SOUTH FLORIDA WADING BIRD REPORT

Volume 9 Gaea E. Crozier and Dale E. Gawlik, Editors November 2003

SYSTEM-WIDE SUMMARY

The estimated number of wading bird nests (excluding cattle egrets, which are not dependent on wetlands) in South Florida in 2003 was 33,739. This is a 51% decrease from last year, which was the best nesting year since the 1940s. It is also a 12% decrease from 2001, which was one of the best years in a decade. The lower nesting effort this year can be attributed to almost 20,000 fewer White Ibis and 12,000 fewer Snowy Egret nests in the Water Conservation Areas compared to last year. There was also a 19% decrease in Wood Stork nests in South Florida compared to last year. Although there were fewer nests in 2003 than in the past couple of years, it was still one of the better nesting years in the last decade.

As usual, nesting effort differed among regions in the Everglades. WCA-3 supported the largest number of nests (52%) whereas ENP supported the lowest number of nests (8%). LNWR supported about 39% of the nests in the Everglades. This pattern is typical of recent years with the main nesting occurring in either LNWR or WCA-3. Since the 1980s, the decrease in birds nesting in ENP has been balanced with an increase in nesting in LNWR. The proportion in WCA-3 has stayed relatively constant over that period.

Unfortunately, 2003 was noteworthy in that there was considerable nest failure by Wood Storks and to a lesser degree other species. Heavy rains during the nesting season caused water levels to increase rapidly multiple times during the breeding season. These water level changes were not apparent from monthly water level averages but their effect on birds was clear and widespread. Approximately 70% of the Wood Stork nests in the Everglades were abandoned between the first week of March and second week of April. During this time period birds had eggs or small chicks in their nests. Only minor abandonment was observed by Wood Storks between mid-April through June, when chicks were older, even though water level reversals continued to occur. These observations are consistent with information gathered in previous years suggesting that birds may be more sensitive to water level reversals during the earlier part of the nesting cycle. In contrast to Wood Storks, abandonment by White Ibises appeared to be less extreme.

The 2003 nesting season was also noteworthy in that there appeared to be a higher than normal nesting asynchrony in comparison to recent years. During a typical nesting season, the number of wading bird nests peaks in April then rapidly decreases. However, this year wading birds initiated new nests throughout the entire breeding season, even as late as mid-June. This was likely the result of birds re-nesting after they abandoned due to water level reversals.

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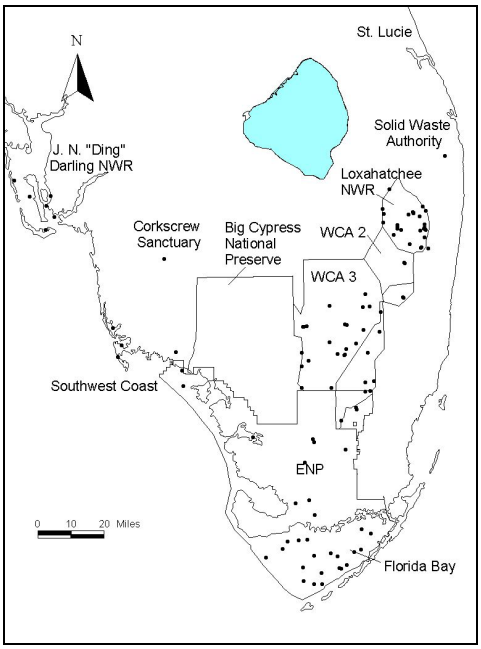
Locations of wading bird colonies in South Florida in 2003. Colonies with ≥ 50 nests are depicted in LNWR and the WCAs. Florida Bay not surveyed completely.



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HYDROLOGY 2003

The rainfall and associated stage readings are shown in Table 1. The 2003 hydrologic conditions were not substantially different from average throughout the EPA. LNWR and WCA-2 were 14% below average while WCA-3 and the Park were slightly above average. These average rainfall amounts are reflected in the 2003 stage data, which were also approximately average everywhere.

The average data does not indicate why there was a 53% decline in the 2003 wading bird nests relative to the previous year. It is the seasonal distribution of the rainfall pattern, exemplified by the data from LNWR (Figure 1), which gives some indication of a cause. The first thing to notice is the low rainfall during the typically wet months of August, September, and October. The second thing to notice is the above average rainfall during the typically dry month of March and its significant contrast to the rainfall amounts in January and February. This is the setup needed to create a too early and too extensive recession in the Everglades, only to end with a significant recession reversal during the peak of wading bird nesting.

Unfortunately, this setup is masked by the reporting of stage data as monthly means and by the management of water for supply and flood control by the SFWMD. Both these practices are indicated in Figures 2, 3 and 4. In Figure 2, the dry season reversal in LNWR is not reflected in the monthly stage data. Instead, what is obvious is that management resulted in a complete shift away from peak high water in October. This occurred because inflows to LNWR were double the outflows from August through December of 2002 (Abtew et al. 2004). Although the January mean stage was right inline with the regulation schedule, due to a significant increase in outflows, it probably was not enough to compensate for the short-term recessional reversal in March due to rainfall.

WCA-2 (Figure 3), a basin that historically has been managed too deep for successful wading bird nesting, was more reflective of the rainfall pattern than LNWR. The October stage was less then the historic stage but was right inline with the regulation schedule. Stage followed the regulation schedule trend until January where, despite a low rainfall, stage levels did not decline. This may have been due to the fact that in an effort to drain LNWR and Lake Okeechobee, inflows to WCA-2 during this dry season were greater than outflows (Abtew et al. 2004).

Finally, Figure 4 illustrates the general trend in water levels throughout WCA-3 and the Park. Again, the monthly

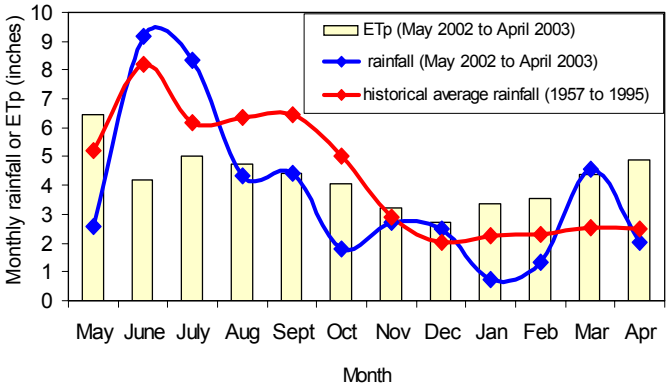

Figure 1. Rainfall and potential evapotranspiration (ETp) for LNWR and WCA-2.

Table 1. Average, minimum and maximum stage (ft NVGD), and total annual rainfall (inches) for water-year 2003 in comparison to historic stage and rainfall[a]. Subtract station elevation from stage to calculate depth.

Area	2003 Rainfall	Historic Rainfall	2003 Stage Mean (Min; Max)	Historic Stage Mean (Min; Max)	Station Elevation
LNWR (1A-7)	44.5	51.96	16.5 (15.6; 17.0)	15.6 (10.0; 18.2)	15.1
WCA-2 (2A-17)	44.5	51.96	12.2 (10.9; 13.6)	12.6 (9.3; 15.6)	11.2
WCA-3 (3A-NE)	51.6	51.37	10.1 (8.6; 11.0)	9.5 (4.8; 12.8)	8.2
Shark Slough (P33)	57.6	55.5	6.4 (5.6; 7.0)	5.9 (2.0; 8.1)	5.1

[a] See Chapter 5 of the 2004 Everglades Consolidated Report (Abtew et al.) for a description of historic databases.

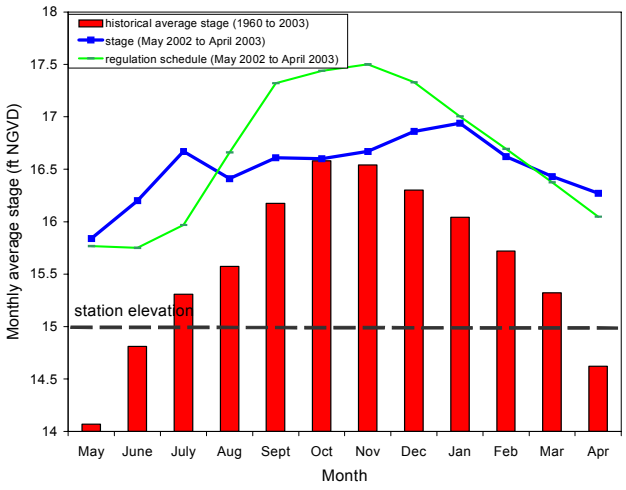

Figure 2. Historical average and current year average stages in LNWR.

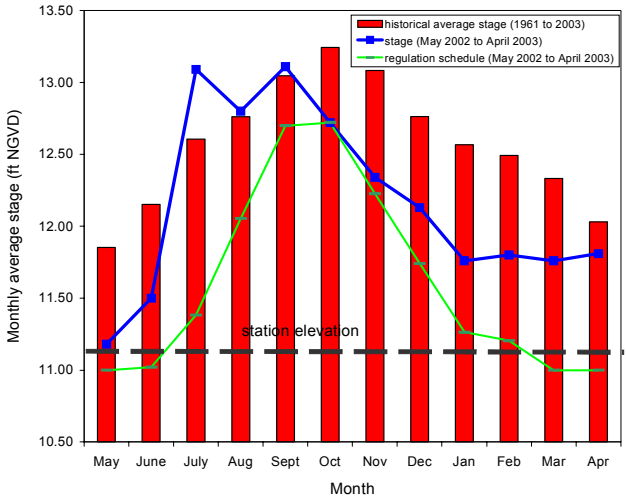

Figure 3. Historical average and current year average stages in WCA-2A.

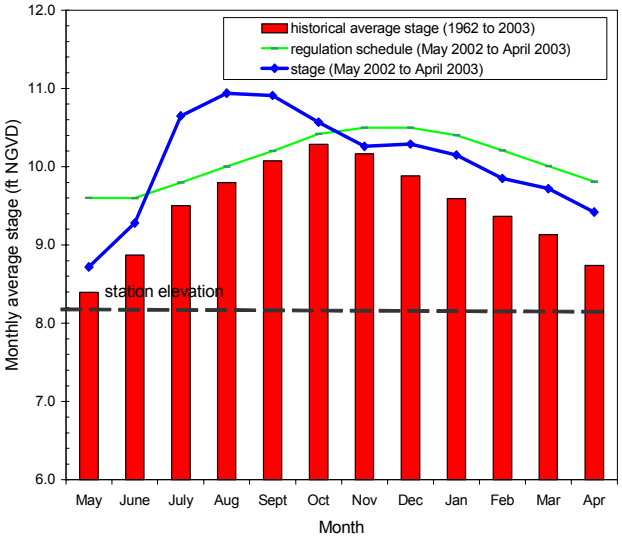

Figure 4. Historical average and current year average stages in WCA-3A.

reporting practice of the SFWMD was not adequate to illustrate the short-term, dry season reversal that occurred in March. However, it does capture the fact that water levels peaked early in the wet season, a shift away from typical high water during October, and above average water levels throughout the wading bird nesting season.

SW Coast Hydrology:
Each year Ted Below, at the Rookery Bay Audubon Society, uses a long term data base (39 years) of inland water levels recorded at Corkscrew Swamp Sanctuary (CSS) and coastal pond water levels at Rookery Bay (RB; 22 years) to compare to the current nesting. Over the years he has 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. Unlike the last 4 years in which water levels in these areas were extremely low, this year was 8.03" above the mean of 16.33" at CSS for mid May, the lowest time of the year. To put this in prospective, 13 of the 39 years at CSS had higher water levels (33%) than this year (the ponds at RB were 26% above the 20 year mean); obviously this is not an unusual occurrence. In other words as far as the water levels in the area go, nothing appeared to be unusual.

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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 2003, the University of Florida team monitored nesting in WCAs 2 and 3 as it has for the past 17 years, and continued similar survey work in Loxahatchee National Wildlife Refuge. We also monitored nest success of Great Egrets, White Ibises, and Wood Storks, and continued our studies of juvenile stork movements and survival (see Survival and Movements of Juvenile Wood Storks in the Special Topics section).

Methods

We performed 2 types of systematic surveys in 2003: 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 2003, we performed systematic aerial surveys for colonies, with observers on both sides of a Cessna 182, 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 all 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 were 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 were summed.

We also estimated the error associated with estimating birds from aerial photos. Using large umbrellas as corner markers, we established 4 quadrats in the Alley North colony, in which we counted all nests on the ground. We compared these ground counts with counts derived from aerial photographs, in order to estimate the error associated with aerial counts.

