3 weeks old (the time when they first leave the nest) with the average of 1.66 chicks per nest attempt (c/n; Table 2). The fledging rate was above average (1.27 chicks/attempt since 1984; Table 2) and is considered successful (the standard for being considered a successful nesting is at least 1 chick fledged per nest on average). Total production for Sandy Key was estimated at 166 chicks fledged (slightly higher than last year's 160 chicks fledged).

Table 2. Mean number of chicks per nest attempt. Numbers in parentheses indicate the percentage of successful nest attempts. Success is defined as fledging 1 or more chicks per nest. Second nesting attempts are not included.

			Summary since 1984			
Sub-region	Colony	2006-2007	Min	Mean	Max	% of Yrs Successful
Northwest	Sandy	1.66 (69%)	0.00	1.27	2.5	65%
Northeast	Tern	.96 (54%)	0.00	0.79	2.2	33%
Cental	Calusa	.76 (52%)	0.00	0.81	1.71	30%
Southeast	Stake	.92 (69%)	0.14	0.95	2.09	27%

The results of the colony surveys were supported by results from the banding program. One-hundred and two nestlings from 38 nests were banded at the Sandy Key colony (Table 3). Chicks were banded between Dec 1 and Dec 8. Although 7% of these chicks were found dead before leaving their nest, approximately 67% of the banded chicks were observed post-fledging on the fringes of the colony. Based on band resightings, nesting success was estimated to be 1.79 c/n. All of the chicks had fledged the island by the Feb 15, 2007 survey. One fledgling was resighted at Lake Ingraham (a popular foraging area for birds of Northwest Florida Bay, approximately 9.5 miles NNW of Sandy Key) on January 22; this bird was approximately two months old at the time of the resighting.

A discussion of water levels and prey fish availability at the BL fish collection station is pertinent to understanding why spoonbills nesting in the Northwestern region were successful. Lorenz (2000) estimated that prey fish become concentrated into small pools when water levels on the surrounding wetland drop to about 12.5 cm, thereby making them susceptible to predation by spoonbills and other wading birds. Peak water levels generally occur in late Sep or Oct but in 2006 water levels at BL peaked in Aug and rapidly declined in Sep. By mid-Oct, when spoonbills typically return to Florida Bay for the nesting season, water levels at BL were already below the 12.5 cm mark indicating that prey were already concentrated. This unusual circumstance likely explains the record early nesting date. Water levels continued to drop throughout Nov and Dec, creating an ideal situation for foraging when the chicks hatched in late Nov. Prey concentration data from BL suggests that prey began to concentrate in November and peaked in Dec. By Jan, prey concentrations at BL were depleted even though water levels remained well below 12.5 cm. The ideal water level and prey concentration conditions observed at BL just prior to and for the six weeks following the mean hatch date likely account for the high success rate at Sandy Key.

Northeastern Region: Tern Key

All eight of the spoonbill nesting colonies were surveyed in the Northeastern region of Florida Bay. A total of 106 nests were found in this region, which is well below average, and only slightly higher than the all-time low of 101 nests in the 2002-03 nesting season (Table 1). We counted nests at all eight colonies, however; only four were active during the first nesting cycle (nesting occurred later at an additional colony during what is typically the second nesting cycle). The 106 total nests in the region is the second lowest nesting effort in terms of the number of active nests, but this has occurred twice before in the last 20 years of survey data (the 2002-02 and 2003-04 seasons each had a low total nest count of 106). Spoonbill nest success surveys were conducted at Tern Key on Nov 3, 17, 29, Dec 11, 20, 28, Jan 4, 10, 18, 30, Feb 20, Mar 6, 13, 21, 28, April 4, 18 and May 9. Since the late 1980's, there has been a second nesting cycle at Tern Key, however, this year a second wave of nesting did not occur at the colony. A late-season nesting 'push' did occur at two other colonies in the Northeastern region after the first cycle of nesting was completed (further discussion follows below). At Tern Key, the first egg was laid on Nov 29 and the last nest was initiated on Dec 16 with the mean laying date estimated at Dec 5. The mean hatching date was Dec 25. Unlike Sandy Key, the nesting was somewhat synchronous, with all nests being initiated within 18 days of each other. As has been the trend in recent years, the nesting effort was alarmingly small: only 64 nests compared to almost 200 nests ten years ago and over 500 nests twenty-five years ago. We believe this decline in northeastern Florida Bay is due to water management practices on the foraging grounds. 2006-07 was the second all-time lowest number of nests for this region and is considered alarmingly small. In contrast, Tern Key birds were successful at producing more chicks per nest this season than birds in most other nesting seasons in the last 10 years. On average, each nest attempt produced 0.96 c/n compare to the average of 0.79 c/n since 1984 (Table 2). Of the 64 nests initiated on the island, 48 were marked for revisitation. Of these, 54% were successful at raising chicks to at least 3 weeks old; this is down from last year's remarkable nesting season (63% successful with 1.61 chicks per nest). Total production for the colony was estimated at 61 chicks.

In the northeastern region, 86 nestlings were banded from 37 nests within 5 colonies (Tern, South Nest, North Park, Deer, and Duck Keys; Table 3). Chicks were banded between Jan 3 and April 11. Forty-seven percent of the banded chicks were observed post-fledging but before they abandoned their natal colony for an estimated production of 1.08 c/n, an average well above that estimated by the Tern Key colony surveys. This high production estimate is perhaps bolstered by the South Nest colony, which produced an impressive 1.38 c/n. Although the overall nest effort on South Nest was small, 65% of the nests were successful at raising chicks to at least 3 weeks of age; this high productivity and success rate along with Tern Key's slightly better than average nest success is a hopeful sign that those birds that nest in the Northeastern region, albeit in small numbers, are able to successfully produce young.

In contrast to the early high water peak at BL, the water levels on the northeastern foraging grounds peaked in Sep (as is more typical) and receded much more gradually than at BL. In both the C-111 and Taylor Slough basins, water levels did not reach the 12.5 cm mark until early Dec. Fish concentrations in Taylor Slough peaked just as the first eggs were hatching. Unfortunately, both the C-111 and Taylor Slough basins experienced a reversal in the water level draw down process shortly after eggs began to hatch. The mean hatch date coincides with the peak of this reversal and water levels remained above the prey concentration depth from Dec 16 to Jan 7 in both basins. Fish concentration in Jan was well below peak concentration in both basins. It is clear from these data that most of the spoonbill chicks hatched at an inopportune time. Of the 33 nests that hatched before the mean hatch date, 20 nests failed. All but one of the nests that hatched after Dec 27 succeeded. It appears that the early nesters were subjected to adverse conditions for a longer period and during peak energetic demands of the chicks, thereby explaining the high mortality. In contrast, the late nesters only had to endure a few days of

Table 3. Number of ROSP banded in Florida Bay Dec 2006-April 2007, and in Tampa Bay, April 2007-May 2007. "Number of ROSP Resighted Alive" indicates the number of birds resighted after the age of 21+ days.

Estuary	Sub-region	Colonies where Roseate Spoonbills were Banded	Number of Nests Banded	Number of Chicks Banded	Number of ROSP Resighted Alive	Number of ROSP Resighted Dead	Number of ROSP where Fate is Unknown
Florida Bay	Northwest	Sandy	38	102	68 (67%)	7 (7%)	27 (26%)
	Northeast	Tern	15	35	15 (43%)	3 (9%)	17 (48%)
		S. Nest	9	20	15 (75%)	0	5 (25%)
		N. Park	5	12	6 (50%)	4 (33%)	2 (17%)
		Deer	5	10	0	0	10 (100%)
		Duck	3	9	4 (44%)	1 (11%)	4 (44%)
	Central	Calusa	13	24	13 (54%)	3 (13%)	8 (33%)
		Jimmie Channel	1	1	1 (100%)	0	0
		E. Bob Allen	2	2	2 (100%)	0	0
		S. Park	3	5	4 (80%)	0	1 (20%)
		Captain	2	4	1 (25%)	1 (25%)	2 (50%)
		L. Jimmie	7	12	6 (50%)	2 (17%)	4 (33%)
	Southeast	Stake	9	14	9 (64%)	0	5 (36%)
		E. Butternut	14	31	25 (81%)	0	6 (19%)
		Pigeon	1	2	1 (50%)	0	1 (50%)
		Crane	2	3	1 (33%)	1 (33%)	1 (33%)
		Bottle	9	20	3 (15%)	2 (10%)	15 (75%)
		Crab	5	9	4 (44%)	4 (44%)	1 (11%)
	Southwest	Barnes	2	4	3 (75%)	0	1 (25%)
		Florida Bay Total	145	319	181 (57%)	28 (9%)	110 (34%)
Tampa Bay		Alafia Bank	73	127	93 (73%)	1 (.8%)	33 (26%)
		Washburn Junior	15	35	24 (69%)	0	11 (31%)
		Tampa Bay Total	88	162	117 (72%)	1 (.6%)	44 (27%)

adverse conditions while chicks were still quite small and their energetic demands relatively low. Shortly after this period, the water level dropped below the prey concentration depth in both basins and, with the exception of two short duration reversals (less than 2d each), water levels remained below 12.5 cm. The Feb fish collections indicated peak concentrations of fish in the C-111 basin and near peak concentrations in Taylor Slough. All combined, these data suggest that the reversal that occurred just prior to the mean hatch date and prolonging into the second week after the mean hatch date resulted in most of the mortality in the northeastern subregion. The draw down reversal did not occur at the BL, suggesting that water management practices that affect the northeastern foraging grounds may have been responsible for chick mortality.

As mentioned above, there was not a second wave of nesting at Tern Key this year, but a later nesting effort did occur at two colonies: Deer and Duck Keys. By mid-February, first nesting attempts in all of the colonies in the Northeastern region had completely finished; this coincided with the initiation of new nests in both Deer and Duck Keys. Nest success surveys were not completed at these colonies, but based on observations and banding at the colonies, the earliest nests were initiated around the second week of February, with the latest chicks hatching out by the last week of March. A total of 13 nests were counted for this second nesting cycle of the Northeastern region (5 nests on Deer Key, 8 nests on Duck Key). It is interesting to note that Deer Key only had 3 nests during the first nesting cycle, and Duck Key had no nests until this second wave of nesting. The small number of nests during the second nesting supports the hypothesis that second nesting is populated by birds that failed to produce young in the primary nesting. It is certain that the birds nesting at Duck Key, and at least a few of the birds at Deer Key, were birds that had failed during the first nesting attempt at other colonies in the area, like Tern Key.

In 2007, the second nesting yielded only two successful nests with an average of 0.31 chicks reaching 21d post-hatching per nest attempt. We estimate that only 4 chicks fledged during the second nesting, based on observations of banded birds. A heavy rainfall event that occurred in early April may have resulted in the complete failure of the Deer Key nests; a nest survey after that event concluded that all adults had abandoned the colony, and that no chicks had survived and fledged on their own.

Southeastern Region: Stake Key

Previous nest success surveys in this region were conducted on Middle Butternut Key. This year, the astonishingly low overall effort of nest production at Middle Butternut (1 nest) instigated us to begin surveying another, more representative colony in this region. We chose Stake Key to replace Middle Butternut Key based on the number of nests on Stake Key at the time when we needed to begin monitoring nests.

All of the 12 Southeastern colonies were surveyed for nesting activity (Table 1). Nest success surveys were conducted at Stake Key on Nov 14, Dec 6, 19, 28, Jan 3, 9, 24, Feb 14, and Mar 2. The first egg was laid on approximately Nov 24, with a mean lay date of Dec 8. The mean hatch date was estimated to be Dec 28. Thirteen nests were initiated on the island; along with last year, which also produced 13 nests, this is the greatest overall nest effort since 1999. On average, each nest attempt produced 0.92 c/n; a marginal success rate. In the Southeastern region, we banded 79 nestlings from 40 nests within 6 colonies (E. Butternut, Stake, Pigeon, Crab, Crane, and Bottle Keys, Table 3). Chicks were banded between Dec 27 and Feb 28. Approximately 9% of these chicks were found dead before leaving their nests, and 54% of the banded chicks were observed post-fledging but before they abandoned their natal colony. Based on the banding effort, the success rate in the Southeastern region was 1.1 c/n, well above the Stake Key survey estimate. This elevated success rate is probably a result of the high number of chicks fledged from the E. Butternut colony (Table 3). Nest surveys were not conducted at E. Butternut, but colony counts of fledged young indicate that overall production for this colony was quite high, contributing to the overall success rate of 1.1 c/n for this region.

The success rate observed through nest surveys is about the same as last year's 0.86 chicks/nest attempt at Middle Butternut Key, and is slightly below the average 0.95 c/n since 1984. Historically, the southeastern colonies focused foraging on the mangrove wetlands on the mainline Florida Keys. Although most of these wetlands were filled by 1972 as part of Keys development boom, we presume (based on anecdotal evidence) that the few remaining Keys wetlands still serve as important foraging grounds for these birds. Since 1972 (when large scale filling of wetlands ended), nesting attempts in the Southeastern region generally faired poorly: 7 of 11 years surveyed were failures (Table 2).

Based on this year's band resight observations, it appears that conditions during the 2006-07 nesting were unusually favorable in the Southeastern region. However, based on previous work (Lorenz et al. 2002) it appears that the quality of the Southeastern region for nesting spoonbills is marginal, at best, thereby explaining the low overall effort. This is in stark contrast to the period prior to the Keys land boom when spoonbills nesting in the Southeastern region successfully fledged young every year with an average production of >2 chicks per nest (Lorenz et al. 2002).

Central Region: Calusa Key

Three new spoonbill nesting colonies were discovered this year in the Central region bringing the number of colonies to nine and the number of nests to 56 (Table 1). Two of the islands on which new nests were found are unnamed according to the Florida Bay Chart #33E, and so we have given them names for the sake of identification during the spoonbill nesting season. They are known as Little Jimmie, based on its proximity to Jimmie Key (~0.75 miles south of Jimmie Key) and First Mate, based on its proximity to Captain Key (~0.65 miles west of Captain Key). Captain Key was the third new spoonbill nesting colony in the Central region for the 2006-07 nesting season.

Nesting success surveys at Calusa Key were conducted on Nov 7, 21, Dec 5, 12, 18, 27, Jan 4, 10, 15, 23, Feb 8, 22, Mar 8 and Mar 29. Twenty-one nests were found on Calusa, which is well above average (12.4 nests since 1984). The first egg was laid on Nov 10, and the last nest initiated on Dec 7, with the mean laying date estimated at Nov 21. The mean hatching date was Dec 10. This nesting effort was much lower than last year's successful season (1.71 chicks per nest attempt) with only 0.76 c/n and only 52% of the nests were successful at raising chicks to at least 3 weeks of age. Total production for the colony was estimated at 16 chicks, and this estimate was confirmed with the observation of 16 fledglings outside the colony (Table 3).

We banded 48 nestlings from 28 nests within 6 colonies (E. Bob Allen, Jimmie, Calusa, South Park, Little Jimmie, and Captain Keys, Table 3) in the Central region. Chicks were banded between Dec 12 and Jan 9. Approximately 56% of the banded chicks were observed post-fledging but before they abandoned their natal colony. The banding effort estimate for production was 0.96 c/n, slightly above the survey estimate.

Significant nesting in the Central region is a relatively new phenomenon, having started in the mid-1980's. As such, little information has been collected on where these birds feed, but the central location suggests that they may opportunistically exploit the primary resources used by the other regions. Spoonbills nesting in the Central region have reasonable access to the entire mosaic of foraging habitats found in the other four regions (Figure 1). This catholic foraging style may cost a little more energetically (longer flights to foraging areas), but the increased likelihood in finding suitable foraging locations may counterbalance the cost. However, if the specific foraging habitats utilized by spoonbills in all of the other four regions become compromised, the spoonbills of the Central region would also be affected deleteriously. If these foraging grounds do not support abundant and concentrated prey, long flights to more productive areas may be too energetically demanding for a spoonbill to make, resulting in lower nest success. Based on flight-line counts and fixed-wing aircraft observations, it appears that the birds from the Central region are flying over the Russell and Black Betsy Keys to the Taylor Slough area to forage. It would appear that this season these flights were perhaps too demanding and foraging habitat was not as productive, resulting in their lower nest success (Table 2).

Southwestern Region: Barnes Keys

All keys in the southwestern region were surveyed multiple times in 2006-07 but only 3 nests were found on Barnes Key (Table 1). This is only the second time since 1984 that spoonbills have nested at Barnes Key. These nests did produce young, and three chicks were observed post 21 days hatching. This is a promising find for the Southwest region, whose historic record high was 153 nests in 1979.

Bay-wide Synthesis

Bay-wide Roseate Spoonbills nest numbers were well below average, indicating a continued downward spiral that began with completion of major water management structures in the early 1980s. Historically, the Northeastern region was the most productive region of the bay (Lorenz et al. 2002). Since 1982, this region has been heavily impacted by major water control structures that lie immediately upstream from the foraging grounds (Lorenz 2000). This year, the success rate at Tern Key was reasonably good and exceeded the 0.79 c/n average since 1984, however, this is still well below the success of 1.4 prior to modern water management. Also, the high degree of nest failure (46%) coinciding with a draw down reversal suggests that water management may have played a role in the overall success rate. Finally, the high success of nests in the Northwestern region and the lack of reversals at BL indicate that conditions should have been good for spoonbills nesting in the Northeastern region in the absence of adverse water management practices.

