SOUTH FLORIDA WADING BIRD REPORT

Volume 11 | Mark I. Cook and Erynn M. Call, Editors | September 2005

SYSTEM-WIDE SUMMARY

Significant hurricane activity in 2004 resulted in above average water levels across much of South Florida at the start of the dry season but rapid recession rates reduced water levels and provided good foraging condition in some regions of the Everglades by February and early March. Subsequent heavy rain events through March and April resulted in a succession of reversals that left protracted high water levels over much of the system until the onset of the summer rainy season.

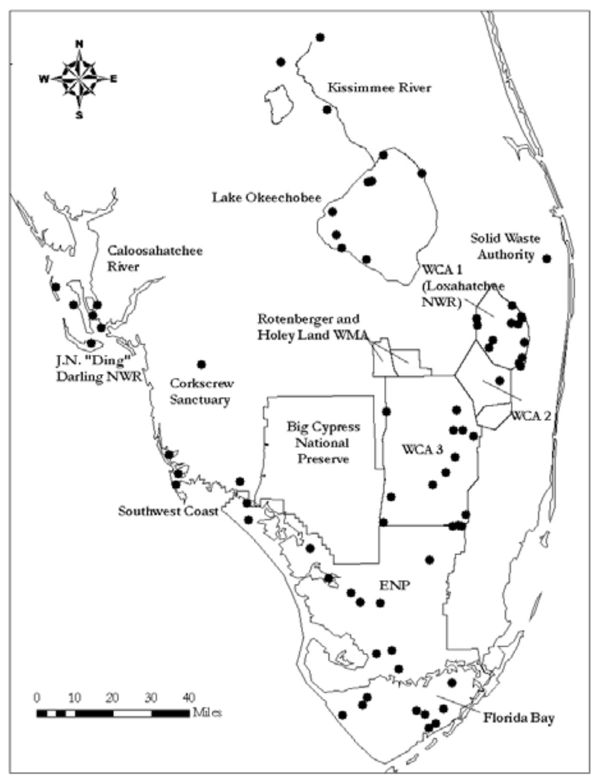
The estimated number of wading bird nests in South Florida in 2005 was 31,869 (excluding Cattle Egrets, which are not dependent on wetlands). This is a 41% reduction in nest numbers from last year's relatively successful season and a 54% decrease from the record year of 2002, which was the best nesting year on record in South Florida since the 1940s. The 2005 season represents a sharp divergence from the general rising trend in the annual number of wading bird nests recorded since 1999, and this decline was observed among all wading bird species. Nesting surveys of Lake Okeechobee and Kissimmee River were initiated this year and are included in the report, but data from these areas were not used to calculate the population total.

As usual for recent years, nesting effort in the Everglades was not uniformly distributed among regions. WCA-3 supported the largest number of nests (73%), WCA 1 supported 19% of nests, whereas ENP supported the lowest number of nests (8%). This pattern is similar to last year and the record year of 2002. Noteworthy is the trend over recent years for a large proportion of nests in south Florida to be concentrated in a single colony (Alley North) located in northeast WCA 3A. This colony contained 52% of all wading bird nests and 69% of White Ibis nests in South Florida.

Systematic Reconnaissance Flight (SRF) surveys show that total bird abundance throughout the Everglades was very high at the beginning of the season (January to March). For example, estimated number of wading birds in the WCAs during February was 288% higher than the same time last year and 20% higher than the record year of 2002. However, the number of birds dropped by about a half in April and remained low throughout the remainder of the season.

Wading bird breeding targets proposed by the South Florida Ecosystem Restoration Task Force fell far short of expectation this year. Wood Storks continue to nest later than the target period of November – January, only two wading bird species, White Ibis and Great Egret, met nest number goals, and ENP continues to contribute relatively low numbers of wading bird nests. However, it is encouraging to note that this is the second successive season in which nesting has occurred at the traditional "rookeries" in the southern, mainland estuaries downstream from Shark River Slough, albeit in small numbers.

Locations of wading bird colonies in South Florida in 2005. Colonies with ≥ 50 nests are depicted in LNWR and the WCAs. Florida Bay not surveyed completely.



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This year was noteworthy in that nesting success was generally very low, particularly in ENP and the WCAs. Nest failures appeared to be primarily the result of spring rainfall events that caused water levels to rise rapidly. At Alley North alone, thousands of white ibis nests were abandoned due to nest flooding or poor foraging conditions. Wood storks were particularly sensitive to the spring rains and experienced significant abandonment at most colonies. At Corkscrew Swamp Sanctuary, the largest Wood Stork colony in the region, all 240 nests failed soon after the first rain event. Stork nests that survived at other colonies generally produced low numbers of fledglings. This continues a disturbing downward spiral of both nesting effort and breeding success in recent years for this federally endangered species. Spoonbills in Florida Bay were not affected by rain induced reversals but continue to fare badly as a result of unsuitable foraging conditions in most areas of the Bay. Note that the 2005 wading bird nest total may be an overestimate of nesting activity if the White Ibises that abandoned their nests at Alley N subsequently re-nested elsewhere, as circumstantial evidence suggests.

The poor nesting season of 2005 does not necessarily infer a decline in the suitability of the system to wading bird nesting. Wading bird breeding populations naturally fluctuate from year to year, and did so considerably even in predrainage years. The very large numbers of foraging wading birds present in the system at the beginning of the 2005 season suggest that the Everglades retains the capacity to attract and support large numbers of birds. Indeed, it is likely that 2005 would have been a relatively successful year if extensive water-level reversals had not occurred.

Irrespective of rain induced reversal events, it is evident that conditions in the Everglades remain unfavorable for breeding for a number of wading bird species, and we have much to learn about the ecological factors affecting the timing and distribution of breeding of all species. Determining causation will require the continuation of long-term system wide monitoring and shorter-term experiments and modeling.

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HYDROLOGY 2005

The rainfall and associated stage readings for the 2005 water-year (May 2004 – April 2005) are shown in Table 1 below. Despite the substantially lower than average rainfall in each of the Everglades sub-basins, the 2005 hydrologic stage conditions were higher than the average throughout most of the EPA. Only WCA-2 stage was somewhat lower than average. This disconnect between lower than average rainfall and higher than average stage appears to be due to two significant hydrologic events. The first was an extended 2004 dry season that ended in mid-July instead of the more typical mid-May. The lack of rain in June 2004, a month that normally contributes 10-12 inches of precipitation to the annual total, accounts for these low totals for the 2005 water-year. The second event was a series of hurricanes that quickly filled all the basins within the SFWMD, which in turn could not be drained for an extended period due to a lack of conveyance everywhere.

The suitability of a site for wading bird foraging is a function of water recession rate and water depth. The following figures highlight the average stage changes in each of the Water Conservation Areas, from Sept. 2004 to June 2005, in relation to a simple categorical classification for wading bird habitat suitability during the nesting season. The dry-season recession rates are classified into three categories by the South Florida Water Management District to facilitate public discussion and operational decisions. These three are labeled Red, Yellow and Green. A Red label means poor conditions. This was due to a recession rate that was too fast (greater than 0.6 ft per week) or too slow (less 0.04 ft for more than two week). A Red label was also given when the average depth change for the week was positive rather than negative. A Yellow label means fair conditions. This was due to a slow recession rate of only 0.04 ft for a week or a rapid recession between 0.17 ft and 0.6 ft per week. A Green/Good label was given when water depth decreased between 0.05 ft and 0.16 ft per week. Although these labels do not take into account appropriate depths for foraging, they have been useful during high water conditions to highlight recession rates that can lead to unsuitable foraging depths during the peak of the breeding season. Optimal foraging depths vary among wading bird species but appear to be between 0.0 and 0.5 ft. The green horizontal line on each graph represents the 0.5 ft stage below which water depths become optimal for wading bird foraging.

WCA-1

Water levels were already on a rapid increase when Hurricanes Frances and Jeanne almost put this basin into operational criteria for flood control. Water depths decreased at a moderate pace after the hurricanes, going from 2 ft in Oct. 2004 to 0.5 ft in Feb. 2005. Then during the critical wading bird foraging and nesting period of March – April, dramatic reversals occurred and rainfall increased depths back up to 1.0 ft. May was a return to favorable recession rates and good foraging depths. This dry-season rain plus a rapid return of the wet season in March created a poor nesting season for wading birds. Despite the March reversals, WCA-1 had the longest duration of good nesting and foraging periods of any region in the EPA.

Table 1. **Average, minimum, and maximum stage (ft NVGD), and total annual rainfall (inches) for water-year 2005 in comparison to historic[a] stage and rainfall. Subtract elevation from stage to calculate average depths.**

Area	2005 Rainfall	Historic Rainfall	2005 Stage Mean (min;max)	Historic Stage Mean (min;max)	Elevation
WCA-1	43.72	51.96	15.85 (13.63; 17.11)	15.59 (10.0; 18.38)	15.1
WCA-2	43.72	51.96	12.21 (10.73; 14.6)	12.56 (9.33; 15.64)	11.2
WCA-3	40.27	51.37	9.94 (8.51; 11.74)	9.51 (4.78; 12.79)	8.2
ENP	40.15	55	6.26 (5.51; 7.16)	5.96 (2.01; 8.08)	5.1

[a]See Chapter 5 of the 2006 South Florida Environmental Report (Abtew et al.) for a more detailed description of rain, stage, inflows, outflows, and historic databases.)

WCA-2A

Wet season response to the Hurricanes Frances and Jeanne put WCA-2A some 2 ft over its regulation schedule by Oct 2004. Marsh water levels decreased rapidly in WCA-2A during the dry season, decreasing from 14 ft NGVD in November to 11.3 ft NGVD by March. As a result, February was a period of numerous reports of wading bird foraging in WCA-2A. As in WCA-1, dramatic reversals occurred in March creating poor foraging habitat. The return of the wet season in June of 2005 ended any potential for delayed nesting and, in fact, was so intensive that it caused this region to exceed the upper flood tolerance for tree islands.

WCA-2B

Water depths in WCA-2B never got low enough to support wading bird foraging in 2005. This was just the opposite of last year when an extended dry season made wading bird foraging during June and July very difficult everywhere except in WCA-2B.

WCA-3A

Four regions are used to characterize WCA-3A (see below). Almost all of WCA-3A saw a water depth increase of 3-4 ft after the 2004 hurricane season. The two northern regions had favorable foraging conditions early in the nesting season. In March, water depths increased by 1.0 ft in the Northwest region creating poor conditions for the rest of the season. The March reversal in the Northeast region was not as intense as that in the NW and birds were found foraging in the NE from March to May despite the poor conditions. The Central and Southern regions of WCA-3A never "recovered" from the 2004 wet season peaks before getting inundated by the March reversals and a rapid return of the wet season in June of 2005.

WCA-3B

This region did not experience the rapid flooding or deep water caused by Hurricanes Frances and Jeanne more to the north. As such, it should have been prime foraging habitat. However, like the rest of the regions of the EPA, WCA-3B experienced significant rainfall in March, April and May, causing significant reversals and deep water making this region marginally effective for foraging.

ENP

Based on data from a gage in Northeast Shark River Slough, most of the Park should have seen favorable water depths and recession rates during the early period of the nesting season. From January to March depths were less than 1.0 ft and recession rates were about 0.1 ft per week. However, like the rest of the regions of the EPA, NE Shark Slough experienced significant rainfall in March, April and May, causing numerous reversals and making this region marginally effective for foraging.

General Trends

What is apparent form the hydrographs throughout the Everglades is that water levels and reversals in March and April were not favorable for optimal foraging or high nesting success. Not shown on the figures below was the rapid and intensive rise in water levels throughout the EPA in June 2005 due to intensive rain events. This made any expansion of the nesting season, to compensate for poor late season hydrologic conditions, very improbable.

Figure 1. Hydrographs for the WCAs and ENP for the 2005 water-year. See text for details on color-coded classification of wading bird habitat suitability.

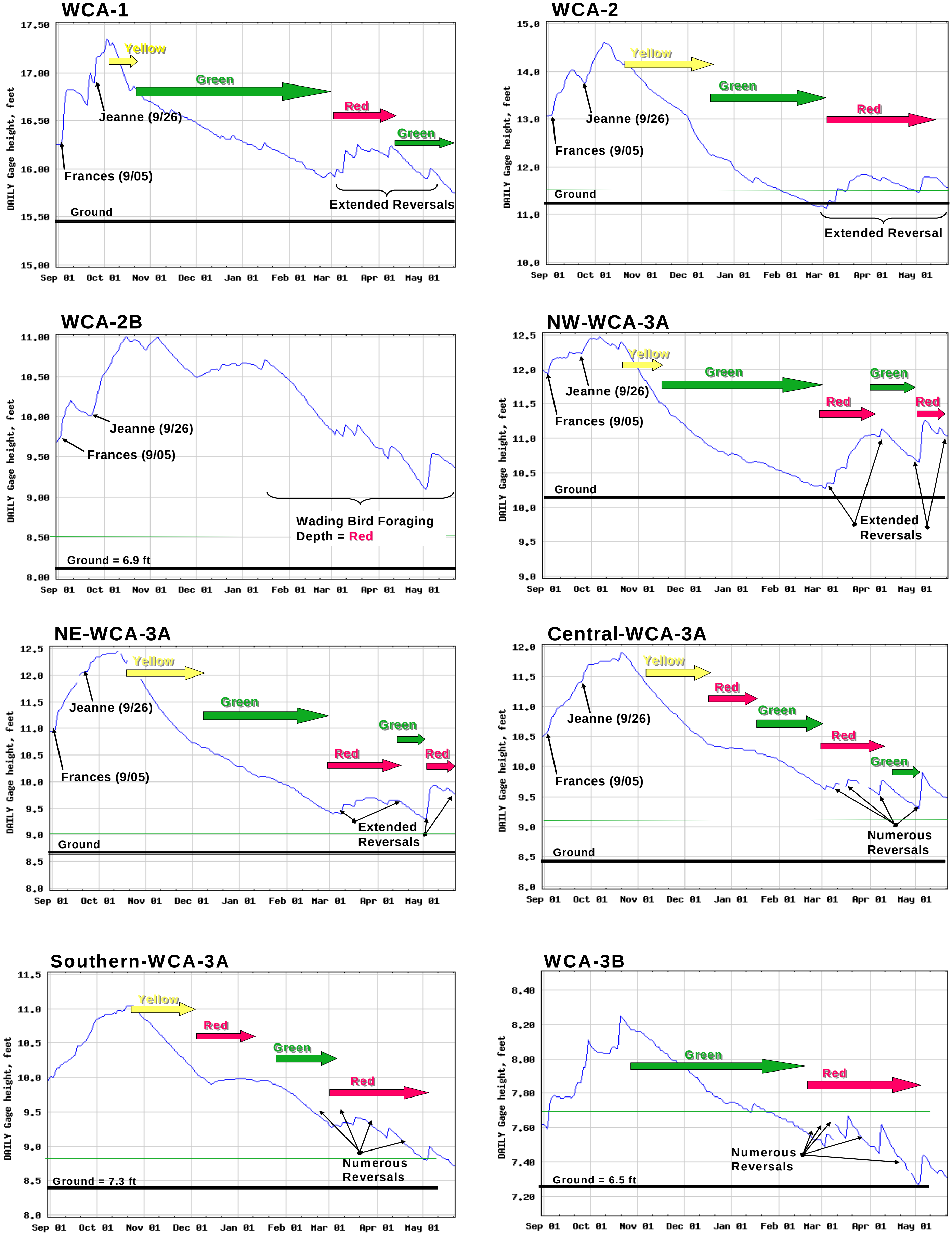
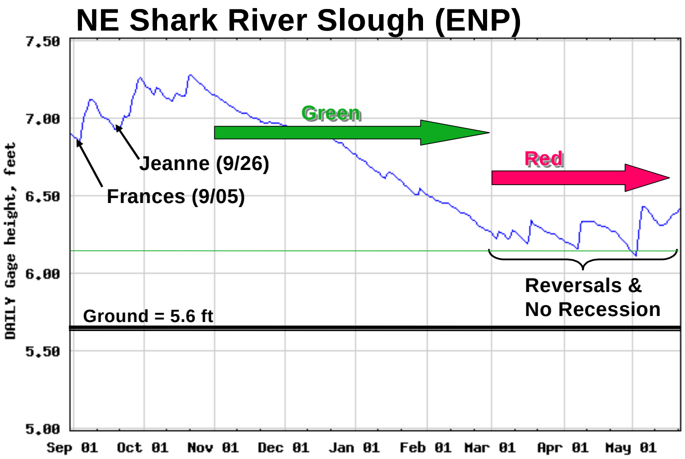


Figure 1 cont. Hydrograph for the WCAs and ENP for the 2005 water-year



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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 (SMDH), and small white herons (SMWH).

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).

REGIONAL NESTING REPORTS

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

In 2005, the University of Florida team monitored nesting in WCAs 2 and 3 and Loxahatchee, and continued similar survey work in Loxahatchee National Wildlife Refuge. We also monitored nest success of Great Egrets, White Ibises, and Wood Storks [from Rena], and continued our studies of juvenile stork movements and survival.

Methods

We performed 2 types of systematic surveys in 2005: 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 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.