Systematic, 100% coverage ground surveys of colonies by airboat were performed throughout 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 survey. GPS-guided belt survey transects were generally in north-south orientations, and were designed to give overlapping coverage. The width of belt transects varied between 0.6 miles apart in extremely open habitat of southern WCA 3, to 0.1 miles apart in the heavier cover of Loxahatchee NWR. All tree islands were approached closely enough to flush nesting birds, and nests were either counted directly, or estimated from flushed birds.

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, 3B Mud East, and Hidden 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 the transect and check the progress of those nests, count failures and add new nesting attempts to the transect. Nest success was expressed using the Mayfield method.

Results

Large Ibis Colonies: The total numbers of wading bird nests initiated this year (Tables 1 & 2) depended strongly on the estimation of numbers of ibis nests. For ibises, nesting turnover in both Alley North and Lox 70 colonies was particularly rapid this year, resulting in large differences in estimates of nests from week to week even in the same colonies. This led to concomitant problems in distinguishing new nesting cohorts from old ones that had abandoned. We therefore suspect that the number of ibis nests we report here is quite conservative as an estimate of total nest starts. We have reported in Tables 1 and 2 that 12,103 ibis nests were initiated in the WCAs of the Everglades (excluding the Tamiami West colony), based on peak estimates made using fixed-wing aerial estimates and slide counts (Univ. of Florida) and aerial estimates made from helicopters (Gawlik, SFWMD).

Particularly in the Alley North colony, the vegetation was quite dense this year, and our impression from viewing the colony from multiple angles is that the majority of ibises were nesting beneath the tree canopy. We compared our ground counts of 4 quadrats at Alley North with aerial photographic counts of the same quadrats. Aerial photo counts generally underestimated the true numbers of nests by a large margin (average aerial estimate in 4 quadrats was 37% below true counts), but there were wide differences among the 4 quadrats (range 78% undercount to 7% overcount, standard deviation of average quadrat error = 36%). This information suggests that the direct counts of ibises (above and expressed in tables) are undercounting the true numbers by at least 37%, and that the wide variation in error estimates among quadrats is due in large part to vegetative differences. If we apply the undercount estimate to the total count of ibises in the WCAs, we estimate that approximately 16,700 ibis nests were probably initiated. This figure takes into account only the visibility bias, and does not take into account the problem of asynchronous nesting in colonies mentioned in the previous paragraph. So the 16,700 figure is probably also conservative. However, both current and past estimates of wading bird nesting effort are probably biased low for similar reasons, and we emphasize that it is extremely important to use only the numbers in Tables 1 and 2 as

Table 1. Numbers of wading bird nest starts found in WCAs 2 and 3 from Jan - Jun 2003

Latitude[1]	Longitude	Colony name	GREG	GBHE	TRHE	BCNH	WOST	SNEG	LBHE	WHIB	ROSP	YCNH	GLIB	SWW[2]	ANHI	CAEG	Colony total[3]
N26 13.13	W80 31.75	Alley North	825		30	5		14	1	6,033	3		7				**6,918**
N25 46.36	W80 50.24	Hidden	205		594			70	22	489							**1,380**
N25 48.08	W80 29.40	3B Mud East	505	3	84	5			10	122		4			6		**733**
N25 53.11	W80 50.61	Jetport	140				375										**515**
N26 2.48	W80 32.36	Donut	350														**350**
N26 2.32	W80 49.85		300														**300**
N26 7.32	W80 32.50	Cypress City	296														**296**
N26 6.11	W80 27.27	Holiday Park	199							70							**269**
N25 55.51	W80 50.10	Cross-over	200				40										**240**
N26 7.55	W80 30.45		236														**236**
N26 2.75	W80 37.10	Big Mel	200														**200**
N26 7.72	W80 42.10		200														**200**
N26 9.78	W80 20.74	2B Mel	188														**188**
N25 55.07	W80 39.93		150														**150**
N26 18.85	W80 20.49		130														**130**
N25 54.76	W80 37.87		120														**120**
N26 0.97	W80 27.61	Mud Canal	20					5		75						75	**100**
N25 47.65	W80 31.85	Heron Alley	52		23				13						5		**88**
N26 2.26	W80 49.66		85														**85**
N26 2.44	W80 48.79		80	2											2		**82**
N25 54.94	W80 37.78		70	2											70		**72**
N25 57.88	W80 34.48	L67	65	6													**71**
N25 46.29	W80 41.61		70														**70**
N26 2.82	W80 37.69		70														**70**
N25 55.41	W80 31.17		65						3								**68**
N26 18.84	W80 20.25		65														**65**
N25 58.26	W80 42.06		63														**63**
N25 56.41	W80 37.25	Starter Mel	61														**61**
N26 9.86	W80 20.79		50	1	1				2	1	2				300	1	**57**
N25 53.34	W80 48.25				30				20						1		**50**
Colonies (594) with <50 nests			716	503	343	109	0	26	329	3	0	2	2	40	1,000	26	**2,073**
Total Nesting Attempts			**5,776**	**517**	**1,105**	**119**	**415**	**115**	**400**	**6,793**	**5**	**6**	**9**	**40**	**1,384**	**102**	**15,300**

[1] Latitude and longitude in degrees, decimal minutes.

[2] SWW = unidentified small white waders. These could be White Ibises, Snowy Egrets, Cattle Egrets, or young Little Blue Herons.

[3] Totals are for wetland waders, and do not include Cattle Egrets or Anhingas.

estimates for the long-term record.

Nesting in LNWR and WCAs 2 and 3: Combining all species at all colonies in LNWR, WCA 2, and WCA 3, we estimated a grand total of 25,995 nests of wading birds (Cattle Egrets, Anhingas and cormorants excluded) were initiated between February and July of 2003. Note that this figure does not include birds nesting at the Tamiami West colony, which is just outside the boundaries of WCA 3. If the Tamiami West colony is included, the total is 27,017.

For perspective, the size of the nesting aggregation in 2003 in the WCAs and LNWR combined was 23% higher than the average of the past 10 years, 24% lower than the average of the last 5 years, and 64% lower than in 2002. Numbers of Great Egret nests were 25%

Table 2. Numbers of wading bird nest starts found in A.R.M. Loxahatchee National Wildlife Refuge, Jan - Jun 2003

Latitude[1]	Longitude	Colony name	GREG	GBHE	TRHE	BCNH	WOST	SNEG	LBHE	WHIB	ROSP	GLIB	SWW[2]	ANHI	CAEG	Colony total[3]
N26 26.25	W80 14.58	Lox 70	400		250	20		350		4,200		50	100	150	100	**5,370**
N26 26.35	W80 23.51	Lox 99	5		5			300		800						**1,110**
N26 33.59	W80 15.06	Canal North	30		140			170	140							**480**
N26 27.45	W80 14.20		367													**367**
N26 28.07	W80 22.32		300													**300**
N26 27.70	W80 14.71		40							210						**250**
N26 32.44	W80 14.11				40				70			20		30		**130**
N26 27.46	W80 21.26				10				100							**110**
N26 30.03	W80 15.78	Lox 111	100													**100**
N26 28.09	W80 14.43				5			2	20			70		4	50	**97**
N26 22.79	W80 15.61		90													**90**
N26 32.97	W80 26.61							85								**85**
Uncertain	Uncertain		80								1					**81**
N26 31.86	W80 17.69				10			20	50					5		**80**
N26 31.92	W80 17.67				2	5		15	3	55						**80**
N26 23.73	W80 18.75				2			1	68					1		**71**
N26 22.53	W80 13.53		70													**70**
N26 28.89	W80 14.51				10			1	5			50			35	**66**
N26 31.64	W80 26.32		65													**65**
N26 22.98	W80 15.33				2			1	45			13		2	60	**61**
N26 29.48	W80 26.40		61													**61**
N26 28.77	W80 22.30		60													**60**
N26 27.74	W80 22.37							2	55							**57**
N26 31.58	W80 19.15		1		1			15	40							**57**
N26 38.15	W80 24.65		55													**55**
N26 27.23	W80 15.77		10							40						**50**
N26 32.16	W80 17.83				10				40							**50**
Colonies (310) with <50 nesting attempts			420	187	99	84	0	47	350	5	0	30	20	669	784	**1,242**
Total Nesting Attempts			**2,154**	**187**	**586**	**109**	**0**	**1,009**	**986**	**5,310**	**1**	**233**	**120**	**861**	**1,029**	**10,695**

[1] Latitude and longitude in degrees, decimal minutes.

[2] SWW = unidentified small white waders. These could be White Ibises, Snowy Egrets, Cattle Egrets, or young Little Blue Herons.

[3] Totals are for wetland waders, and do not include Cattle Egrets or Anhingas.

higher than the average of the last 5 years, and 60% higher than the last 10. In 2003, Wood Stork nests were 2.1 times the average of the last 5 years, and 3.9 times the average of the last 10 years. Little Blue Heron nests seemed reduced in 2003, being only 32% of the 5 and 10 year averages.

It is also important to note that in the context of the recent history of the Everglades, the 2003 nesting event can be considered a large and important one, ranking fifth largest in the 18 years during which systematic surveys have been conducted. This continues a recent trend towards distinctly larger numbers of total nesting attempts – since 1999, 5 of the 6 largest nestings in the 18-year history have been recorded.

Nesting Success: Nesting success varied widely between colonies but was generally poor. We noted abandonments of large numbers of nests by Wood Storks, White Ibises, and Great Egrets at all of the major colonies occupied by these species. Alley North had the lowest nest success with only 19.7% of nest initiations estimated to have produced young (Mayfield method) for Great Egrets and 17.3% for White Ibises. Hidden had 64.0% success for Great Egrets and 3B Mud East had 68.7%. When collapsed across colonies, Great Egret nest success was 49% for the study area. As reported elsewhere in this document, Wood Stork nest success was extremely low.

These failures can be attributed in large part to heavy rainfall that occurred several times during the season, particularly in late March, which resulted in abandonments by adults. At the Alley North colony, the abandonment problem may have been exacerbated by an unusually large population of Boat-tailed Grackles. Grackle predation of White Ibis eggs was often witnessed, and the grackles were not deterred by loud noises. This bold behavior seemed a departure from what we have experienced in the past at the same and at other colonies. Although nest success for Great Egrets seemed to be considerably lower at Alley North than at other colonies, it is not clear that this was due to grackle predation.

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WOOD STORK NESTING AT CORKSCREW SWAMP SANCTUARY

Fourteen aerial surveys were conducted via a fixed wing aircraft with complete coverage of the nesting area. Visual estimations were made counting each nest when the colony size was small, and estimating as the colony approached its maximum density. 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 400ft during a single pass to assist in productivity estimates and stage of development. These flights occurred between Jan 27, 2003 and Jun 17, 2003 (42 person-hrs). Photos of each aerial survey were projected on a grid and analyzed. Photos from 1000' were used to identify the total number of possible nests. Slide photos taken from approximately 400' 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'. Nest productivity was also determined using the slides taken at 400'. Two-hundred and 6 nests were clearly visible in the 400' slide set taken on May 17th. There were 348 chicks occupying these nests, which yield a productivity of 1.69 chicks per successful nest. Season totals indicate an estimated 780 chicks fledging from approximately 1100 nest attempts, roughly 460 of these nests were successful. Productivity was 0.42 chicks per nest attempt. Rainfall levels were above average for the area in January, March, April and May. High winds associated with a late February storm and a heavy rainfall event in mid-March seem responsible for a large portion of the nest failures in 2003.

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EVERGLADES NATIONAL PARK

Methods

Aerial colony surveys were conducted monthly or bimonthly (Jan through Jul) by 1 or 2 observers using a Cessna 182 fixed-wing aircraft (~26 person-hrs). Both traditional colony sites as well as new colonies discovered during other project flights were surveyed. Survey dates were: 21 Jan, 19 Feb, 21 Mar, 4 Apr, 17 Apr, 7 May, 22 May, 5 Jun, and 14 Jul.

Results

Nesting began in January and increased through March and April. Most colonies had fledged all young by the end of May; however, several colonies were still active as of mid-August. Great Egrets initiated a second nesting at the Rodgers River Bay colony around August, and Cattle Egrets initiated nesting in June at several colonies including Tamiami West.

We observed an overall decrease of 14% in the numbers of nesting wading birds compared to the 2002 nesting season. We located approximately 2,667 wading bird nests within 13 mainland colonies. Compared to the 2002 nesting season, the numbers of nesting White Ibis decreased by 71%, Wood Storks by 12%, Great Egrets by 14%, while Cattle Egrets increased by 94%. The size of individual colonies was generally smaller than in previous years, and 2 colonies that were active last year did not form this year. Unfortunately, several of the larger traditional Wood Stork and Great Egret colonies experienced nest failures (Cuthbert Lake, Paurotis Pond, Tamiami East and Tamiami West). The failures appeared to be associated with significant rain events that occurred near the middle and end of March. Rodgers River Bay was the only large traditional colony that did well this year. The Wood Storks and Great Egrets nesting there seemed to be unaffected by the rain events that led to failures in other colonies.