In all, 319 chicks were banded from 145 nests across Florida Bay. Of these 9% were observed dead either before leaving the nest or outside the colony and 57% were observed alive post-fledging. Outside of their natal colonies, there has been one resighting of a bird banded at Sandy Key in December observed foraging at Lake Ingraham, Everglades National Park, in January.

Comparison to Tampa Bay Nesting Population

We began banding spoonbill nestlings at the Alafia Bank, Tampa Bay, in 2003 as part of a pilot study for the banding program. The goals of this program were two-fold: 1) to determine the movements of spoonbills within the state and the region and 2) to get estimates of nesting success to compare to Florida Bay. Reports of spoonbills producing greater than 2 c/n in Florida Bay were regularly reported throughout Florida Bay as late as the early 1970s. Following the destruction of wetlands in the Keys and water diversion in the northeastern part of Florida Bay, the average dropped below 1 c/n on average. Tampa Bay colonies provided an opportunity to see how productive spoonbills were in another part of the state to assess if this decline was unique to Florida Bay or a more regional response. Answering this question is critical to demonstrating the causal relationships between Everglades management and the observed decline in Florida Bay.

Spoonbills nested in 11 colonies in the greater Tampa Bay area this year. The largest colony in the region is the Alafia Bank in Hillsborough Bay, with 325 pairs in 2007. The colony of Washburn Junior was the second largest with 45 pairs. A total of 393 fledged birds were observed during one survey of the Alafia Bank colony this season.

We concentrated our banding efforts for the Tampa Bay area at the Alafia Bank and Washburn Junior colonies. We banded nestlings on April 12, 13, 20, 25, 26, 30, and May 1. At the Alafia Bank, we banded 127 nestlings from 73 nests (Table 3) during 5 banding sessions (April 13, 25, 26, 30, and May 1). Of the 127 nestlings banded, we resighted 93 (73.2%) of them alive. One bird was observed dead in the colony. Only 33 of the total birds banded have not been resighted at all. Based on our estimation of 1.22 fledged birds/nest (93 resighted nestlings/73 nests), we expect about 397 spoonbills (325 pairs X 1.22 birds/nest) fledged from Alafia Bank. At Washburn Junior, we banded 35 nestlings from 15 nests. Of the 35 nestlings banded, we resighted 24 (68.6%) of them alive in the colony. We do not have any band recoveries for dead birds, and 11 of the total birds banded have not been resighted at all. Based on our estimation of 1.60 fledged birds/nest (24 resighted nestlings/15 nests), we expect about 72 spoonbills (45 pairs X 1.60 birds/nest) fledged from Washburn Junior. Based on the estimates from Alafia Bank and Washburn Junior, we estimate a total of 469 chicks fledged from 370 total nests in two colonies in Tampa Bay. In contrast, Florida Bay fledged virtually the same number of chicks (470) but from 20% more nests than in Tampa Bay. This further indicates the lack of production in the Florida Bay system.

We banded 164 birds in April 2003, 233 birds in 2004, 105 birds in 2005, and 264 birds in 2006. Since then we have received resight reports for over 170 (22.2%) of those birds. These birds were resighted in Brevard, Collier, Dade, Duval, Flagler, Hendry, Hernando, Hillsborough, Lake, Lee, Manatee, Monroe, Nassau, Palm Beach, Pasco, Pinellas, Polk, Sarasota, St. John's, Taylor, and Wakullah Counties. Banded birds have frequently been observed at Merritt Island, Ding Darling, St. Marks, and Loxahatchee National Wildlife Refuges. Of those resighted birds, 5 birds were observed in Georgia. Over 70 birds have been resighted more than once, with one bird having been resighted 11 times in two locations. Three of the birds that were resighted in Georgia in 2004 and 2005 were resighted in 2006 and 2007 back in the Tampa Bay area. Twenty-two birds have been resighted at the St. Augustine Alligator Farm in the past four years.

Perhaps our most interesting and significant find is a Tampa Bay bird banded in 2003 that is now nesting at Gatorland in Orlando. As of June 11, the bird had hatched out 3 young, and by June 25 two of the nestlings were almost ready to fledge. This is the first documented banded bird reaching reproductive maturity and breeding. Incidentally, this is the first year since the creation of the breeding marsh at Gatorland that a Roseate Spoonbill has nested there, and this banded bird is the only nesting spoonbill at the marsh. It is also interesting to note that this bird had been resighted at the St. Augustine Alligator Farm in 2005.

Of the 205 resightings reported from across the state, 171 (83.4%) were birds banded in Tampa Bay and only 34 (16.6%) were banded in Florida Bay. Florida Bay birds have been resighted as far away as Hillsborough, Lee (Ding Darling), Nassau, Pinellas, and St. Johns Counties (4 out of 5 of the St. Johns County birds were at the Alligator Farm). This further suggests that Florida Bay's productivity is greatly diminished; however, migrations from Florida Bay southward to Cuba and the Yucatan Peninsula cannot be discounted as a cause for the low resightings from Florida Bay.

Clearly, Florida Bay has been, and continues to be, impacted by anthropogenic forces that render production to be less than that of healthy spoonbill nesting areas, including the highly industrialized habitats of Tampa Bay. It is also interesting to note that the rapid growth of spoonbill numbers in Tampa Bay coincides with the rapid decline in spoonbill numbers in Florida Bay since the early 1980s. We will continue to band in both locations using Alafia Bank as a pseudo-control for Florida Bay, as well as a source of information on spoonbill demographics in Florida and the larger Gulf of Mexico and Caribbean geographical regions.

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BIG CYPRESS NATIONAL PRESERVE

Systematic wading bird surveys were not conducted in Big Cypress in 2007.

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HOLEY LAND AND ROTENBERGER WMAS

Systematic wading bird surveys were not conducted this year in Holey Land or Rotenberger WMAs.

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SOUTHWEST COAST

The coastal waterbird nesting season starts toward the end of December in Southwest Florida when a few Ospreys start to sit; then several weeks later Brown Pelicans begin constructing nests. The first wader activity (Great Egret) generally starts mid March but this year they started nesting mid February, at Marco. On the first nest census (4/18), both Great, Snowy and Reddish Egrets had a few nests but the other three small waders (Little Blue Heron, Tricolored Heron, and Cattle Egret), which are usually breeding, were hardly present. After that, wader nesting went down hill, with the desertion of nests not only at Marco but also at Rookery Bay and Chokoloskee Bay. By mid May, there were hardly any waders, let alone any nesting at all three colonies. Usually there is a second wave of wader nesting in June that can be either equal to or slightly smaller than the first wave; this year the second wave started but was smaller than the first. The waders of the second wave, unlike the first, have not deserted and as of the end of July are raising chicks. The above indicates how different wader nesting was and is this year, two years after a severe hurricane.

Note: Nest censusing this year was conducted as it was done last year, from a small boat slowly moving around the periphery of the colonies rather than walking through as described below in Location and Methods. As the Marco, Rookery Bay and Smokehouse Key colonies still have much storm debris collapsed in the understory, it is impossible to go through them on foot without causing unacceptable disturbance.

Hydrology

The coastal ponds at Rookery Bay dried down completely this year as did the inland ponds at Corkscrew Swamp Sanctuary. The dry-down at Corkscrew was more prolonged than on the coast because the coastal ponds are influenced by spring high tides. On the coast and inland, the dry-down although severe was not as intense as the only other two dry periods (1989-90 and 2000-01) that have occurred both on the coast and inland over the 24 years of data collection.

Location and Methods

Rookery Bay (RB): N26 01.850, W081 44.716. Two Red Mangrove islands, 0.22 ha in size. Nest census were conducted 6/8, boat, 2 observers, 0.5 hours. All wader nests were on the southern island, as has been the case for the past four years.

Marco Colony (ABC): (named, ABC Islands by State of Florida): N25 57.400, W081 42.216. Three Red Mangrove islands, 2.08 ha in size. Nest census conducted 4/12, two observers, boat, two hours.

Smokehouse Key: (SK): (This colony formerly named Henry Key, now named for the closest body of water) N25 54.850, W081 42.866. One island in Caxambas Pass, 0.8 ha (Red Mangrove; a little terrestrial vegetation on sand ridge in center). Censused 6/23, boat, one hour, two observers.

East River (ER): N25 55.650, W081 26.583. Three Red Mangrove islands, about 0.25 ha in size. Nest census conducted 6/6, canoe, complete coverage, two observers, one hour.

Chokoloskee Bay (CHOK): N25 50.716, W081 24.766. Four Red Mangrove islands, 0.2 ha. This year most of the waders in the area used three of the four islands, boat census, 4/15, two people, one hour.

Note: All of the censuses are conducted during peak nesting and this varies according to species and timing.

Sundown Censusing

For two of the colonies above, 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 were anchored in the two major flyways and species and numbers of birds flying in (and out during the nesting season) one hour before sunset to one half hour after sunset were recorded. This project is ongoing and started in 1979.

Rookery Bay (RBSD)

Censused bi-weekly with one boat, two observers. The boat was anchored so that most of the birds could be observed returning to the roost one hour before sunset to one half hour after sunset. We recorded, species and numbers of birds flying in (and out during the nesting season). This project is ongoing and started in 1977.

Species Accounts

Great Egret

As stated in the introduction, Great Egrets started nesting early at Marco. Nesting had started by the middle of April at Rookery Bay and Chokoloskee. On the first nest census, this species had low numbers of nests. Smokehouse did not have any Great nests but has never had many, nor has East River. As subsequent observations confirmed, something was different and, since censusing did not involve disturbance (see note above), nest censusing was increased as much as possible. These additional censuses showed that many of these first nests were being deserted. See Table 1, for peak numbers of nests.

Examples: At Marco, Great Egret nests dropped from 36 to 10 (4/28) in ten days, only two nests were productive; a much reduced second wave of nesting had also declined from 26 nests on 7/5 to 10 on 7/29.

At Rookery Bay, seven Great Egret nests dropped to one (4/25) in seven days and then that one disappeared; there was no second nesting wave.

Smokehouse Key had no wader nesting (except Reddish Egrets see below) during the first nesting wave; later on 7/3 in the second wave, there were seven Great Egret nests.

Table 1. Peak Wader Nests Coastal Southwest Florida 2007.

Colony	GBHE	GREG	SNEG	LBHE	TRHE	REEG	CAEG	WHIB	GLIB	Total
Rookery Bay	0	8	9	2	10	0	11	0	0	40
Marco	11	62	33	2	29	6	46	0	3	192
Smokehouse Key	0	12	19	1	15	3	1	165	0	216
East River	0	0	4	2	27	0	0	0	0	33
Chokoloskee Bay	0	64	7	0	0	0	0	0	0	71
Total	11	146	72	7	81	9	58	165	3	552
Mean (24 year)	12	222	287	58	474	5	408	51	40	1557

At Chokoloskee Bay, Great Egret nests dropped from 34 to 20 (4/17) in 17 days; on 7/10 there were 30 nests with small chicks (Note this is a much harder colony for us to visit frequently, therefore we have less data). In summary, this was not much of a year for this species.

Snowy Egret, Little Blue Heron, Tricolored Heron and Cattle Egret
With slight variations, all these species up until now have had similar nesting patterns; therefore I will treat them together. At Marco and Rookery Bay a few nests started early and then were deserted and then later (second wave) about the same number started, some of these were deserted but a few have good sized chicks. At Smokehouse there was no early nesting but there were 19 nests in the second wave. Only one census was done at East River (volunteers) and numbers of nests were lower than usual (Table 1).

Reddish Egret
Although above the annual mean (Table 1), this species had problems similar to the small waders above. They started five nests at Marco and three at Smokehouse but fledged few chicks; possibly one dark and 2 white at Marco; 2 dark at Smokehouse. At present, both colonies have one new active nest; no other attempts at the other colonies.

White Ibis
This species did not attempt to nest at Marco this year; but at Smokehouse they continued the pattern of coming in late in the season and starting nests just about when all of the other waders were almost finished. Smokehouse is the only colony that we monitor in which this species now nests (for this species, coastal nesting in the area has always been limited) and the colony has only been active since 2003. White Ibis started nesting here in 2004 with 3 nests and jumped to 373 nests in 2005, three months before hurricane Wilma. In 2006, with the mangrove destruction from Wilma, the ibis only had 45 nests; interestingly not many adults (65 the most) were recorded nesting. This year 338 adults and 165 nests (Table 1) were the most recorded; as of now a few adults are in high breeding plumage but not building nests. It would appear that there is not enough nesting habitat left in the decaying storm debris.

Glossy Ibis
With only three nests that produced six fledglings at the ABCs not much can be said about this species, except that they are still present. In the sundown censuses the numbers have been very erratic; difficult to guess what is going on.

Once again the natural world has handed us another nesting season that is unlike anything recorded in the 24 years of data collection. Waders (also Pelicans, Cormorants and Anhingas) attempted very few nests and more than half of those that attempted deserted before chicks were showing in the nests. As usual we can make all kinds of assumptions as to the cause (s) but can't come even close to understanding why. All of this seems to indicate that there was not enough food in the area for the birds to be able to start much nesting, let alone sustain it. Food would be the major factor to check, but as there is very little work being done in the area on the fish that are a major part of these birds' diet, it is impossible to draw any conclusions. The following comments serve to illustrate the frustrating aspect of having some data but obviously not the right data.

The drought, although strong, was not as severe as the two periods cited above in hydrology (1989-90 and 2000-01) and, according to the nesting data, in neither of those periods was breeding affected adversely.

Ospreys, whose nesting has about leveled out in the last eight years in the area; again had a good year with 1.23 fledglings per nest. But this species is not directly comparable with waders as they take larger fish and the population of approximately 130 adults in the area, is much smaller.

According to the sundown censusing (description above) there were waders in the area during the nesting period. Great Egrets and White Ibis were actually above the means for both sites and small waders were 43% lower for the same period (this is down but not the lowest that has been recorded in a few normal nesting years).

Least Terns and Black Skimmers (approximate numbers of adults nesting in the area 650 and 700 respectively) had reasonable numbers of nests and have fledged fair numbers of chicks so far. This indicates that there is at least some bait fish around.

Interestingly, the 2007 decline of 66% from the 24 yr. mean in wader nesting was higher than the 2006 drop of 46% after Wilma. The destruction from the hurricane is still obvious at three of the colonies (ABC, RB, SK) and could be affecting nesting, but at the other two colonies (ER, CHOK) which had little damage, the same pattern of poor nesting was recorded. That ought to shoot down the idea that the storm effects had at least a major effect.

Well this could go on but in truth there is not even a decent hint as to what has caused this very unusual nesting season.

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UPCOMING MEETINGS

Waterbird Society Annual Meeting. 30 Oct – 3 Nov 2007. Barcelona, Spain. http://www.wbs2007.org

American Ornithologists' Union, Cooper Ornithological Society, and the Society for Canadian Ornithologists joint meeting. 5-9 Aug 2008. Portland, OR.
http://www.pdxbirds08.org/

The Wildlife Society 2008 Annual Conference: 8-12 Nov 2008. Miami, FL. www.wildlife.org/

WADING BIRD COLONY LOCATION, SIZE, TIMING, AND SUCCESS AT LAKE OKEECHOBEE

Introduction
Lake Okeechobee wading bird populations have been assessed since National Audubon Society wardens began patrolling the area during the early 20th century (David 1994). Systematic aerial surveys began during the early 1970s and then continued annually from 1977–1992 (Zaffke 1984, David 1994, Smith and Collopy 1995). Over the decades, wading bird nest counts ranged from a high of 10,400 in 1974 to a low of 130 nests in 1971 (Ogden 1974, David 1994).

In 2005, Florida Atlantic University renewed wading bird nesting surveys to determine the size and location of wading bird colonies on Lake Okeechobee as part of the CERP Monitoring and Assessment Plan. In 2006, we recorded 11,310 nests. Herein, we report the results of the 2007 surveys and attempt to link results to environmental conditions prevalent during the drought.

Methods
From January through June 2007, two observers surveyed wading bird nests along aerial transects. We flew transects in a Cessna 172 at an altitude of 244 m (800 ft) and a speed of 185 km/hr (100 knots). One transect paralleled the eastern rim of the lake from Eagle Bay Island to the Clewiston Lock. Remaining transects were oriented East-West, spaced at an interval of 3 km (1.6 nm), and traversed the littoral zone. Two observers searched for colonies from each side of the plane. Colonies were defined as any assemblage of ≥ 2 nests that were separated by ≥ 200 m (Erwin et al. 1981, Smith and Collopy 1995). When a colony was located, we lowered to 91 m (300 ft), and the colony was circled several times while we documented species composition and nest count. We also recorded photographs and geographic coordinates with each visit and then mapped colonies to specific stands of vegetation or islands onto 1-m resolution digital orthophotoquarterquadrangles (DOQQs). We calculated intercolony distances using ArcGIS. To maintain consistency with past wading bird reports for Lake Okeechobee (e.g. Zaffke 1984, David 1994a, Smith and Collopy 1995), we counted all birds sighted and categorized them as "nesting" if nests were visible or known assemblages of nests existed for a species. At the largest, most diverse, and accessible colonies, we followed aerial surveys with ground monitoring to improve count accuracy (Frederick et al. 1996).