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. In 2005, 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. We established belt transects in Alley North, Vacation, Vulture and Cypress City colonies early in the nesting period and marked active nests within a designated distance from the center of the transect. We then returned every 5-7 days to walk transects and check the progress of those nests, count failures and add new nesting attempts to the transect. Nest success has not yet been analyzed for White Ibises, Snowy Egrets and Great Egrets, but will be expressed using the Mayfield method.

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 24,248 nests of wading birds (Cattle Egrets, Anhingas and cormorants excluded) were initiated between February and July of 2005. Note that this figure does not include birds nesting at the Tamiami West and East colonies, which we also monitored intensively in ENP.

It is also important to realize that this total may not be entirely comparable to previous years, since we did not perform the same level of effort in the ground surveys (i.e., complete ground surveys may have increased the totals). One way to make the 2005 grand total estimate more comparable to previous years is to consider that on average, ground surveys alone have contributed 30% of the total numbers of nests. If we take the numbers of nests estimated from aerial surveys in 2005, and add 30% (30,412), this would probably be closer to the estimate if we had completed a comprehensive ground survey. We are planning to refine this estimate in the near future.

Using the lower of the two figures above (grand total of 24,248), the size of the nesting aggregation in 2005 in the WCAs and LNWR combined was slightly under 100% of the average of the past ten years, 61% of the average of the last five years, and about 40% of the recent high of 2002. Numbers of Great Egret nests were 52% the average of the last five years, and 68% of the average of the last ten. In 2004, Wood Stork nests were very much reduced, with only 20 pairs attempting to nest in the WCAs. White Ibis nests were 71% of the average of the last five and 130% the average of the last ten years. Compared with the banner year of 2002, only half the ibis pairs (50.7%) nested in 2005.

The ground surveys that we accomplished totaled approximately half of WCA 3A, and were located in a large area that has in the past had high colony densities. We used this survey as an indicator for change in numbers of species that are poorly quantified by aerial surveys alone (dark colored species). We have so far compared the numbers from this survey with numbers of nests from the same area of ground surveys in 2004. In 2005, we found 1.2 times the number of Tricolored Herons as in 2004, 1.3 times the Great Blue Herons, 2.4 times the Anhingas, and 0.9 times the Little Blue Herons. If this survey can be taken as an honest indicator of nesting in the larger Everglades, it does not seem as though the dark colored species that nest in small colonies experienced as much of a decline as the white colored species nesting in large colonies.

In terms of total numbers, the 2005 nesting event can be considered a considerable reduction from the very large and increasing numbers seen in 1999 – 2004. While this numerical reduction seems like a change from the increasing trend of nesting numbers, it should be remembered that the numbers were quite large given the deep and rising water level conditions that prevailed during the most important part of the nesting season.

Table 1. Numbers of nests of aquatic birds found in WCAs 2, 3, and Loxahatchee National Wildlife Refuge during systematic surveys, January through July of 2005.

Latitude	Longitude	WCA	Name	GREG	WHIB	WOST	ANHI	GBHE	TRHE	BCNH	SNEG	LBHE	ROSP	YCNH	GLIB	CAEG	**Colony Total***
N26 31.834	W80 15.977	1	Lox 111		2,458												**2,458**
N26 26.396	W80 23.473	1	Lox 99	935	536						134						**1,605**
N26 27.609	W80 14.442	1		226							104						**330**
N26 33.580	W80 15.060	1	Canal North									264					**264**
N26 33.081	W80 26.568	1										261					**261**
N26 28.093	W80 22.362	1		105													**105**
N26 22.076	W80 15.481	1		53													**53**
N26 12.130	W80 31.750	3A	Alley North	850	12,750		150	25	300	150	2,250	200	10		75		**16,610**
N25 48.080	W80 29.400	3B	3B Mud E	480		20	30		10								**510**
N26 11.763	W80 49.493	3A										233					**233**
N26 06.136	W80 27.435	3A		59	93												**152**
N26 01.331	W80 32.213	3A	Vulture	121			25	5									**126**
N26 07.468	W80 30.163	3A	Cypress City	107			30	6									**113**
N25 52.142	W80 48.357	3A							55			65					**120**
N25 46.360	W80 50.240	3A	Hidden	38	63		10										**101**
N25 54.939	W80 37.813	3A	Vacation	79			20	6									**85**
N25 57.880	W80 34.480	3A	L-67	104													**104**
N26 18.715	W80 20.709	2A		37								56					**93**
N26 07.550	W80 32.500	3A	6th Bridge	75													**75**
Totals from colonies > 50				**3,269**	**15,900**	**20**	**265**	**42**	**365**	**150**	**2,488**	**1,079**	**10**	**0**	**75**	**0**	**23398***
Totals from colonies < 50				**302**	**100**	**0**	**507**	**155**	**23**	**70**	**3**	**154**	**0**	**1**	**43**	**0**	**851***
	GRAND TOTALS**			**3,571**	**16,000**	**20**	**772**	**197**	**388**	**220**	**2,491**	**1,233**	**10**	**1**	**118**	**0**	**24249***

* totals do not include Cattle Egrets or Anhingas.

** See text for discussion of the effect of incomplete ground surveys on comparability between years.

Nesting Success: In general, nesting success was very low this year, with nearly all colonies experiencing abandonment of the majority of nests at some point during the season. Wood Storks initiated nesting somewhat late even by the standards of the last 20 years (February), and experienced extremely poor nest success. Of 59 nests marked in Tamiami West in March, none survived to produce fledged young, and most abandoned by the egg stage. Most abandonments occurred between 18 March and the first week of April.

Great Egrets were nesting in large numbers by late February, which suggests a relatively normal initiation schedule. We found evidence of complete or large scale abandonments by Great Egrets at most of the colonies that we surveyed from the air, and all of those at which nesting success was tracked through marked nests (Alley North, Cypress City, Vulture, Vacation). Great Egrets have in the past been the least likely species to abandon nesting in the Everglades, suggesting that the spring of 2005 was very unfavorable for nesting. We followed the fates of a total of 253 marked Great Egret nests, and found that only 32% fledged young (traditional nest success, analysis of Mayfield success underway).

White Ibises began nesting at Alley North, and Tamiami West in early March. We estimated through aerial photographs and the use of ground counts that there were at least 12,750 nests in the Alley North colony by mid March, many of them nesting in cattails along the southwest perimeter of the colony. However, these counts are almost certainly considerable underestimates of the true numbers, since we were aware that several thousand ibises must have been nesting in the willows, but we were unable to count them directly because they were underneath the canopy. In addition, there were many nests still in courtship stage at the time of the March survey, which were not included in the total.

Most of the ibis nests in the cattails were abandoned in late March, following a series of rainfall events and rising water alluded to in the summary of this report. Just north of the Alley North colony (Gage 3A-NE), water levels in March rose by 30 cm, resulting in deeply flooded foraging areas and in some cases inundated nests. These nests were in early chick or late incubation stages at the time of abandonment. By early April, nearly all of the ibises had abandoned in this area, and the colony was frequented by large numbers of vultures. Several thousand young were found in the cattails at this time, but given their nutritional condition it seems unlikely that many survived. In all, we followed the fates of 478 nests in Alley North, and found 19% of them fledged young (traditional nest success measure, Mayfield estimates underway).

Very few ibises were found in the Loxahatchee colonies (99 and 111) during the March surveys, suggesting that the large numbers found in April had not initiated by late March and so may not have endured the high water conditions at that time. There is also the possibility that the Loxahatchee birds may have come from the abandoned Alley North colony. Combining the numbers of nests from Alley North and the Lox colonies may therefore be a gross exaggeration of the total numbers of nesting pairs of ibises in 2005.

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EVERGLADES NATIONAL PARK

Methods
Aerial colony surveys were conducted monthly (January through June) by 1 or 2 observers using a Cessna 182 fixed-wing aircraft (~22 person hours). Traditional colony sites as well as the new colonies discovered during the previous season were surveyed. Survey dates were: 10 & 24 January (checked during SRF flights - no colonies seen) 15 February, 22 March (Frank Key only), 30 March, 8 April, 29 April, 12 May, 26 May, 3 June, 13 June, and 24 June.

Results
Wading birds in Everglades National Park formed colonies and initiated nesting late this year. The timing for this season was similar to the 2004 season. Nesting was not initiated until well into February and March at most sites. Most colonies had fledged all young by the end of May, however several colonies were still active into June.

The overall number of nests initiated was comparable to previous seasons, however partial or total nest failures resulted in a less successful nesting season compared to previous seasons. The relatively small and transient (mostly Great Egret) colonies that usually appear at the eastern and western sides of Shark River Slough did not form this year. This may have been due to drought conditions that drastically reduced water levels in the slough.

We observed a total of 1,988 nests within 12 active mainland colonies in Everglades National Park.

Colony summaries
Alligator Bay (renamed from "2004 New Colony13")
This colony had approximately 110 Great Egret/White Ibis/Snowy Egret nest starts combined, but it did not remain active. It completely failed at some point between April 8th and April 29th.

Broad River (renamed from "2004 New Colony7")
This colony increased slightly in size from 80 nests seen during the previous season to 150 nests this season. It consisted of mostly Great Egrets, Snowy Egrets and White Ibis, but a few Roseate Spoonbills also nested in this colony. Some of the spoonbill nests can be seen in photos. During the March flight, 30 Great Egret nests and a few egret young were seen. On 8 April there were 80 nests –50 in one area of the colony and 30 in another, but this time young egrets were not seen. On 3 June, Great Egrets were observed roosting but only 4-5 flapping young were seen during the flight.

Cuthbert Lake
Wood Storks initiated 40 nests and 80 Great Egret nests were built by 30 March. The stork nest count had increased to 60 in April while egrets remained the same through 12 May. In early June, young storks were seen roosting on and off nests and Great Egret fledglings were flapping in the mangrove tops. By 24 June a few Great Egret fledglings remained and all Wood Storks were gone. Although it was a little smaller this season, this was the only Wood Stork colony in the park that didn't have nest failures.

East River
This colony again consisted of only 20 Great Egret nests. It appears that their nests were successful as flapping young were seen later in the season.

Grossman Ridge
Great Egrets had 60 nest starts on 15 February but all had been abandoned when checked again on 30 March.

Otter Creek (renamed from "2004 New Colony8")
Like the previous season, this colony contained a mix of species but with fewer nests than the previous season (450 nests this year compared to 650 nests in 2004.) It consisted mostly of White Ibis, Snowy Egrets and Great Egrets. Wood Storks nested in this colony during the 2004 season but were not seen this season. Roseate Spoonbills may have been nesting at this colony as they were observed flying in and out of the mangroves, however we could not tell from the airplane if they had nests. The colony was mostly empty on June 28th except for a few flapping White Ibis, Great and Snowy Egret young.

Paurotis Pond
Wood Storks initiated nesting at Paurotis before any of the other 3 stork colonies. On 15 February, there were 8 nests. By 30 March the numbers increased to 75. At some point between 30 March and 8 April, the count of active nests was down to about 55 and abandoned nests were seen. By 29 April, the count decreased to 30, but half-sized young were seen in most of these remaining nests. The count remained the same during the 12 May flight and on 26 May (checked by helicopter) when large fledglings were seen on and off the nests. When checked on the 13th of June, no storks were seen in the colony.

Great Egrets had 100 active nests by 30 March but most were abandoned and only 40 nests were still active by 29 April. It appears that few Great Egret nests produced young; only 20

Peak numbers of wading bird nests found in Everglades National Park colonies from February through June 2005

COLONY NAME	Latitude WGS 84	Longitude WGS 84	Easting NAD83	Northing NAD83	GREG	WOST	WHIB	SNEG	CAEG	ROSP	TRHE	LBHE	BCNH	TOTAL
Alligator Bay (2004 col-13) *	25 40.259	-81 08.828	485234	2839257	50	0	40	20	0	0	+	0	0	**110**
Broad River (2004 col-7) *	25 30.176	-80 58.464	502573	2820638	80	0	30	30	0	10	0	+	0	**150**
Cuthbert Lake	25 12.560	-80 46.500	522666	2788146	80	60	0	0	0	0	0	0	0	**140**
East River Rookery	25 16.116	-80 52.071	513306	2794697	20	0	0	0	0	0	0	0	0	**20**
Grossman Ridge *	25 37.680	-80 38.740	535572	2834536	60	0	0	0	0	0	0	0	0	**60**
Otter Creek (2004 col-8) *	25 28.068	-80 56.263	506261	2816750	100	0	250	100	0	+	0	0	0	**450**
Paurotis Pond *	25 16.890	-80 48.180	519834	2796133	100	75	125	+	0	4	+	+	0	**304**
Rodgers River Bay *	25 33.400	-81 04.190	492985	2826591	50	8	0	0	0	0	0	0	0	**58**
Rookery Branch (2004 col-9)*	25 27.814	-80 51.153	514822	2816287	+	nd	+	+	nd	nd	nd	nd	nd	**nd**
Tamiami East *	25 45.457	-80 30.481	549338	2848934	8	0	0	0	0	0	0	0	0	**8**
Tamiami East-2 *	25 45.561	-80 31.474	547677	2849120	3	0	0	0	0	0	0	0	0	**3**
Tamiami West *	25 45.447	-80 32.701	545627	2848902	75	110	500	+	0	0	+	0	+	**685**
Totals for mainland colonies					**626**	**253**	**945**	**150**	**0**	**14**	**+**	**2**	**+**	**1990**
Florida Bay - Frank Key	25 06.146	-80 54.400	509410	2776293	**60**	**0**	**200**	**150**	**0**	**+**	**+**	**0**	**0**	**410**

+ Indicates species present but unable to determine numbers

* Alligator Bay	Colony completely failed between 4/8 and 4/29 flight dates
* Broad River	GREG built 80 nests at peak but down to 50 nests in April. At end only a few young were seen.
* Grossman Ridge	GREG - 60 nest starts on 2/15 but no birds seen from 3/30 to present
* Otter Creek	GREG made nests but produced few young - May 12th, 40 nests. WHIB/SNEG active. Need another flight to determine outcome.
* Paurotis Pond	GREG had 100 nests 4/8, but only 40 nests 4/29; large young in nests, 5/26 down to 20 nests with large young. 6/3 no young seen.
* Paurotis Pond	WOST had ~75 nests on 3/30, 4/8 = 55, 4/29-5/12 = 30, 5/26 = 20. Large young seen.
* Paurotis Pond	WHIB - fledged young seen on center island 5/26
* Rodgers River Bay	WOST had 5 nests 3/30-4/8; no birds seen 5/4-5/12
* Rodgers River Bay	GREG had 50 nests on 4/8 but no birds seen 5/4-5/12
* Rookery Branch	Formed late and was not checked in time to count nests. GREG, SNEG & WHIB present but no WOST seen
* Tamiami East	Most GREG failed between 3/30-4/8. All 8 failed by 5/12
* Tamiami East-2	All 3 GREG nests failed between 3/30-4/8
* Tamiami West	GREG made nests but never saw any young. On 4/8 had ~75 nests. By 5/12= no nests seen and very few adults present.
* Tamiami West	WHIB went from 500 to 200 nests; no young seen last flight on 5/12
* Tamiami West	WOST only had ~35 nests; did see branchlings and almost fledged birds

nests still had large young when checked by helicopter on 26 May. On 13 June birds were roosting off nests and no flapping young were seen in the colony.

White Ibis and Snowy Egrets were difficult to estimate as most were inside the center island and below the tree canopy. There were at least 250 nests and probably more. They appeared to be successful as many fledged young were seen flying around as well as making trips back and forth from the island to mangroves at the edge of the pond.

Rodgers River
Wood Storks had initiated only eight nests and Great Egrets had 50 active nests by 8 April. At least three stork nests had small young (less than half-sized), however at some point between 8 April and 4 May (checked during an SRF wading bird flight) the colony had failed completely.

Rookery Branch (renamed from "2004 New Colony9")
It appears that this colony was active but initiated later than the Otter Creek and Broad River colonies. Approximately 300 White Ibis, Snowy and Great Egrets plus some fledged young were seen during a flight on 13 June. Some nests remained but the birds were already finished (empty nests can be seen in photos). Additionally, many nests may have fallen apart by the June flight and so an accurate count for this colony is not possible. Photos were taken to document the site, nests, and roosting birds.

Tamiami West
This colony was active but few Great Egrets and Wood Storks successfully nested here this season. Approximately 110 Wood Stork nests were initiated but most of these were later abandoned. We counted only 35 Wood Stork nests when checked later in the season. Most of these remaining nests appeared to be successful as large nestlings and fledglings were seen in them during later flights. Great Egrets had approximately 75 nests started but most of these were later abandoned and no fledged young were seen during later flights. The colony was still active when checked on 13 June, but only consisted of White Ibis. The ibis seemed to be successful as many juvenile birds were seen flapping at the top of the colony and making short flights back and forth across the treetops.

Tamiami East
Both of these small Great Egret colonies failed. Between the 2 colonies, only about 11 Great Egrets attempted to nest this season.