The most prevalent species recorded nesting in mainland ENP colonies were Great Egrets, Wood Storks, Cattle Egrets, and White Ibis. The following species were found in nesting colonies but numbers of nests could not be estimated due to their location within the colonies: Snowy Egret, Little Blue Heron, Tricolored Heron, Black-Crowned Night Heron, and Roseate Spoonbill.

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Peak numbers of wading bird nests found in Everglades National Park mainland colonies, Jan - Jun 2003

Latitude	Longitude	Colony name	GREG	WOST	WHIB	GWHE	SNEG	CAEG	TRHE	LBHE	ROSP	BCNH	SWW[1]	Colony total
N25 12.56	W80 46.50	Cuthbert Lake	125	75										**200**
N25 16.12	W80 52.07	East River Rookery	15											**15**
N25 37.68	W80 38.74	Grossman Ridge	35											**35**
N25 41.10	W80 34.50	NE Grossman B	20											**20**
N25 16.89	W80 48.18	Paurotis Pond	150	130	130				+	+	+			**410**
N25 33.40	W81 04.19	Rodgers River Bay	250*	130			+							**380**
N25 45.46	W80 30.48	Tamiami East	20											**20**
N25 45.45	W80 32.70	Tamiami West[2]	200	400	150		250	400	3		1	4	14	**1,422**
N25 26.71	W80 49.32	2003 new colony1	20											**20**
N25 32.92	W80 46.94	2003 new colony2	40											**40**
N25 32.15	W80 46.74	2003 new colony3	20											**20**
N25 30.21	W80 37.54	2003 CE colony1						35						**35**
N25 40.54	W80 34.44	2003 CE colony2						50						**50**
		TOTAL	**895**	**735**	**280**	**0**	**250**	**485**	**3**	**+**	**1**	**4**	**14**	**2,667**

+ Indicates species present but unable to determine numbers.

* Includes second nest attempt.

[1] SWW = unidentified small white waders. These could be White Ibises, Snowy Egrets, Cattle Egrets, or young Little Blue Herons.

[2] Numbers for the Tamiami West colony from Peter Frederick.

BIG CYPRESS NATIONAL PRESERVE

Nonsystematic searches for wading bird rookeries in Big Cypress National Preserve were conducted during the 3 times per week fixed-wing flights used to locate Florida panthers and during all routine helicopter work. A random search of a sample of previously active rookeries, including the only 2002 stork nesting site, was conducted on Feb 19, 2003. No activity was documented. Although the drydown was initially normal, the above average rainfall from March through May may account for the lack of wading bird nesting in Big Cypress this year.

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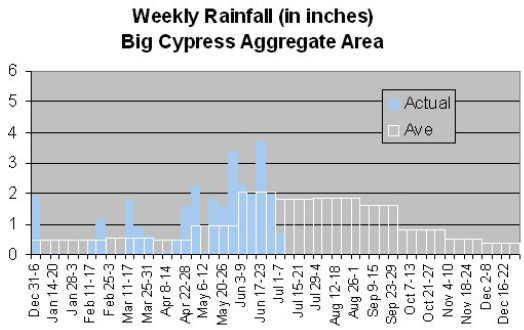

HOLEY LAND AND ROTENBERGER WMAs

The wading bird survey for Holey Land and Rotenberger Wildlife Management Areas was not conducted due to environmental conditions of the area at the time needed and equipment scheduling conflicts.

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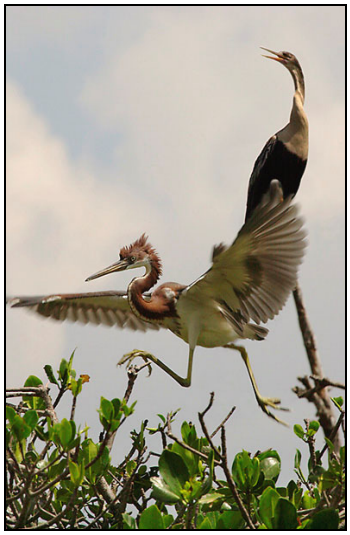

SOLID WASTE AUTHORITY OF PALM BEACH COUNTY COLONY

Methods
From February – July 2003, Breeding Bird Censuses (BBCs) were conducted in the SWA Roost by 2 observers every 8 weeks, representing approximately 12 person-hrs. During the BBC, all islands from 3 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 and 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 with vegetation touching among close islands. The borrow pits are flooded with fresh water to a depth of 3 m. Dominant vegetation is Brazilian pepper (*Schinus terebinthifolius*), Australian pine (*Casurina spp.*), and Melaleuca (*Melaleuca quinquenervia*), all non-native species. Local features influencing the roost include: 1) the North County Resource Recovery Facility and landfill and 2) the City of West Palm Beach's Loxahatchee Watershed Preserve (Water Catchment Area), a 44 km^2 remnant of the Loxahatchee Slough.

Results
This report presents preliminary data for the 2003 breeding season. Typically nesting activities have been observed at this colony through September, and these surveys being reported are only through the end of July. Nest surveys were conducted on February 21st, Apr 9th, and Jun 10th 2003. Only the peak nest numbers are being reported for each of the bird species.

The estimated peak number of wading bird nests for the SWA Colony is 3,060 which represents a 6.8% increase from the 2002 season. The number of White Ibis, Tricolored Heron, Anhinga, Cattle Egret, and Great Blue Heron nests are higher during this year than the 2002 season. Wood Stork, Snowy Egret, Great Egret, and Little Blue Heron nest numbers appeared to be less than observed in 2002. There was a 34% decrease in Wood Stork nests from last year. However, the peak nest numbers may have been missed because there appeared to be a loss of Wood Stork nests after heavy rains (personal observation).

It should also be mentioned that a Roseate Spoonbill and several Glossy Ibis nests and young of both species have been observed this year in the SWA Rookery. However, these nests were 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 the SWA Rookery Feb - Jul 2003

GREG	SNEG	CAEG	GBHE	LBHE	WOST	WHIB	ANHI	TRHE	Total nests
75	15	954	9	65	140	1914	356	112	3060

UPCOMING MEETINGS

Florida Chapter of The Wildlife Society: April 2004, Central Florida (for more information visit: http://fltws.org/)

EVERGLADES NATIONAL PARK - FLORIDA BAY

Methods

Florida Bay colony flights were conducted this year simultaneously with Florida Bay Bald Eagle surveys. Therefore, with the exception of the large Frank Key colony, flights for smaller colonies were only conducted twice on 29 Jan and 25 Feb.

Results

Success for most of the colonies could not be determined because we visited most colonies only once or twice. However, large young were observed on many islands in March and April. Nesting for most species began in January and increased through April. The largest colony, Frank Key, appeared to be successful as fledged birds (Great Egret, White Ibis, and Snowy Egret) were seen roosting on the island.

We located only 694 wading bird nests on 17 Florida Bay islands during the 2003 season. This is a 49% decrease from the 2002 nesting season. We observed the following species nesting in Florida Bay: Great Egret, Great White Heron, White Ibis, Snowy Egret, Tricolored Heron, and Roseate Spoonbill. Tricolored Heron and Roseate Spoonbill nest numbers could not be estimated due to their hidden location under tree canopies.

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Numbers of wading bird nests found in Florida Bay, Jan - Jun 2003

Latitude	Longitude	Colony Name	Number of times checked	Date	GREG	GWHE	WHIB	SNEG	TRHE	ROSP	Total
N24 55.79	W80 49.70	Arsenickers Keys	1	1/29/03		15					**15**
N25 02.97	W80 38.93	Big Jimmie Channel Key	1	1/29/03	10					+	**10**
N24 59.35	W80 49.83	Big Rabbit Key	2	2/25/03	10						**10**
N24 55.05	W80 46.71	Buchanan Keys	1	1/29/03		3					**3**
N25 06.61	W80 48.65	Camp Key	1	2/25/03		5					**5**
N25 06.45	W80 51.09	Cormorant Key	1	1/29/03		3					**3**
N24 59.28	W80 39.39	Crab Key	1	1/29/03		8					**8**
N25 00.00	W80 37.30	Crane Key	2	2/25/03		8					**8**
N25 06.15	W80 54.40	Frank Key	6	4/17/03	200		250	75	+	+	**525**
N25 06.77	W80 52.74	Palm Key	1	1/29/03						+	**+**
N24 55.00	W80 44.47	Peterson Keys	2	1/29/03		16					**16**
N25. 02.00	W81 00.56	Sandy Key	2	4/22/03		30					**30**
N25 03.44	W80 35.19	Stake Key	1	1/29/03	5						**5**
N25 09.33	W80 33.10	Tern Key	1	2/25/03	40					+	**40**
N25 02.51	W80 46.64	Topsy Key	2	2/25/03		5					**5**
N24 57.92	W80 44.64	Twin Key	2	2/25/03		6					**6**
N24 59.01	W80 38.99	West Key	1	1/29/03		5					**5**
Total Nesting Attempts					**265**	**104**	**250**	**75**	**+**	**+**	**694**

+ Indicates species present but unable to determine numbers.

ROSEATE SPOONBILLS IN FLORIDA BAY

Methods

Thirty-three of Florida Bay's keys have been used by Roseate Spoonbills as nesting colonies (Figure 1, Table 1). These colonies have been divided into 5 distinct nesting sub-regions (Table 1) based on each colony's primary foraging location (Figure 1, Lorenz et al. 2002). During the 2002-2003 nesting cycle (Nov-May), complete nest counts were performed in all 5 sub-regions, however no nesting occurred in the Southwestern sub-region. Nest counts were performed by entering the active colony and thoroughly searching for nests. Nesting success was estimated for the 4 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 2 week cycle to monitor chick development. Prey fish availability was estimated at 4 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 November through April with a 9m² 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.

Results

Northwestern Sub-Region: Sandy Key

The 251 nests counted in the Northwestern sub-region in 2002-03 were well above average (Table 1). Nesting success surveys were conducted at Sandy Key on Nov 26, Dec 6, 17, 30, Jan 20, Feb 8, and Mar 19. We estimate that eggs were first laid on Nov 14, the mean egg laying date was Nov 23, and mean hatch date was Dec. 14. Although the 128 nests counted at Sandy Key were below the average (166 nests since 1984), the count does fall within the range experienced over that same time period (lowest year 1984-85: 62 nests, highest year 1994-95: 250 nests). Forty-seven nests were marked for revisitation. Of these, an estimated 63% were successful at raising chicks to at least 3 weeks old (the time when they first leave the nest) with the average of 2.5 chicks per successful nest (1.5 chicks fledged per nest attempt; Table 2). The fledging rate was above average (1.29 chicks/attempt since 1984; Table 2), and we estimate that the Sandy Key colony fledged almost 200 young spoonbills during this nesting. These calculations were supported by the observation of numerous fledglings observed around Sandy Key on Feb. 8.

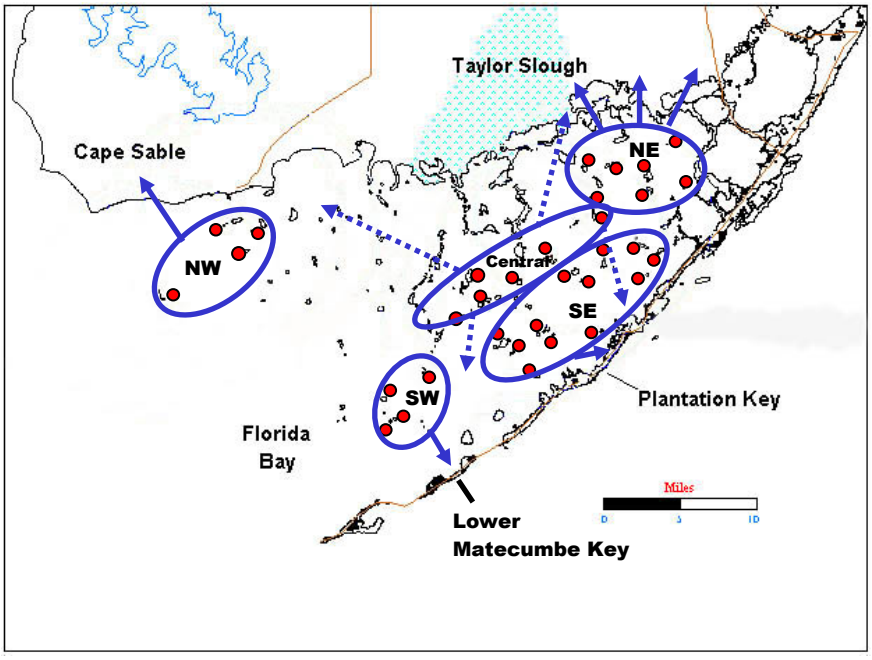

Figure 1. Map of Florida Bay indicating spoonbill colony locations (red circles) and nesting sub-regions (blue circles). Arrows indicate the primary foraging area for each sub-region. The dashed lines from the central sub-region are speculative.