Nest visits began as soon as colonies of incubating wading birds were observed. Two observers monitored nests along paired 50 X 10-m strip transects within selected wading bird colonies. All nests detected within 5 m of the transect line were marked with orange flagging and assigned a nest number. We visited nests every 6-8 days. We documented a nest as "successful" if at least one young survived to an age where they could branch away from the nest and mature feathers had emerged (Frederick et al. 1992).

Regional rainfall and hydrology data were obtained from the South Florida Water Management District's DBHYDRO database and the National Climatic Data Center. Lake stages and recession rates reported herein were based on average stage readings from four principal gauges located in the pelagic zone at Lake Okeechobee (L001, L005, L006, and LZ40). Lake stages were reported as feet National Geodetic Vertical Datum 1929 (NGVD29). We used the recession rate index from Sklar (2005) to assess the suitability of wading bird foraging conditions. The index was based on weekly changes in lake stage.

Hydrology
From June to December 2006, the Lake Okeechobee region received its lowest, wet-season, rainfall accumulation over the last twelve years, with 4 out of 6 months (JUN, SEP, OCT, NOV) receiving less than half their long-term monthly averages. The South Florida Water Management District reported the recent drought was the third most severe on record. Lake levels at the beginning of 2007 were low and continued to recede toward a historical low by the end of June. Average lake stage was 12.13 ft on January 1, 2007, and steadily receded throughout the breeding season, eventually reaching a low of 8.86 ft on June 30, 2007.

Recession rates suggested that foraging conditions were good to fair throughout the breeding season (Fig. 1). But given low lake levels and a drought that lasted from the previous wet season, conditions left much of the littoral zone waterless and unavailable to foraging birds following last year's recession. Low habitat availability and declining habitat suitability persisted throughout the season, which acted to reduce foraging opportunities and the carrying capacity of Okeechobee for nesting wading birds.

Figure 1. Weekly precipitation totals (in) and average stage levels (feet NGVD 29) for Lake Okeechobee during the 2007 wading bird breeding season. Suitability of wading bird foraging recession rates were depicted in colored arrows. Good foraging conditions (green) existed when average lake stage decreased between 0.05 ft and 0.16 ft per week. Fair foraging conditions (yellow) existed when stage decreased between 0.17 ft and 0.6 ft or decreased only 0.04 ft per week.

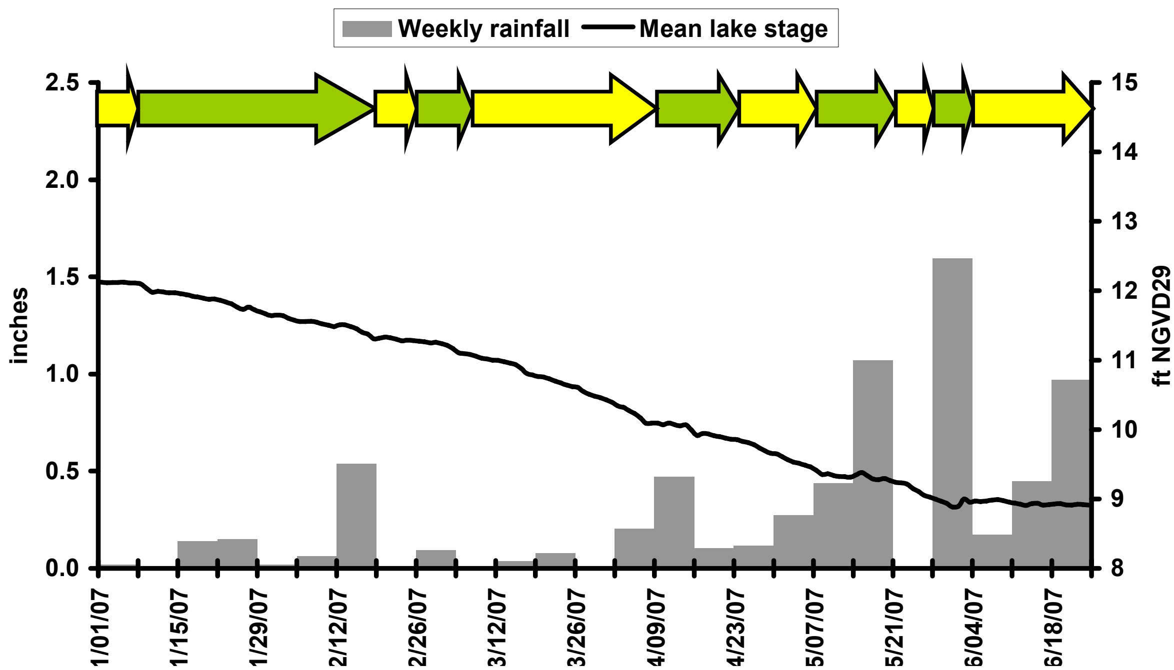


Table 1. Geographic coordinates (ddmmss, NAD 83) and species-specific peak nest efforts in detected colonies during the 2007 breeding season at Lake Okeechobee.

Colony name	ID	Geographic Location		Peak wading bird nesting month [1]	GBHE	GREG	SNEG	TRHE	LBHE	WHIB	GLIB	WOST	ANHI	CAEG
		Latitude	Longitude											
Clewiston Spit [2]	B1	80° 54' 27" W	26° 46' 36" N	APR 2007	'--- [3]	---	485	115	---	---	35	---	---	---
Bird Island	B2	81° 00' 31" W	26° 58' 20" N	JUN 2007	---	---	---	---	---	---	---	---	---	350
Gator Farm	B3	81° 03' 39" W	27° 01' 22" N	MAY 2007	---	7	25	37	14	---	---	12	---	340
Clewiston Channel	B4	80° 53' 53" W	26° 46' 50" N	MAY 2007	---	---	33	---	18	---	3	---	---	---
Little Bear Beach	B6	80° 50' 32" W	26° 43' 17" N	MAY 2007	---	---	70	40	---	---	---	---	---	---
Port Mayaca	B7	80° 34' 28" W	27° 03' 17" N	JUN 2006	3	---	m [4]	m	m	---	---	---	18	640

[1] Does not consider timing of peak CAEG or ANHI nesting

[2] Only colony consistent with 2005 and 2006 locations.

[3] Species undetected during monthly survey effort

[4] Unable to finish counts due to proximity of colony to the Martin County Florida Power and Light power plant (m = missing value).

Results

Locations

We located six wading bird colonies in the Okeechobee area—4 on-lake and 2 off-lake (Fig. 2). The Clewiston Spit colony was the largest colony and the only site perennially occupied from 2005–2007 (Table 1). A smaller colony on another island along the channel was spatially distinct at ca. 800 m ENE from the colony at Clewiston Spit. Bird Island was the second colony we located early in April. Smith and Collopy (1995) reported that Bird Island was occupied from 1989–1992, but we did not detect a colony there until this year. In May, wading birds also nested along the rim canal levee near Little Bear Beach. We also detected two colonies off-lake during foraging wading bird reconnaissance—one on a gator farm near Lakeport, FL and another at the Martin County Florida Power and Light Reservoir.

Size

Season-wide nest effort for all wading birds peaked at 774 nests (Table 2). Nest effort among Great Blue Herons, Great Egrets, Snowy Egrets, White Ibis, and Glossy Ibis was 550. This estimate is important because the pre-1989 record for Lake Okeechobee includes only those 5 species (David 1994). By comparison, this year's nest effort ranked third lowest on record. Only counts from 1971 and 1981 ranked lower with 130 and 520 nests, respectively.

Figure 2. Map of wading bird colonies found at Lake Okeechobee from January to June 2007.

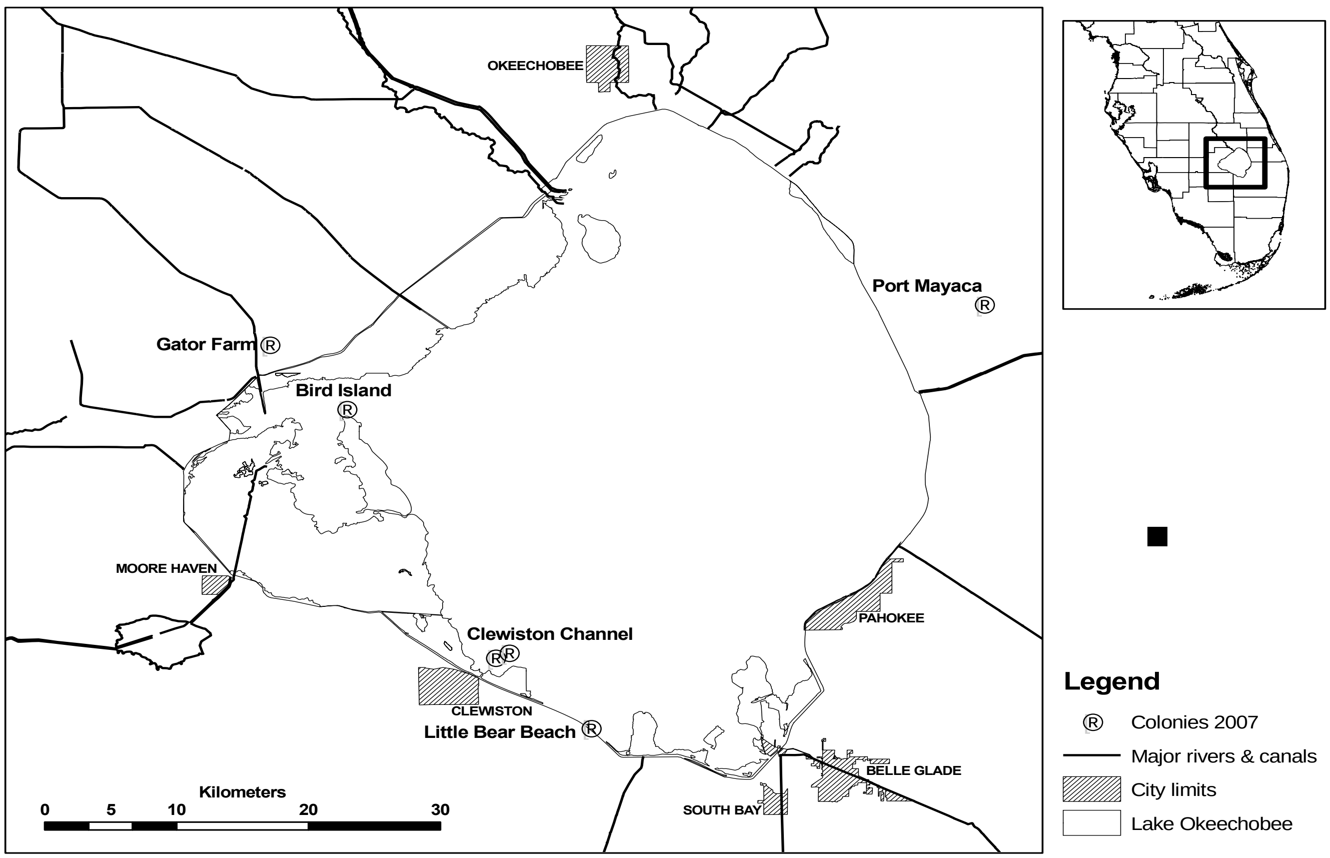


Table 2. Timing and nest effort for species breeding in wading bird colonies during 2007 at Lake Okeechobee. Italics denote species peak nest effort.

Month	ANHI	GREG	SNEG	TRHE	LBHE	GBHE	CAEG	GLIB	WHIB	WOST
January	---	---	---	---	---	---	---	---	---	---[1]
February	---	---	---	---	---	---	---	---	---	---
March	---	---	---	---	---	---	---	---	---	---
April	---	*7*	*543*	*157*	---	---	15	*41*	---	*12*
May	---	7	137	107	*14*	---	886	5	---	11
June	*18*	---	---	---	4	3	*1,260*	---	---	11

[1] Species undetected during monthly survey efforts.

In 2007, we observed no on-lake nesting among Great Blue Herons, Great Egrets, Little Blue Herons, or White Ibis. Similarly, in 1971, no Great Egrets and no Great Blue Herons were detected, and in 1981, Great Egrets nested but not Great Blue Herons or Glossy Ibis (David 1994). The three seasons shared similar hydrological patterns as well, which were characterized by low lake stages to start the breeding season and below average rainfall during the preceding wet season. These pre-conditions likely contributed to the poor reproductive performance of wading birds at Okeechobee despite a favorable recession throughout the breeding season.

Timing and Success

No wading bird nesting was detected via aerial surveys until April 2007. Although on April 3, 2007, we detected Snowy Egrets and Tricolored Herons carrying nest material near Clewiston Spit and Bird Island via ground surveys. Nest monitoring efforts began on April 11. We found that 43% of nests had full clutches, suggesting that courtship and nest building began during the second or third week of March, which was similar to the timing of small ardeid nest initiation last year. However, colonies appeared to already be under considerable depredation pressure, and by the following week, 38% of nests had failed. During monitoring visits, we observed Boat-tailed Grackles depredating nests, and Fish Crows carrying eggs out of the colony. River otters were also commonly seen in colonies and are documented nest predators of other colonially breeding birds (Verbeek and Morgan 1978, Quinlan 1983).

By May 8, predation pressure, complete recession of water surrounding the island, and an intense storm event a few days prior to the visit combined to trigger wholesale abandonment of the largest colony at Clewiston Spit. The neighboring Clewiston Channel colony did not wholesale abandon with Clewiston Spit and fledged young. Nesting at Little Bear Beach began following abandonment of Clewiston Spit and may have been a re-nesting effort, but was abandoned by June surveys. All told, only 12% of 179 monitored nests fledged young—10 Snowy Egret and 11 Tricolored Heron nests, 4 nests from Bird Island and 17 from Clewiston Channel.

At Bird Island, Cattle Egrets outnumbered small ardeids 8:1 by May 9. Many Tricolored Herons and Snowy Egrets without chicks began to abandon. Glossy Ibis abandoned entirely. On May 15, only 22% of the original 96 wading bird nests remained. Even so, 1 Snowy Egret and 3 Tricolored Heron pairs eventually fledged young by the end of May.

Wood Storks

Most interesting this year was the development of a small Wood Stork colony in cypress trees on an alligator farm about 4 km north of Harney Pond along Highway 721. During aerial reconnaissance, we detected 12 Wood Stork pairs nesting on April 19. Maturity of Wood Stork chicks at the time suggested that storks began nesting between the first and second weeks of March.

Despite getting a late start, the colony fledged 22 young at the end of June. On June 14, plumage condition and movement away from the nest to adjacent branches suggested that chicks were 55-60 days old (Coulter et al. 1999). During our last visit on June 26, we observed only 9 chicks left at the colony and expect that all nestlings eventually fledged following the postflight period of attachment to nest sites (Kahl 1964, Coulter et al. 1999).

Discussion

Wading bird productivity can be limited by access to high quality foraging patches (Powell 1983, 1987, Frederick and Collopy 1989, Kushlan 1989, Gawlik et al. 2004). Yet the exact role that foraging patch dynamics plays in driving wading bird populations is somewhat unclear. Smith and Collopy (1995) found that high nest effort and high nest success were related to falling lake stages. They reasoned that recessions could either concentrate prey into shallower patches, increase access to preferred foraging habitats, or improve foraging efficiency.

Recession rates suggested that foraging conditions were good to fair throughout the breeding season. But given low lake levels and a drought that lasted from the previous wet season, conditions left much of the littoral zone waterless and unavailable to foraging birds following last year's recession. These conditions precluded interaction of hydrology with local floristic and topographic pattern, which is a necessary mechanism for enhancing prey availability across the landscape (Kushlan 1976, Frederick and Collopy 1989a, Gawlik 2002).

During 2007, drought conditions also reduced the availability of suitable nesting and foraging habitat, which acted to reduce carrying capacity of the region for colonially breeding wading birds. To begin, drought conditions reduced the availability of suitable colony locations. Nesting wading birds tend to prefer woody islands surrounded by water for colony sites (Frederick and Collopy 1989b, Smith and Collopy 1995). By January 2007, however, lake levels were low enough that few suitable colony sites remained in the littoral zone where birds traditionally nested. In May, the islands of the Clewiston Spit colony became completely exposed and may have been one of the factors that triggered abandonment.

In complement, drought conditions reduced the availability of suitable wading bird foraging habitat as well. On-lake foraging observations indicated that wading birds were limited to feeding in grass and bulrush beds along the margin of the nearshore and littoral zones to start the season, because water had receded into the near-shore zone. Only the exterior fringes of the littoral zone remained inundated to start the nesting season, and isolated pools of concentrated prey were sparse because patches with suitable water depths were still contiguous with the pelagic zone where fish could disperse into lower densities (Chick and McIvor 1994). These fringes dried-down completely by the middle of May, leaving wading birds only able to forage within the shallow, wide-open-water, nearshore and pelagic zones (Fig. 3).