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EVERGLADES NATIONAL PARK

FLORIDA BAY

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

Frank Key
Great Egret had 60 active nests on 22 March (the colony was checked during another project flight.) White Ibis and Snowy Egrets were present but had not yet initiated nesting. On 29 April, 60 Great Egret, 75 White Ibis and 125 Snowy Egret nests were seen. On 3 June small Great Egret young were seen in a few nests and adults were seen incubating or brooding on other nests. Juvenile ibis were also seen during this flight. By 13 June only roosting adult ibis were seen along with fledged Snowy Egrets. Small young were again observed in some of the Great Egret nests. The last check of this colony was 24 June. Great Egrets were still incubating on nests but many of the other birds were gone. Snowy Egrets and White Ibis were seen roosting only and some juvenile Snowy egrets were seen flapping in the center of the colony. We will continue to monitor this colony as long as it remains active.

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WOOD STORK NESTING AT CORKSCREW SWAMP SANCTUARY

Methods

Five aerial surveys were conducted at Corkscrew swamp sanctuary (N 26º 22.551' W 081º 36.538') from February 1st to April 7th using fixed-wing aircraft. Jason Lauritsen (jlauritsen@audubon.org) made visual estimates of colony size from the aircraft by counting all individual nests when the colony size was small (three counts were made and averaged to establish the aerial estimate). Once the colony was too large to accurately use this method, counting was done in clusters of five (again, three estimates were made and averaged). To improve accuracy of nest counts, slide photos were taken with a 70-200mm lens of the entire colony on each survey date from approximately 1000ft, circling the colony until full slide coverage was attained. Photos of each sub-colony were taken from 500ft during a single pass to assist in productivity estimates and stage of development (12 person-hours).

Analysis

Photos of each aerial survey were projected on a grid and analyzed. Photos from 1000' were used to identify the total number of possible Wood Stork nests. Slide photos taken from approximately 500' were further analyzed to determine what proportion of the colony were Wood Stork nests, Great Egret nests, loafing birds, or birds of indeterminate status, in order to reduce the error associated with the image quality of slides taken at 1000'. These values were used to extrapolate the final number of nest starts for wood storks in the Corkscrew colony (5 person hours)

Results

Total Wood Stork nests for Corkscrew are estimated to be 240. By March 31st all nests failed and subsequent aerial surveys did not discover re-nesting. Significant dry-season rainfall likely motivated the widespread abandonment. Corkscrew received nearly 8 inches of rain between February 24th and March 18th. Nest starts were determined by analysis of the March 2nd set of aerial slides, where approximately 89% of the large white wading birds visible from the slides taken at 500' were identifiable as wood storks, 1% were identified as great egret nests, 3% were loafing storks and nearly 8% could not be clearly identified.

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SOLID WASTE AUTHORITY OF PALM BEACH COUNTY COLONY

Methods

From February – July 2005, Breeding Bird Censuses (BBCs) were conducted 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 were systematically surveyed from a small boat, and the identified bird species and nest numbers were recorded. Surveys were conducted during the morning hours so as to minimize any burden caused by the presence of observers.

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 (Lat. 26°46'41"N: Long. 80°08'32"W 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 but vegetation touches 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 Loxahatchee Watershed Preserve (Water Catchment Area), a 44 km^2 remnant of the Loxahatchee Slough.

Results

This report presents preliminary data for the 2005 breeding season. Typically, nesting activities have been observed at this colony through September, and this survey reports only through end of July. Only the peak nest numbers are reported for each bird species.

The estimated peak number of wading bird nests for the SWA Colony is 1,171 which represents a 60% decrease from the previous 2004 season. There was an overall decline in nest numbers from last year for all of the bird species as follows: Great Egret (75%), White Ibis (72%), Snowy Egret (70%), Cattle Egret (27%), Little Blue Heron (13%), Wood Stork (17%), Anhinga (31%), and Tricolor Heron (8%). The Wood Storks appeared to be off to a good start with 200 nests, but after heavy rains in March there was about a 50% loss of nests observed. Even though the area was impacted by Hurricanes Frances and Jeanne, the nesting habitat remained relatively intact, and there did not appear to be any change in the numbers of adult birds utilizing the colony. The number of high nest loss may be attributed to unusually heavy rainfall that occurred in March.

It should also be mentioned that there were 3-5 Roseate Spoonbill nests. There were several Glossy Ibis nests. However, Glossy Ibis nests are not easily identified during the nest surveys and therefore are not included in the reports.

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Peak number of wading bird nests in SWA Rookery from February to July 2005

GREG	SNEG	CAEG	GBHE	LBHE	WOST	WHIB	ANHI	TRHE	Total Nests
32	12	296	2	41	200	394	226	82	1171

ROSEATE SPOONBILLS IN FLORIDA BAY

Spoonbill Monitoring Methods

Thirty-four of Florida Bay's keys have been used by Roseate Spoonbills as nesting colonies (Figure 1, Table 1). These colonies have been divided into five distinct nesting sub-regions (Table 1) based on each colony's primary foraging location (Figure 1, Lorenz et al. 2002). During the 2004-2005 nesting cycle (Nov-May), complete nest counts were performed in all five sub-regions. Nest counts were performed by entering the active colony and thoroughly searching for nests. Nesting success was estimated for the four active sub-regions through mark and re-visit surveys of the most active colony within the sub-region. These surveys entail marking between 15 and 50 nests shortly after full clutches had been laid and re-visiting the nests on an approximate two-week cycle to monitor chick development. Prey fish availability was estimated at four sites (TR, JB, HC, and BS) in the coastal wetlands of northeastern Florida Bay (see Lorenz et al. 1997 for location coordinates) known to be spoonbill foraging locations for the Northeastern and Central sub-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 sub-region regularly feed. Prey fish were collected monthly from Nov through Apr with a 9 m^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.

Spoonbill Monitoring Results

Northwestern Sub-Region: Sandy Key

All five colonies in the Northwestern sub-region were surveyed for nesting activity in 2004-05 (Table 1). A total of 264 nests were counted in this sub-region, which is slightly above average for this region compared to the last twenty years of survey data. Nesting success surveys were conducted at Sandy Key on Oct 28, Nov 9, 23, Dec 3, 13, 19, 29, Jan 3, 12, 21, 27, Feb 4, Feb 15, and Mar 14. Individual nest attempts were asynchronous compared to this colony's historical nesting record; however, in the last few years, nest attempts have typically been asynchronous. We estimate that the first pair to lay eggs was on Nov 19 while the last didn't lay eggs until Dec 19. Usually, all nests are initiated within 14 to 21 days of each other. The mean egg laying date was Nov 30, and mean hatch date was Dec 20 (based on previous years, the average nest initiation date is Nov 18). The 155 nests counted were slightly below average (166 nests since 1984). Thirty-eight nests were marked for revisitation. Of these, an auspicious 74% were successful at raising chicks to at least three weeks old (the time when they first leave the nest) with the average of 1.08 chicks per nest attempt (Table 2). Resighting data supported the nest monitoring estimate: the fate of 131 chicks banded at Sandy Key are known and 60% of these survived to become flighted juveniles (Table 3). The fledging rate was below average (1.25 chicks/attempt since 1984; Table 2) but was 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 an encouraging 167 chicks fledged (compared to last year's dismal 82 chicks fledged). This estimate was confirmed by the observation of a total of 120 banded fledglings outside the colony (Table 3).

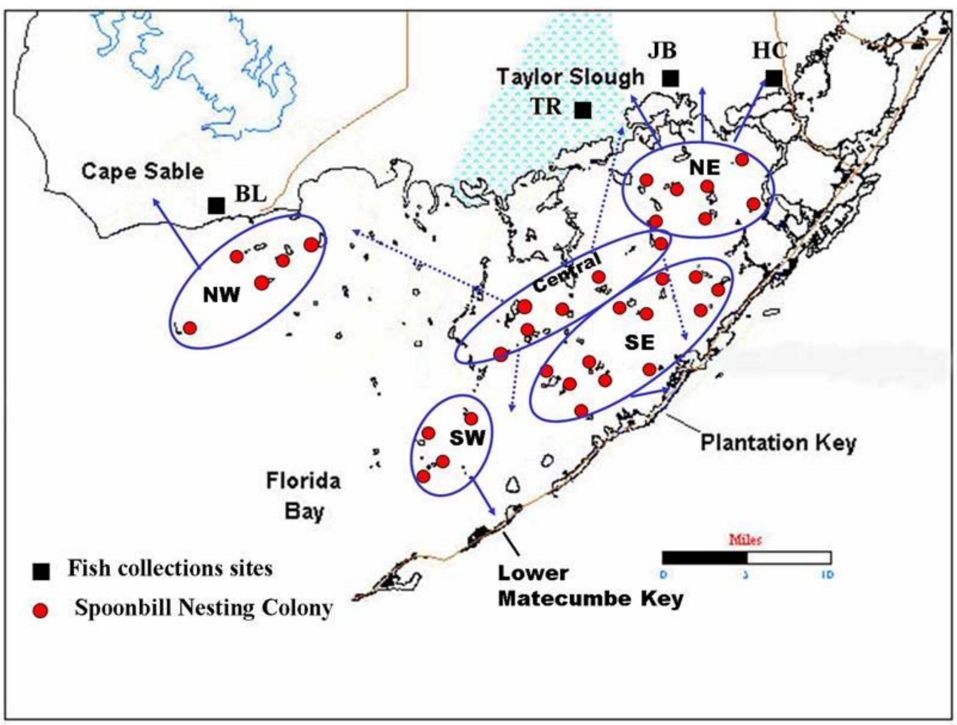

Figure 1. Map of Florida Bay Indicating spoonbill colony locations (red circles) and nesting sub-regions (blue circles). Arrows indicate the primary foraging area for each sub-region. The dashed lines from the central sub-region are speculative. Approximate location of fish sampling sites are represented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

Table 1. Number of ROSP nests in Florida Bay Nov 2004 - May 2005. An asterisk (*) indicates colony with nesting success surveys (see Table 2).

Sub-region	Colony	2004-05	Summary since 1984		
			Min	Mean	Max
Northwest	Sandy*	155	62	162.2	250
	Frank	77	0	51.14	125
	Clive	11	11	18	24
	Palm	20	20	20.5	21
	Oyster	1	0	7.21	45
	Subtotal	**264**	**65**	**208.7**	**325**
Northeast	Tern*	101	60	111.75	184
	N. Nest	1	0	0.08	1
	S. Nest	0	0	18.67	59
	Porjoe	0	0	33	118
	N Park	6	0	20.2	50
	Duck	0	0	2.29	13
	Pass	0	0	0.62	4
	Subtotal	**108**	**101**	**195.13**	**333**
Cental	E. Bob Allen*	8	0	16.4	35
	Manatee	0	0	0	0
	Jimmie Channel	26	6	20.67	47
	Calusa	11	0	9.8	15
	Little Pollach	0	0	3.67	13
	S. Park	14	0	11	39
	Subtotal	**59**	**15**	**52.93**	**96**
Southwest	E. Buchanon	0	0	7.54	27
	W. Buchanon	0	0	4.25	9
	Barnes	1	0	0.08	1
	Twin	0	0	1.92	8
	Subtotal	**1**	**0**	**12.25**	**35**
Southeast	M. Butternut*	9	7	23.6	66
	Bottle	0	0	11.29	40
	Stake	2	0	3.85	19
	Cowpens	0	0	3.58	15
	Cotton	0	0	0	0
	West	2	0	3.58	9
	Low	0	0	0	0
	Pigeon	56	0	8.15	56
	Crab	1	0	2	8
	East	13	0	3.71	13
	Crane	2	2	13.77	27
	E. Butternut	0	0	4.25	11
	Subtotal	**85**	**39**	**81.92**	**117**

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 sub-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. From Oct 19 to Nov 12 water levels rapidly declined from 32 cm relative depth to 6 cm, probably providing the stimulus for courtship activity. Water levels remained below the fish concentration threshold (FCT) of 12.5 cm through the mean nest initiation date of Nov 20. By the mean hatch date (Dec 20), relative water depth was -5cm indicating that the prey base was highly concentrated into the remaining wetted areas on the foraging ground. At this time available fish biomass was estimated to be relatively high at 6 g/m^2. During the critical 21 days post hatch period, water levels continued to recede to -10cm with available biomass estimated at 4.5g/m^2. By 42 post hatch (Jan 31), water levels had slightly increased to 0cm relative but fish remained highly concentrated. A storm event raised water levels above the FCT from approximately Feb 11-15 and available fish estimates dropped to 0.5 g/m^2. Fortunately, 8-10 week old chicks are more resilient to low food availability than 3 or 6 week old chicks and no mortality was documented during this event. Within a week following this event, water levels dropped back below 0 cm relative depth and remained there through Mar and Apr. Fish samples collected in Mar and Apr indicated fish availability at about 7.5g/m^2. These conditions were ideal for fledging chicks from the natal colony which occurred between Mar 14 and Apr 7.

Northeastern Sub-Region: Tern Key

All seven colonies in the northeastern sub-region were surveyed for nesting activity, however, only three were active with one of the active colonies having only one nest (Table 1). The 108 total nests in the sub-region is not the lowest nesting effort in terms of the number of active colonies (2002-03 count was 101), but is still well below the average nesting effort of this region. Spoonbill nesting success surveys were conducted at Tern Key on Nov 5, 19, Dec 2, 16, 30, Jan 13, 20, 26, 31, Feb 3, 13, 22, Mar 1, 8, 22, 30, April 6, 14, 22, May 5 and 24. As has been the norm for the last several decades, there were two distinct nestings at Tern Key during the 2004-05 breeding cycle. During the first nesting, the first egg was laid on Dec 20 and the last nest initiated on Jan 12 with the mean laying date estimated at Dec 28. The mean hatching date was Jan 17. As at Sandy Key, the nesting was asynchronous. The mean initiation date was much later than that of Sandy Key. As has been the trend in recent years, the first nesting effort was alarmingly small: only 108 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 ground. In addition to the alarmingly low nesting effort, the success rate was abysmal. On average, each nest attempt produced 0.1 chicks per nest, well below the average of 0.72 since 1984 and well below the pre-1980 average of 2.0 chicks/nest (Table 2). Almost all of the nests failed (only 3% successful) and total production for the colony was estimated at only 10 chicks.

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

			Summary since 1984			
Sub-region	**Colony**	**2004-2005**	**Min**	**Mean**	**Max**	**% of Yrs Succssful**
Northwest	Sandy	1.08 (74%)	0.00	1.25	2.5	65%
Northeast	Tern	0.1 (3%)	0.00	0.72	2.2	30%
Central	E. Bob Allen	.43 (20%)	0.00	0.67	1.52	30%
Southeast	M. Butternut	1.11 (67%)	0.14	0.98	2.09	40%

As at BL, water levels at the northeastern foraging grounds began to decline in mid-Oct through mid-Dec, and dropped below the FCT for the first time in early Dec. Between Dec 20 and Dec 24, water levels at one of the fish sampling sites (HC) were at one of the lowest points for the year (0cm relative depth). Shortly thereafter, water levels began to rise and fluctuated back and forth across the FCT through mid-Jan. These fluctuating water levels occurred at about the mean nest initiation date of Dec 28, thereby possibly explaining the asynchronous nature of the nesting effort, i.e., many nests were initiated during the low water period of Dec 20-24, but the remaining nest attempts were staggered across the next few weeks as water levels fluctuated. At the time of the mean hatch date (Jan 17) the JB site was at its lowest water level of the year (-8cm) and fish availability was high across the landscape (mean of 7 g/m^{2}from three sites). Had conditions remained this favorable, the nesting attempt would likely have succeeded. Unfortunately, within one week (Jan 23) water levels increased to 17cm relative depth, well above the FCT of 12.5 cm. Fish availability dropped to 1.8 g/m^2 at a time when chicks were most vulnerable (on average, less than one week old). Water level remained above the FCT across the landscape through mid-Feb. By early Feb, there were only 3 active nests within the colony. Of interest is that the only nest that succeeded to 21 days post hatch was the earliest nest initiated in our survey. These chicks were near 21d when water levels increased in mid-Jan, indicating that these chicks were hatched under more favorable conditions than the rest of the colony.

The second wave of nesting at Tern Key was more successful than the dismal first nesting attempt, but was much more disappointing than previous years' second nesting attempts. The nesting began in mid-March but still exhibited somewhat asynchronous timing of nest initiation. The first eggs were laid on Mar 10 and the last nest initiated on Mar 31 with the mean laying date of Mar 23. The mean hatch date was Apr 12. This effort was much smaller than the first nesting (about 35 nests) however 44% of the nests succeeded with an average of 0.48 chicks reaching 21d post-hatching per nest attempt. Of the successful nests, the average production was 1.08 chicks per nest. We estimate that only 17 chicks fledged during the second nesting. During the second nesting, water levels on the northeastern foraging grounds continued to fluctuate rapidly across the FCT with resultant low fish availability for significant periods of time (3-7 days)--thereby explaining the nesting failure.