Table 1. Number of ROSP nests in Florida Bay Nov 2002-May 2003. An asterisk (*) indicates a colony with nesting success surveys (see Table 2).

Sub-region	Colony	2002-2003	Summary since 1984		
			Min	Mean	Max
Northwest	Sandy*	128	62	166.11	250
	Frank	107	0	44	125
	Clive	15	15	19.5	24
	Oyster	1	0	8.33	45
	Subtotal	**251**	**65**	**203.17**	**325**
Northeast	Tern*	98	65	113.94	184
	N. Nest	0	0	0	0
	S. Nest	3	0	21.31	59
	Porjoe	0	0	37.4	118
	N Park	0	0	22.08	50
	Duck	0	0	1.83	13
	Pass	0	0	0.73	4
	Subtotal	**101**	**101**	**208.69**	**310**
Central	E. Bob Allen*	19	0	17.62	35
	Manatee	0	0	0	0
	Jimmie Channel	7	6	20.77	47
	Caloosa	11	0	7.67	12
	Little Pollach	1	0	5.5	13
	S. Park	0	0	11.54	39
	Subtotal	**38**	**15**	**53.58**	**96**
Southwest	E. Buchanon	0	0	8.73	27
	W. Buchanon	0	0	5.1	9
	Barnes	0	0	0	0
	Twin	0	0	2.3	0
	Subtotal	**0**	**0**	**14.4**	**35**
Southeast	M. Butternut*	9	9	26	66
	Bottle	9	0	13	40
	Stake	0	0	4.09	19
	Cowpens	0	0	8.36	15
	Cotton	0	0	0	0
	West	0	0	4.1	9
	Low	0	0	0	0
	Pigeon	0	0	4	12
	Crab	4	0	1.9	7
	East	2	0	2.58	12
	Crane	11	11	15.36	27
	E. Butternut	4	4	4.7	11
	Subtotal	**39**	**39**	**85.6**	**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 achieved a higher degree of success than average. 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. In October, while spoonbills were courting, water levels at BL were declining rapidly but were well above the fish concentration threshold. Fish availability on the foraging site was estimated about 4 fish/m^2. In November and early December, water levels declined to about 12.5 cm and fish density increased to between 55 and 65 fish/m^2 (about 50g/m^2). In late December, chicks began to hatch at Sandy Key. Water levels continued to fall in January until the flats were completely dry. Fish were heavily concentrated into the remaining deep pools and density increased to 120 fish/m^2. For the 6 weeks post-hatching (when chicks are most susceptible to mortality), parental spoonbills likely experienced a high degree of foraging success as a result of the high prey availability on proximal wetlands (as indicated by BL samples). Water levels at BL remained below 12.5 cm throughout January and February, and fish availability remained above 50 fish/m^2 for the 3 months following hatching. Adult spoonbills were observed utilizing the BL foraging location during this period.

Northeastern Sub-region: Tern Key

All 7 colonies in the Northeastern sub-region were surveyed for nesting activity, however, only 2 were active with 1 of the active colonies having only 3 nests (Table 1). The 101 total nests in the sub-region was the lowest nesting effort since 1969, and the number of active colonies (2) was the lowest since 1962. Spoonbill nesting success surveys were conducted at Tern Key on Dec 2, 13, Jan 3, 16, 29, Feb 17, Mar 3, & 19. As has been the norm for the last several decades, there were 2 distinct nestings at Tern Key during the 2002-03 breeding cycle. During the first nesting, the first egg was laid on Nov 22 with the mean laying date estimated at Dec 6. The mean hatching date was Dec 28. As has been the trend in recent years, the first nesting effort was alarmingly small: only 98 nests compared to almost 200 nests 10 years ago and over 500 nests 25 years ago. We believe this decline in northeastern Florida Bay is due to water management practices on the foraging ground and is the focal point of our research efforts (see synthesis section below). In addition to the alarmingly low nesting effort, the success rate was also very poor. On average, each nest attempt produced 0.6 chicks per nest, significantly below the average of .79 and well below the pre-1980 average of 2.0 chicks/nest. Less than half (39%) of nest attempts were successful with successful nests producing only 1.5 chicks on average.

As at BL, water levels at the northeastern foraging grounds began to decline in October, coinciding with the onset of spoonbill courtship at Tern Key. However, the declining

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

Sub-region	Colony	2002-2003	Summary since 1984			
			Min	Mean	Max	% of years successful
Northwest	Sandy	1.54 (63%)	0.00	1.29	2.5	67%
Northeast	Tern	0.69 (31%)	0.00	0.82	1.88	33%
Central	E. Bob Allen	0.90 (54%)	0.40	0.90	1.52	38%
Southeast	M. Butternut	1.00 (43%)	0.29	1.12	2.09	38%

trend reversed at the end of November and water levels increased from about 7 cm to almost 30 cm on the flats. When the chicks hatched in later December, water levels at all of the 4 foraging locations being monitored were above the 12.5 cm threshold. Conditions remained above 12.5 at most sites for the first 2 weeks post hatch. In December the average estimated fish density from the 4 sites was 6.6 fish/m^2. It appears that spoonbills hatched at the most inopportune time: water levels were high, fish were not readily available and the colony experienced low productivity.

The second wave of nesting at Tern Key began in January, however, nest initiation were strongly asynchronous. The mean laying date for these nests was Feb 4 and the mean hatch date was Feb 25. This effort was roughly the same size as the first nesting (about 100 nests). Only one third of the nests succeeded with an average of 0.9 chicks reaching 21d post-hatching per nest attempt. Although this seems relatively high, these numbers were artificially inflated by the few nests that were initiated early in January. Furthermore, there were very few living chicks during the Mar 19 survey indicating that well less than this estimate actually survived to leave Tern Key. As a result, the second nesting should be considered an overall failure.

The reason for questioning the relatively high rate of success and considering the second nesting a failure can be attributed to the asynchronous nature of the nesting cycle. The majority of nests were initiated after the middle of the month, however, about one third of nests were initiated earlier and hatched in mid-to-late February. These early nests hatched when water levels were below the concentration threshold and prey was abundant. Early nests raised young to older than 21d and were, therefore, technically considered successful. Late nests made up the majority and hatched in early March during a period of increasing water levels. Mean fish density at the 4 sites in March was less than 6 fish/m^2, resulting in failure in the late nests and almost total mortality of the post-21d chicks from the early nests, i.e., the early nests raised chicks beyond 21d, but these chicks did not fledge from the key.

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 Dec 5, 19, Jan 6, 21, and 31. The first egg was laid on approximately Nov 25, with a mean lay date of Dec 1. The mean hatch date was estimated to be Dec 22. Only 7 nests were initiated on the island--the lowest ever recorded at Butternut Key since the colony first formed in 1984. By accepted standard, this nesting effort was a success, with a production rate of 1 chick per nest attempt. Five fledglings were observed flying about the island on Jan 31 indicating that the nesting was a success; however, the low number of nests indicates that only 7 young fledged from the island.

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 land 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: 5 of 7 years surveyed were failures (Table 2). Based on these observations it appears that conditions during the 2003 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.

Central Sub-Region: East Bob Allen Key

All 7 colonies in the Central sub-region were surveyed in 2002-03 (Table 1). Nesting success surveys at East Bob Allen Key (EBA) were performed on Dec 11, Jan 2, 22 and Feb 4. Nineteen nests were found on EBA which is slightly above average (17.6 nests since 1984). We estimated that the first egg was laid on Nov 19 with a mean laying date of Dec 1. The average hatching date was Dec 22. This nesting was marginally successful with an average of 0.9 chicks per attempt. The standard definition of successful nesting (≥1 chick/nest attempt) suggests a failed nesting, however, about half of the nests succeeded in fledging young with an average of 1.8 chicks/nest indicating a high degree of success for at least some attempts. Furthermore, fledged young were seen flying around the island for some time after fledging. Although this colony had a similar success rate to the second nesting at Tern Key, this nesting should be considered a success since (unlike Tern Key) young were observed until old enough to leave the island.

Significant nesting in the Central sub-region is a relatively new phenomena, having started in the mid-1980s. As such, little information has been collected on where these birds feed, but the central locations suggest that they may opportunistically exploit the primary resources used by the other sub-regions. Compared to the Central colonies, the stringent foraging nature of birds in the other 4 sub-regions commits them to a particular foraging habitat (Figure 1). If, for some reason, the specific foraging

habitat becomes compromised, then the nesting attempt is likely doomed (as occurred in the northeast this year). However, spoonbills nesting in the Central sub-region have reasonable access to the entire mosaic of foraging habitats found in the other 4 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. This hypothesis will be tested in the future by making flight line observations and through following flights with fixed wing aircraft.

Southwestern Sub-Region: Buchanon Keys

All keys in the southwestern region were surveyed multiple times in 2002-03 but no active nests were found (Table 1). Although the Southwest region had been declining since the mid-1970's, this was the first time that an entire region of the bay had no spoonbill nests.

Bay-wide synthesis

Using this year as an example, the foraging grounds associated with both the Southeastern and Northwestern sub-regions were of relatively high quality while those in the northeastern bay were poor quality. Perhaps the birds from the Central sub-region were flying the relatively long distance to Cape Sable or the mainline Keys for their foraging areas (Figure 1). The extra travel time and energetic costs of the longer foraging flights may have manifested itself in reduced nesting success compared to the Northwestern sub-region (Table 2). In contrast, the Central bay nesters performed much better than the Northeastern sub-region (Table 2). As indicated above, foraging areas in the northeastern bay were likely of poor quality resulting in failure. Northeastern nesting birds were likely too distant from other more accommodating foraging grounds (e.g. Cape Sable or the mainline Keys) to take advantage of their high quality conditions. To use a gambling analogy, the birds nesting in the Central sub-region "hedged their bets" such that they were more likely to win (succeed in nesting) but with a lower payoff (reduced success). Birds nesting in the Northeastern region "bet the losing ticket" in that they did not win (succeed) but if they had the payoff would be big (high success rate). Birds nesting in the northwest "bet the winner" in that they won (succeeded) and received a nice payout (good success).

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). This year, bay-wide Roseate Spoonbills nest numbers were at their lowest since 1969-70 indicating a continued downward spiral that began with completion of these major water management structures in the early 1980's. That the nesting effort failed in the Northeastern sub-region while successful in the other 3 active sub-regions adds further evidence that the observed decline in nesting effort is anthropogenic in nature. The other sub-regions are buffered by distance from water management practices. 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.

One programmatic note: in conjunction with Dr. Robert Bennetts and USGS-BRD, Audubon staff began banding spoonbill chicks at several locations in Florida. The object of this work is to better understand the movements and dynamics of the state's spoonbill population. Because our efforts got off to a late start, the initial effort in Florida Bay was modest (about 30 chicks from 2 colonies). These chicks were banded with a USGS band on the left "tarsus" and a black band with a 2-digit alphanumeric code on the right "tibia." At Alafia Bank in Tampa Bay, about 170 chicks were similarly banded except the alphanumeric band was red. Several birds from the Tampa colony have already been resighted in central Florida. Please refer anyone with information regarding banding spoonbills to the author.

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SOUTHWEST COAST

The year started typically with Great Blue Herons nesting in December. For me the next wader event is the buildup of the dry-down feeding aggregations along the Tamiami Trail. This more often than not happens in February with the largest concentrations in roadside ponds a couple of miles west of C29 on the south side of the Trail. This year was no exception. At the beginning of February I encountered several large aggregations (500-1000) in the usual ponds, lots of feeding behaviors, lots of aggression between the individuals present (most numerous GREG, SNEG, TRHE, WHIB, then some GLIB and a few scattered LBHE), and very interesting to watch and photograph. This year was different; typically in 4 or 5 weeks the area is completely dry and the birds gone, but this year in the middle of March the area was still wet (see Hydrology 2003 section) and there were just a few scattered GREG around. This brings up an obvious question. Had the waders left because they had fed the area out or was there another reason?

Wader nesting progressed about on schedule with fair numbers of GREG starting in the usual colonies I monitor first (see table) then SNEG, TRHE, CAEG just after those 2 and LBHE last. WHIB were still fooling around the Marco (ABC) colony but not nesting as of Jul 10. Last year I commented on the possibility that the small waders were being affected by 4 years of early strong dry-downs, but I suspect this year's low numbers of nests of the same species and higher water does away with that theory. As of the beginning of July some new wader nesting has started at ABC, RB and CHOK (I haven't yet had a chance to check the other colonies) so this report will be slightly biased but these late nestings are usually small and do not change the numbers much.