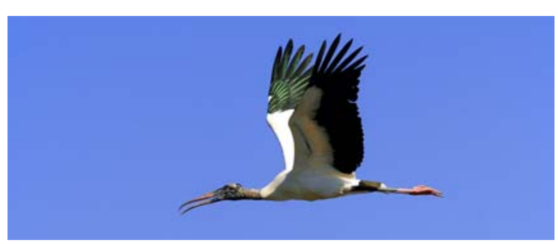
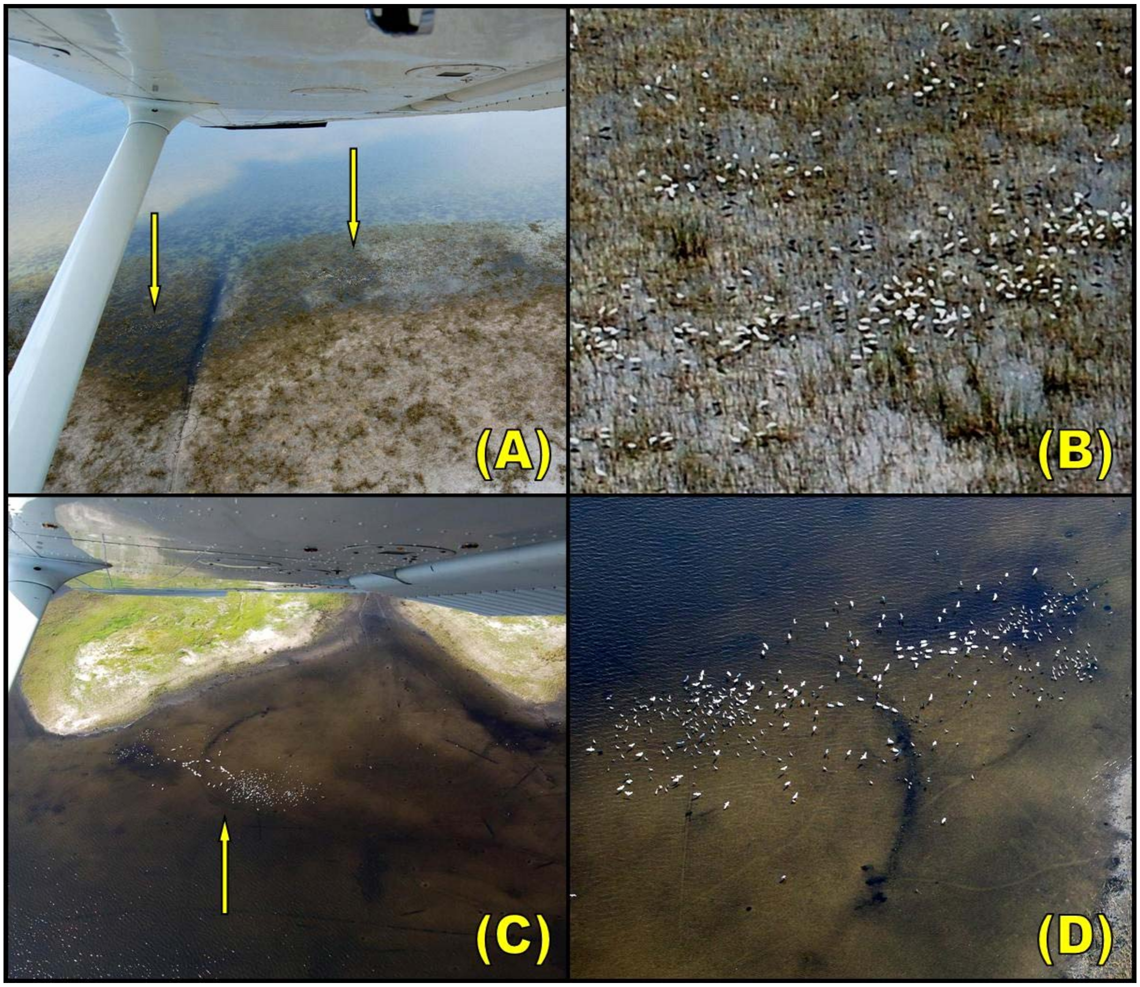


Figure 3. Landscape and zoomed views of foraging wading birds at Lake Okeechobee, FL during the 2007 nesting season. Figs. 3A & 3B depict wading birds foraging in grass beds along littoral zone fringes in February. Figs. 3C & 3D depict wading birds foraging in shallow, wide-open, nearshore areas in May. Notice both foraging areas were still hydrologically connected to the pelagic zone. Yellow arrows mark foraging flock locations in landscape views.



We observed a 93% reduction in nest effort between the 2006 and 2007 breeding seasons and suspect that this year's poor reproductive effort was associated with drought conditions that limited prey and habitat availability. Hydrological conditions between 2007 and other correspondingly low nesting years (i.e. 1971 and 1981) exhibited similar patterns. For each of these years, the region received below average rainfall accumulation and lake stages remained low (< 14.5 ft) during wet season months, which precluded inundation of the littoral zone. Then, a steady recession across the dry season brought lake stages below 11 ft, which left the littoral zone completely waterless and exposed the lake bottom in many near shore areas. The hydrological similarity between these three breeding seasons suggested that persistent drought conditions may negatively affect wading bird reproductive effort in the Okeechobee area.

Even so, we should note that low nest effort has also been linked to high lake stages (> 15 ft NGVD29) at the opposite extreme of the management envelope. David (1994) reported that prolonged high water levels during the late 1970s and early 1980s coincided with declines in wading bird nest effort. And in 1984, the only other year with extreme low wading bird nest effort (< 1,000 nests), lake stages had remained high since August 1982, and breeding season hydrology was characterized by periodic reversals and increasing lake levels. Additional research into the effects of different hydrological scenarios on habitat availability and wading bird reproduction is on-going.

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KISSIMMEE RIVER

Introduction/Background
Prior to its channelization, the Kissimmee River, its 1 – 3 km wide floodplain, and surrounding wetland/upland complex supported substantial numbers of foraging and nesting wading birds (National Audubon Society, 1936 – 1959). Between 1962 and 1971, the Kissimmee River was channelized and its headwater lakes regulated, resulting in the drainage of the majority of its floodplain wetlands and a substantial reduction in the number of wading birds (excluding cattle egrets) using the system (Williams and Melvin, 2005). The Kissimmee River Restoration Project, which was authorized in 1992, seeks to restore ecological integrity to the middle portion of the original river system via 1) reconstruction of the physical form of the river (i.e., canal backfilling, removal of water control structures, and recarving/reconnecting river channels); and 2) reestablishment of historical (pre-channelization) hydrologic (i.e., discharge and stage) characteristics through modifications to regulation schedules of headwater lakes. When completed, the project will restore approximately 104 km² of river-floodplain ecosystem, including 70 km of continuous river channel. The restored area is expected to experience seasonal flood pulses and recessions that are favorable for wading bird reproduction. To date, approximately one third of project construction has been completed. All construction is scheduled for completion by the end of 2012; new regulation schedules for headwater lakes will be implemented in 2010. Wading bird responses to the restoration project will be monitored through 2017.

Methods
As part of the Kissimmee River Restoration Project evaluation program, we performed systematic aerial surveys (May 17, Jun 11, Jul 16) to search for wading bird nesting colonies within the floodplain and surrounding wetland/upland complex of the Kissimmee River. Flights dedicated specifically for colony surveys were not conducted from January through April due to a position vacancy. Surveys began at the S65 structure at Lake Kissimmee and proceeded southward to the S65-D structure (Fig. 1). Observers were placed on both sides of a helicopter flying at an altitude of 244 m along east-west transects spaced 2 km apart. Each transect spanned the 100 yr flood line of the river plus an additional 3 km east and west of the flood line. In addition to dedicated flights for colony surveys, nesting colonies were also monitored, when encountered, during separate aerial surveys of foraging wading birds. These surveys (Mar 26, Apr 23, May 21, Jun 18, Jul 23) were flown at a lower altitude (30 m) and were limited to the area within the 100 yr flood line of the river between S65 and S65-D. Once a colony was located, nesting species and the number of active nests were visually estimated by both observers. The number of nests reported for each colony represents the maximum number of nests for each species. Nesting success was not monitored, but two ground surveys (May 8, Jun 29) were conducted at the C-38 colony to obtain more accurate nest counts and determine the presence of less visible dark-colored herons.

Results
One colony containing an estimated 227 nests was observed during the 2007 season, including 226 CAEG and 1 TRHE (Fig. 1). The colony was first encountered by boat on May 8 when brds were either building nests or incubating eggs. The colony was subsequently abandoned sometime between discovery and the May 17 survey flight. Four of five 2006 colonies were absent from this years surveys, but it should be noted that dedicated flights were not conducted this year during the typical peak of nesting activity (Feb-Apr; Table 1).

It is unlikely, however, that any colonies formed and successfully fledged young prior to our May 17 flight given the below-average nesting activity and unfavorable foraging conditions throughout the region (see Kissimmee River Foraging Densities below) and lack of observations during the Mar 26 survey for foraging birds. As in 2006, nearly all nests occurred in a single CAEG colony. The abandonment of this colony in mid-May may have been due in part to the absence of nesting stimuli from native wading bird species that may have lacked sufficient aquatic prey to initiate breeding (Belzer and Lombardi 1989).

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Figure 1. Transect layout and locations of nesting colonies within the Kissimmee River floodplain and surrounding wetland/upland complex during 2006-7.

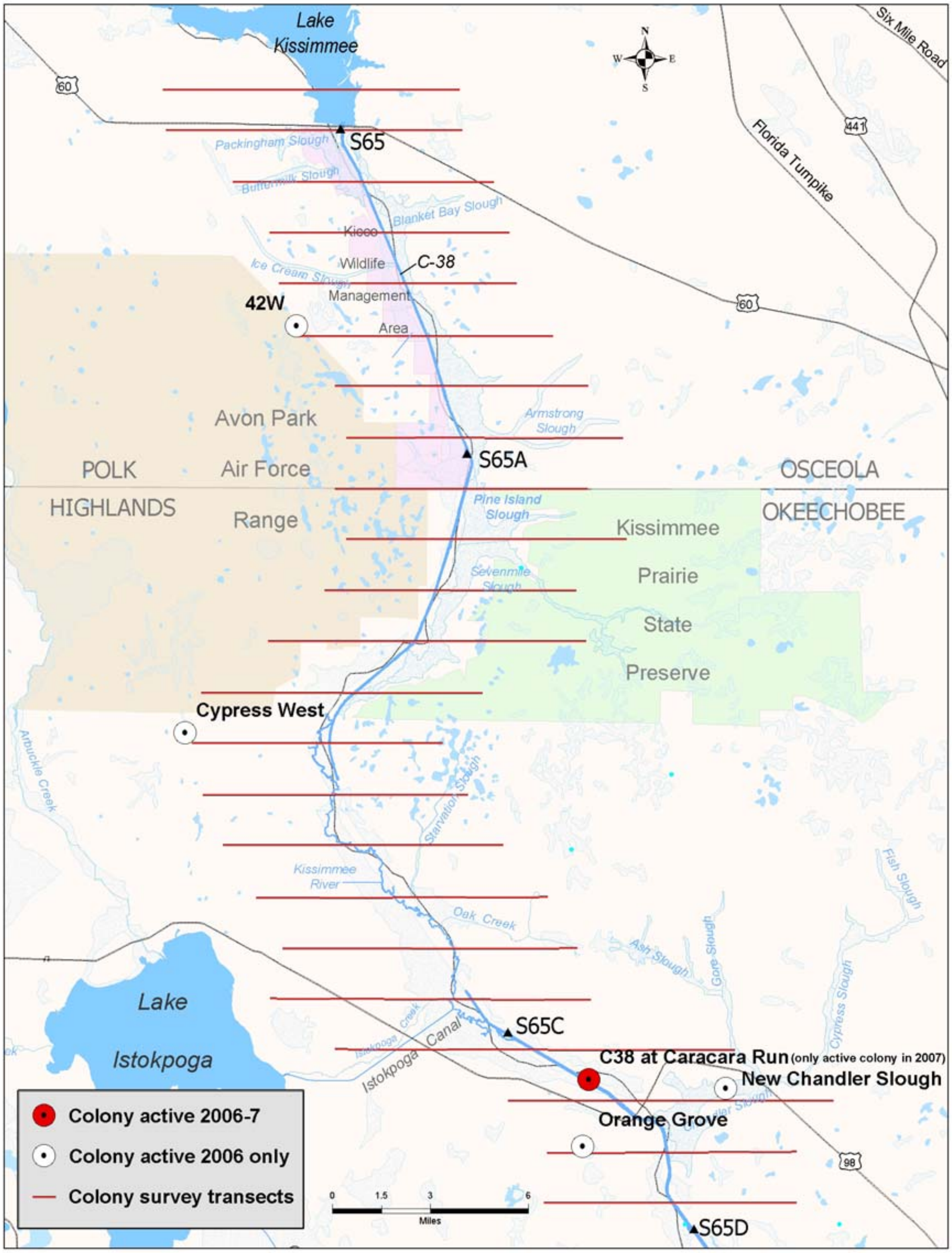

Table 1. Peak numbers of wading bird nesting colonies inside or within 3 km of the Kissimmee River 100 yr flood line between the S65 and S65-D structures. Surveys were conducted Mar-Jun, 2004; Mar-Jun, 2005; Feb-Jun, 2006; and May-Jul 2007.

Latitude	Longitude	Colony Name	Year	ANHI	CAEG	GBHE	GREG	TRHE	Colony Total
81 13.219	27 42.946	42W	2004	-	-	-	-	-	**-**
			2005	-	-	-	-	-	**-**
			2006	-	-	-	8	-	**8**
			2007	-	-	-	-	-	**-**
81 04.466	27 22.853	C38 Caracara Run	2004	-	-	-	-	-	**-**
			2005	-	-	-	-	-	**-**
			2006	-	500	-	-	-	**500**
			2007	-	226	-	-	1	**227**
81 16.527	27 32.088	Cypress West	2004	-	-	-	-	-	**-**
			2005	-	-	-	21	-	**21**
			2006	-	-	-	25		**25**
			2007	-	-	-	-	-	**-**
81 00.380	27 22.620	New Chandler Slough	2004	-	-	-	-	-	**-**
			2005	-	-	-	-	-	**-**
			2006	-	-	-	40	-	**40**
			2007	-	-	-	-	-	**-**
81 04.649	27 21.076	Orange Grove	2004	-	-	-	-	-	**-**
			2005	30	-	5	60	-	**95**
			2006	20	-	4	60		**84**
			2007	-	-	-	-	-	**-**
81 06.442	27 37.791	Pine Island	2004	-	-	-	-	-	**-**
			2005	-	400	-	-	-	**400**
			2006	-	-	-	-	-	-
			2007	-	-	-	-	-	**-**
Total Nests			**2004**	**0**	**0**	**0**	**0**	**0**	**0**
			2005	**30**	**400**	**5**	**81**	**0**	**516**
			2006	**20**	**500**	**4**	**133**	**0**	**657**
			2007	**-**	**226**	**-**	**-**	**1**	**227**

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REGIONAL WADING BIRD ABUNDANCE

EVERGLADES NATIONAL PARK AREA

Methods
Systematic reconnaissance flights (SRF's) were performed monthly between Dec 2006 and May 2007. Flights were conducted over 3 to 4 consecutive days using a fixed-wing Cessna 182 at an altitude of 60 m. The area covered included the Everglades National Park mainland, the zone east and southeast of the main park entrance, and the southern region of Big Cypress National Preserve. The area was surveyed using transects oriented E to W and separated by 2 km (see Figure 1). Wading birds were counted, identified and geographically located using GPS units. Changes in surface water patterns (hydropatterns) were also recorded. Five categories were used to describe the hydropatterns: DD - absence of surface water and no groundwater visible in solution holes or ponds; WD - absence of surface water but groundwater present in solution holes or ponds; DT - ground surface area mostly dry but small scattered pools of surface water present and groundwater visible in solution holes or ponds; WT - ground surface area mostly wet but small scattered dry areas; and WW - continuous surface water over the area.

Data obtained during each SRF were compiled into a database, which contains the information collected since 1985 to the present. During this period, SRF surveys were not conducted during December 1984, December 1987 and January 1998. Missing data for those months were estimated using years with complete sets of data. From those years, it was calculated the overall percentage of increase or decrease from month to month in order to estimate missing values. In some years, due to personnel constraints, only one observer was used to collect those data. This situation occurred during the surveys of April 1990, May 1990 and from January 1991 to May 1991. Finally, some transects were missing for one observer during April 2004 and May 2005. Densities of birds were estimated using a 2X2 km grid. The number of birds counted during the SRF inside the 300m width surveyed stripe were extrapolated to the rest of the 4 km² cell dividing the number of birds observed by 0.15 for surveys were data from two observers were available. In cases were only data from one observer were available the number of birds inside the 150m strip were extrapolated to the rest of the cell by dividing the birds observed by 0.075.