Southeastern Sub-Region: Middle Butternut Key

All of the 12 Southeastern colonies were surveyed for nesting activity (Table 1). Nesting success surveys were conducted at Middle Butternut Key on Nov 2, 16, 30, Dec 16, 22, 31, Jan 7, 14, 21, 27, Feb 2, 9, 18, 25, Mar 11, and 21. The first egg was laid on approximately Dec 14, with a mean lay date of Dec 24. The mean hatch date was estimated to be Jan 13. Only nine nests were initiated on the island, which is slightly better than the two previous years' nest attempts (seven nests). On average, each nest attempt produced 1.11 chicks per nest attempt; this is dramatically better than last year's almost complete failure, and is well above the average 0.98 chicks per nest since 1984. However, only two fledglings were observed flying about the island from Feb 18 through Mar 11.

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 sub-region generally faired poorly: six of ten years surveyed were failures (Table 2). Based on these observations it appears that conditions during the 2004 nesting were above average in the Southeastern sub-region. However, based on previous work (Lorenz et al. 2002) it appears that the quality of the Southeastern sub-region for nesting spoonbills is marginal at best thereby explaining the low overall effort. This is stark contrast to the period prior to the keys land boom when spoonbills nesting in the Southeastern sub-region successfully fledged young every year with an average production of more than two chicks per nest (Lorenz et al. 2002).

Central Sub-Region: East Bob Allen Key

All six colonies in the Central sub-region were surveyed in 2004-05 (Table 1). Nesting success surveys at East Bob Allen Key (EBA) were performed on Oct 26, Nov 11, 24, 29, Dec 14, 28, Jan 11, 12, 19, 25, Feb 2, 10, 15, 23, Mar 7, 17, and 29. Only 8 nests were found on EBA, which is well below average (16 nests since 1984). The first egg was laid on Dec. 16, and the last nest initiated on Jan 8 with the mean laying date estimated at Dec 29. The mean hatching date was Jan 18. Although this nesting effort was not a complete failure like last year (zero chicks per nest attempt), it was well below the average and produced only 0.43 chicks per nest attempt. Only 20% of the nests were successful and the total production for the colony was estimated at only three chicks.

Significant nesting in the Central sub-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 locations suggests that they may opportunistically exploit the primary resources used by the other sub-regions. Spoonbills nesting in the Central sub-region have reasonable access to the entire mosaic of foraging habitats found in the other four sub-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 sub-regions become compromised, the spoonbills of the Central sub-region would also be deleteriously affected (as in this year). This year, fixed wing aircraft followed one adult spoonbill from the Central sub-region to its foraging grounds over ten miles and 30 minutes away. If these foraging grounds do not support abundant and concentrated prey, such a long flight may be too energetically demanding for a spoonbill to make, resulting in lower nest success. This hypothesis will be tested in the future through more following flights with fixed wing aircraft.

Southwestern Sub-Region: Buchanon Keys
All keys in the southwestern sub-region were surveyed multiple times in 2004-05 but only one nest was found on Barnes Key (Table 1). This is the first time since 1963 that a spoonbill has nested at Barnes Key. This nest did produce young, and one chick was observed post 21d hatching. This is a promising find for the Southwest sub-region, whose historic record high was 153 nests in 1979.

Bay-wide synthesis
Bay-wide Roseate Spoonbills nest numbers were below average, indicating a continued downward spiral that began with completion of these major water management structures in the early 1980's. Historically, the Northeastern sub-region was the most productive sub-region of the bay (Lorenz et al. 2002). Since 1982, this sub-region has been heavily impacted by major water control structures that lie immediately upstream from the foraging grounds (Lorenz 2000).

The foraging grounds associated with the Northwestern sub-region were of relatively high quality while those in the Northeastern and Southeastern sub-regions were of poor quality. Nest production rates in these sub-regions reflect these conditions with Sandy Key in the northwest experiencing nest success and focal colonies in the northeast and central regions essentially experiencing a total failure. It is possible that the birds from the Central sub-region were flying the relatively long distances to the Northwest foraging grounds on Cape Sable, however the extra travel time and energetic costs of the longer foraging flights, coupled with foraging in marginal quality habitat, may have manifested itself in low nesting success (Table 2). Spoonbill nest productivity was considered successful in the western bay, while the eastern bay was almost a complete failure. Since water management practices directly affect the foraging grounds in the eastern bay, and those in the west are only indirectly affected, these results suggest a possible negative impact of water management on spoonbills.

This year's observations that the nesting effort failed in the Northeastern sub-region while successful in the Northwestern sub-region indicate that upstream operations continue to damage the Florida Bay ecosystem. Overall, the 2004-05 nesting was generally poor compared to average nest success over the years, however, water management practices exacerbated the problems in the eastern bay resulting in an abysmal production rate compared to the western bay. These data suggest that Florida Bay will continue to decline in ecologic health unless major changes are made to water management practices that affect the region.

ROSEATE SPOONBILL BANDING IN FLORIDA AND TAMPA BAY

The purpose of this banding program is to better understand the movements and dynamics of the state's spoonbill population. We are interested in where the post-breeding dispersers go, and if there is an exchange of breeders between Florida Bay and Tampa Bay, as well as state-wide and regional movements. 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/science/spoonbills.htm).

Methods used in Florida Bay and Tampa Bay
In Florida Bay, Roseate Spoonbill nestlings were banded at 15 out of the 20 colonies in which they nested. In Tampa Bay, we banded spoonbills at the largest colony in the region, Alafia Bank. The 15 colonies in Florida Bay were distributed by sub-region in the following way: four colonies in the Northwest, two colonies in the Northeast, four colonies in the Central, and five colonies in Southeast Florida Bay. Although the Southwest sub-region did have one nest, the nest was inaccessible to banding. Nestlings were banded any where between five days and 20 days of age. We found that a five-day-old chick was the absolute 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

Table 3. Number of ROSP banded in Florida Bay Dec 2004-April 2005, and in Tampa Bay, April 2005. "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	86	200	120 (60%)	11 (6%)	69 (34%)
		Frank	20	42	6 (14%)		36 (86%)
		Clive	2	3			3 (100%)
		Palm	11	26	10 (38%)		16 (62%)
	Northeast	Tern	17	32	11 (34%)	8 (25%)	13 (41%)
		N. Nest	1	2	1 (50%)		1 (50%)
	Central	E. Bob Allen	2	4	3 (75%)		1 (25%)
		Jimmie Channel	6	12	1 (8%)	4 (33%)	7 (58%)
		Calusa	5	11	1 (9%)	8 (73%)	2 (18%)
		S. Park	2	3	2 (67%)		1 (33%)
	Southeast	M. Butternut	4	9	1 (11%)	6 (67%)	2 (22%)
		Stake	1	2		2 (100%)	
		Pigeon	23	57	29 (51%)	2 (4%)	26 (45%)
		East	5	10	2 (20%)	5 (50%)	3 (30%)
		Crane	1	2			2 (100%)
		Florida Bay Total	**186**	**415**	**187 (45%)**	**46 (11%)**	**182 (44%)**
Tampa Bay	**Alafia Bank**		**58**	**105**	**89 (85%)**		**16 (15%)**

banding station. To keep the birds warm and calm, we lined and covered the buckets with towels.

In Florida Bay, a total of three bands were placed on each nestling. A USGS band was placed on the tarsus, and a two-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 sub-region in which the bird was banded (blue for NW, white for NE, red for Central, and yellow for SE). Tampa Bay birds received a red alphanumeric band but did not receive an additional celluloid band. All Tampa Bay birds were banded from one colony (Alafia Bank). 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.

Spoonbill Banding Results

Florida Bay

In all 415 chicks were banded from 186 nests across Florida Bay. Of these 11% were observed dead either before leaving the nest or outside the colony and 45% 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 at Shark Valley, Everglades National Park, in February. Two fledglings arrived at two wildlife rehabilitation centers in the Florida Keys, but both later died.

In the Northwestern sub-region, 271 nestlings from 119 nests within four colonies (Sandy, Frank, Clive, and Palm Keys) were banded (Table 3). Chicks were banded between Dec 19 and Jan 21. Four percent of these chicks were found dead before leaving their nest. Approximately 50% of the banded chicks were observed post-fledging.

In the northeastern sub-region, 34 nestlings from 18 nests within two colonies (Tern and North Nest Keys) were banded (Table 3). Chicks were banded between Jan 20 and April 22. More than 23% of these chicks were found dead before leaving their nest. Only 35% of the banded chicks were observed post-fledging but before they abandoned their natal colony.

In the Central sub-region, we banded 30 nestlings from 15 nests within four colonies (E. Bob Allen, Jimmie, Calusa, and South Park Keys, Table 3). Chicks were banded between Jan 12 and Jan 21. At least 40% of these chicks were found dead before leaving their nest. Approximately 23% of the banded chicks were observed post-fledging but before they abandoned their natal colony.

In the Southeastern sub-region, we banded 80 nestlings from 34 nests within 5 colonies (M. Butternut, Stake, Pigeon, East, and Crane Keys, Table 3). Chicks were banded between Jan 12 and Jan 19. More than 18% of these chicks were found dead before leaving their nests but approximately 39% of the banded chicks were observed post-fledging but before they abandoned their natal colony.

Tampa Bay: Alafia Bank

We began banding spoonbill nestlings at Alafia Bank in 2003 as part of a pilot study for the banding program. We banded 164 birds in April 2003 and 233 birds in 2004, and since then we have received resight reports for over 50 of those birds.

These birds were resighted in Polk, Pasco, Taylor, Palm Beach, St. John's (St. Augustine), Hillsborough (Alafia Bank), and Nassau Counties, and Merritt Island and Ding Darling National Wildlife Refuges. Of those resighted birds, five birds were observed in Georgia. Three birds were observed in the same location in both 2004 and 2005. Three birds were observed in two different locations within the same year.

Spoonbills nested in five colonies in the Greater Tampa Bay area this year. The largest colony in the region is Alafia Bank in Hillsborough Bay, with approximately 200 pairs. Therefore, we concentrated our banding efforts for the Tampa Bay area at Alafia Bank. We banded 105 nestlings from 58 nests (Table 3) during three banding sessions (Apr 1, 12, and 29). Out of the 105 nestlings banded, we have resighted 89 of them alive during 14 resighting surveys of the colony. We do not have any band recoveries for dead birds so the fate of the 16 banded birds is unknown, however, given the conspicuous nature of banded fledglings at Alafia Bank, it seems likely that these chicks did not survive. The mean ratio of marked to unmarked chicks during our resighting surveys was 32.7%. This suggests that the total number of chicks fledged at Alafia was approximately 372 (89 resighted banded chicks made up about 32.7% of the total fledgling population). This suggests a production of approximately 1.9 chicks per nest attempt (376 fledges from 200 nests).

Discussion of Banding Results

The high degree of mortality observed and the low resighting rate of banded spoonbill chicks before they abandoned their natal colony further demonstrates the poor conditions in Florida Bay. That 85% of the birds banded in Tampa Bay were resighted as flighted juveniles not only demonstrates that the techniques used were not harmful but that spoonbills are highly productive when conditions are appropriate for reproduction. It is also interesting to note that rapid growth of spoonbill numbers at the Alafia Colony in Tampa Bay coincides with the rapid decline in spoonbill numbers in Florida Bay since the early 1980's. We will continue to band in both locations using Alafia Bank as control of sorts for Florida Bay as well as 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

Systemic surveys of wading birds were not conducted in Big Cypress, however, nonsystematic searches occurred during routine aerial work. Monthly rainfall fell below the 10-year average between September 2004 and March 2005, resulting in water levels not conducive to rookery establishment. Rainfall in June, however, was the highest on record since 1947. Since late June four great egret rookeries have been found, ranging from an estimated 60-285 nests each. No loss of nests or young from Hurricane Katrina was observed.

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HOLEY LAND AND ROTENBERGER WMAs

Surveys were conducted this year and no birds were detected.

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UPCOMING MEETINGS

Waterbird Society: Oct 12–16, 2005, Jekyl Island, Georgia (for more information visit: http://www.waterbirds.org)

Florida Chapter of The Wildlife Society: Oct 12-14, 2005, Sanibel Island, FL (for more information visit: http://fltws.org)

Fourth North American Ornithological Conference: Oct 3-7, 2006, Vera Cruz, Mexico (for more information visit: http://www.naoc2006.org)

SOUTHWEST COAST

At Marco colony (ABC) in December, Great Blue Herons and Reddish Egrets started carrying sticks, heralding the start of a new wader nesting season. The next so called indicator for coastal nesting, the concentration of waders along the Tamiami Trail west of County Road 29 did not occur this year as last year (see hydrology). Great Egret nesting activity at ABC commenced in February right on time. Small waders did not start until mid May, late for them. By the beginning of June neither Great Egrets nor small herons had many nests, it looked as though at least at Marco the wader nesting was going to be low. Then in mid June, a good number of Great Egrets and small waders appeared on the two nesting islands (A & B) in high breeding plumage and proceeding to nest in good numbers. This second wave of nesting looks as if it will be productive but at this writing it is to early to be sure. At Chokoloskee Bay, Great Egrets went through the same scenario as ABC, apparently the same factors influenced their nesting in colonies 35 km. (22 statute miles) apart. In all, greater numbers of nests at Marco and Chokoloskee Bay, average numbers at the other colonies making this nesting season better (or at least with higher numbers) than the last 10 years along this part of the coast. The only exceptional occurrence this year was the large increase of White Ibis nesting at Henry Key (see below).

Hydrology: Each year I use a long term data base (46 years) of inland water levels recorded at Corkscrew Swamp Sanctuary (CSS) and coastal pond water levels at Rookery Bay (23 years) to compare to the current nesting. Over the years I have found that water levels in RB generally fluctuate in unison with the inland ponds at CSS (36 km. N) and this year was no exception. At both CSS and RB water levels were slightly higher in 2003, this trend continued into 2004 to the point that the driest month was May rather than April as is typical (this is what I wrote last year and it would apply except for the following). Twice as much rain fell in March and then in June there was an unprecedented amount of rain in the area making the inland pond water levels the highest ever for June (second time in 46 years at Corkscrew with rain over 23"). The water along the Trail started the year high and never did dry down enough to concentrate food to concentrate waders making it a different year. This may have caused the low number of nests in the beginning of the season but it is hard to imagine where the food came from to support the second wave of nesting that occurred.

Location and Methods

Rookery Bay (RB): 26°01'51"N 81°44'43"W. Two Red Mangrove islands, 0.22 ha.. Nest census conducted 6/13 and 7/27, walk through, complete coverage; one-person, one hour. Again this year all the wader nests were on the southern island, this is the forth year in a row this has happened.

Marco Colony (ABC) (named, ABC Islands by State of Florida): 25°57'24"N 81°42'13"W. Three Red Mangrove islands, 2.08 ha.. Nest census conducted 4/15, 6/8 and 7/25, walk through, complete coverage; one person, two hours each census.

Henry Key (HK): 25°54'51"(.476)N-81°42'52"(.838)W. One island in Caxambas Pass, 0.8579 hectares (Red Mangrove; a little terrestrial vegetation on sand ridge in center). Walk-through census, 6/23 and 7/26, one person, one hour. This is the third year this colony has been active; in the last two reports I called it Caxambas Pass but have changed the name to conform to a recent chart.

East River (ER): 25°55'39"N 81°26'35"W. Three Red Mangrove islands, 0.25 ha. (about). Nest census conducted 6/4 and 7/30, canoe, complete coverage, one person, one hour; no second wave nesting this year.

Chokoloskee Bay (CHOK): 25°50'43"N 81°24'46"W. Four Red Mangrove islands, 0.2 ha. (about). This year most of the waders in the area used three of the four islands, boat census, two people, one hour, 4/19 and 7/5.

Chokoloskee Pass (CHPS): 25°46'48"N 81°24'26"W. One mostly Red Mangrove (2-3 Blacks) island, 0.5 ha. (about) boat census, two people, one hour, 7/5 and 8/1. This year as last, almost no wader activity.

Note: All of the censuses are conducted during peak nesting and this varies according to species and timing, which accounts for the spread and differences of the dates (and the increase in the number of censuses this year).

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 to the use of the area by the different species is derived from these projects.

Number of wading bird nests in coastal Southwest Florida during 2005.

Colony	GBHE	GREG	SNEG	LBHE	TRHE	REEG	CAEG	WHIB	GLIB	Total
Rookery Bay	0	19	80	4	92	1	45	0	0	**241**
Marco (ABC)	16	191	192	3	338	11	172	0	24	**947**
Henry Key	1	10	34	0	33	2	11	373	0	**464**
East River	0	0	41	5	212	0	0	0	0	**258**
Chokoloskee Bay	1	103	6	0	0	0	0	0	0	**110**
Chokoloskee Pass	11	0	0	0	0	0	0	0	0	**11**
Total	**29**	**323**	**353**	**12**	**675**	**14**	**228**	**373**	**24**	**2031**
Mean (22 year)	**12**	**213**	**295**	**60**	**487**	**5**	**423**	**51**	**44**	**2011**

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

Species Accounts

Great Egret (GREG): As with most years these birds nested mostly at ABC and CHOK and had a promising year (see Table). Notable this season was the high numbers of fledglings in the first part of the season and the large numbers of adults in high breeding plumage at the beginning of the second wave of nesting. This would seem to indicate that the second wave nesters had not nested earlier this year. The sundown censuses show that the numbers of GREG in the area were a little low in March and high in May but in all average for the studies.