Location and Methods

Rookery Bay (RB): 26°01'51"N 81°44'43"W. Two Red Mangrove islands, 0.22 ha. Nest census conducted Apr 3 and Jun 5, walk through, complete coverage; 1-person, 1 hr. This year all the wader nests were on the southern island; this is the second year 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 Apr 3 and Jun 5, walk through, complete coverage; 1 person, 2 hrs each census.

East River (ER): 25°55'39"N 81°26'35"W. Three Red Mangrove islands, 0.25 ha (about). Nest census conducted Jun 2, canoe, complete coverage, 1 person, 1 hr. On the same schedule as the other colonies 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 3 of the 4 islands, boat census, 1 person, 1 hr, May 12. On Jul 11, there were 19 pairs in breeding plumage standing around and 5 new nests.

Chokoloskee Pass (CHPS): 25°46'48"N 81°24'26"W. One mostly Red Mangrove (2-3 Blacks) island, 0.5 ha (about). This year, as last, had almost no wader activity.

Caxambas Pass (CAX): 25°54'17"N 81°43'19"W. One Red Mangrove island, 0.5 ha (approximate). This colony formed last year with a few BRPE & GBHE nests; waders increased this year. Walk through nest census, Jun 4, 1 person 1 hr.

Note: All of the walk or canoe censuses are conducted during peak nesting, about the beginning of June.

Sundown Censusing: For 2 of the colonies above, birds coming in to roost for the night are censused; the goal of this project is to get an index of the numbers and species in the area year round. References to use of the area by the different species is derived from this project.

Marco Colony (ABCSD): Censused monthly with 2 boats and various numbers of volunteers (4-8). Boats are anchored in the 2 major flyways, and species and numbers of birds flying in (and out during the nesting season) 1 hr before sunset to 1 half hr after sunset are recorded. This project is ongoing and started in 1979.

Rookery Bay (RBSD): Censused bi-weekly with 1 boat and 1 volunteer. The boat is anchored so that most of the birds can be observed flying in 1 hr before sunset to 1 half hr after sunset. Species and numbers of birds flying in (and out during the nesting season) are recorded. This project is ongoing and started in 1977.

Species Accounts

Great Egret (GREG): Although the graph of nesting (Fig. 1) shows a lot for variation, it is obvious that there has been a steady increase over the 21 years. Compared to last year nesting was down considerably, but in truth the first nesting which this represents was quite good and fledged a fair numbers of chicks. It is too early to tell if the second nesting, which started about Jul 1 (later than last year which was quite late), will amount to anything.

Number of wading bird nests in coastal Southwest Florida during 2003

Colony	GBHE	GREG	SNEG	LBHE	TRHE	REEG	CAEG	GLIB	WHIB	Total
Rookery Bay		20	18	4	28	1	32			**103**
Marco (ABC)	34	170	59	5	125	4	127	28		**552**
East River			8	2	187					**197**
Chokoloskee Bay		38								**38**
Chokoloskee Pass		1	1							**2**
Caxambas Pass	1	1	34		12		7		24	**79**
Total	**35**	**230**	**120**	**11**	**352**	**5**	**166**	**28**	**24**	**971**
Mean (20-year)	**10**	**193**	**295**	**66**	**479**	**4**	**451**	**47**		**1545**

Figure 1

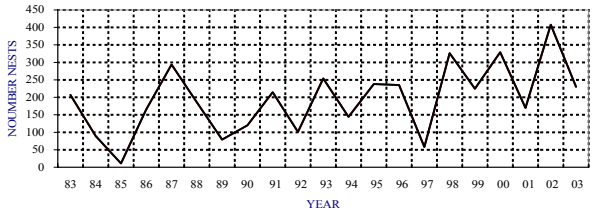


Figure 2

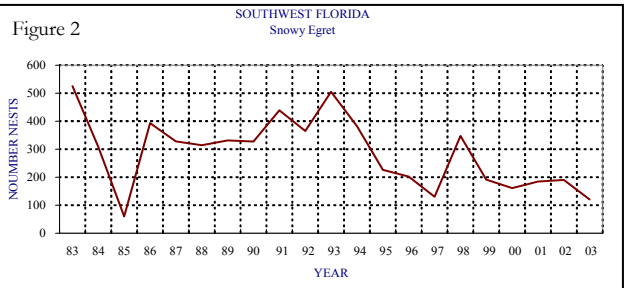


Figure 3

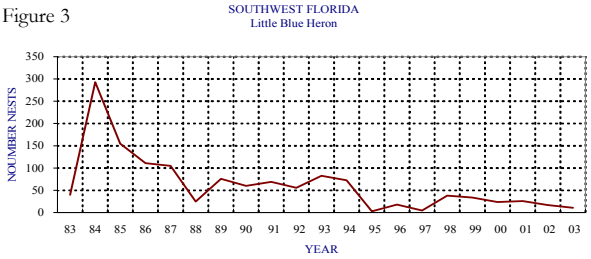


Figure 4

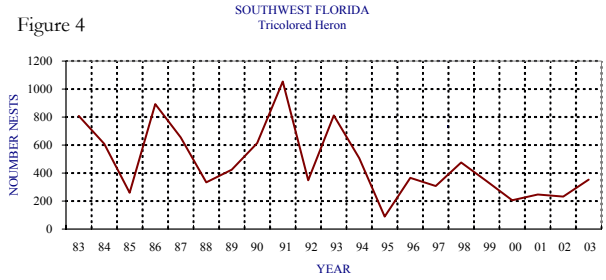


Figure 5

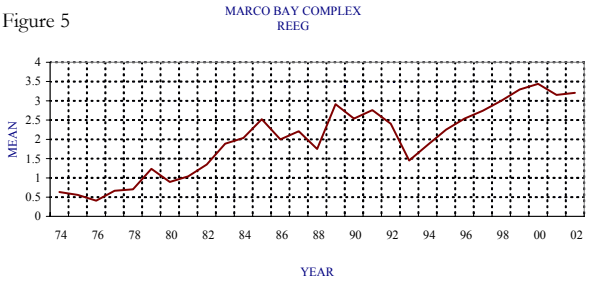
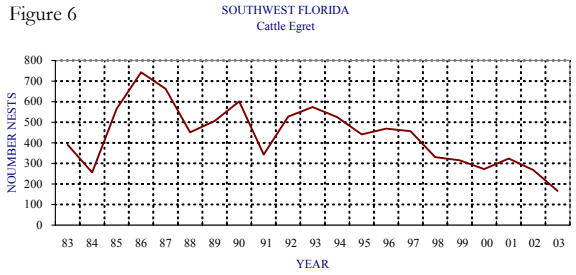


Figure 6



Snowy Egret (SNEG): Began nesting about on schedule but in low numbers and the numbers never picked up much. They appear to be fledging young successfully. For the last several years the sundown censuses have been quite high in the latter part of the breeding season, which indicates that there are many more SNEG in the area than are breeding; but nesting does not reflect this (Fig. 2).

Little Blue Heron (LBHE): This is a species to watch; Audubon wardens in the 1930s 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 (Fig. 3). As with SNEG (and all of the small waders), there are more individuals in the area than nesting indicates.

Tricolored Heron (TRHE): Nested right on schedule and appears to be producing fledglings in good numbers. This year's nesting is up a little from the last 3 but still nothing to brag about (Fig. 4).

Reddish Egret (REEG): About an average number of nests for the last 4 years that produced good numbers of fledglings. Although there are not many nests in the area the steady production of the young is presumably reflected by the increase in the number of sightings of mature birds in the area over the years (Fig. 5).

Cattle Egret (CAEG): Another species to watch; the general decline in nesting (Fig. 6) is now starting to be reflected in the numbers coming to roost at sundown (one would think it would be the other way).

White Ibis (WHIB): There has been a considerable decline in the number of adults coming in at sundown this year. Ironically the numbers of fledglings coming in from the nesting inland (or somewhere else but not from this coast) are at about the usual level for the past few years. As far as nesting, nothing has started at ABC this year but a new colony formed this year (see CAX above) that had 24 nests (that did not make it into the table).

Glossy Ibis (GLIB): Nesting down at ABC (the only nesting location I know about along this coast) as are the numbers coming in at sundown. They appear to be fledging young alright.

The graphs show a steady decline in small waders in this area. This is also reflected in the long term sundown censusing data (but with a lot more static). I can't help but wonder if the constant increase of human activity in the area is causing this but cannot think of a way to prove it.

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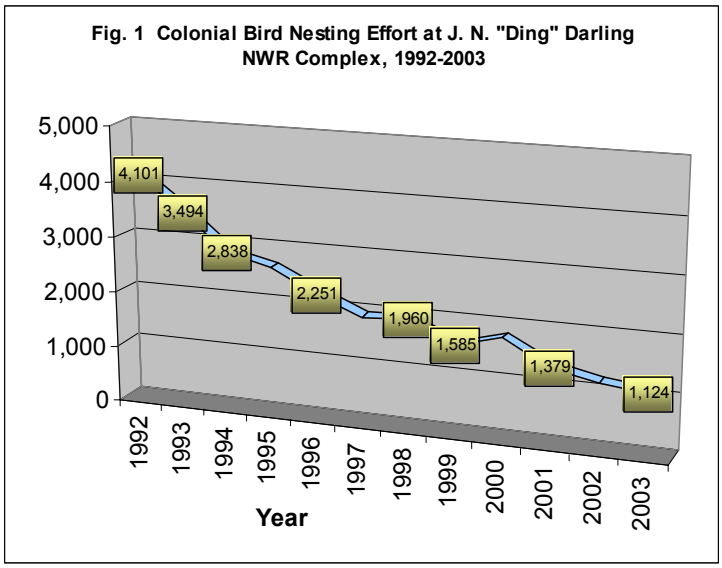
J.N. "DING" DARLING NATIONAL WILDLIFE REFUGE COMPLEX

Methods

Colonial nesting bird surveys at J.N. "Ding" Darling National Wildlife Refuge Complex were conducted via motorboat once per month within Pine Island Sound (Hemp Island and Bird Key) from February to June at 2 rookery islands and twice per month at 4 rookery islands located within Tarpon Bay (Tarpon Bay Keys) and Matlacha Pass (Lumpkin Island, Upper Bird Island and Lower Bird Island). Colonial nesting bird surveys include wading birds (herons, egrets and ibis) as well as diving birds (brown pelicans, double-crested cormorant and anhingas). Total nests are derived from the maximum number of nest-tending birds observed for each species. All distinguishable immature birds are tallied separately. Survey dates for Matlacha Pass in 2003 were Feb 27, Mar 25, Apr 14, Apr 28, May 12, May 27, and Jun 10. Survey dates for Pine Island Sound were Feb 27, Mar 28, Apr 21, May 19, and Jun 11.



Results

The 2003 peak estimate for colonial nesting birds (*n*=1,124) was 7% below the 2002 peak estimate (*n*=1,204). Trends in the maximum total number of estimated nests indicate a 73% decline in overall nesting effort since 1992 (Fig 1). Wading birds decreased 16% from 2002 to 2003 (261 to 219) and diving birds decreased 4% from 2002 to 2003 (943 to 905; Table 1).

Tarpon Bay Keys: Colonial nesting birds decreased from 2002 by 15%. Wading birds decreased 22% and diving birds decreased 8% from 2002 to 2003.

Pine Island Sound: Colonial nesting birds increased by 36% at Hemp Island and decreased by 34% at Bird Key from 2001. Additionally, wading bird nesting increased 1,333% at Hemp Island and decreased 88% at Bird Key. Diving bird nesting numbers also increased 22% at Hemp Island and decreased 26% at Bird Key.

Matlacha Pass: Colonial nesting birds on Upper Bird Island increased from 2002 by 67% and decreased 18% at Lower Bird Island. On Lumpkin Island colonial nesting birds decreased 30% from 2002. Nesting wading birds decreased 25% at Upper Bird Island and increased 77% at Lower Bird Island. Also, on Lumpkin Island, nesting wading birds decreased 57% from 2002. Diving birds decreased 139% and 36% at Upper Bird Island and Lower Bird Island, respectively. Nesting diving birds on Lumpkin Island increased 14% from 2002.

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Table 1. Colonial bird nesting survey peak estimates for J.N. "Ding" Darling National Wildlife Refuge Complex, Feb - Jul, 2003. Counts reflect the maximum number of nest-tending adults.