Results
During this year survey period (December 2006 – May 2007) an increase of thirteen-percent in the abundance of wading birds was observed, for all species combined, in comparison to the previous year (Figure 2). This represents the third consecutive year that an increase in the number of birds was observed since 2005. This year's increase contributed to the overall significant increasing trend observed since 1985 to present, when a linear regression model was used to fit the data ($F=7.112$; $P=0.014$).

Seven of the nine species of birds studied, showed an annual increase in their numbers in relation to those observed in 2006 (see Figure 3). Great White Heron (GWHE) showed an increase of 56%; followed by small dark herons (SMDH) with 34%, Great Blue Herons (GBHE) 31%, Wood Stork (WOST) 20%, White Ibis (WHIB) 19% and small white heron (SMWH) as well as Great Egrets (GREG) with 5% increase for each one. Two species showed a decline in number of birds; those species were Roseate Spoonbill (ROSP) with 7% decreased and Glossy Ibis (GLIB) with 52%.

Figure 3 also shows the annual estimated number of birds by species from 1985 to present. Despite the annual fluctuations observed for each of the different species, a general increase was observed in five of the nine species. Those species are in order of significance; GREG, GBHE, WHIB, SMWH and WOST. Once again, a linear regression model was used to determine the general trend for each species.

This is the fifth consecutive year, since 2003, that GREG showed an increase in the annual estimated number of birds. GBHE also has showed consecutive increases since 2004. Finally, WHIB, SMWH and WOST have been showing increases in their numbers since 2005. Estimates for the number of GLIB and ROSP have declined during the past two years, while SMDH have exhibited an increase during the last three years. Despite the opposite recent trends observed in those species, the overall long term trend since 1985 was basically neutral. Finally, GWHE is the only species that displayed an overall decline; despite increases observed during the last two years.

Although this type of analysis can provide some general ideas of the trends in the number of individuals observed for each species or groups of birds through the years, additional studies and more data analysis will be necessary in order to evaluate the significance of these observations and its relevance to the wading bird populations occurring in Everglades National Park.

Figure 1. Map of ENP and southern Big Cypress National Preserve with sampling transects and drainage basins.

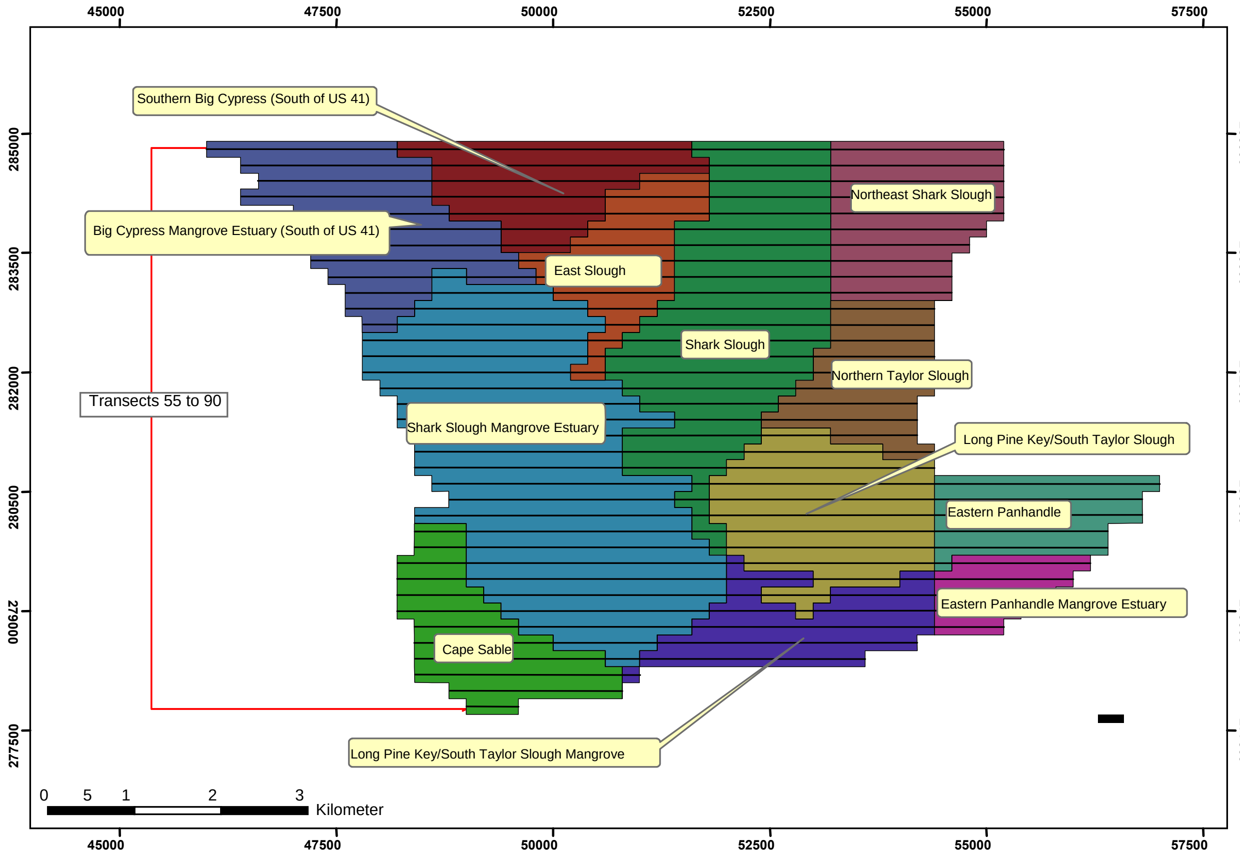


Figure 2. Estimated number of wading birds (all species pooled) observed from the months of Dec-May from 1985 to 2007. Red marks represent years with estimated missing data for one month.

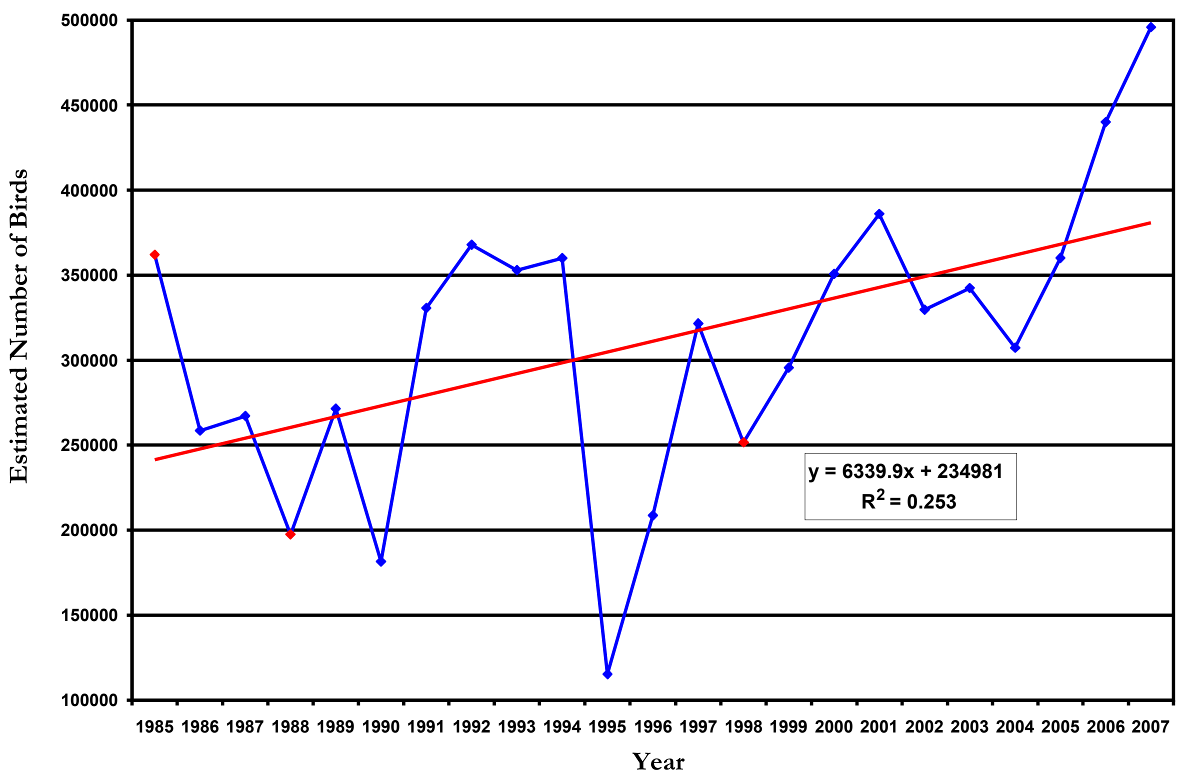
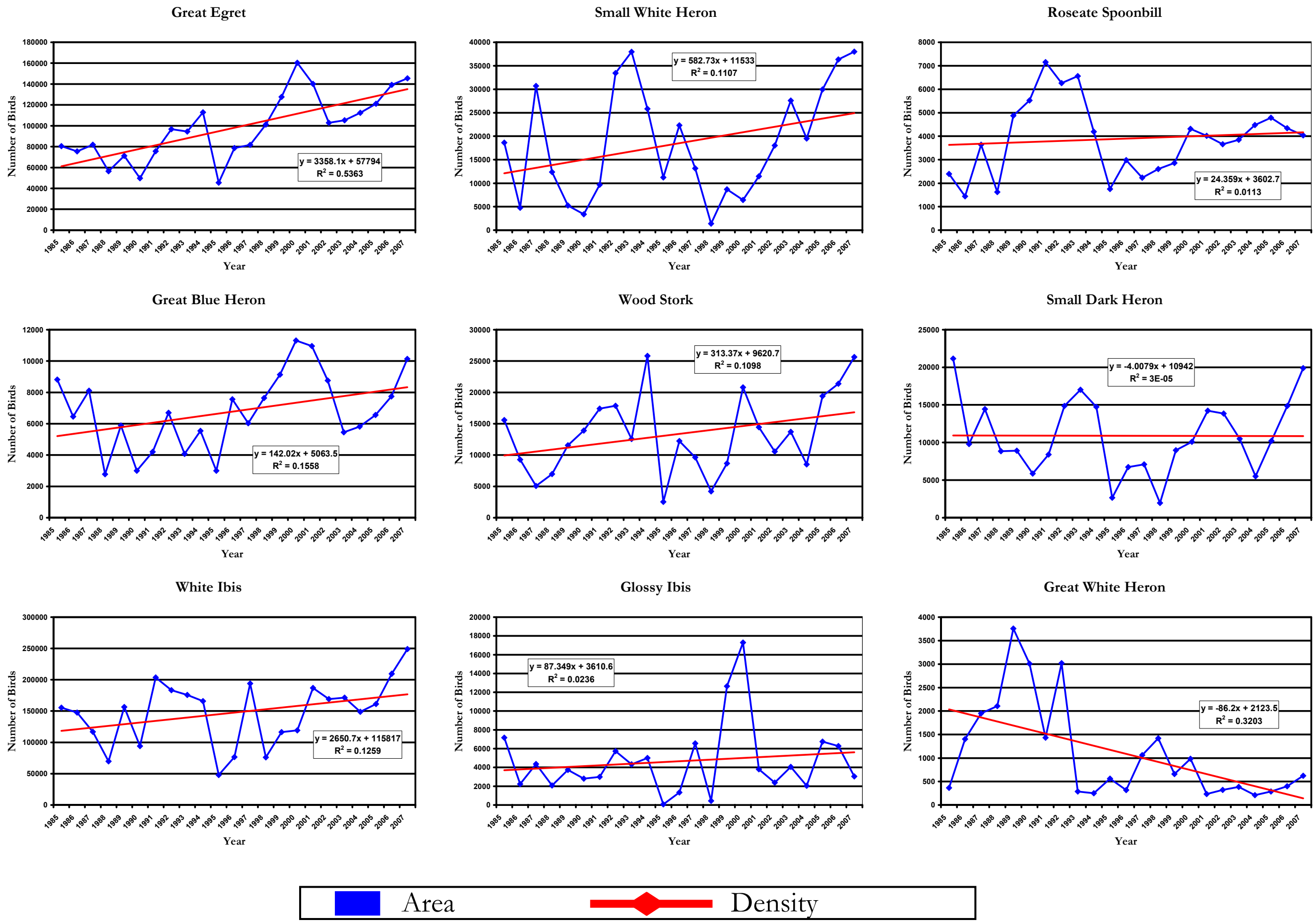


Figure 3. General trends in wading bird populations based on the total number of birds estimated during the surveys performed each year in the Everglades National Park from 1985 to the present.



The maximum density of birds, regardless of the species, occurred this year during the month of December (see Table 1). It was during this month that the highest numbers of GREG, GBHE, SMDH, SMWH and ROSP were observed. Other species such as WHIB, GLIB and WOST reached their peak numbers in February, while GWHE peaked in the month of March. May was the month with the fewest number of birds for all the species combined. It was also in May where the lowest number of birds was observed for all the species but for GLIB, ROSP and GWHE. For those particular species, the lowest concentration of individuals occurred during December, March and April respectively

The most abundant species during the survey period was WHIB representing approximately half of the total number of birds observed followed by GREG (29.3%). These two species combined accounted for almost 80% of the total of birds observed this year. The remaining 20% was composed of the following species SMWH (7.6%), WOST (5.2%), SMDH (4.0%), GBHE (2.0%), ROSP (0.8%), GLIB (0.6%), and GWHE (0.1%).

Table 2 shows the distribution and abundance of wading birds for each of the different drainage basins. Shark Slough (SS) contained the highest number of wading birds (23%), followed by Shark Slough Mangrove Estuary (SSME) with 20%, and East Slough (ES) and Big Cypress Mangrove Estuary (BCME) with 11% each one. These four basins combined, made up 65% of the total number of birds observed during the entire season. In contrast; the basins with the lower number of birds were Northern Taylor Slough (NTS) with less than 1%, Eastern Panhandle Mangrove Estuary (EPME) 1% and Eastern Panhandle with only 2%. A great concentration of birds was observed during December and January at SSME in relation to the other basins. By February, SS became the basin with the greatest number of birds and remained like that until May.

Changes in hydro-patterns and bird distribution observed this season were less pronounced than in the previous year (see Figure 4). The greatest changes in the area covered by the different hydro-patterns took place at the extreme categories. From December to May, the original extent of the area covered by WW was reduced from 28% to 16% (560 km² reduction), while DD area experienced an increase going from 10% at the beginning of the season to 22% at the end of the season (608 km² increase). Intermediate categories such as WT and WD showed very slight changes throughout the season. The areal extend for WT decreased from 31% to 28% (148 km²), while WD increased from 13% to 15% (96 km²). Finally, very small fluctuations occurred in the middle category, DT, with no more that 3% change at the most.

Table 1. Estimated abundance of wading birds in the Everglades National Park and adjacent areas, Dec 2006- May 2007.

Species	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Total
GREG	36,525	29,251	33,089	24,664	15,929	5,991	145,449
GBHE	3,769	1,721	1,687	1,390	1,200	367	10,134
SMDH	5,924	2,983	3,858	3,359	2,762	1,005	19,891
SMWH	13,070	6,150	7,195	5,457	4,646	1,497	38,015
WHIB	56,977	37,304	60,926	56,764	27,300	9,780	249,051
GLIB	86	240	1,068	986	427	234	3,041
WOST	5,928	4,968	7,260	4,554	2,873	62	25,645
ROSP	1,153	641	802	240	808	394	4,038
GWHE	97	89	129	135	62	111	623
TOTAL	123,529	83,347	116,014	97,549	56,007	19,441	495,887

Table 2. Estimated abundance of wading birds (all species combined) for the different drainage basins in the Everglades National Park, Dec 2006 – May 2007.