Snowy Egret (SNEG): Good numbers of nests at both ABC and RB, a little low at ER; for the year nicely above the mean of the study (see Table). Interestingly for both of the sundown projects this species is running well below the mean, indicating that there not many Snowys in the area, this did not seem to be reflected in the nesting.

Little Blue Heron (LBHE: "This is a species to watch; Audubon wardens in the nineteen thirties recorded them as the most numerous small wader species in South Florida; now in Southwest Florida they are the least numerous. Numbers coming in at sundown and nests are still declining." The preceding is what I wrote last year and I see no reason to change it; nesting and numbers in the area are still going down.

Tricolored Heron (TRHE): These herons picked up their activity this year; both the numbers of birds and the numbers of nests in the area are up considerably (see Table). Encouragingly there are lots of fledglings around the colonies where they are nesting.

Reddish Egret (REEG): The REEG has done very well this year (see Table); of note is that this species usually starts nesting in December and continues right through the nesting season (as Great Blue Herons), on 7/25 two nests with half grown chicks were recorded on the A Island of the ABC colony. Also of interest was the first REEG nest on the C Island of the colony; this nest produced one white fledgling. Less than 10% of the REEG in the area are white and occasionally a white chick will be produced at the ABC colony but it is rare. Only one adult (white) was ever observed tending this nest, which generates the question; were the parents of this fledge both white or mixed?

Cattle Egret (CAEG): "Another species to watch the general decline in nesting is now starting to be reflected in the numbers coming to roost at sundown (one would think it would be the other way)." This is what I used two years ago and last year; this year nesting went up a little but at the night roosts the downward trend continues.

White Ibis (WHIB): I wrote last year, "This species breeds along the coast in such small numbers that it is not reasonable to analyze the nesting. Considerable numbers come into both of the sundown roosts and are in the area a good part of the year." Well this year they made a liar of me. At Henry Key for the last two years they had 24 and 13 nests respectively (last year's nesting was finished by hurricane Charlie (8/13/04)

Rookery Bay (RBSD): Censused bi-weekly with one boat two observers (one a volunteer). The boat is anchored so that most of the birds can be observed flying in one hour before sunset to one half hour after sunset. Recorded, species and numbers of birds flying in (and out during the nesting season). This project is ongoing and started in 1977 which caused considerable damage to this island), good numbers of adults in high breeding plumage moved in along the damaged south edge late in June 2005. By 7/26, there were 373 WHIB nests with anywhere from one egg to a few medium size chicks. This is the largest coastal nesting recorded in the area for 31 years. The sundown censuses showed that at RB this year WHIB were running exactly equal to the mean; at ABC for the first six months of the year they were very low. In July the numbers picked up at ABC (but still were 21% below the 19 year mean) with a large increase of just fledged young. In fact young of the year were 47% above the 19 year mean for July; this indicates they must have had a very productive nesting.

Glossy Ibis (GLIB): Nesting down at ABC again this year (the only nesting location I know of along this coast). There was a big increase at July's, ABC sundown census GLIB were 66% above the 19 year mean. That both GLIB and WHIB jumped considerably in July leads one to speculate that the rise in numbers in GLIB may have been due to a good nesting season as it appears to have been for WHIB. The problem with this is that although it is easy to identify and record WHIB fledglings, for incoming flights of GLIB it is impossible to separate fledglings from adults. A quick look at the project data shows GLIB were exceptionally high in either July or August for six of the 19 years (1990, 95, 96, 98, 02, and 05). In those same years fledgling WHIB also peaked in the sundown censuses; possibly indicating that those years were productive for both species. I doubt this is a coincidence, but do not think the data is good enough to prove it.

This year as in most years there are differences that stand out such as the two months with high rain (March and June), the late and strong second wave of nesting at both ABC and CHOK, the WHIB nesting at HE and the large influx of juvenile ibis in the sundown counts. This year is impressive in that of the nine species addressed here six (66%) were higher than the 23 year mean but this year's mean for total nests was only 20 nests higher than the 23 year mean (see Table). What is extraordinary is that for a coast that is undergoing unprecedented change from human activity these birds are able to survive. One good example is that almost half of the wader nesting occurred at the ABC colony situated on a very busy waterway; only 366 m (1200') from dense residential development and 640 m (2100') from a high heavily used bridge. A good year - in fact the highest number of wader nests for the southwest Florida coast in the last 10 years.

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J.N. “DING” DARLING NATIONAL WILDLIFE REFUGE COMPLEX

Introduction

Wading birds are often used as indicator species for the health of estuaries since they feed at a relatively high trophic level. Wading birds have been studied extensively because of their indicator species status and the awareness that their numbers have drastically declined since the 1930s. Several methods have been used to survey wading birds, but no one method has been accepted by the scientific community. Rather, survey methods are chosen dependent on study objectives, habitat accessibility and availability of funds and labor. Results from various methodologies have shown a high degree of variability, thereby limiting their usefulness in determining trends in population status. Using these standard methods (direct ground counts, aerial surveys) to obtain count statistics (number of nesting pairs of wading birds) that are then used in trend estimation or for other comparisons assumes either that detection probabilities are 1 (if the counts are assumed equal to abundance) or that the detection probabilities are similar for the species and sites being studied (if the counts are treated as indices to abundance). Count statistics (C_i) are related to abundance (N_i) through the detection probability (p_i) (i.e. $E(C_i)= N_i\ p_i$; Lancia et al. 1994) For currently used wading bird survey methods, the detection probabilities are likely variable over space and time due to the asynchronous breeding of wading birds, mixed species nesting, and visibility problems caused by the nesting habitat, i.e., mangroves. Therefore, estimating detection probabilities would provide more accurate abundance estimates, facilitate valid comparisons between sites, and develop a more rigorous scientific data set upon which management decisions can be based.

The first objective of this project is to test the efficacy of a method to estimate detection probabilities for standard survey methods used for nesting wading birds on selected colonies on the J. N. “Ding” Darling NWR Complex. The method will be evaluated with respect to both the ability to carry it out logistically and the associated costs. The second objective is to estimate these detection probabilities and numbers of nesting birds for selected colonies.

Study Sites

Colonial birds nest on six islands that are part of the J. N. “Ding” Darling NWR Complex. Hemp Island (82º9'8.82"W 26º36'2.24"N) and Bird Key (82º13'40.46"W 26º40'3.74"N) are located in Pine Island Sound NWR, while Lumpkin Island (82º3'9.66"W 26º36'5.97"N), Upper Bird Island (82º4'16.54"W 26º33'32.98"N), and Lower Bird Island (82 º 1'59.13"W 26º 30'45.49"N) are part of the Matlacha Pass NWR, and Tarpon Bay Keys (82º4'37.45"W 26º27'19.79"N) are located in Tarpon Bay, part of J. N. “Ding” Darling NWR.

The rookery islands fall into three, broad categories: overwash forests, fringe forests and basin forests (Lugo and Snedaker 1974; Odum et al. 1982). Several islands have more than one type of mangrove forest present. The Tarpon Bay Keys are very low in elevation and are inundated at high tide. Thus these are overwash islands, and the red mangrove is the dominant tree. Lower and Upper Bird Islands are relatively small. They have fringing type mangrove forests around the perimeters. The interiors of these islands are slightly elevated open area, with woody vines (e.g. Nicker bean) and exotics (e.g. Brazilian pepper).

The other three islands are more complex and have higher elevation areas that lie well above mean high tide. These higher elevations support both native and exotic plants. Bird Key, Hemp Island, and Lumpkin Island are fringed by red mangroves, just inland of which lies an elevated berm. These berms have both tropical hardwood species (e.g. gumbo limbo) and invasive exotic plants (e.g. Brazilian pepper) growing on them. Interiors of these four islands are typical basin type mangrove forests. The presence of these basin mangroves sets these islands apart from the others. Basin mangroves are poorly drained and thus are often flooded for long periods of time. The forest soils are fine to coarse sands with shell hash and high organic matter content (Smith, pers. obs.). These interior basin forests were dominated by the black mangrove, with red mangroves abundant only on Lumpkin Island. Hemp Island is further differentiated from the others by the presence of a very high (≈20’ amsl) mound that formed a partial ring around the western side of the island. This mound is covered in a tropical hardwood hammock dominated by gumbo limbo with an understory of Jamaica dogwood.

Methods

Tarpon Bay Key, Bird Key and Hemp Island

On overwash and fringe islands (Tarpon Bay Keys and Bird Key) observers counted nesting birds from the boat using the double observer method (Nichols et al. 2000). Surveys on these islands occurred biweekly, as close to sunrise as logistics allowed. It is assumed that due to the structure and size of these islands, the majority of nesting birds should be visible to the observers from the boat. The boat was anchored a consistent location and distance from the island, in a sufficient number of locations to allow complete visual coverage of the island by observers. Each location was marked with a GPS and assigned a unique identifier. The anchored points were consistent over time. The primary observer identified each nesting bird to species and nest stage (incubation, chicks,

Table 1. Colonial nesting bird survey peak estimates for J.N. "Ding" Darling National Wildlife Refuge Complex, March-June, 2005. Counts reflect the maximum number of nest-tending adults. (DO-double observer/ NM-nest marking)

Island Surveyed	BRPE	ANHI	DCCO	UNKNH	TRHE	LBHE	REEG	CAEG	SNEG	GREG	GBHE	WHIB	TOTAL
Tarpon Bay Keys DO	73	0	31	25	6	13	2	2	14	22	3	0	191
Hemp Island DO	260	0	172	20	46	17	23	8	65	84	11	613	1319
Bird Key DO	138	0	144	5	0	3	3	2	4	4	9	0	312
Upper Bird Island NM	19	3	0	9	88	6	5	43	48	1	2	0	224
Lower Bird Island NM	67	5	38	31	53	2	7	1	29	25	5	0	263
Lumpkin Island NM	0	4	9	37	205	37	1	203	72	6	10	2	587
TOTAL	**557**	**12**	**394**	**127**	**398**	**42**	**41**	**259**	**110**	**142**	**40**	**615**	**2896**

unknown), the secondary observer recorded any nesting birds the primary observer missed and nest stage. Half way through the survey for each island, the observers swapped duties (Nichols 2001).

Hemp Island was also surveyed using the double observer method. However, observers counted nests from established vantage points on the island, being extremely careful not to overlap counting areas.

Lumpkin Island, Upper and Lower Bird Islands
On these islands, observers counted and marked nests to estimate nesting effort, (to subsequently aid in peak number of nests), individual nests and/or nests trees were flagged and marked with a unique identification number. Any new nests located during subsequent visits were also marked. Three to four observers conducted the survey on these islands. The methods on these islands were designed to permit estimation of nesting turnover and total number of nests constructed during the entire nesting season.

Results
Data reported are peak numbers of nests, and analysis has yet to be conducted as data collection just concluded (Table 1). The numbers reported are not likely an accurate representation of nesting effort, as many of the birds exhibited asynchronous nesting (white ibis excluded), and it initially appears that we had two separate nesting efforts. Additionally, the change in methodology precludes any comparison to the 2004 data set. However, the drastic increase in the peak number of wading bird nests observed in 2005 (n=1,933) compared to 2004 (n=269) provides strong evidence that the previous year's counts were not a good index to abundance. Part of the large increase may be attributed to a larger nesting effort in 2005, but it is unlikely, as large numbers of wading birds were observed utilizing the island in previous years, but could not be counted from the boat.

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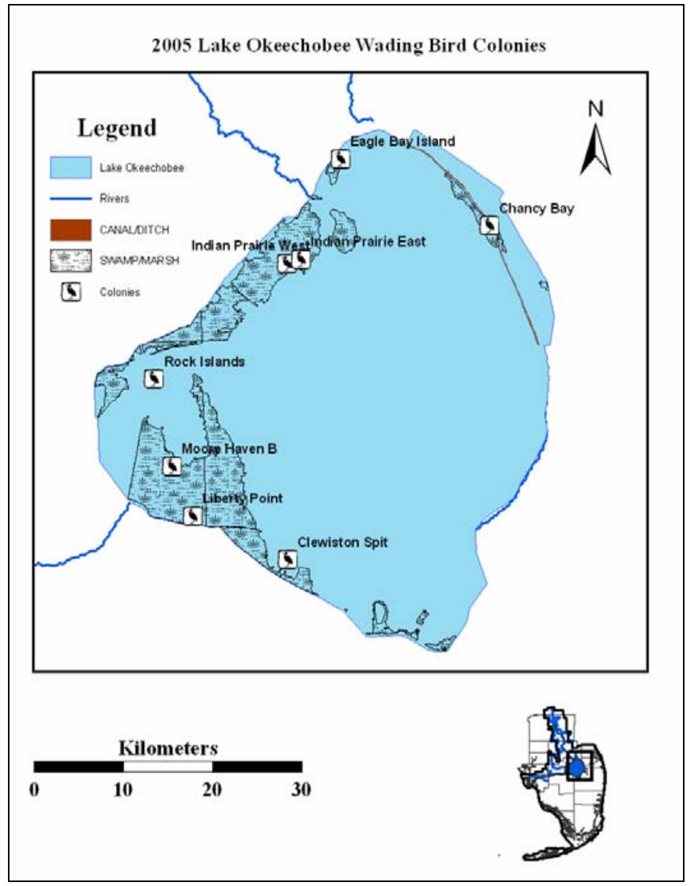
LAKE OKEECHOBEE

Colony counts of nesting wading birds in Lake Okeechobee (hereafter Lake O) were reported by National Audubon Society Wardens sporadically during the 1930 and 1940s. The first systematic aerial survey of Lake O was conducted in 1957 (David 1994). Thereafter surveys were done sporadically until 1977. From 1977 to 1992 aerial surveys were conducted annually (David 1994, Smith and Collopy 1995). In May of 2005, Florida Atlantic University received funding to survey wading bird nests on Lake O as part of the Monitoring and Assessment Plan of CERP. We conducted one complete aerial survey just as the rainy season was beginning and lake levels were rising. To our knowledge, our survey represents the first systematic wading bird nest survey of Lake O since 1992. Because of the late project start, it is possible that some colonies had already abandoned their nests, as they had done in the Everglades.



Methods

During the morning of 3 Jun 2005, two observers surveyed wading bird nests along aerial transects flown with a Cessna 172 at an altitude of 800 ft and a speed of 100 knots. Transects were oriented E-W and spaced at an interval of 1.6 nautical miles. One observer was placed on either side of the plane. Once a colony was located, the altitude was reduced to 300 feet and the colony was circled until a nest count was completed. While circling, one observer counted while the other recorded the data. We report numbers for only birds on nests. In many cases large numbers of birds were perched in the colony but not on nests.

Glossy Ibises were seen in the Chancy Bay colony but were not on nests. Although the monitoring protocol calls for ground counts in addition to aerial surveys, we did not have enough time to conduct a ground count and therefore we probably missed many dark-colored wading birds. We report the lack of dark-colored birds as a missing value rather than as a 0, in contrast to the light birds which we feel confident we saw when they were present.

Results

We located 8 colonies with nesting wading birds (Fig. 1). One colony with only Anhingas was not reported. The number of colonies is within the range reported by Smith and Collopy (1995) and typical of a year with high water. Our surveys showed that nesting this year was dominated overwhelmingly by the Cattle Egret and Great Egret, respectively (Table 1). The former species feeds primarily outside the lake boundaries and the latter species can feed in fairly deep water. The number of Great Egrets was above the historic average (David 1994) whereas the number of nests of other species, as well as the total number of nesting wading birds (excluding Cattle Egrets) was below average.

Table 1. Number of wading bird nests found on Lake Okeechobee, 3 June 2005.

Colony Name	Longitude	Latitude	GREG	TRHE	LBHE	CAEG	Colony total[1]
Clewiston Spit	-80.908533	26.777767	30			20	**30**
Liberty Point	-81.014717	26.82355	85	5		20	**90**
Moore Haven B	-81.03635	26.874317	600	15	8	25	**623**
Rock Islands	-81.0543	26.962617	655	2		300	**657**
Indian Prairie West	-80.901083	27.075633	20	6	1	0	**27**
Indian Prairie East	-80.885133	27.0795	90			740	**90**
Eagle Bay Island	-80.837133	27.179183	110			1200	**110**
Chancy Bay	-80.670867	27.108117	0			700	**0**
Total nests			**1590**	**28**	**9**	**3005**	**1627**

[1]Total excluding Cattle Egrets

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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, in press). 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 historic (pre-channelization) hydrologic (i.e., discharge and stage) characteristics through modifications to regulation schedules of headwater lakes. When completed, the project is expected to produce seasonal flood pulses and recessions that are favorable for wading bird reproduction. To date, approximately 1/3 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 evaluation program, we performed systematic aerial surveys to search for nesting colonies within the floodplain and surrounding wetland/upland complex of the Kissimmee River from the S65 structure at Lake Kissimmee southward to the S65-D structure (Fig 1). Aerial surveys (n = 4) were conducted on March 21, April 21, May 19, and June 28, with observers on both sides of a helicopter flying at an altitude of 800 ft 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. Once a colony was located, the number of active nests was 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 and no ground surveys were conducted.