Island Surveyed	BRPE	ANHI	DCCO	BCNH	GRHE	TRHE	LBHE	REEG	CAEG	YCNH	SNEG	GREG	GBHE	WHIB	TOTAL
Tarpon Bay Keys	61	0	30	2	0	2	3	6	7	0	7	40	3	0	**161**
Hemp Island	260	1	79	2	0	0	0	1	0	0	2	6	0	32	**383**
Bird Key	193	0	54	0	0	1	1	0	0	0	3	1	0	0	**253**
Upper Bird Island	75	0	11	0	0	2	3	2	3	1	2	5	3	0	**107**
Lower Bird Island	82	0	18	1	0	4	3	3	0	0	3	31	8	0	**153**
Lumpkin Island	3	15	23	0	1	3	3	0	6	0	4	6	3	0	**67**
TOTAL	**674**	**16**	**215**	**5**	**1**	**12**	**13**	**12**	**16**	**1**	**21**	**89**	**17**	**32**	**1,124**

WADING BIRD ABUNDANCE (FORAGING & NESTING)

EVERGLADES NATIONAL PARK AREA

Methods: Systematic reconnaissance flights (SRF) were performed monthly between December 2002 and May 2003. Flights were conducted over 3 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 that 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 a general-purpose multiple imputation model (Honaker *et al.* 2001, King *et al.* 2001). Densities of birds were estimated using a 2x2 km grid. The number of birds counted during the SRF inside the 300m strip width was extrapolated to the rest of the 4 km^2 cell by dividing the number of birds observed by 0.15.

Results: No difference was observed in the estimated number of wading birds in relation to the previous year (Fig. 2). Despite that the overall number of birds has increased since 1985, this increase has not been significant (R^2=0.070, P=0.274). Even though the total estimated number of wading birds during 2003 was very similar to the one estimated in 2002, the bird numbers by species were substantially different for the majority of the species. Great egrets (GREG) and roseate spoonbills (ROSP) did not show significant differences. However, a decline was observed for some species such as great blue herons (GBHE) with a 38% decline, small dark herons (SMDH) 19% and white ibis (WHIB) with 2%. The other species showed an increase in the estimated numbers of birds; glossy ibis (GLIB) increased 35%, small white heron (SMWH) 31%, wood stork (WOST) 12% and great white heron (GWHE) 25%.

The maximum density of birds occurred in December (Table 1), with 5 of the 9 species surveyed showing peak numbers, including those species with the largest number of individuals such as GREG and WHIB. Other species such as WOST and ROSP reached maximum densities in January, while SMWH and GLIB peak densities were in February.
Table 2 shows the distribution and abundance of wading birds in the different drainage basins in what could be considered as typical rainfall year. East Slough (ES) and Shark Slough (SS) were the basins where most of the birds

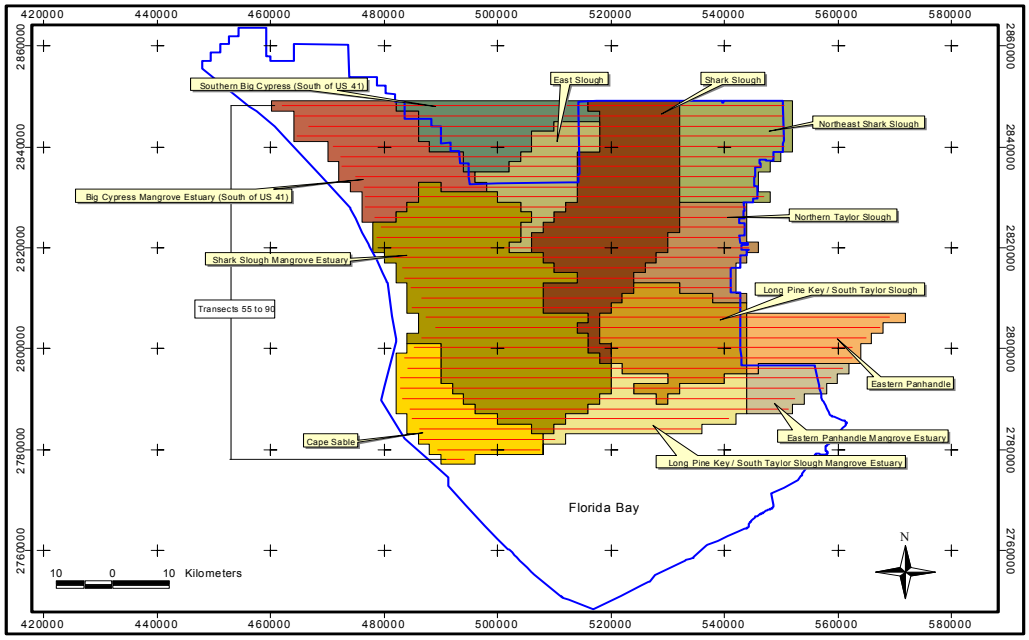

Figure 1. Map of ENP and southern Big Cypress National Preserve with sampling transects and drainage basins.

were found (20%) in each one, followed by Shark Slough Mangrove Estuary (SSME) and Big Cypress Mangrove Estuary (BCME) with 15% and 13%, respectively. These 4 basins combined made up to 69% of the total number of birds observed during the entire season. As would be expected in a normal rainfall year, most birds were found in ES and SSME during the first part of the year. During the last 4 months, when water recedes, the largest concentration of birds shifted mainly to SS.

Considerable changes in hydropatterns and bird distribution were observed throughout the season as shown in Figure 3. A very significant correlation (R^2=0.979, P=0.001) was observed between the number of birds and the amount of area covered for each hydropattern in December. As the season progressed, less significance values were observed for this correlation. By February, this correlation was barely significant (R^2=0.749, P=0.058). No significant correlation was observed for March (R^2=0.116, P=0.575) and April (R^2=0.687, P=0.083). Finally by May, when water levels started to increase, the correlation between number of birds and area covered for each hydropattern became significant again (R^2=0.837, P=0.029).

During the month of December, most of the study area was covered by water; 53% of the area was classified as WW and 30% as WT. It was also in these areas that the highest densities of birds occurred during this month. From December to February, a gradual reduction in surface water was observed. Despite these changes in hydropattern, no major changes were observed in the bird distribution. During March, the area covered by the 5 different hydropatterns was very similar (approximately 20% for each one) and changes in bird distribution were obvious. Most of the birds were concentrated in WT (33%) and DT (27%), while only 25% of the birds were located at areas with WW hydropatterns. During the months of April

Table 1. Estimated abundance of wading birds in the Everglades National Park and adjacent areas, Dec 2002 -May 2003.

Species	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03
GREG	24,273	22,460	19,607	15,480	10,220	10,727
GBHE	1,400	1,153	960	1,167	467	307
SMDH	3,533	2,947	2,007	1,633	567	480
SMWH	4,853	4,320	6,133	5,087	3,780	1,813
WHIB	48,673	48,607	38,287	15,240	8,360	6,520
GLIB	467	647	1,700	707	113	47
WOST	2,267	2,533	4,147	1,827	887	353
ROSP	707	1,047	360	313	947	327
GWHE	87	60	60	80	60	80
Total Abundance	**86,259**	**83,772**	**73,259**	**41,532**	**25,399**	**20,652**

Table 2. Estimated abundance of wading birds (all species combined) for the different drainage basins in the Everglades National Park, Dec 2002 - May 2003.

Month	SBC	BCME	SS	NESS	ES	SSME	NTS	LPK/STS	EP	CS	LPK/STSM	EPME	Total
Dec-02	5,767	12,367	9,613	947	24,413	15,820	260	1,473	3,980	6,173	2,467	2,980	**86,260**
Jan-03	6,627	12,453	12,573	953	17,073	14,720	380	3,627	4,433	6,453	3,200	1,280	**83,772**
Feb-03	4,287	7,207	20,573	1,327	14,207	12,267	747	1,873	1,280	3,060	6,293	140	**73,261**
Mar-03	2,713	4,953	10,120	1,873	6,753	4,540	653	2,653	540	2,227	4,433	73	**41,531**
Apr-03	1,347	4,940	7,027	2,740	2,327	2,360	100	720	453	1,360	1,940	87	**25,401**
May-03	1,507	2,700	5,473	2,633	1,160	1,440	73	1,053	953	1,187	2,180	293	**20,652**
Total	**22,248**	**44,620**	**65,379**	**10,473**	**65,933**	**51,147**	**2,213**	**11,399**	**11,639**	**20,460**	**20,513**	**4,853**	**330,877**

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

and May, water levels started to increase gradually and, correspondingly, bird distribution began to resemble the one observed at the beginning of the season.

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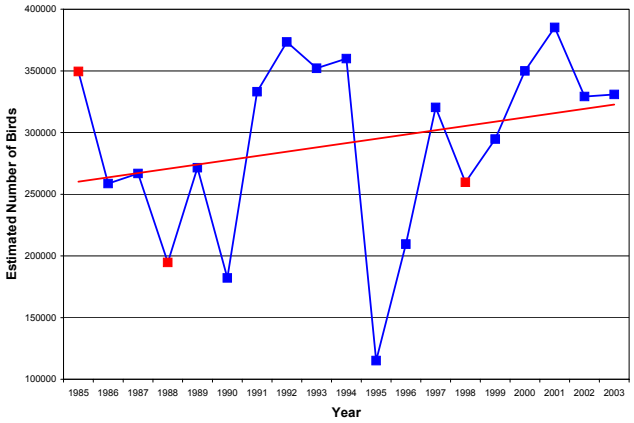
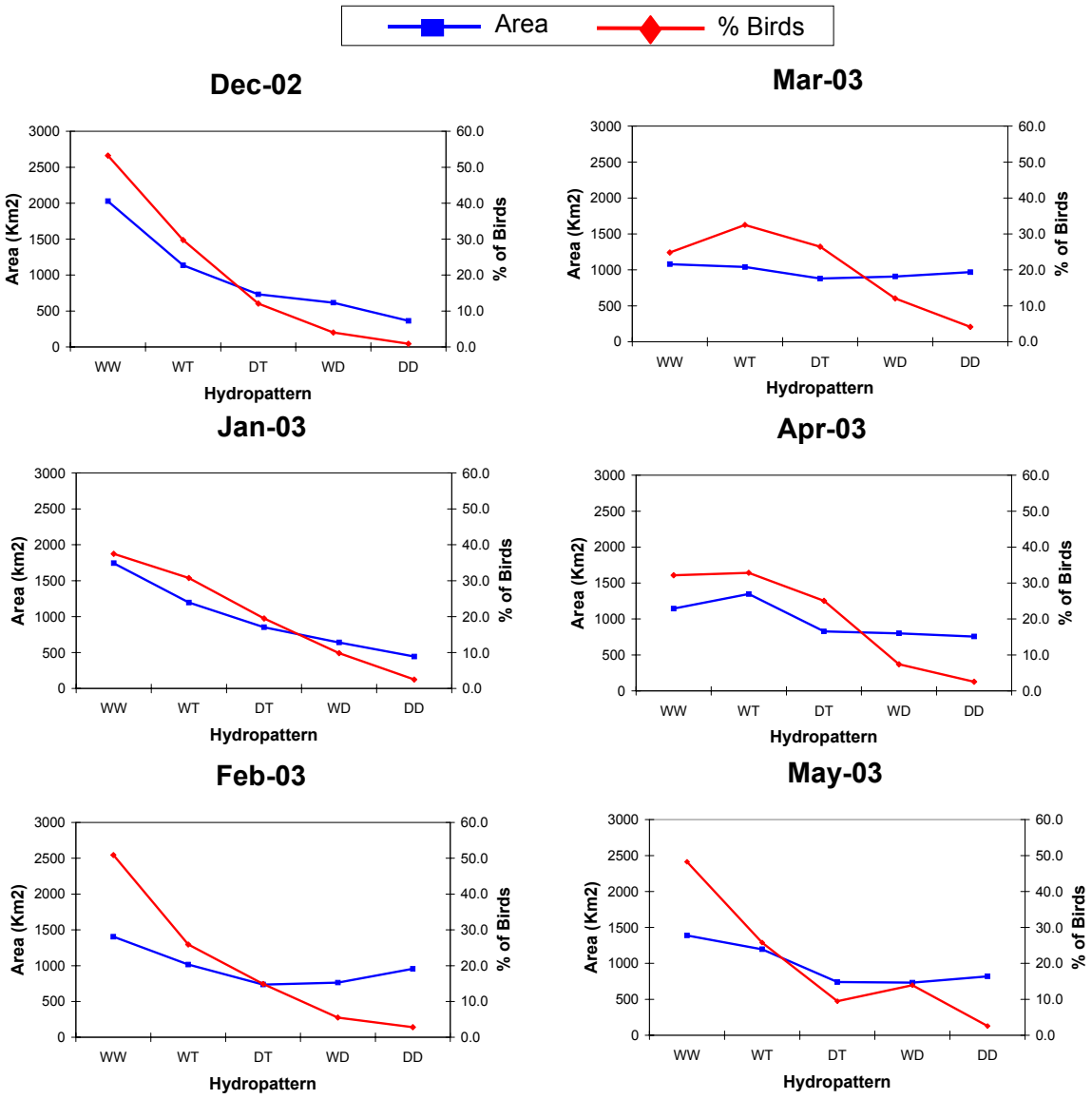


Figure 2. Estimated number of wading birds (all species pooled) observed from the months of Dec - May from 1985 - 2003. Red marks represent years with estimated missing data.