Month	SBC	BCME	SS	NESS	ES	SSME	NTS	LPK/ STS	EP	CS	LPK/ STSM	EPME	Total
Dec-06	12,723	17,339	16,477	2,723	11,523	32,042	283	5,310	4,455	12,885	6,523	1,246	123,529
Jan-07	4,686	8,816	16,826	4,243	7,742	23,175	432	1,626	2,468	9,544	2,992	797	83,347
Feb-07	9,323	15,457	22,607	8,711	16,007	20,170	332	1,866	1,290	4,058	13,184	3,009	116,014
Mar-07	5,045	5,801	30,740	12,838	15,464	13,840	34	2,127	873	4,818	5,781	188	97,549
Apr-07	1,208	6,738	24,858	4,558	3,563	4,996	20	3,948	1,051	1,432	3,500	135	56,007
May-07	725	1,103	3,803	1,937	2,023	2,616	35	1,263	664	3,095	2,014	163	19,441
Total	33,710	55,254	115,311	35,010	56,322	96,839	1,136	16,140	10,801	35,832	33,994	5,538	495,887

SBC = Southern Big Cypress (South of US 41)
BCME = Big Cypress Mangrove Estuary (South of US 41)
SS = Shark Slough
NESS = Northeast Shark Slough
ES = East Slough
SSME = Shark Slough Mangrove Estuary
NTS = Northern Taylor Slough
LPK/STS = Long Pine Key / South Taylor Slough
EP = Eastern Panhandle
CS = Cape Sable
LPK/STSM = Long Pine Key / South Taylor Slough Mangrove Estuary
EPME = Eastern Panhandle Mangrove Estuary

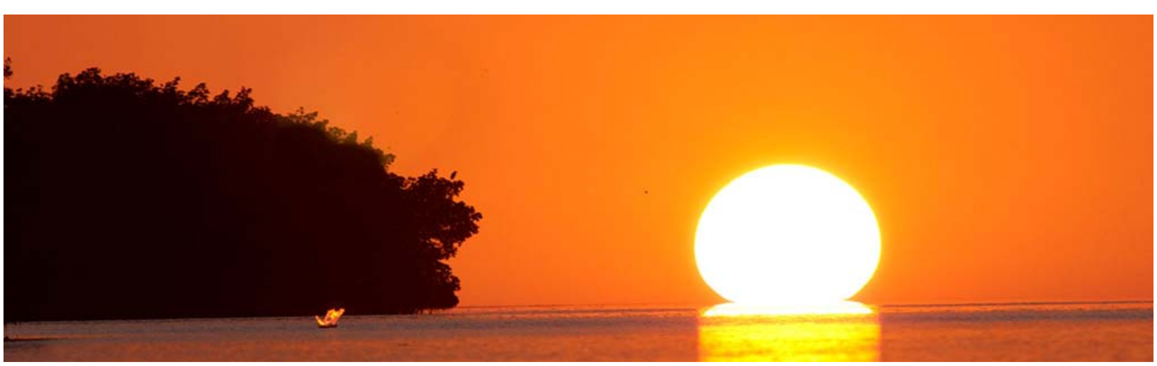
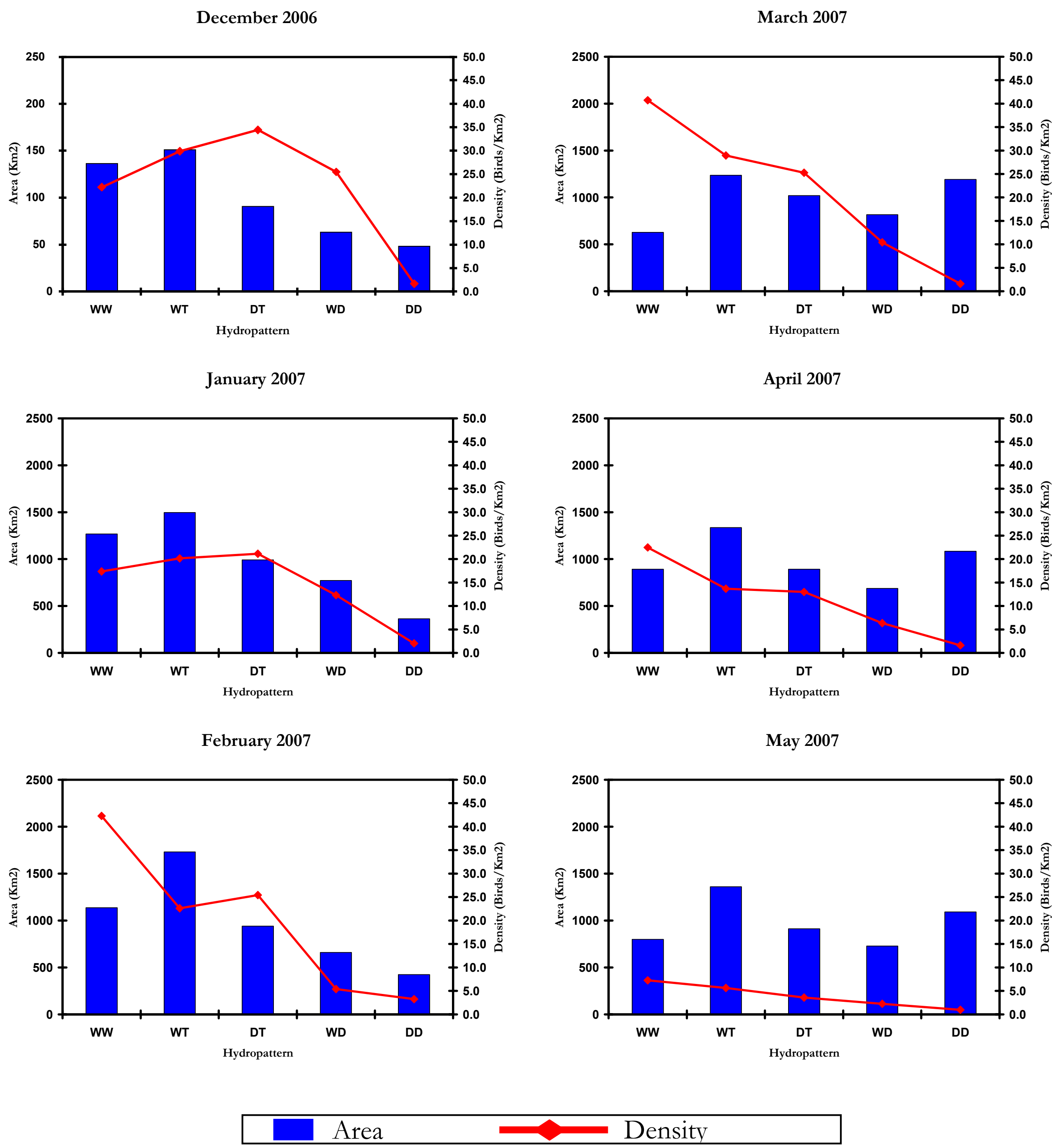
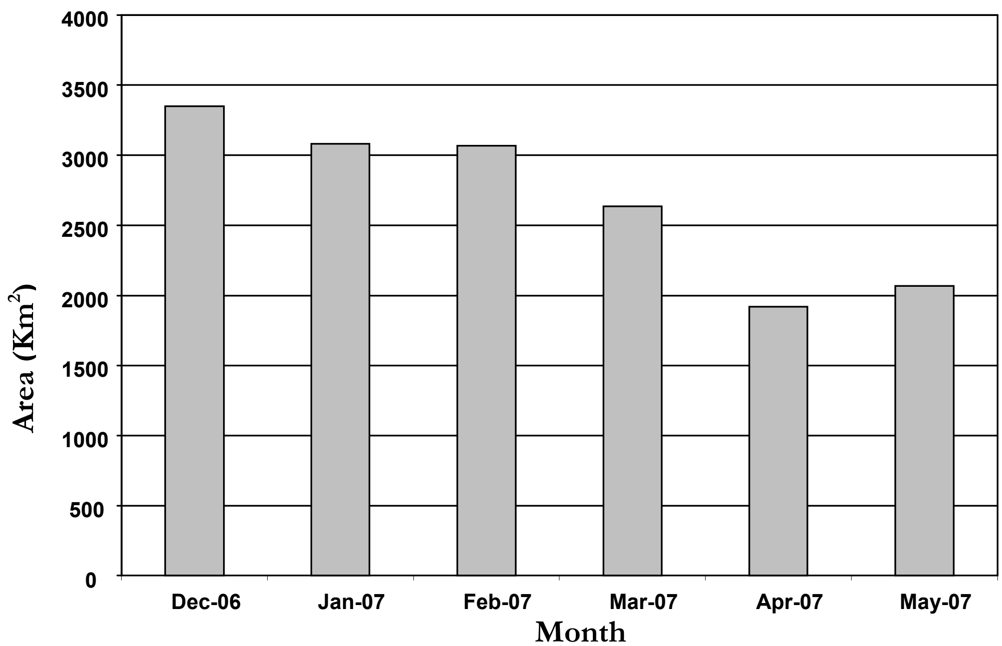


Figure 4. The 2007 areal extent and density of wading birds (all species pooled) in each surface water category.



WW = continuous surface water; WT = mostly wet with scattered dry areas; DT = mostly dry with small scattered pools of water; WD = dry with water only in solution holes; DD = dry surface.

Figure 5. Monthly changes in wading bird areal utilization in the Everglades National Park from Dec-2006 to May-2007



During December and January, the highest densities of birds were mainly located in the DT hydropattern. By February and March, as water receded, birds began to concentrate in WW, WT and DT areas respectively. As water depth continued to decrease during the following months, WW, WT and DT areas continued holding the higher densities; however it was obvious that great numbers of birds were leaving the study area. The fact that WW areas are completely covered by water, do not necessarily implies that those areas are to deep for wading birds to forage. Overall, as water recedes, low water levels turned these areas into new territories accessible to foraging birds.

Birds were found foraging in 68% of the study area during the month of December (see Figure 5). This represents the month were birds were more widely distributed. The rainfall deficit observed during this year was the probable cause of this early widespread bird distribution. As water continued to receded, birds began to concentrate. By January and March, birds utilized 63% of the total available area. During March, birds concentrated in an area slightly larger than half of study area, while April was the month with the smallest area utilized. During this month birds were concentrated in only 39% of the total available area. At the end of the season (May), a slight increase in areal utilization (42%) was observed. This increase was probably a result of two major rain events which occurred during the survey.

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WADING BIRD SURVEYS FOR WATER CONSERVATION AREAS AND BIG CYPRESS NATIONAL PRESERVE

Methods

Wading bird surveys were flown with a fixed wing aircraft at an altitude of about 60 meters along parallel transects with 2-km spacing each month from January to July 2006. Wading birds were identified to species when possible, enumerated, their locations recorded, their data entered into a database, and summarized into tables. Densities of each species were separated into 4-km^2 cells and plotted onto maps. Data were recorded using HP720 palm top computers linked to GPS. The data were downloaded into a computer spreadsheet, edited for errors, and compiled using a program written in Dephi programming language.

Results

In the Water Conservation Areas, monthly wading bird relative abundance was generally higher during 2007 than 2006. In the Water Conservation Areas, the maximum relative abundance was observed during April 2007 (108,034; Table 1) and during May 2006 (87,887). In 2007, February, March and April relative abundances were higher than the same months in 2006. The wading bird abundances in June 2006 and July 2006 were higher than the respective months in 2007. During 2007, there were increasingly drought-like conditions from January to April then and an increase in water with the increase in rain during June and July. In the Big Cypress National Preserve, monthly wading bird abundances were slightly higher in 2007 than 2006. The maximum relative abundance was observed during February 2007 (34,407; Table 2) and during February 2006 (32,480). In the Big Cypress National Preserve, February, June and July relative abundances were higher in 2007 than in 2006; March and April wading bird abundances were lower in 2007 than 2006. In the Big Cypress National Preserve, monthly wading bird abundance peaked in February 2007 then declined until April 2007 in response to very dry conditions then increased with the increase in rain in June 2007 and July 2007. Final reports from 1996 to 2006 are currently available.

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Table 1. Wading Bird Estimated Abundances for the Water Conservation Areas, 2007.

Species	January	February	March	April	June	July	Mean
Great Blue Heron	720	680	1093	1320	1173	760	957.67
Great Egret	31527	27800	44274	55474	12327	11527	30488.17
Small Dark Heron	220	380	513	1073	540	220	491.00
Small White Heron	853	633	700	900	600	1000	781.00
White Ibis	40227	69787	48300	38254	6560	5327	34742.50
Glossy Ibis	767	1800	1133	1473	33	53	876.50
Wood Stork	507	947	5287	6860	40	47	2281.33
Great White Heron	1213	1573	1727	2573	1040	0	1354.33
Roseate Spoonbill	187	33	107	107	27	0	76.83
All Species	76220	103634	103134	108034	22340	18933	72049.17

Table 2. Wading Bird Estimated Abundances for Big Cypress National Preserve, 2007.

Species	January	February	March	April	June	July	Mean
Great Blue Heron	240	173	267	140	60	107	164.50
Great Egret	10640	13000	5620	1027	3227	5153	6444.50
Small Dark Heron	33	513	13	33	140	107	139.83
Small White Heron	780	147	453	87	353	527	391.17
White Ibis	17427	18193	2193	940	2613	2527	7315.50
Glossy Ibis	7	287	40	0	27	7	61.33
Wood Stork	1267	1280	907	520	260	27	710.17
Great White Heron	813	807	187	173	300	387	444.50
Roseate Spoonbill	13	7	0	0	0	0	3.33
All Species	31220	34407	9680	2920	6980	8840	15674.50

KISSIMMEE RIVER FORAGING DENSITIES

Aerial surveys were used to measure the densities of wading birds. Surveys were conducted approximately monthly during the baseline period (pre-restoration; 1996–1998) and have continued after Phase I of the restoration project was completed in 2001. Restoration is expected to bring increased use of the floodplain by long-legged wading birds (excluding Cattle Egrets). Furthermore, mixed species wading bird rookeries are anticipated to regularly form on and near the floodplain and tributary sloughs once abundant food resources and appropriate hydrology have been reestablished.

To investigate densities of wading birds on the floodplain, 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 1 for structure locations). Each month, transects were randomly selected for counts until a minimum of 15 percent of the 100-year floodplain was surveyed in both the Phase I and unrestored portion of the river/floodplain. Surveys were conducted via helicopter flying at an altitude of 30.5 m and a speed of 130 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 (*Egretta tricolor*) from adult Little Blue Herons (*E. caerulea*) during aerial surveys (Bancroft et al. 1990), the two are lumped into the category, small dark herons. Likewise, Snowy Egrets (*E. thula*) and immature Little Blue Herons were classified as small white herons (Bancroft et al. 1990). Densities of wading birds were calculated separately for restored and unrestored areas.

Because no quantitative data are available for densities or relative abundances of long-legged wading birds of the pre-channelized Kissimmee River, restoration expectations for responses by wading birds to the KRRP are based on reference data from aerial surveys of a flow-through marsh in Pool B that was built as part of the Kissimmee River Demonstration Project and for floodplain areas along Paradise Run, a portion of the Kissimmee River near Lake Okeechobee that still retains some channel flow and periodic floodplain inundation (Toland 1990; Perrin et al. 1982). The 3.5 km² flow-through marsh was constructed just south of the S65-A tieback levee during 1984–1985 and was manipulated to simulate inundation and overland flow that were typical of the pre-channelized Kissimmee River floodplain (Toth 1991). Based on these reference data, it is expected that annual dry season (December–May) densities of long-legged wading bird (excluding Cattle Egrets) will be $\geq$ 30.6 birds/km².

Prior to Phase I construction (baseline period), mean annual dry season densities of long-legged wading birds in the Phase I area averaged ($\pm$ SE) 3.6 $\pm$ 0.9 birds/km² in 1997 and 14.3 $\pm$ 3.4 birds/km² in 1998. Since completion of Phase I, densities of long-legged wading birds have exceeded the restoration expectation of 30.6 birds/km² each year except 2007, averaging 37.8 $\pm$ 15.4 birds/km², 61.7 $\pm$ 14.5 birds/km², 59.6 $\pm$ 24.4 birds/km², 103.0 $\pm$ 31.5 birds/km², and 11.0 $\pm$ 2.1 birds/km² in the dry seasons of 2002, 2004, 2005, 2006, and 2007 respectively (2003 data were not collected; Figure 1). Furthermore, the lower limit of the 95 percent confidence interval (95% C.I.) has exceeded the expectation in three of five years. However, this dry season was the first since Phase I completion that the restoration expectation was not met and densities were similar to those observed during the 1998 baseline surveys. This is likely to be an effect of the extreme drought conditions experienced during the 2007 dry season rather than effects of Phase I restoration per se. Most floodplain foraging habitat was completely dry this year and was inundated only during a brief period (Sep 4-16, Hurricane Ernesto) in the wet season prior to an earlier than average fall recession. These conditions may have prevented significant prey base production within abandoned river channels and isolated wetlands and limited prey availability during the winter/spring breeding season (see nesting colony information above). Water levels have not returned to appropriate foraging depths throughout most of the floodplain as of mid-July 2007. Wading bird density remains low, with the exception of Cattle Egrets that continue to occur in significant numbers throughout the floodplain. In areas where water levels are currently returning to appropriate foraging depths with the onset of summer rains, it is likely that prey items are widely dispersed at low densities in newly inundated areas which precludes efficient foraging by wading birds. Anecdotal evidence from June and July survey flights indicates that birds were utilizing adjacent isolated wetlands in greater numbers outside of the floodplain where prey availability may have been greater. Excluding Cattle Egrets, White Ibis was the most common species in all 2007 dry season surveys, with Great Egret, Glossy Ibis, small white heron (Snowy Egret and immature Little Blue Heron), Great Blue Heron, and Little Blue Heron also commonly encountered. Wood Storks were observed only during the December survey.