Results

Three colonies containing an estimated 516 total nests were observed during 2005 aerial surveys (Table 1). Of this number, 400 were cattle egrets and 30 were Anhingas; long-legged wading birds (great egret, great blue heron) constituted the remainder of nests. Numbers of great egret nests peaked during the April 21 survey for both Cypress West and Orange Grove colonies, while the number of great blue heron and anhinga nests was highest during March 21 surveys. The Pine Island colony, which appeared to be entirely composed of cattle egrets, was first observed during the June 28 survey. No colonies were found during surveys in 2004 that employed identical protocols.

Table 1. Peak number of wading bird nests along the Kissimmee River, Mar 21 – Jun 28, 2005

Latitude	Longitude	Colony Name	GREG	CAEG	GBHE	ANHI	Colony Total
27 37.791	81 06.442	Pine Island	-	400	-	-	**400**
27 32.088	81 16.527	Cypress West	21	-	-	-	**21**
27 21.076	81 04.649	Orange Grove	60	-	5	30	**95**
Total Nests			**81**	**400**	**5**	**30**	**516**

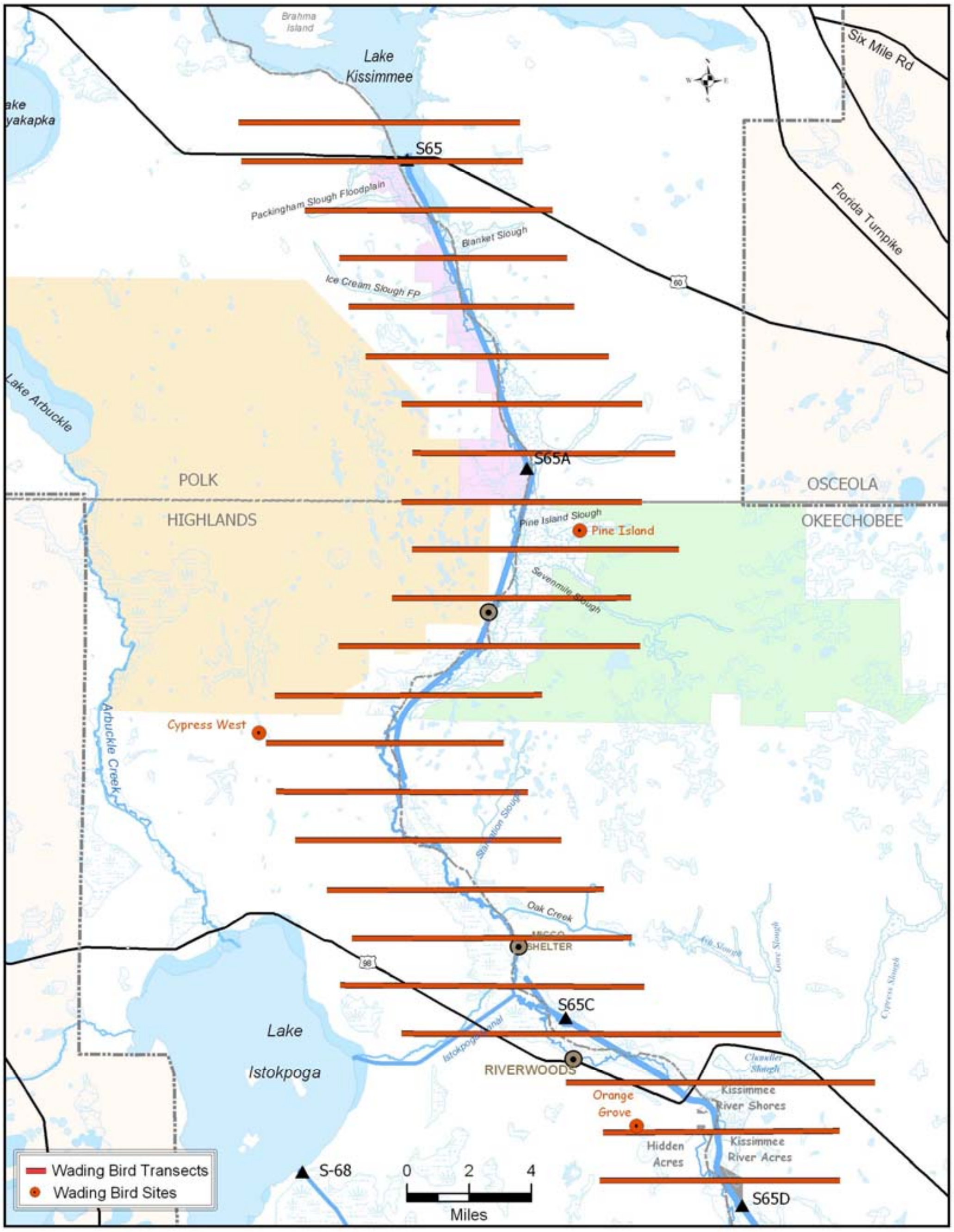

Figure 1. Transect layout and locations of 2005 nesting colonies within the Kissimmee River floodplain and surrounding wetland/upland complex.

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WADING BIRD ABUNDANCE (FORAGING & NESTING)

EVERGLADES NATIONAL PARK AREA

Methods

Systematic reconnaissance flights (SRF's) were performed monthly between Dec 2004 and May 2005. Flights were conducted over three to four consecutive days using a fixed-wing Cessna 182 at an altitude of 60 m. The area covered, included Everglades National Park and the southern region of Big Cypress National Preserve. The area was surveyed using transects oriented E to W and separated by 2 km (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 the 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 stripe width were extrapolated to the rest of the 4Km^2 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 stripe were extrapolate to the rest of the cell by dividing the birds observed by 0.075.

Results

During the survey period (December 2004 – May 2005) an increase of fifteen-percent in the abundance of wading birds was observed, for all the species combined, in comparison to the previous year (Figure 2). This increase in the number of birds observed in 2005 just adds more positive slope to the overall increasing trend observed from 1985 to the present, when a linear regression model is used to fit the data.

Figure 3 shows that the numbers of all the nine species of birds increased in relation to those observed in 2004. Glossy Ibis (GLIB) increased 70%, Wood Stork (WOST) 56%, Small Dark Herons (SMDH) 46%, Small White Heron (SMWH) 35%, Great White Heron (GWHE) 27%, Great Blue Herons (GBHE) 11%, White Ibis (WHIB) 8%, Great Egrets (GREG) 7% and Roseate Spoonbill (ROSP) with 6% increase. Figure 3 also shows the annual estimates of the number of birds by species from 1985 to the present.

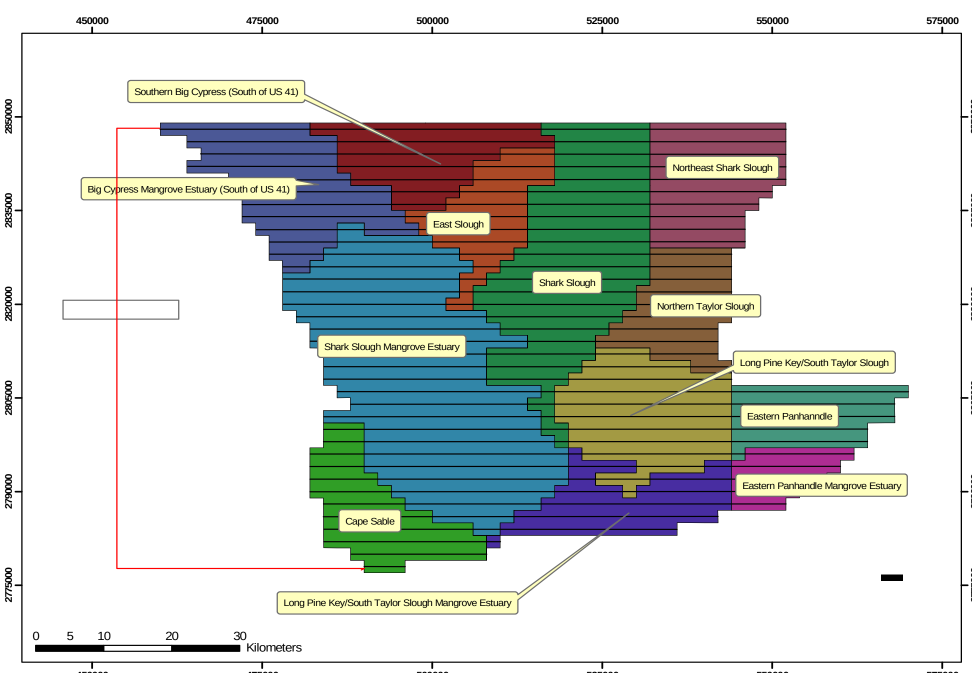

Figure 1. Map of ENP and southern Big Cypress National Preserve with sampling transects and drainage basins.

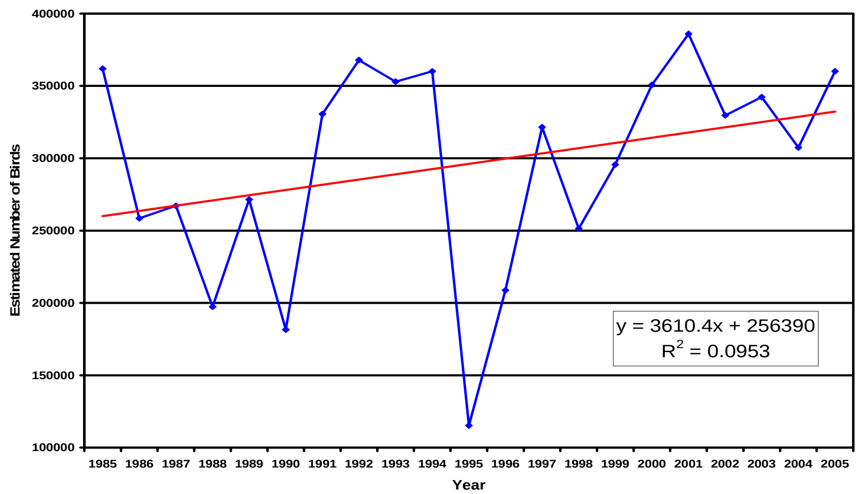

Figure 2. Estimated number of wading birds (all species pooled) observed from the months of Dec-May from 1985 to 2005. Red marks represent years with estimated missing data for one month.

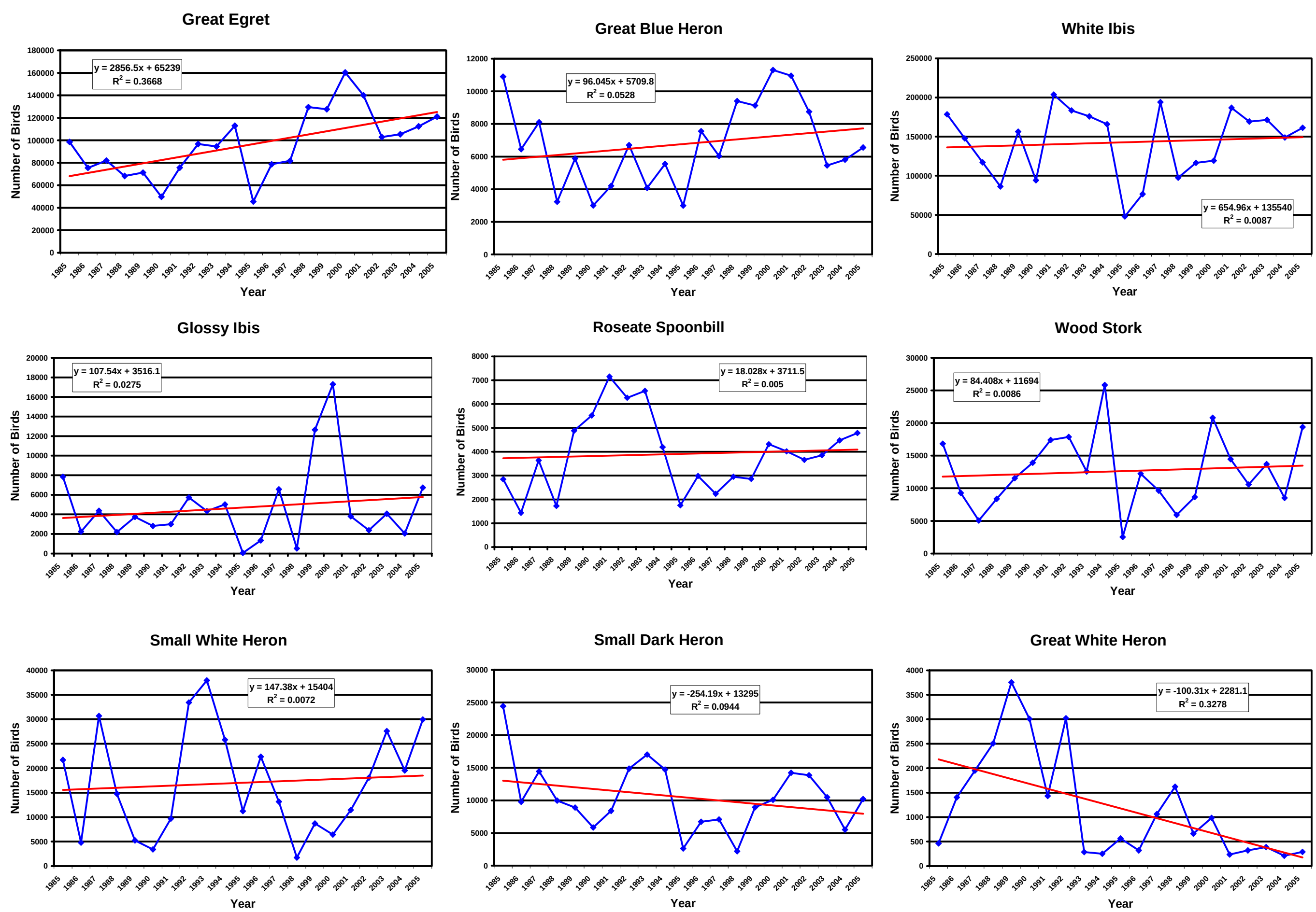

Figure 3. General trends in wading bird populations based on the total number of birds estimated during the surveys performed each year in the Everglades National Park from 1985 to the present.

Once again, linear regression models were use to determine the general trend for each species. A tendency to increase in the number of birds estimated for GREG, GBHE, GLIB and WHIB was observed. Some species such as ROSP, WOST, and SMWH showed a stable trend; while only two species SMDH and GWHE, showed tendencies to decrease. Although this type of analysis can provide with an idea of the general trends observed for each species or groups of birds through those years, additional studies and data analysis will be necessary in order to evaluate the significance of these observations and its relevance to the wading bird populations at the Everglades National Park.

The maximum density of birds occurred this year during the month of March (see Table 1). During this month, also was observed the greater numbers of WHIB, WOST and SMWH. Other species such as GREG and GLIB reached their maximum numbers in January, while ROSP and GWHE peaks were in May. December was the month when more GBHE were observed, while January was highest for SMDH. The month of April was the month with the least number of birds. It was during this month that the lower numbers of birds occurred for all the species but for WHIB which showed the minimum number of birds in May.

Table 2 shows the distribution and abundance of wading birds in the different drainage basins in what could be considered a year with normal precipitation throughout the survey season. Shark Slough (SS) was the basin where most of the birds (27%) were found, followed by Shark Slough Mangrove Estuary (SSME) with 17%, and East Slough (ES) with 12%. These three basins combined, made up 56% 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) with less than 2% and Eastern Panhandle with a little more than 2%. Most birds were concentrated in Cape Sable (CS) and SSME during December. By January, as the water recedes, a great increase in the number of birds in the SS basin was noticed, despite that SSME still had the largest number of birds. In February, as water continued to recede, a large number of birds moved to the SS basin where high numbers persisted until the end of the season.

Table 1. Estimated abundance of wading birds in the Everglades National Park and adjacent areas, Dec 2004- May 2005.

Species	Dec-04	Jan-05	Feb-05	Mar-05	Apr-05	May-05
GREG	21,106	27,441	26,335	22,793	11,225	12,154
GBHE	1,636	1,272	1,169	1,467	367	648
SMDH	1,529	1,854	2,717	2,522	562	1,032
SMWH	5,134	7,454	4,197	6,428	3,178	3,562
WHIB	21,873	33,831	39,228	42,040	12,785	11,426
GLIB	247	2480	1875	1147	213	780
WOST	1,365	3,801	3,702	5,534	1,976	3,012
ROSP	554	646	1,438	756	548	844
GWHE	61	28	62	49	21	68
Total Abundance	**53,505**	**78,807**	**80,723**	**82,736**	**30,875**	**33,526**

Table 2. Estimated abundance of wading birds (all species combined) for the different drainage basins in the Everglades National Park, Dec 2004 – May 2005.