Figure 3. The areal extent and percentage 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.



Northern and Central Everglades

Methods

Wading bird surveys were flown with a fixed wing aircraft at an altitude of about 60 meters along parallel transects with 2-km spacing each month from January to June 2003. 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 slightly lower in 2003 than 2002. In 2003, the wading bird monthly relative abundance peaked in January and then declined each month to a low in June. In the Big Cypress National Preserve, monthly wading bird abundance was slightly lower in 2003 than 2002. In the Holey Land Wildlife Management Area, wading bird monthly relative abundance peaked in February (140) then decreased as the surface water dried up to less than 135 birds per month for the remainder of 2003. Final reports from 1996 to 2002 are currently available and the 2003 report should be available in December.

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Estimated wading bird abundance (15% coverage) in 2003 from SRFs.

Region	Species	Jan	Feb	Mar	Apr	May	Jun
Water Conservation Areas	GREG	10,400	18,367	15,967	18,260	16,653	6,133
	GBHE	693	847	427	753	453	247
	SMDH	620	980	213	207	160	86
	SMWH	267	653	413	3,727	2,280	827
	WHIB	11,220	48,620	38,367	9,340	6,967	1,707
	GLIB	407	733	700	167	567	0
	WOST	740	2,720	1,547	960	2,253	880
	CAEG	0	0	0	0	0	33
	ROSP	7	100	7	47	7	0
	GWHE	387	473	333	640	633	633
	Regional total	**24,741**	**73,493**	**57,974**	**34,101**	**29,973**	**10,546**
Big Cypress National Preserve	GREG	18,980	7,660	3,293	4,093	1,760	4,427
	GBHE	613	333	40	120	13	0
	SMDH	127	93	47	27	57	127
	SMWH	420	233	120	567	147	187
	WHIB	10,013	14,260	4,487	3,053	1,467	460
	GLIB	73	7	0	107	0	0
	WOST	1,520	1,247	627	647	273	20
	CAEG	160	973	1,333	1,360	447	1,027
	ROSP	0	0	47	0	0	0
	GWHE	253	153	47	147	260	353
	Regional total	**32,159**	**24,959**	**10,041**	**10,121**	**4,424**	**6,601**

STATUS OF WADING BIRD RECOVERY – 2003

The purpose of this report is to provide a regional integration and interpretation of wading bird nesting data from the Everglades Water Conservation Areas and Everglades National Park, in the context of the recovery goals established for wading birds by the Comprehensive Everglades Restoration Plan (CERP). These reports have been produced annually since 1996 for inclusion in the South Florida Wading Bird Report. Recovery of more historical wading bird nesting patterns in the greater Everglades basin will be measured using four parameters: (1) numbers of nesting pairs for six species, (2) locations of major nesting colonies, (3) timing of nesting for Wood Storks, and (4) frequency of supra-normal colonies (super colonies). Although the development of the CERP monitoring and assessment plan (MAP) and an "official" set of CERP assessment performance measures during the past year has been an essential step towards formalizing the restoration goals for wading birds in south Florida, numerical endpoints for these four parameters now need to be reviewed, refined or developed, as appropriate. The information on nesting patterns now being collected is being used to better define the pre-CERP condition for wading birds – the baseline from which wading bird responses to CERP will be measured. Information used in this annual status report is extracted from data collected during aerial and ground surveys of nesting colonies in LNWR, WCAs 2 and 3, and mainland ENP, and reported in more detail in other sections of this South Florida Wading Bird Report.

2003 Results

Numbers of Nesting Birds: In 2003, the reported total number of nesting pairs (rounded to the nearest 100) for the five mainland, indicator species was 8,800 Great Egret pairs, 1,400 Snowy Egret pairs, 1,700 Tricolored Heron pairs, 12,400 White Ibis pairs and 1,100 Wood Stork pairs. The total for the five species in 2003 was 25,400 pairs, compared to 8,000 pairs in 1996, 8,300 pairs in 1997, 6,900 pairs in 1998, 21,600 pairs in 1999, 32,900 pairs in 2000, 30,600 pairs in 2001, and 60,100 pairs in 2002. In addition, an estimated 1,100 pairs of Wood Storks nested at Corkscrew Swamp Sanctuary in 2003.

Seasonal Timing of Nesting: In general, the sub-regional colony survey reports provide information on numbers of nesting pairs, locations of colonies, and to a lesser extent, on nesting success. In these reports, information on timing of nesting is often incidental or omitted. The 2003 sub-regional reports did not provide enough information on timing for me to be able to comment on this years' patterns. The restoration goal for Wood Storks is to shift the initiation of nesting to a December-January time frame (January - March in most recent years), which more closely matches pre-C&SF Project nesting patterns for storks in the Big Cypress and southern Everglades.

Locations of Colonies: The number of pairs for the five indicator species that nested in the southern Everglades ecotone region of Everglades National Park in 2003 was an estimated 1,200 pairs, or about 4.5% of the total Everglades nesting effort. The percentage nesting in the southern ecotone region probably exceeded 90% in many years during the 1930s and early 1940s, averaged 26% during the years 1986-1995, was 11% in 1996, and has been less than 5% in all years since 1997. The restoration goal is to recover large, sustainable nesting colonies in the marsh-mangrove ecotone region of the southern Everglades, where the largest known colonies occurred in the pre-C&SF Project Everglades.

Recovery of "Supra-Normal Colonies": The recovery of a "super colony" nesting pattern is a new performance measure and restoration goal for wading birds in the Everglades. This restoration goal is based on a paper published by Frederick and Ogden (2001) that describes a historical pattern of supra-normal nesting events in the Everglades. The presence of these regional-scaled, super-normal nesting events in the historical Everglades was one of the defining characteristics of this ecosystem. It was in these occasional years of supra-normal nesting that the huge "rookeries" formed in the old Everglades. For the period 1931-1946, supra-normal nesting events occurred in 25% of the years, with an average regional nesting effort of 85,000

Species	1986 -88	1987 -89	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
GREG	1,946	1,980	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
SNEG/ TRHE	2,057	1,680	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
WHIB	2,974	2,676	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
WOST	175	255	276	276	294	250	277	130	343	283	228	279	863	1,538	1,868	1,596
ROSP	538	559	578	645	720											643

pairs. For the recent period, 1986-1998, supra-normal nesting events occurred in 15% of the years, with an average nesting effort of 24,000 pairs. The restoration goal is to recover the frequency and magnitude of these supra-normal nesting events.

Discussion

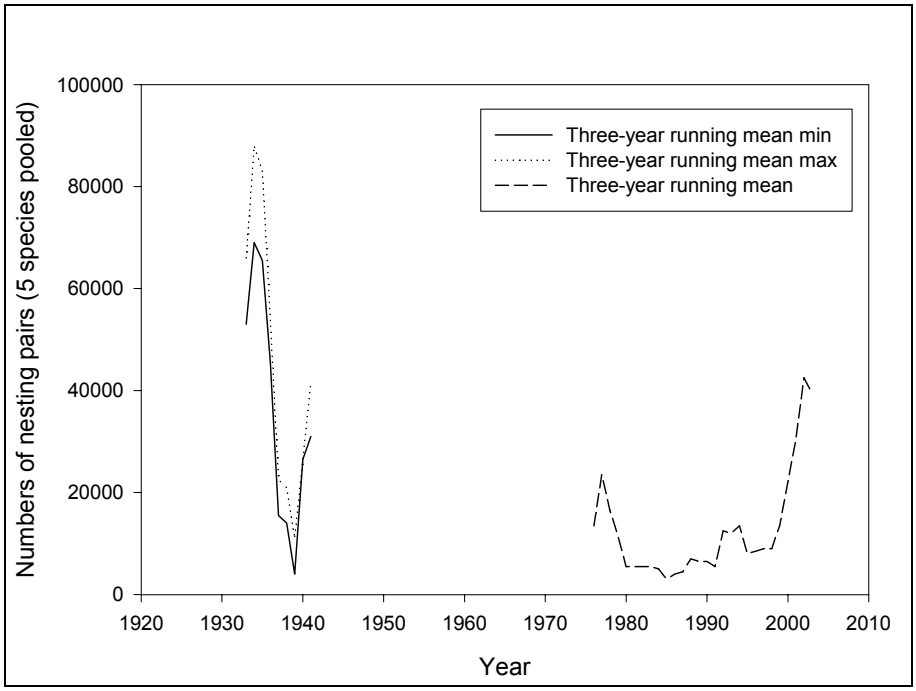
For the four parameters of wading bird nesting patterns that will be used to assess responses to the CERP and other restoration programs in south Florida (numbers of pairs, timing, locations, supra-normal nesting years), the baseline or pre-CERP condition for each seems to be reasonably understood except for numbers of nesting pairs. The percentage of birds nesting in the southern Everglades ecotone region has settled in at < 5% annually since 1997; storks generally initiate nesting in February or March (except earlier in the wetter years); and supra-normal nesting events are smaller and less frequent than during the historical period, 1931-1946.

The numbers of nesting pairs in the mainland colonies (keeping in mind that the Big Cypress and Lake Okeechobee regions continue to be un-surveyed!) has in recent years shown increases for all species, which raise challenges for those who are attempting to characterize pre-CERP patterns. The attached table shows three-year running averages for nesting pairs of Great Egrets, Snowy Egrets and Tricolored Herons (combined), White Ibis, Wood Storks and Roseate Spoonbills for the years 1986-2003. The numbers for the egrets, herons, ibis and storks are from the mainland colonies in the three WCAs and ENP, while the spoonbill numbers are from Florida Bay. The spoonbill running averages are incomplete because total surveys of the bay were not conducted in 1993-1998 and in 2000 (J. Lorenz).

The table shows that Great Egrets have been increasing almost throughout this period of years, doubling their numbers between the 1986-1988 and 1994-1996 periods, and doubling again between the 1994-1996 and 2001-2003 periods. As mentioned in previous annual status reports, the number of Great Egrets nesting in this region of south Florida equals or exceeds the numbers estimated during the 1930s-1940s (Ogden 1994).

The other mainland species reported in the table have all shown increases, but for the most part only since the late 1990s. The running averages for snowies and tricoloreds (combined) and for storks generally remained constant from the mid-1980s to late 1990s, but then abruptly increased beginning in the 1999-2001 period for the egrets/herons, and in the 1998-2000 period for storks. With the exception of a substantial bump in nesting effort by ibis in the early 1990s (entirely consistent with the nomadic nesting patterns of ibis; see Frederick and Ogden 1997), ibis showed a similar dramatic increase in nesting beginning in the 1998-2000 period.

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.



A major unanswered question at this time is whether the increased nesting effort since the late 1990s will be sustained. If these increases were at least in part due to the favorable rainfall and drying patterns in the Everglades during these recent years, then we might expect to see substantially reduced nesting in future dryer years, and in years with unseasonable winter rains. This year, 2003, may have been a demonstration of the effects from unseasonable rains in March, which apparently caused reductions both in nesting numbers and nesting success.

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SPECIAL TOPICS

SURVIVAL AND MOVEMENTS OF JUVENILE WOOD STORKS

This was the second year of study examining factors that may affect the survival of juvenile Wood Storks, *Mycteria americana*. Wood Storks are of special interest with regard to the restoration of the South Florida Ecosystem, both because wetlands of south Florida are considered prime habitat for this federally endangered species and because the storks' demographic responses are thought to be indicators of several aspects of normal ecosystem function. As the first few months of a bird's life are often the period of time when birds may experience their highest mortality, we examined health and body condition of Wood Stork nestlings prior to fledging. Storks nesting in south Florida are actually a fluid subset of the larger southeastern U.S. population, yet the movements of these birds and the specific habitats they use remain poorly understood. This study of the movement-dependent survival of individual storks may therefore lead to the identification of specific wetland areas used most heavily, and those that are most valuable.