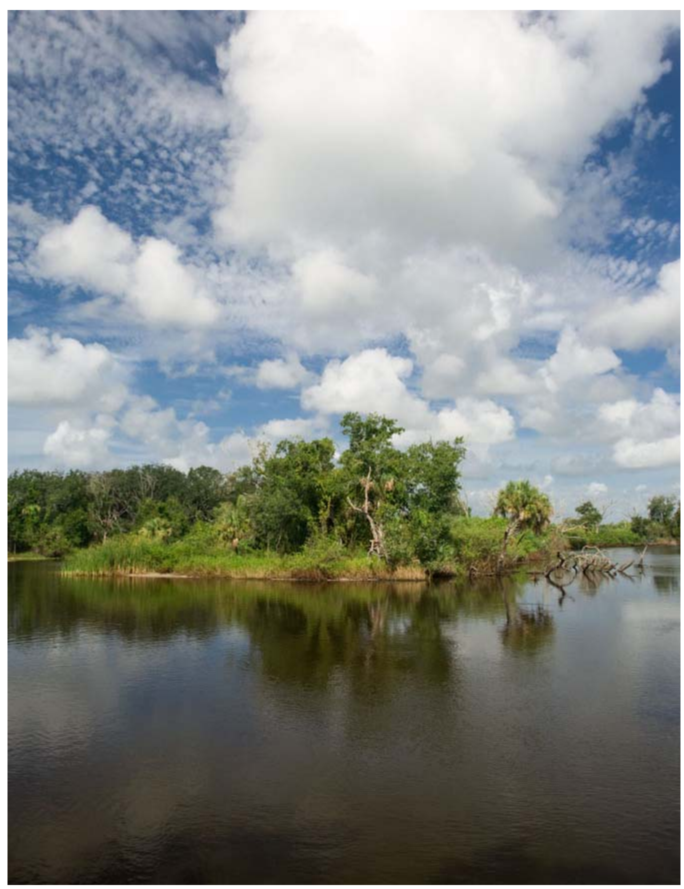
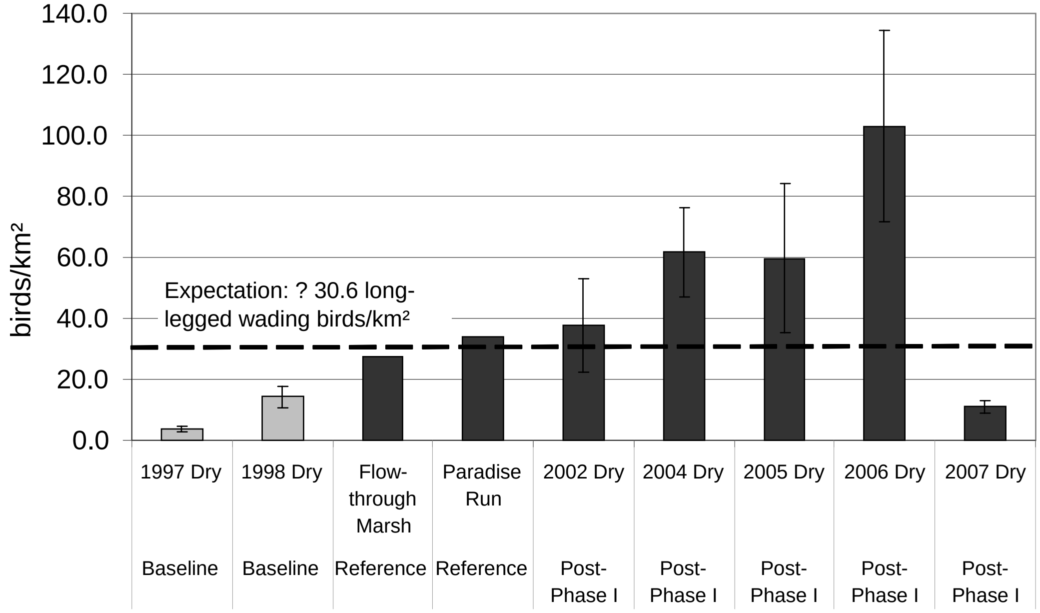


Figure 1. Baseline, reference, and post-Phase I densities (± SE) of long-legged wading birds (excluding cattle egrets) during the dry season (Dec-May) within the 100-year flood line of the Kissimmee River. Baseline densities were measured in the Phase I area prior to restoration. Post-restoration densities were measured beginning approximately 10 months following completion of Phase I.



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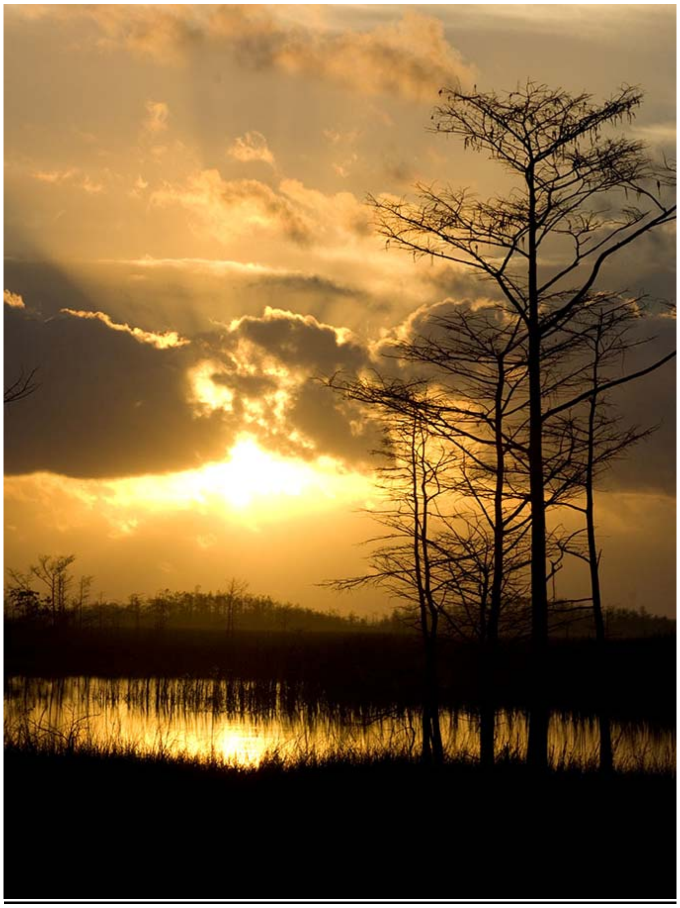

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STATUS OF WADING BIRD RECOVERY

The purpose of these wading bird status reports is to summarize the annual nesting patterns of wading birds in the context of the wading bird performance measures that have been established for tracking progress by CERP and other ecosystem restoration programs in the south Florida wetlands. These status reports have been produced annually for each volume of the South Florida Wading Bird Report. Up to this point, these annual reports have summarized monitoring data for three parameters of wading bird nesting: numbers of nesting pairs, locations of nesting colonies, and timing of nesting (storks only). The species of wading birds reported in these summaries are Great Egret, Snowy Egret, Tricolored Heron, White Ibis, and Wood Stork. These data have been reported from the three Water Conservation Areas and mainland Everglades National Park only. Following is the results from the 2007 colony surveys, including an updated 3-year running average for numbers of nesting pairs.

Results

Numbers of Pairs: The combined total number of nesting pairs for four species for 2007 (Tricolored Herons are excluded from this total because no ground counts were conducted in ENP, and only partial ground counts were conducted in the WCAs) was 26,411 pairs, divided as follows: 5,193 pairs of Great Egrets, 217 pairs of Snowy Egrets, 20,661 pairs of White Ibis, and 340 pairs of Wood Storks. The 3-year running averages for 2005-2007 for these four species are 6,987 pairs, 4,559 pairs, 21,660 pairs, and 636 pairs, respectively. Comparisons with earlier running averages are shown in the accompanying table.

Table 1. Three year running averages of the number of nesting pairs for the five indicator species in the Everglades

Time Period	GREG	SNEG/ TRHE	WHIB	WOST
Target	4,000	10,000 -20,000	10,000 -25,000	1,500 -2,500
1986-88	1,946	2,057	2,974	175
1987-89	1,980	1,680	2,676	255
1988-90	1,640	1,229	3,433	276
1989-91	1,163	903	3,066	276
1990-92	2,112	1,965	8,020	294
1991-93	2,924	2,792	6,162	250
1992-94	3,677	2,939	6,511	277
1993-95	3,843	2,060	2,107	130
1994-96	4,043	1,508	2,172	343
1995-97	4,302	1,488	2,850	283
1996-98	4,017	1,334	2,270	228
1997-99	5,084	1,862	5,100	279
1998-00	5,544	2,788	11,270	863
1999-01	5,996	4,270	16,555	1,538
2000-02	7,276	8,614	23,983	1,868
2001-03	8,460	8,088	20,758	1,596
2002-04	9,656	8,079	24,947	1,191
2003-05	7,829	4,085	20,993	742
2004-06	8,296	6,410	24,926	800
2005-07	6,600	4,400*	21,133	633

*Tricolored Herons are excluded from this total due to incomplete surveys for this species in 2007.

Colony Locations

Approximately 7.5% of the combined total for these four species nested in the region of the southern Everglades marsh/mangrove ecotone, including the southern mainland mangrove estuary. This southern mainland ecotone/estuary was the location of most large wading bird colonies during the 1930s-1950s, prior to the compartmentalization of the system, and altered flow volumes into the mainland estuaries.

Timing of Nesting

The timing of nesting parameter applies only to Wood Storks. The only stork nesting effort in the Everglades in 2007 was in ENP, including the Tamiami West site. The survey and reporting format in 2007 did not allow for a determination of the timing (month of colony formation) for the four Park colonies.

Discussion

During July 2007, most of the biologists who are now conducting wading bird studies and surveys in the greater Everglades basin met to review and refine the parameters of wading bird nesting that will be used to track the success of the ecosystem restoration programs. An objective for this meeting was to develop a more comprehensive set of wading bird indicators and performance measures, which collectively will better describe the relevant and desired responses by wading birds as the restoration programs are implemented.

The result of this discussion is an expanded list of potential indicators of wading bird responses to ecosystem restoration in south Florida. The following is a list of proposed wading bird indicators for future tracking of wading bird nesting patterns. Some are already in use (for example see above). The newly proposed indicators will be developed and vetted in the coming year.

- *Coastal nesting.* The number and percentage (emphasis on number) of wading birds nesting in the southern coastal zone.
- *Timing of nesting.* For storks, the timing of nesting in the southern coastal zone and Big Cypress basin (there was some agreement that timing by storks will not change for birds nesting in Everglades impoundments).
- A ratio of number of nesting pairs of stork/ibis to number of pairs of Great Egrets in the coastal colonies (or for all colonies; higher proportion of egrets in the WCAs illustrates a pattern that is different from the pre-drainage condition).
- Three year running averages for number of nesting pairs of Great Egrets, Snowy Egrets, White Ibis, Roseate Spoonbills, and Wood Storks.
- *Reproductive success.* Some measure of nesting success (different from number of nest initiations) to track future trends (not a comparison with past patterns).
- *"Super Colony" patterns.* A measure of the interval between events, and the magnitude of each event (measured either for regional numbers or single, large colonies).
- *Tricolored Heron Index.* The possibility of developing an index of nesting effort based on some sampling design.

The goal is to have a common set of wading bird indicators and performance measures applicable at system-wide scales, which can support all restoration planning, assessment and reporting needs and requirements. These comprehensive wading bird performance measures will be used to support, (1) RECOVER's program of CERP assessments, including the System Status Reports and Interim Goals Reports, (2) the reports by the Science Coordination Group to the SFER Task Force on overall progress in restoration, and (3) reports to the public in the form of restoration report cards.

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SPECIAL TOPICS

FOOD AVAILABILITY AND WHITE IBIS REPRODUCTIVE SUCCESS: AN EXPERIMENTAL STUDY

The number of wading bird nests in the Everglades has decreased by approximately 70% since the 1930s (Crozier and Gawlik, 2003) and those individuals that do nest often experience reduced reproductive output. A reduction in prey availability brought about by water management activities is considered the most important factor responsible for these declines. This view is supported by studies showing correlations between hydrologic variables and wading bird reproductive effort and success (e.g., Kushlan et al. 1975, Frederick and Collopy 1989). An observational approach, however, does not verify a causal relationship between hydrology, food supply and breeding success, and understanding the specific mechanisms and pathways responsible for the population declines remain limited. Needed are empirical studies that manipulate food supplies and control for naturally correlated variables that also affect nesting success.

Here we present preliminary results from an experimental study that examines whether food supply limits white ibis nestling growth and survival. The primary objectives were to determine experimentally (1) whether food supply limits White Ibis (*Eudocimus albus*) nesting success, and (2) whether food limitation is a function of hydrologic conditions. The study uses a supplementary feeding experiment in which a group of ibis nestlings were fed with locally collected aquatic prey. The effects of food-supplementation on nestling fitness (growth, survival and physiological responses), nestling behavior, and parental provisioning responses were quantified and compared to a control group. Food was supplemented only during the nestling stage but its effects on offspring fitness and behavior were measured from the early nestling stage into the initial natal dispersal period (i.e., from 5d to 60-80d). The study will be repeated in three breeding seasons with contrasting hydrologic conditions to examine the effects of hydrology on food limitation. We present preliminary data analysis from the first two years of the study. The hypotheses are that (1) the success of chicks from food-supplemented nests should be greater than those of control nests and, 2) the magnitude of the difference between treatments should be greatest during breeding seasons when hydrologic conditions are not conducive to optimal foraging.

The Scientific Details

The study was conducted at tree island colonies in A. R. Marshall Loxahatchee National Wildlife Refuge (hereafter Refuge), between April and June in 2006 and 2007. In 2006 the study colony (New Colony 3: 26º 31' N, 80º 16' W) comprised approximately 5000 White Ibis nests. In 2007 the colony site moved approximately one mile east of its 2006 position (New Colony 4: 26º 32' N, 80º 16' W) and contained about 8000 White Ibis nests.

Nestling behavior and parental food provisioning in supplementary fed and control groups were recorded directly from two raised observation blinds using spotting scopes. Data were collected from 36 and 46 randomly selected nests (2006 and 2007 respectively) situated approx. 50 m from the blinds. Every nest was numbered and visible from at least one blind. Nests with chicks of similar age were matched (to control for possible differences in breeding performance of adults related to hatching date) and assigned to either a supplemented or control group (18 control and 18 supplemented nests in 2006; 24 control and 22 supplemented nests in 2007). Chicks in the supplemented group were hand fed every 1.4 days 10 g of fresh, locally caught fish. This provided sufficient energy to have a potential affect on growth/survival but not so much that the parents would lose their provisioning response. Supplementary feeding began when chicks were six days old and continued until nest departure at about 22d. Growth of all chicks was measured every 3-4 days from age 5d (1-day prior to supplementation) until they could no longer be captured (15-25d). On each occasion, body mass, bill length, right tarsus length and right wing length was measured, and the survival status of each chick was recorded. The District collaborated with FAU to measure physiological parameters (e.g., triglycerides, glycerol, and corticosterone) from blood and fecal samples taken at ages 10d and 20d. Feather samples were also taken at these ages to measure mercury loads. As many nestlings as possible were banded with a BBL aluminum band and a combination of unique color bands to identify individuals after nest departure. At 20d each chick was captured and fitted with a radio transmitter and tracked daily by airboat or helicopter until departure from the Refuge and adjacent areas.

Hydrologic variables and prey density were measured once per week at ten random sloughs within a 5 km radius of the colony (i.e. within the foraging range of the parent ibis). Prey density was quantified using standard methods (1 m^2 throw trap).

To determine chick diet during the study, bolus samples were taken from a group of surrogate nestlings at roughly weekly intervals and analyzed in the lab. Prey species will be identified to family level or higher.

Growth and survival data were analyzed in relation to treatment (supplemented and control), hatching order (first-hatched and second-hatched), for each breeding season (2006 and 2007). We used a repeated measures mixed model (PROC MIXED) to compare mass growth of nestlings and a logistic regression model to examine chick survival from age 5d to 25d post-hatch. Non-parametric Kruskal-Wallis tests were used for all other analyses.

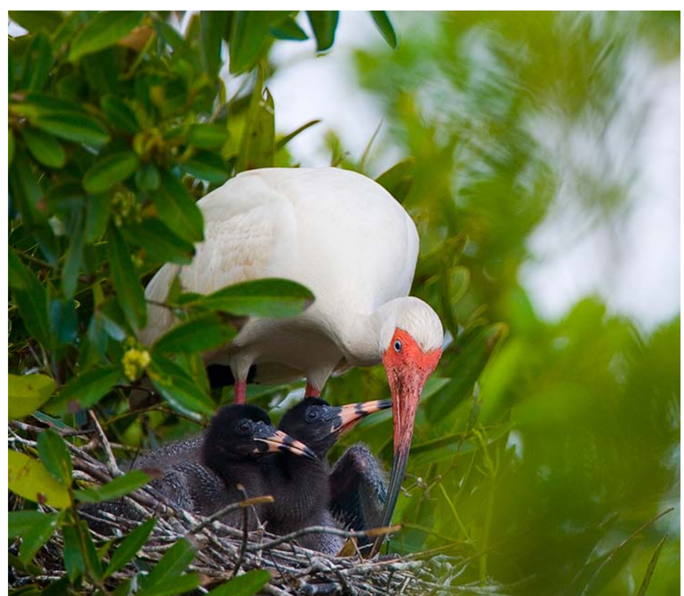
Results

Nestling Growth

The effect of food supplements on nestling growth varied between the two years. The mass of nestlings in the two treatments just after the start of food supplementation (7d post-hatch) was similar in both 2006 and 2007 (2006: P>0.05; 2007: P>0.05). Mass growth from 7d to 25d post-hatch was similar between treatments in 2006 ($F_{1,61} = 0.8$, P = 0.37), but in 2007 food supplemented chicks grew larger than control chicks ($F_{1,59} = 21.3$, P <0.001, Fig. 1). In general, A-chicks grew larger than B-chicks but the non-significant interaction between treatment and hatching order suggests that the relative increase in mass due to supplementation in 2007 was similar for both A- and B-chicks ($F_{1,59} = 1.46$, P = 0.23).