Month	SBC	BCME	SS	NESS	ES	SSME	NTS	LPK/STS	EP	CS	LPK/STS M	EPME	Total
4-Dec	7,804	4,284	3,469	1,120	2,879	10,213	462	2,720	4,025	13,717	2,128	684	53,505
5-Jan	3,660	6,340	15,340	1,843	15,411	19,394	338	2,746	1,316	5,886	3,873	2,660	78,807
5-Feb	8,219	11,739	21,753	3,310	13,178	8,336	1,483	3,734	801	3,194	3,903	1,073	80,723
5-Mar	7,340	5,214	26,246	7,474	7,716	19,145	91	2,503	1,152	1,971	2,814	1,070	82,736
5-Apr	1,236	991	12,345	1,732	2,132	3,014	14	1,662	797	1,846	3,301	243	29,313
5-May	1,305	2,553	19,546	1,794	2,737	793	0	1,766	163	1,438	2,906	87	35,088
Total	**29,564**	**31,121**	**98,699**	**17,273**	**44,053**	**60,895**	**2,388**	**15,131**	**8,254**	**28,052**	**18,925**	**5,817**	**360,172**

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

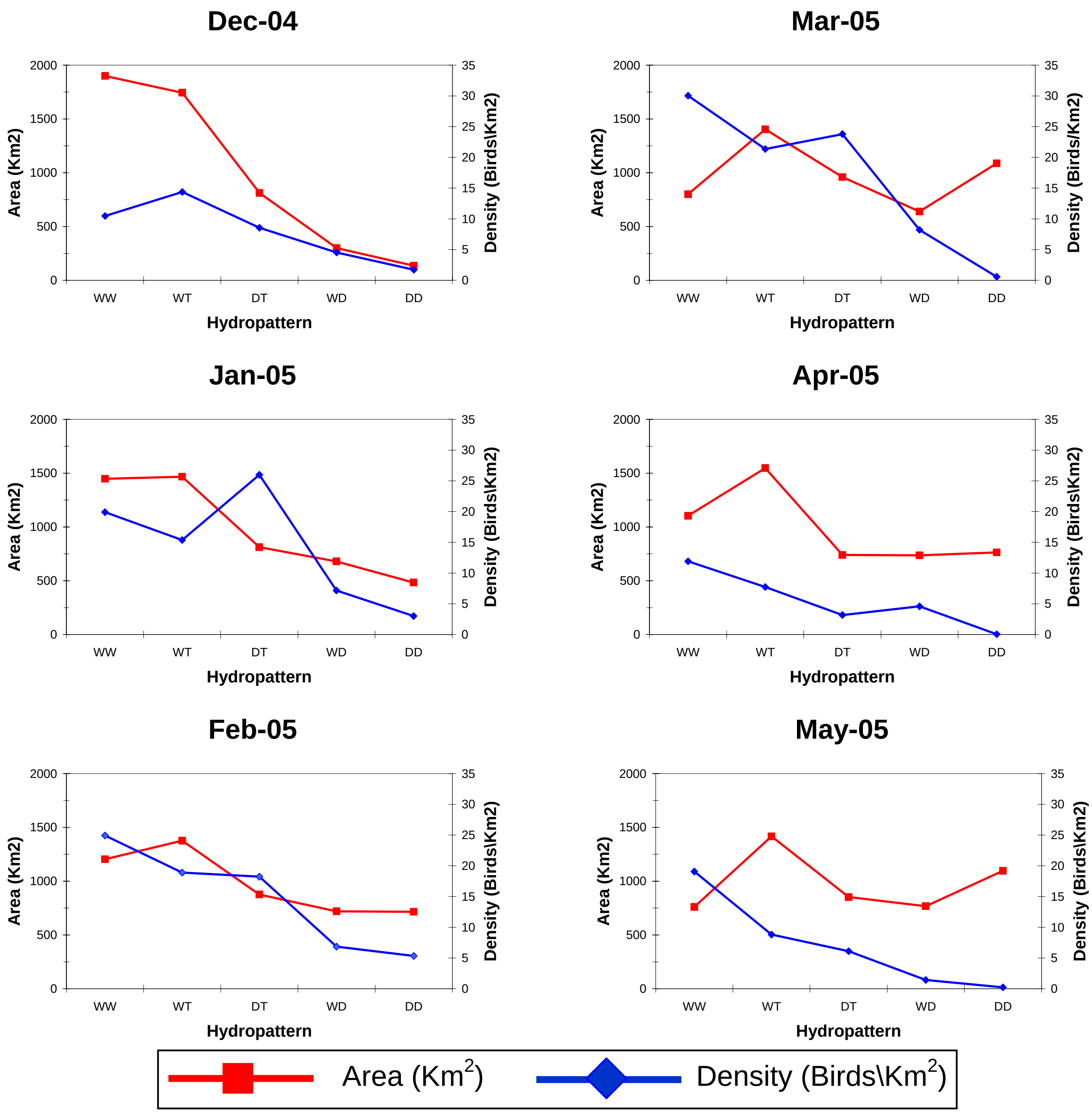

Figure 4. The areal extent and density of wading birds (all species pooled) in each surface water category. WW = continuous surface water; WT = mostly wet with scattered dry areas; DT = mostly dry with small scattered pools of water; WD = dry with water only in solution holes; DD = dry surface.

Considerable changes in hydropatterns and bird distributions were observed throughout the season as shown in Figure 4. From December to May, a gradual reduction in surface water covered by the WW category was observed, except in April. Despite the reduction in surface water, the hydro pattern WT which experience a reduction in the area covered from December to January, stayed almost unchanged until the end of the season. Most of the changes in area covered by the different hydro patterns took place at the extreme categories either WW or DD, while modest changes occurred in the intermediate ones. From December to January, highest densities of birds were observed in WT or DT areas where water depth was suitable for them to forage successfully. As water depth decreases during the following months, densities at the WT and DT areas began to decrease while densities at WW gradually increased. By February, the highest densities of birds were observed in WW areas. Despite the WW areas were covered completely by water, low water levels made these new territories accessible to foraging birds.

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WADING BIRD SURVEYS FOR WATER CONSERVATION AREAS, BIG CYPRESS NATIONAL PRESERVE, AND HOLEY LAND WMA

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 February to July 2005. 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. High resolution digital video linked with GPS recorded each transect.

Results

In the Water Conservation Areas, monthly wading birds abundance was higher during 2005 than 2004 from February to April. In June and July bird numbers were greatly reduced due to heavy rains. During 2005 in the Water Conservation Areas, the wading bird monthly relative abundance generally decreased from February to July. In the Big Cypress National Preserve, monthly wading bird abundance was generally lower in 2005 than 2004. In the Big Cypress National Preserve, monthly wading bird abundance peaked in February then declined until May and increased in June and July. In the Holey Land Wildlife Management Area, wading bird monthly relative abundance remained low for much of the survey period. Final reports from 1996 to 2004 are currently available.

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Table 1. Water Conservation Areas wading bird estimated abundance, 2005.

Species	Feb	Mar	Apr	May	Jun	Jul
GREG	37,760	19,847	15,853	15,773	8,467	1,380
GBHE	1320	893	687	600	433	100
SMDH	673	667	593	273	187	27
SMWH	447	320	597	493	200	60
WHIB	69,287	59,787	23,940	23,360	807	427
GLIB	0	2,600	893	80	13	0
WOST	607	300	1,573	320	220	7
ROSP	0	27	27	13	0	0
GWHE	827	1,413	1,407	1,013	1,273	273
Totals	**110,921**	**85,854**	**45,560**	**41,927**	**11,600**	**2,273**

Table 2. Big Cypress National Preserve wading bird estimated abundance, 2005.

Species	Feb	Mar	Apr	May	Jun	Jul
GREG	5,160	3,887	2,087	2,040	3,913	3,733
GBHE	133	113	53	0	20	7
SMDH	127	93	13	33	113	460
SMWH	140	147	0	160	53	20
WHIB	13,840	5,307	800	147	667	1,527
GLIB	0	27	0	0	93	87
WOST	820	293	187	513	47	427
ROSP	0	0	0	0	0	0
GWHE	260	173	127	40	300	460
Totals	**20,480**	**10,040**	**3,267**	**2,933**	**5,207**	**6,720**

STATUS OF WADING BIRD RECOVERY – 2005

Since 1995 the status reports have provided annual summaries of the parameters of wading bird nesting patterns that have been selected for tracking responses by wading birds during and following implementation of the Comprehensive Everglades Restoration Plan (CERP). These key parameters are, (1) numbers of nesting pairs, (2) location of colonies, (3) timing of nesting, and (4) the occurrence of large "super colonies". The five species of wading birds that were the most common and consistent occupants of the historical nesting colonies in the greater Everglades basin are reported in these status reports. These are, Great Egret, Snowy Egret, Tricolored Heron, White Ibis and Wood Stork.

The monitoring and assessment teams of RECOVER have set preliminary restoration goals for each of these key wading bird parameters. These goals are described in several RECOVER documents dealing with the CERP system-wide monitoring plan, the CERP performance measures, and the recommended CERP interim goals and targets. In general, however, these goals are for, (1) a substantial increase in the total number of nesting pairs of these five species, as shown by three-year running averages of nesting numbers, (2) a recovery of large nesting colonies in the region of the traditional "rookeries" in the southern, mainland estuaries downstream from Shark Slough (i.e., in the region of the former Broad River, East River, Lane River, Rookery Branch and Cuthbert Lake colony sites), (3) a return to early dry season nesting (November – January) by Wood Storks, and (4) an increase in the frequency of supernormal nesting events (i.e., "super colonies"). The preliminary restoration goals for these parameters have been influenced by wading bird nesting patterns that were known in the Everglades basin during the period, 1930s-1940s, and which were summarized by Ogden (1994. Everglades. The ecosystem and its restoration. S.M. Davis & J.C. Ogden, editors. St. Lucie Press, Delray Beach, FL).

Up to this time the primary value of the annual status reports has been to characterize the status, variability and trends of wading bird nesting patterns prior to the initiation of the CERP projects. Thus the information presented here, which actually includes data going back to the 1986 through 1988 three-year period, is serving to describe the "base condition" for CERP, i.e., the pre-CERP condition against which CERP-influenced changes will be detected and assessed relative to the goals of the restoration plan.

Results
The 2005 colony surveys, as in other years, provided information for each of the key parameters for birds nesting in the three Water Conservation Areas and mainland Everglades National Park, and not for the Big Cypress Basin (which was not surveyed) and Lake Okeechobee (which was surveyed only towards the end of the season).
Numbers of pairs: The total of approximately 29,425 nesting pairs in 2005 for the five species is substantially less than in recent years, reflecting the regional reduction in nesting effort this year due to high water conditions (see 2005 WCAs and ENP survey results elsewhere in the South Florida Wading Bird Report for details). The breakdown for the five species is 5,618 pairs of Great Egrets, 3,029 pairs of Snowy Egrets, 388 pairs of Tricolored Herons, 20,139 pairs of White Ibis, and 253 pairs of Wood Storks. A comparison of the 2003-2005 running averages for these species with previous years back to 1986-1988 is shown in the attached table.
Colony Locations: Continuing the pattern of recent years during which time most wading birds have nested in the central and northern Everglades (in contrast to the historical pattern), only 5.5% (1,620 pairs) of the nesting birds in 2005 were in colonies located in the southern estuarine region.
Timing of Nesting (Wood Storks): Although specific dates of colony formations are not provided in the survey reports, it appears that no Wood Stork colonies formed prior to February.
Super Colonies: The comparatively low nesting effort by all species in 2005 means that no supernormal nesting event occurred, by whatever definition one might use to describe such events.

Discussion
Although the three-year running averages for the five species dropped below the values for recent years, especially for Snowy Egrets/Tricolored Herons combined, and for Wood Storks, one comparatively poor year of nesting is not an indication of any change in nesting patterns. And although the percentage of pairs nesting in the region of the southern mainland estuaries continues to be low, the number of estuarine colonies and their locations are of interest. The survey report from Everglades National Park shows a total of eight active estuarine colony sites (including Frank Key; these birds feed mostly to the north on the mainland), which represents an increase in estuarine sites (that apparently began in the 2004 season). Included in the "new" sites are Alligator Bay, Broad River, Rookery Branch and Otter Creek; all of these are traditional nesting locations from years past.

The three-year running averages of the number of nesting pairs for the five indicator species in the Everglades.

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

One new challenge for the RECOVER team that is responsible for setting and refining restoration goals for CERP has been created by requirements in the Federal Programmatic Regulations ("ProRegs") for CERP. The ProRegs assign RECOVER with the task of recommending two forms of interim goals for select CERP indicators. Applied to wading birds, the assessment team must create a set of predictions (ideally using models) of the performance of the four key parameters of wading bird nesting patterns - for each five year interval throughout implementation of the currently approved version of CERP. And for each of these same five year intervals, the team must also create a separate set of values called "desired levels of performance" that lays out the pathway over time that the indicator should follow if it is to achieve its desired restoration condition following the completion of CERP. These two sets of values will be used by Congress, the implementing agencies, and the public, to track how well CERP is achieving its goals during the implementation of the plan. For any given indicator (parameter) the two sets of values will be similar over time if the currently approved version of the plan is correctly designed to achieve full restoration for that indicator. The values will follow a different track over time if the plan still requires improvements. Differences between actual performance as monitored in the field and the two sets of interim goal values – over time – will help to trigger the CERP adaptive management program (i.e., make improvements in the plan). The specific challenge is to develop a means for calculating or estimating the desired levels of performance throughout implementation of CERP. Since these values are not derived from model predictions for a specific plan, the actual patterns of wading bird nesting behavior described over time in these South Florida Wading Bird Reports may be important information for the RECOVER team, as a basis for estimating desired, future trends under a range of hydrological conditions.

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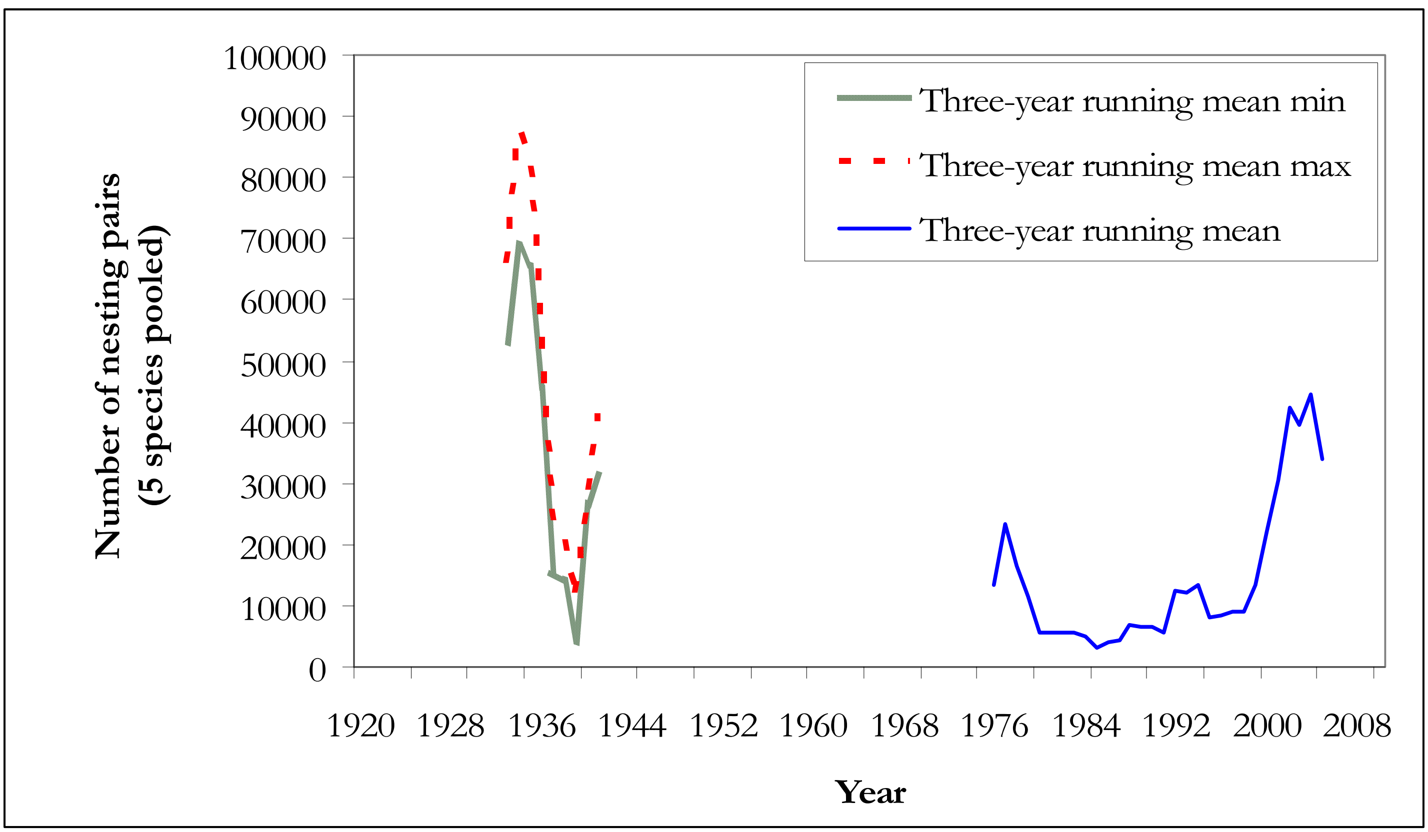
Three-year running averages for total number of nesting pairs for the 5 indicator species in the mainland Everglades basin. A low and high value was calculated for each 3-year period, 1931-1941, using low and high estimates of annual nesting.