We worked in the Tamiami West colony in Everglades National Park during both 2002 and 2003 as this colony was centrally located in the Everglades ecosystem, hosted a large number of nesting Wood storks (>400 pairs), and had stork nests easily reachable by ladder. The colony was visited on the ground from February through July 2003. After high levels of abandonment and chick death in the Tamiami West colony in 2003, we also briefly worked in the Martin County Spoil Island 2 (MC2) colony (N27 11.40, W80 11.27), located just south of Sewalls Point, FL. MC2 is a mixed-species wading bird colony with approximately 50 storks nesting in red mangrove (*Rhizophora mangle)* and sea grape (*Coccoloba uvifera)*. Although we conducted health exams and deployed satellite transmitters on 5 juvenile storks hatched in this colony, we did not monitor nesting success in this colony. We worked in this colony in late May 2003, only after all available juvenile storks in Tamiami West colony had died or fledged.

Reproductive Success

Approximately 350 Wood Stork nests were initiated in Tamiami West in 2003, but heavy rain events in February and March were probably responsible for the roughly 50% abandonment rate seen in this colony. A total of 108 nests were marked with numbered surveyors flagging to determine rates of survival. We conducted nest checks every 4-7 days throughout the nesting season to determine nest contents and age of nestlings. At the initial time of marking in early March, 96% of the 84 nests marked were still being incubated. The average clutch size of marked nests located during incubation was 3.56 (SE=0.08, n=84). Average brood size for nests monitored during the period when nestlings were 8-14 days old was 2.97 (SE=0.15, n=38; Table 1).

Overall traditional nesting success (number of nests fledging at least one young /number of nests studied) for this colony was 24.07% (26/108 nests; Table 2). This success rate was 31% lower than in 2002 (77.39% 89/115 nests). Of 87 nests that failed during 2003, 68.96% failures occurred early in the nesting season, during March. We also used Mayfield's method of analyzing nesting success, which pro-rates survival on a daily basis. During the incubation stage, Mayfield survival was 19.04% (SE=0.57). This was 61% lower than in 2002 (49.66% SE= 1.02). Although Mayfield success during the nestling period in 2002 was quite high at 89.29% (SE=1.63) in 2002, nestling survival during 2003 was only 23.28% (SE=0.76). The overall, combined Mayfield nesting success for these 2 periods was 44.34% (SE=0.624) in 2002, and 4.43% (SE=0.17) in 2003.

Nestling Health

After the 2003 nestlings reached 4-6 weeks of age, first-hatched nestlings from 34 nests from Tamiami West and 5 nests from MC2 were randomly selected for inclusion in our health and telemetry studies. After a juvenile stork was captured on the nest, we performed a health exam on each individual. Skeletal measurements (culmen and tarsus) and mass were recorded which will be used to develop an index of body condition. Each health exam included a physical examination for ectoparasites, palpation for *Eustrongylides* nematodes, and collection of up to 2 mL of blood. Blood was used for sexing, hematocrit, white blood cell counts, and blood smears which will later be

Table 1. Average clutch and brood sizes of Wood Storks in Tamiami West colony.

Year	Average Clutch Size	Average Brood Size
2002	3.09 ± 0.08	2.81 ± 0.09
2003	3.56 ± 0.08	2.97 ± 0.15

Table 2. Nesting success of Wood Storks in Tamiami West colony in 2003.

		Mayfield Method of Success		
Year	Traditional Method	Incubation Period	Nesting Period	Combined
2002	77.39%	49.66%	89.29%	44.34%
2003	24.07%	19.04%	23.28%	4.43%

examined for the presence of blood parasites. In addition, 4 – 6 growing scapular feathers were collected from each bird to determine level of mercury contamination. This information will be used to construct an estimation of the health, parasite load, and body condition of each bird.

Satellite Telemetry – Juvenile Survival and Movement Patterns

Following the health exam, each bird was fitted with a backpack harness that combined a 10g VHF radio transmitter and a 35g solar-powered ARGOS certified platform transmitter terminals (PTT) for satellite tracking. The total weight of the Teflon harness, VHF transmitter and PTT did not exceed 3% of the Wood Stork's fledging mass (2 – 2.8 kg).

Signals from the PTTs are recorded by polar-orbiting environmental satellites and then processed by Argos Satellite Location and Data Collection System, Landover, MD. PTTs work on a 10 hr on/24 hr off cycle. Argos assigns each location an accuracy rating, and only locations with estimated accuracies of <1000m are being used in this study. These data will be used to follow their post-fledging survival and to examine their movement patterns and habitat use in years to come.

Of the 39 nestling storks tagged in 2003, 17 died in the Tamiami West colony and 2 died in the MC2 colony before fledging. The 3 remaining live birds in MC2 had not fledged as of late June. Of the remaining 17 tagged birds that fledged from Tamiami West, satellite data suggests that 7 have died as of 25 June 2003 (41.18%). These tagged fledglings are believed to have all died in central and south Florida. Of those 26 mortalities, we have recovered 13 transmitters; relocations of the remaining 13 transmitters are ongoing.

Juvenile stork movement patterns in 2003 were similar to patterns recorded in 2002. After fledging, juveniles generally moved north through the Water Conservation Areas and Big Cypress National Preserve. Following this initial local movement, the majority of storks continued moving north. As of 1 Jul 2003, 3 of the newly fledged 2003 birds were in Georgia, while the rest were spread across central and north Florida. Of the 12 surviving 2002 birds, 2 are in Georgia, 1 is in Alabama, and the remainder are in Florida. We anticipate many more of these birds to leave Florida in the upcoming months for Mississippi, Alabama, South Carolina, and Georgia, as this pattern was observed in 2002.

Movement Patterns of Birds Tagged in 2002

In south Florida, birds monitored by radio telemetry were seen foraging individually as well as in large mixed groups containing both adults and other juveniles. In the past 6 months however, we have very few indications that any of the tagged fledged storks have been traveling together. This is quite interesting considering many young were tagged from adjacent nests in the same colony and therefore had plenty of chance to develop social groupings based on natal colony. Many of these birds have also frequently visited the same areas throughout the southeastern United States, although not simultaneously.

After tagged storks left the colony in a permanent way, in general they moved north through the Water Conservation Areas and Big Cypress National Preserve. After this initial local movement, the majority (16 of 27) of storks continued moving north, spreading across the coastal plains of Florida, Georgia, South Carolina, Alabama, and Mississippi (Figure 1). The birds that left Florida did so in a roughly simultaneous way during the second week of June, and tagged birds were found in Alabama, Georgia, and South Carolina. Of 16 birds to leave Florida, 11 moved through Georgia, 8 through Alabama, 3 through South Carolina, and 1 briefly crossed the border into North Carolina. To date, a total of 5 birds have moved through Alabama into Mississippi, with the first bird having arrived the last week of June. Fifteen of these 16 birds set up primary summer "home ranges" outside of Florida: 2 in South Carolina, 7 in Georgia, and 6 in Alabama/Mississippi. The simultaneous departure of 3 birds from Mississippi into Alabama and Florida and one Alabama bird into Florida during the last week of September coincided with the arrival of tropical storm Isidore that made landfall directly over New Orleans, LA. The rains and strong winds from this storm may have been an impetus for withdrawal from these areas.

We identified multiple northern movement pathways for these juvenile birds. Three birds left south Florida and flew north through the western-central portion of peninsular Florida, turning northwest into Alabama once they reached the Florida panhandle (Figure 2). Two other birds also arrived at the same destination, but followed a coastal path through Florida along the Gulf of Mexico before making their way into Alabama. All 5 birds remained in Alabama or moved into northeast Mississippi for the remainder of the summer. These birds were most frequently located along the Tennessee-Tombigbee Waterway in Alabama and Mississippi.

There were an additional 6 birds that spent the majority of their summer (Jun – Sep) in Georgia. Of these, 2 traveled north along the Gulf Coast of Florida, 2 along

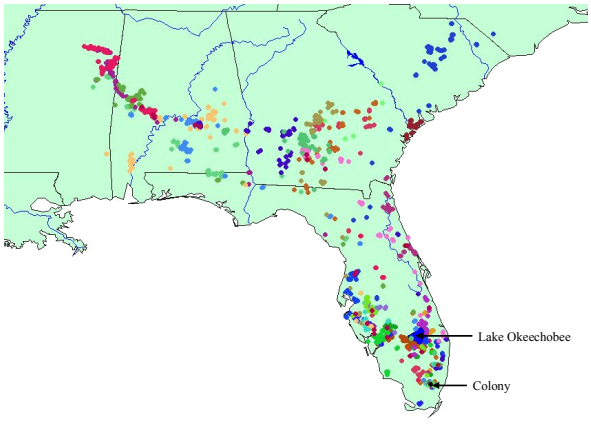

Figure 1. All good quality satellite transmitter locations of juvenile Everglades Wood Storks between 15 May and 6 Oct 2002. Each color represents a different individual.

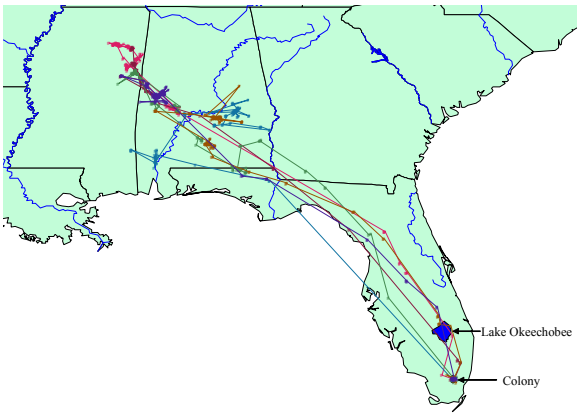

Figure 2. Migratory pathway of juvenile Everglades Wood Storks that summered in Alabama and Mississippi in 2002. Each color represents a different individual (n=5).

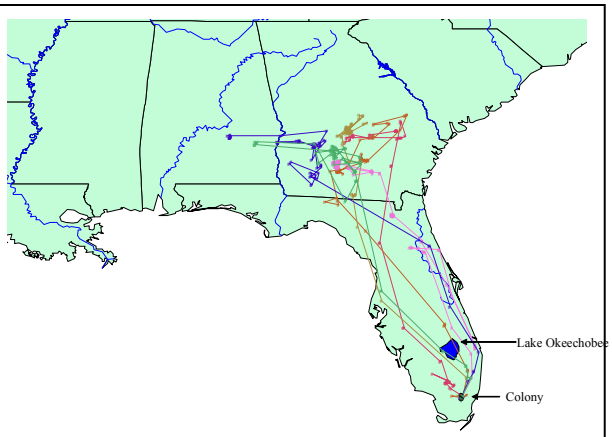

Figure 3. Migratory pathway of juvenile Everglades Wood Storks that summered in Georgia in 2002. Each color represents a different individual (n=6).

the Atlantic Coast, and 2 directly through the center of peninsular Florida after leaving the colony located just west of Miami (Figure 3).

A large portion of tagged birds, 11 of 26, remained in Florida after fledging from the colony (Figure 4). Most of these birds summered around the edges of Lake Okeechobee or headed further west along the Gulf Coast. These western birds tended to be localized between Tampa and Fort Myers. In this area, the C.M. Webb Wildlife Management Area, just southwest of Port Charlotte, was frequented most often. By the beginning of November, all northern birds located outside of Florida moved back south into central and south Florida. The areas around Lake Okeechobee and along the Gulf Coast appeared to be important wintering areas for many of these young birds.

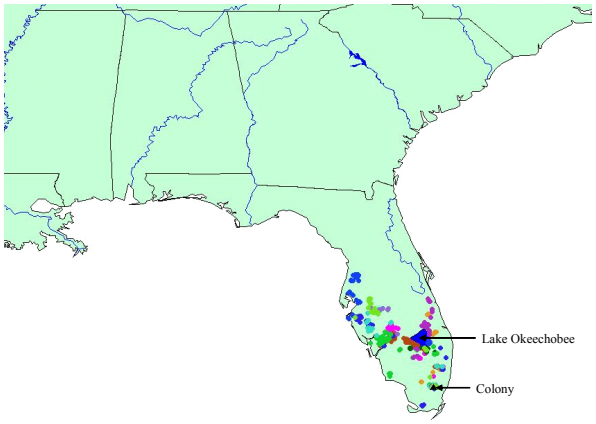

Figure 4. Locations of juvenile Everglades Wood Storks that remained in south and central Florida after fledging. Each color represents a different individual (n=11).

Educational Website

An educational website detailing the ecological requirements and environmental concerns relating to Wood Storks was developed as a result of this project (http://www.wec.ufl.edu/faculty/FrederickP/stork/index.htm). This website focuses on the biology of wading birds and the dynamic movements of the study group of juvenile storks. In an effort to make the movement information available to the public and other professionals, the satellite telemetry project is emphasized on this site and includes maps and descriptions of their movements which are updated bi-weekly. In addition, this site references many other telemetry projects around the world.

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