Survival

The role of food supplements on nestling survival also varied between years. In 2006, overall nestling survival was high throughout the colony and supplements had no effect on survival from 5d to 25d post-hatch (supplemented: 84% survived; control: 88% survived; $X_1^2 = 0.21$, P = 0.64; Fig. 2). Moreover, there was no difference in survival between first and second hatched chicks ($X_1^2 = 1.76$, P = 0.18). In 2007, however, overall survival within the colony was relatively low and food supplementation resulted in a significant increase in nestling survival (supplemented: 82% survived; control: 48% survived; $X_1^2 = 10.59$, P = 0.001; Fig. 2). This increase in survival was a function of hatching order, with supplements affecting the survival of second-hatched chicks (supplemented: 64% survival; controls 20% survival) more than that of first-hatched chicks (supplemented: 100%; controls: 82%). In both years, mortality tended to occur at a young age (2006: mean age 6.1d± 1.09 SE days, min: 1d, max: 16d; 2007: mean age 7.2d± 0.66 SE days, min: 1d; max: 16d) but age of mortality was not effected by treatment or hatching order (P>0.05). Probability of survival increased once birds reached 20-25d (the crèche period) and the proportion of birds that survived from 25d to dispersal from the colony was extremely high for both treatments in both years (2006: 92% of 39 radio-tracked birds fledged; 2007: 88% of 32 radio-tracked birds fledged). Mean age of dispersal (2006: 59.4 ± 1.3 SE days old, range: 52-66 days; 2007: 60.3 ± 1.3 SE days old, range: 49-74 days) was not affected by treatment or hatching order in either year (all P >0.05). In 2007, the pattern of fledgling dispersal was similar to that in 2006: after leaving the colony fledglings immediately flew out of the Refuge and in most cases were not relocated thereafter.



Discussion

The primary aim of this study was to test whether prey availability limits White Ibis reproduction during the nesting period. We predicted that if prey availability was a limiting factor then food supplementation would improve nestling fitness. This prediction was upheld in 2007 with a marked increase in nestling growth and survival. By contrast, the prediction was not supported during the particularly successful nesting season of 2006 when nestling growth and survival rates of both treatment groups were high. Taken together these results show that prey availability can limit White Ibis reproduction but that the Everglades still retains the capacity to provide sufficient prey when ecological conditions permit. Moreover, the marked increase in fitness in response to supplements in 2007 and the overall successful nesting of 2006 suggest that nestlings were not unduly affected by other factors thought to limit wading bird breeding such as mercury poisoning or parasitism.

A second objective was to test our understanding of the relationship between nestling fitness and hydrologic conditions. We predicted that the effects of supplementation on nestling fitness would be most marked when conditions were wetter or dryer than are considered optimal for wading bird foraging. To gain a rudimentary understanding of the role of hydrology on nestling production it is necessary to examine at least three contrasting hydrologic years (wet, dry and optimal) and control for potentially confounding factors such as the productivity of prey. As predicted, our results to date show that nestling fitness increased with supplementation during a breeding season with sub-optimal, dry hydrologic conditions (2007) but not when conditions were considered optimal (2006); see Fig. 3 and discussions about hydrology elsewhere in this report. A precise assessment of the importance of food limitation on White Ibis reproduction requires further years of study and our aim is to continue this study during at least one more breeding season when conditions are wetter than average.

Figure 1. Mean nestling mass (±1 SE) at age categories 7, 10, 13, 16 and 19d post-hatch for A- and B-chicks in food-supplemented and control nests in WY2006 and 2007. Sample sizes are above and below error bars.

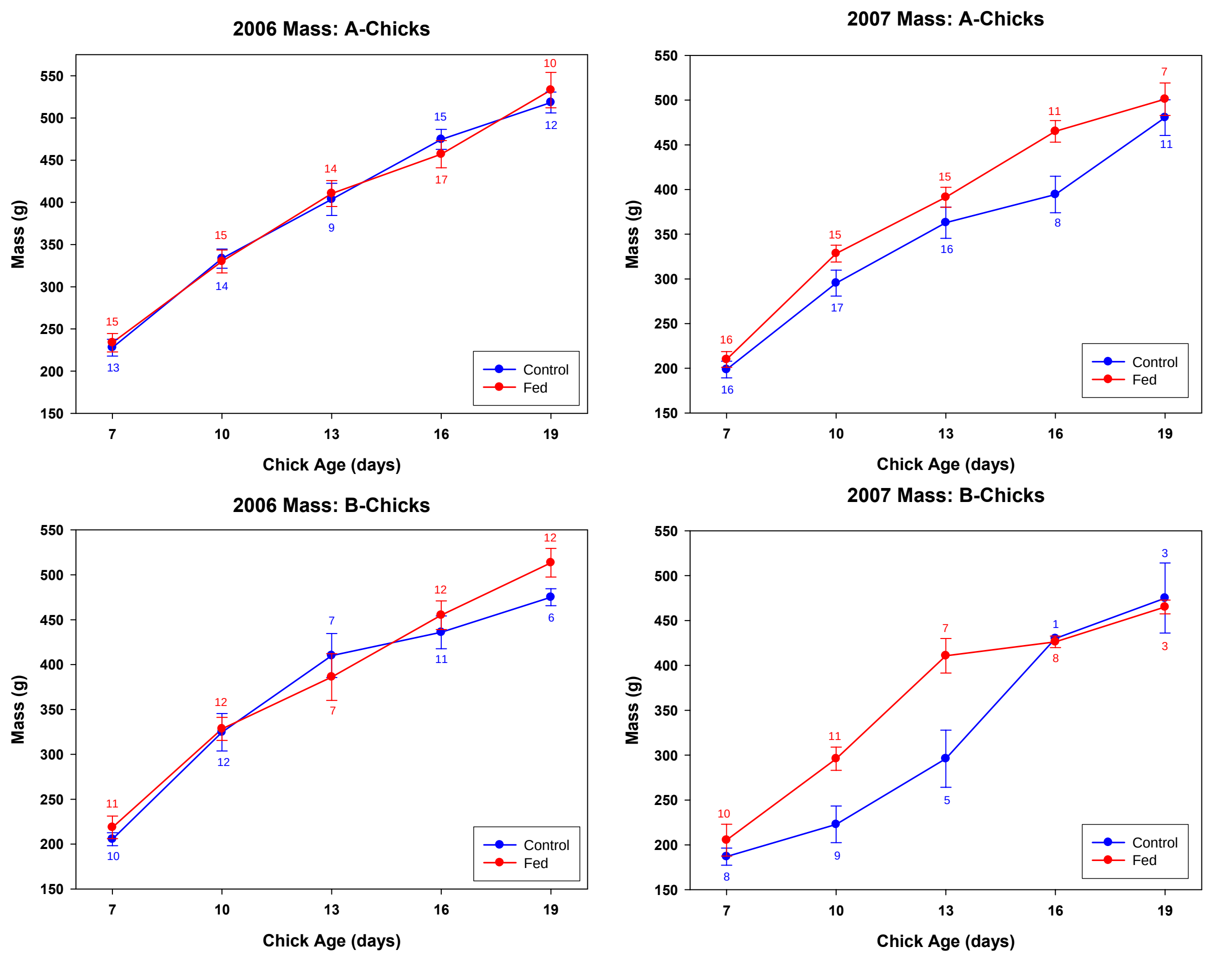


Figure 2. Percentage of nestlings that survived to 25 days old. Sample sizes are shown above data bars.

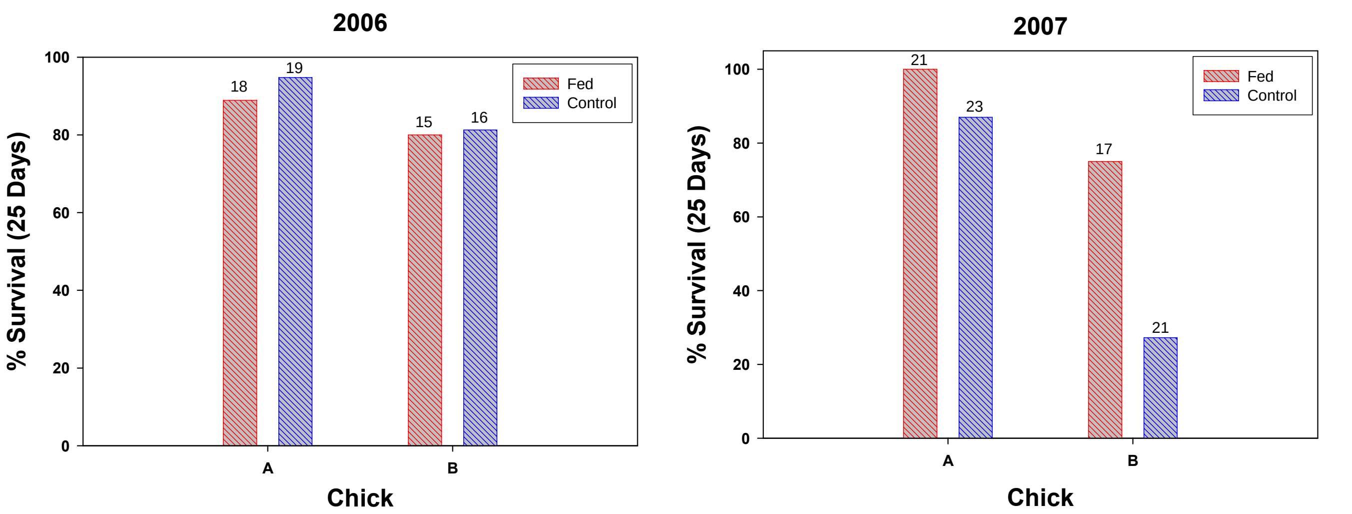
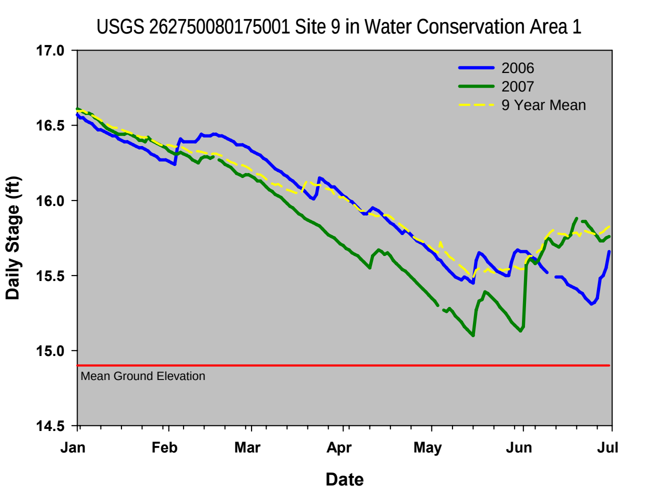


Figure 3. Hydrograph depicting mean water levels in the Refuge during the optimal water year of 2006, the drought year 2007, and the nine year mean.



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SACRED IBIS

Background

Sacred Ibis (*Threskiornis aethiopicus*) were first discovered breeding in the Florida Everglades in 2005 in the Arthur R. Marshall Loxahatchee National Wildlife Refuge, Palm Beach County (Herring et al. 2006). Prior to this, Sacred Ibis have been observed periodically throughout South Florida since the mid 1990s, with occasional breeding confirmed at the Miami Metro Zoo in Miami-Dade County and the Palm Beach Waste Management Facility in Palm Beach County (Herring et al. 2006).

Sacred Ibis are colonial wading birds, native to wetlands throughout Africa (Hancock et al. 1992). However, they have escaped captivity in 12 European countries and the United States and currently breed in the wild in Belgium, France, Italy, the Canary Islands of Spain (Clergeau et al. 2005), the Netherlands (Ottens 2006) and the United States (Herring et al. 2006). Clergeau and Yésou (2006) reviewed the recent population growth and expansion of the escaped Sacred Ibises' range in Western Europe, noting that the species' foraging plasticity, human commensalism, and tolerance of wide ranging environmental conditions increase their chance of successful population establishment and growth.

The potential for successful establishment and population growth of nonindigenous Sacred Ibis is best illustrated by its recent expansion in France. The French nonindigenous Sacred Ibis population stemmed from less than 75 individuals that escaped in the mid 1980s, and now exhibit an exponential population growth rate with over five thousand individuals (Clergeau and Yésou 2006). Sacred Ibis in France have also dispersed hundreds of kilometers from their original site (Clergeau and Yésou 2006) suggesting similar rates of dispersal could occur in Florida if those birds become established.

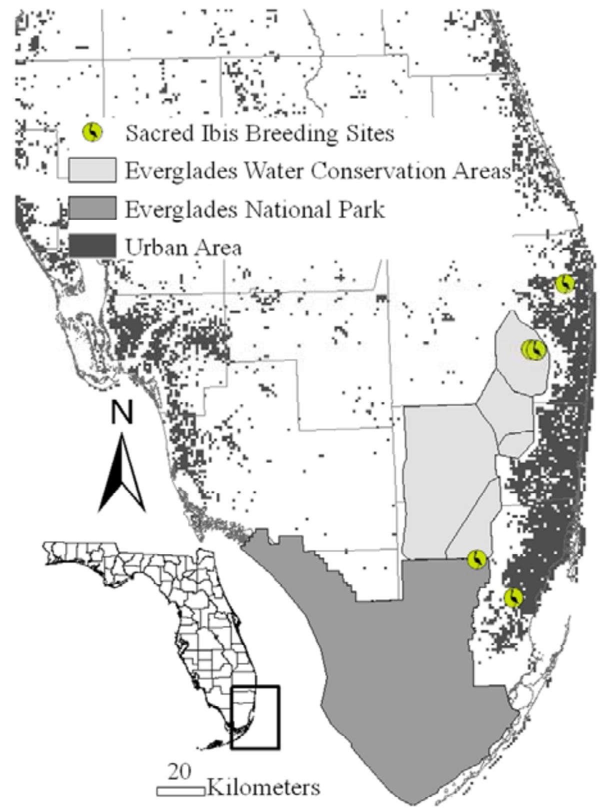
Recent research has shown that Sacred Ibis are effective predators of both eggs and chicks in colonial nesting birds in their native region (Ward and Williams 2006). Sacred Ibis have also been documented destroying Sandwich Tern (*Sterna sandvicensis*), Black Tern (*Chlidonias niger*), and Whiskered Tern (*C. hybridus*) nests in large numbers in areas where they have recently become established (Vaslin 2005; Clergeau and Yésou 2006).

The extent to which nonindigenous populations of Sacred Ibis will predate eggs and chicks of native colonial nesting species has not been determined. However Sacred Ibis in their native range have been known to impact other waterbirds (Williams and Ward 2006). Sacred Ibis were responsible for the predation of 65% of all Cape Cormorant (*Phalacrocorax capensis*) chick predation mortalities on Penguin Island, Lambert Bay, South Africa (Williams and Ward 2006). Williams and Ward (2006) calculated that the total Cape Cormorant losses at the Penguin Island colony due to Sacred Ibis predation were between 10% - 15% of the total annual production. Predation by Sacred Ibis occurred throughout much of the nesting cycle, with ibis targeting eggs and chicks up to five or more weeks old (Williams and Ward 2006).

Nesting

Between 2005 and 2007, Sacred Ibis nesting was documented at 3 wading bird colonies in the Everglades, and at one wading bird colony within the city of Palm Beach (West Palm Solid Waste Management Facility; Fig. 1). Mean number of Sacred Ibis nests per colony was 2.4 ± 0.5 SE, with a mean number of chicks or eggs per nest of 2.3 ± 0.2 SE. Twenty-three adults were observed in wading bird breeding colonies in the Everglades during this same period.

Figure 1. Location of sacred ibis nests between 2005 and 2007 in South Florida.



Potential for establishment

Recent research has shown that Sacred Ibis have a high probability of successful establishment (>70%) in the Florida Everglades (Herring and Gawlik in review). A qualitative assessment of the source population in urban South Florida suggests that it is small enough that eradication is still feasible (Herring and Gawlik 2007). Removing Sacred Ibis from the Everglades without addressing the urban source population will likely only postpone a repeated population expansion by the bird and possible negative interactions with native Everglades wading birds.

Contributors to the South Florida Wading Bird Report are encouraged to be on the lookout for Sacred Ibis, and report their observations in a timely manner to Larry Connor, FWC exotic species database manager, at Larry.Connor@MyFWC.com. Those wishing to discuss control strategies for Sacred Ibis in South Florida, are welcome to contact ENP biologist Skip Snow at skip_snow@nps.gov.

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