SPECIAL TOPICS

PHYSIOLOGICAL CONDITION OF GREAT EGRET AND WHITE IBIS CHICKS

We present preliminary results from our 2005 pilot study, focusing on white ibis and great egret nesting success and chick physiological condition in response to system-wide levels of prey availability.

Methods

We randomly selected nests at Colony 111 (Loxahatchee National Wildlife Refuge) and Alley North (Water Conservation Area 3). We visited hatched nests approximately every 5-7 days and recorded standard morphometric measurements [total length, tarsus length, wing chord, bill length (±1 mm), and mass (±1 g)] for individual nestlings. We palpated the pectoral muscle to subjectively score pectoral mass (Heath et al. 2003) on a scale of 1-5 (1: prominent keel, -5: muscle greater than keel). Chick ages were determined from De Santo et al. (1990) and McCrimmon et al. (2001). We minimized disturbance and abandonment bias by limiting time spent at either individual or clusters of nests to approximately five minutes and wore camouflage (Riffell and Riffell 2002). Nest success was defined as at least one chick fledging, and date of nest failure date was calculated as the mid point between the last visit when at least one chick was alive and the succeeding visit when no chicks were present and the nest was assumed to have failed. Because nest survival (age at failure) data did not meet normality and equal variance assumptions (Levene's test: JMP 2001) we used Wilcoxon non-parametric tests for analyses comparing differences between great egret and white ibis. We divided the chick age at nest failure into 10 day sections and used analysis of variance (ANOVA) to test for differences within species. We used a t-test to examine pectoral score differences between species.

Preliminary Results

Apparent nest success for marked nests varied from low to none; 20% of great egret nests fledged at least one chick, while none of our marked white ibis nests survived to fledge any chicks. However, although our white ibis nests did not fledge young there were a fair number of young produced in both colonies. Great egret and white ibis time to nest failure differed (T = 2.54, P = 0.01), averaging 44.5 days ± 5.4 SE (N = 12) and 30.9 days ± 0.8 SE (N = 71), respectively. Mean time to fledge for successful great egrets nests was 70 days ± 5.5 SE (N = 3).

Chick masses increased progressively and similarly (P = 0.12) for both species (Fig. 1), however, mean pectoral scores remained similar throughout the study period; great egret ($F_{2,45}$ = 2.25, P = 0.09), white ibis ($F_{2,9}$ = 3.03, P = 0.11). Pectoral scores did not differ (t = 1.8, P = 0.07) between great egret and white ibis chicks, averaging 3.2 ± 0.2 SE.

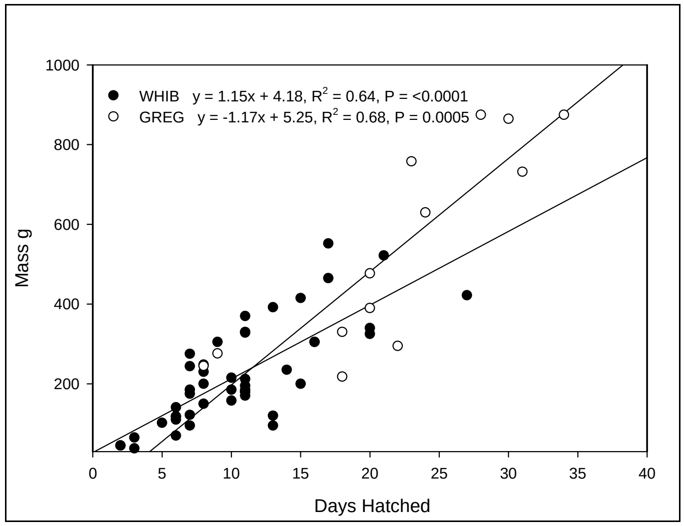


Figure 1. Relationship between mass of great egret and white ibis chicks and days hatched at Alley North and Loxahatchee Colony 111.

Discussion

Differences between great egret and white ibis nest success likely stem from their relative abilities to withstand hydrological variability (Frederick and Collopy 1989). White ibis exhibiting pulsed abandonment behavior regularly, where within 2-3 days of heavy rain events those nests with either young chicks (<10 days) or eggs were abandoned at high rates. Great egret nests appeared to be able to endure these conditions with less severe consequences. These responses are likely the result of the foraging apparatus of great egrets, which makes them less sensitive to hydrologic constraints (Gawlik 2002) and allowed them to capture sufficient prey to maintain provisioning to nests. Determining whether great egrets and white ibis are able to re-nest after hydrological reversals and if so how often will be an important component of future research. The use of radio-tagged individuals will allow us to examine this poorly understood component of wading bird nesting ecology in subsequent years of research.

Measurements of chick physiological parameters during this pilot study also suggest some fundamental differences between species for both mass gain and overall physiological condition (albeit not significant). Great egrets tended to increase mass more rapidly than ibis, and had somewhat higher pectoral scores. These differences are consistent with the pattern of nesting success for great egrets and likely stem from the same reason. However, overall both species' chicks had stable pectoral scores throughout the breeding season. We expected that chicks would increase physiological condition with age in preparation for fledging as in the case of mass and lipids (Ricklefs and Schew 1994). Future research will examine whether these measures of physiological condition (pectoral scores) actually increase throughout the nesting period when prey availability conditions are more optimal. Understanding how these different physiological components influence chick and nest survival will advance our understanding of how hydrology influences wading bird reproduction. These components may also be important determinants of chick survival after fledging, during their first year when mortality levels are high in most wading bird species.

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WOOD STORK PROVISIONING RATES & NEST ATTENDANCE AT PAUROTIS POND, EVERGLADES NATIONAL PARK

Low numbers of nesting wood storks in Everglades National Park (ENP) during the 2005 nesting season suggest that breeding conditions were poor. A leading hypothesis for poor breeding conditions in the Everglades is that prey availability was reduced because of rainfall driven reversals in the dry season water recession. Parental activities of Wood Storks, such as nest attendance and food provisioning rates, are thought to reflect the availability of prey in the landscape and this project seeks to identify relationships between the two. We examined parental activities of Wood Storks at the Paurotis Pond colony during the 2005 breeding season. Provisioning rates and parental nest attendance information were recorded for five nests during early, mid, and late nest stages, and before and after rain events.

Methods
Nests were observed from the Paurotis Pond parking lot at a distance of approximately 100 m with 20-60x spotting scope. Only nests that were clearly visible from the observation area where adult and chick activities were discernible were included in this study. Observation bouts ranged from 4 to 6 continuous hours between 0700 and 2000. A total of 425 nest hours of observation was conducted over 29 survey days. Observations were conducted from 7 April – 8 June, covering the period when chicks were less than one week old until they fledged. Provisioning rates and nest attendance data were examined at three stages of the nesting season (early, mid, and late season). Chick age stages were divided according to Kahl (1962) who found that nestling Wood Storks show a linear increase in daily food intake at 0-22 days, plateau of maximal food intake 23-45 days, and a linear decrease in daily food intake at 46-60 days, or when chicks fledge. Nest attendance and provisioning rates were recorded and these data were compared to water level data taken from water gauge NESRS2 in northern ENP. Nest attendance was defined as the percentage of the survey period that at least one adult was either standing or sitting on the nest or standing directly adjacent to the nest. Provisioning rate was defined as the number of food deliveries per nest hour. Differences in nest attendance and provisioning rates over the three nest stages and between successful and unsuccessful nests were examined using Kruskal-Wallis tests. We used a one sided Chi-square test to examine differences in probabilities of decreasing provisioning rates after increasing water levels. Data from water gauge NESRS2 was used because it detected the water recession reversals brought on by five major rain events, which occurred on 4 April, 3-5 May, 15 May, 21-22 May, and 28-29 May (which marked the end of the dry season). This gauge seemed to accurately reflect the water fluctuations throughout the Everglades system (non-tidally influenced areas), but not necessarily exact water depth.

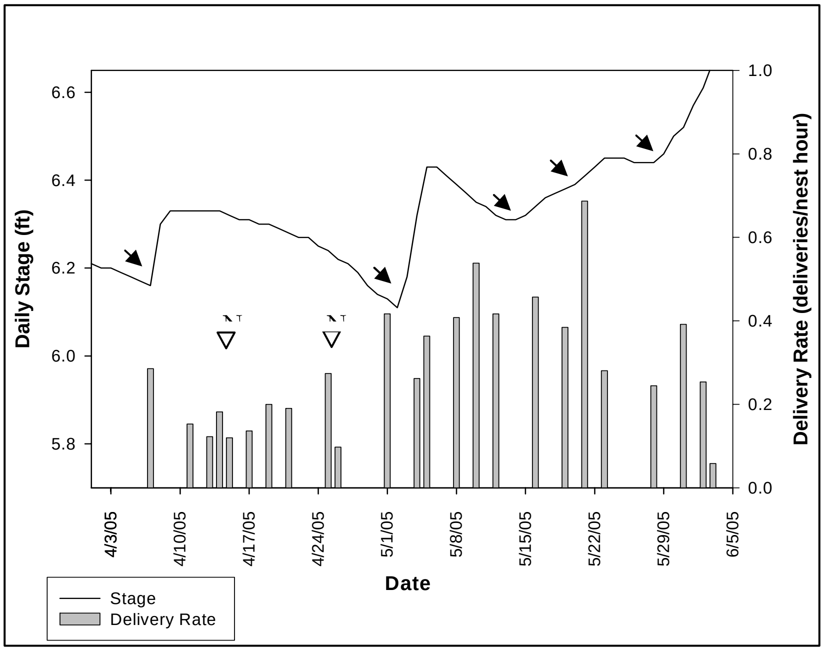

Figure 1. Daily Water Stage (Gauge NESRS2) and Provisioning Rate throughout the chick raising period. Arrows indicate a reversal in seasonal dry down. Triangles show failures of Nest 1 and Nest 2.

Results

Nest Success

Monitored nests had a 60% apparent success rate with three of the five nests successfully fledging young. Successful nests fledged on average 2.3 young/nest. Fledging (final departure from nesting colony) of all observed nestlings occurred by 8 June. Nest failures occurred at two nests in the early nest stage (14 April and 25 April) when young were approximately one and three weeks old. Fledging success rate for all monitored nests (including successful and unsuccessful nests) was 63.6% (mean 1.4 young/nest) with seven of the potential eleven young fledging.

Provisioning Rates

Provisioning rates for all observations are shown in Fig. 1. Preliminary data show that provisioning rates temporarily decreased when water level increased ($T_1 = 1.93$, df = 1, $P < 0.05$). Water level reversals occurred five times between chick hatching and fledging and provisioning rates were taken before and after each water level fluctuation.

Combined data from all five nests showed varying provisioning rates during the three nest stages. Provisioning rates increased significantly (Kruskal-Wallis = 33.02, df = 2, P = 0.0001) from 0.12 ±0.02 SE (early season) to 0.40 ±0.03 SE (mid-season). Rates then decreased somewhat to 0.32 ±0.05 SE (late season) (Fig.2).

Provisioning rates for failed and successful nests showed no significant difference during the first nest stage (Kruskal-Wallis = 6.38, df = 3, P = 0.09).

Nest Attendance

Parental nest attendance for pooled nests dropped dramatically during the late nest stage (Fig. 3). During nest stages 1 and 2 at least one adult was present at the nest for 80.9% ±4.57 SE

Parental attendance at individual nests showed no significant difference between successful and failed nests (Kruskal-Wallis = 7.34, df = 3, P = 0.06). However, mean attendance rate for Nest 2, which failed when chicks were three weeks old, was 57% whereas the lowest successful attendance rate was 74% during the first three weeks (Fig. 4).

Discussion

Low numbers of Wood Storks (<50 pairs) nesting at Paurotis Pond during the 2005 breeding season suggest that foraging conditions in the surrounding landscape were not ideal. The two unsuccessful nests may have failed due to predation, although little data from Nest 1 was collected before it failed. Given the sudden disappearance of the young (overnight) and low parental attendance rates of Nest 2, predation was likely cause of this nest failure. Fledging rates among successful nests (2.3 fledglings/nest) were similar but slightly lower than those seen by Kahl at Corkscrew Swamp in 1960, who reported 2.9 fledglings per nest (Kahl 1964). Fledging success of all nests were also lower (1.4 fledglings/nest) than those previously reported for ENP colonies (mean 2.0 fledglings/nest) (Ogden et al. 1978).

Lowered provisioning rates following a dry down reversal suggest that landscape level prey availability in potential foraging areas decreased, at least temporarily, after rainfall events. Marked water level increases interspersed throughout the breeding season may have interrupted the storks' ability to utilize the previous days' suitable foraging sites, thus exhibiting temporary decreases in provisioning rates. Further analysis is needed to determine the magnitude and duration of this relationship. Small decreases in provisioning rate, especially when rates are already low, may be detrimental to a very young chick that depends on frequent feedings. Missed feedings may weaken chicks during the same time they are battling inclement weather and longer periods without parental care. Kushlan et al (1975) found that storks will abandon nests after a 3 cm rise in water level during the first two months of nesting. All these factors indicate that chicks are most at risk due to abandonment, starvation, and predation during the first three weeks after hatching. Both nesting failures we observed occurred during the first nestling stage after a hydrological reversal (the first reversal to occur after hatching). None of the monitored nests failed after the chicks were three weeks old, even after four additional water level increases.

Although a temporary decrease in provisioning rate was seen following an increase in water level, monitored nests showed steadily increasing provisioning rates throughout the season until approximately two weeks before fledging. Increasing provisioning rates throughout the season concur with findings by Bryan et al. (2005); however, feeding rates have also been observed to be highest when chicks were <10 day old (Coulter et al. 1999). This is may be due to adult storks reinjesting uneaten food brought to the nest, then regurgitating it again at a later time, thus able to feed chicks more often than once per provisioning trip. Provisioning rates observed at Paurotis Pond also may have been due to poor foraging conditions early in the nesting season (caused by March rainfall) and improving foraging conditions close to the colony later in the season. Large numbers of wading birds foraged less than 10 km east and south of Paurotis Pond in late May (H. K., pers. obs.) Increased provisioning rates later in the season may also be attributed to both parents feeding the young (also seen as decreased parental attendance at the nest).

Nest attendance data were similar to Bryan et al. (2005), decreasing throughout the breeding season. Increased demand for prey and the ability of older chicks to defend themselves against intruders necessitates and permits adults to spend more time foraging. Although attendance rates of successful and failed nests were similar, there was a general trend that failed nests had lower attendance rates during the first nest stage. Differing foraging strategies among pairs of adults may account for higher attendance rates at successful nests.

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IBIS MERCURY EFFECTS PROJECT

Most of us are aware of the problem of mercury contamination of wading birds and fish in south Florida. Evidence has been accumulating during the past ten years that mercury levels may have been high enough to have affected survival and reproduction in wading birds. At Everglades exposure levels, young egrets show reduced appetite, impaired immune response, and altered behavior, and adult ibises show altered endocrine response. In addition, the marked decline in tissue mercury in the late 1990's (up to 90%) has been coincident with a very marked increase in nesting effort (see 2004 Wading Bird Report). While suggestive, the evidence that mercury may have affected breeding effort or breeding success in the Everglades remains largely correlative. Despite the decline of mercury contamination in many parts of the Everglades, mercury remains a large concern. Fish mercury levels in ENP and other areas continue to increase, and there is reason to believe that hydrological restoration or its interim conditions could either release mercury stored in sediments or affect methylation of mercury. So future mercury contamination remains an important concern for restoration planning, and the actual effects of mercury on bird reproduction remain an unknown.

In 2004, the Florida Department of Environmental Protection and the U.S. Fish and Wildlife Service (Vero Beach) began funding a project at University of Florida to investigate the effects of methylmercury on captive juvenile and breeding-age ibises. The goals of the project are to experimentally measure the effects of Everglades-relevant mercury exposure levels on health, behavior, development, survival and reproduction of ibises.

In April 2005 we completed construction of a 13,000 ft^2 free-flight aviary in Gainesville, and began populating it with ibises from the Everglades. The majority of birds were collected at 30 – 40 d of age from the Alley North colony. The Alley North birds turned out to have a very skewed sex ratio, with 42% more males than females. We hypothesize that starvation in the colony at the time of collection (early April, see timing of abandonments earlier in this report) caused higher mortality among females. In late May we balanced the sex ratio of the flock by collecting female nestlings from a colony in Hamilton County, Fl.

The birds have been divided randomly into 4 dose groups – 0.3, 0.1, 0.05 and 0 ppm mercury wet weight in diet. The birds are fed with pelletized Flamingo zoo diet, upon which the appropriate mercury dose has been sprayed as a corn oil solution. We are currently monitoring behavior, fecal hormones, health, and food consumption as endpoints, and also plan to investigate effects of Hg on solving foraging problems. The birds will mature to breeding age in approximately 2 years from hatching. Since ibises breed readily in captivity, we are hoping to see our first breeding season in spring 2007.

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This document is the result of continued cooperation among a diverse group of ecologists. It is not a peer-reviewed scientific publication; narratives reflect the views of individual authors rather than the collective participants. We thank Mac Kobza and Ted Schall for technical assistance. Photos provided by Erynn Call, Patrick Lynch, and Lori Oberhofer. The South Florida Wading Bird Report is available on the web at www.sfwmd.gov.

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