SOUTH FLORIDA WADING BIRD REPORT

Volume 6, Issue 1 Dale E. Gawlik, Editor September 2000

SYSTEM-WIDE SUMMARY

At the start of the dry season, water levels throughout the Everglades were much higher than normal due to Hurricane Irene. As the dry season progressed, water levels receded rapidly so that by June, they were close to, or slightly above, normal. A heavy rain in April caused water levels to rise quickly, albeit temporarily, but the amount of increase differed among regions, as did the response by wading birds.

The estimated number of wading bird nests in south Florida in 2000 was 39,480 (excluding Cattle Egrets, which are not dependent on wetlands). That represents a 40% increase over 1999, which was one of the best years in a decade. Increased nesting effort in 2000 was almost solely a function of increases in White Ibises, Wood Storks, and Snowy Egrets, the 3 species that have declined most over the long-term. This was the best year since at least the 1970s for White Ibises and Wood Storks. Most other species decreased from last year, illustrating the importance of understanding species-specific responses to environmental conditions.

Nesting effort differed strongly among regions. The overall increase was due mostly to increases in WCA3 with smaller increases in ENP and Florida Bay. Nest estimates for LNWR were down 75% from 1999, and it was the only region where sizeable nest abandonment followed the April water level rise.

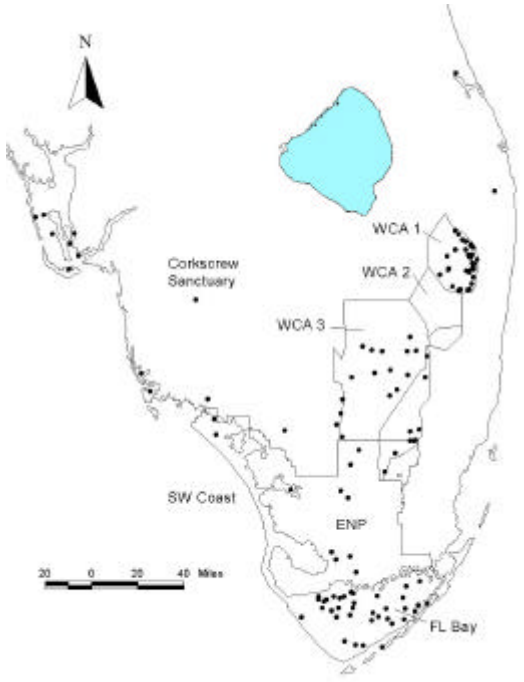
Aerial wading bird distribution surveys in the WCAs indicated that bird abundance before the breeding season (Feb) in 2000 was 129% higher than in 1999, which was roughly 3 times that of 1998. Clearly, more birds are coming into the Everglades in the early dry season than have done so in the recent past.

This year's good nesting effort is encouraging because it suggests the Everglades still has the capacity to produce large numbers of the most sensitive species, even if the precise cause of the increase in nesting is unknown. One hypothesis is that it was the combination of 3 factors: more birds than usual in the ecosystem prior to the breeding season (probably because of droughts in the SE U.S.), a very wet system at the start of the dry season (even the short hydroperiod marshes were inundated), and a rapid and prolonged drydown (concentrated prey patches moved over the entire landscape as water receded across it). But, other hypotheses are equally plausible (see Frederick et al. this report). Determining causation so that key conditions can be repeated will require both long-term monitoring and shorter-term experiments and modeling.

Past differences in survey methodology and effort among regions are starting to be addressed. All regions of the Everglades proper now have systematic aerial colony surveys. However, ground counts are not universal and no surveys are done in Big Cypress National Preserve or Lake Okeechobee. Thus although we have made some progress, our ability to get an accurate system-wide nest estimate is still limited.

Dale E. Gawlik
Everglades Department
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406
(561) 682-6712
dale.gawlik@sfwmd.gov

Locations of wading bird colonies in S Florida Feb-Jun 2000. Colonies with more than 3 nests are depicted in WCA 1 (LNWR) and colonies with more than 39 nests are depicted in WCA 2 and 3.



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2000 HYDROLOGY

Everglades Protection Area

The recent hydrologic trends, summarized below, compare the 1999-2000 Water-Year with the 30-year average. A water-year is defined as beginning 1 July (the start of the wet season) and ending 30 June (the end of the dry season). Average water depths in each of the WCAs and ENP were above average in 2000.

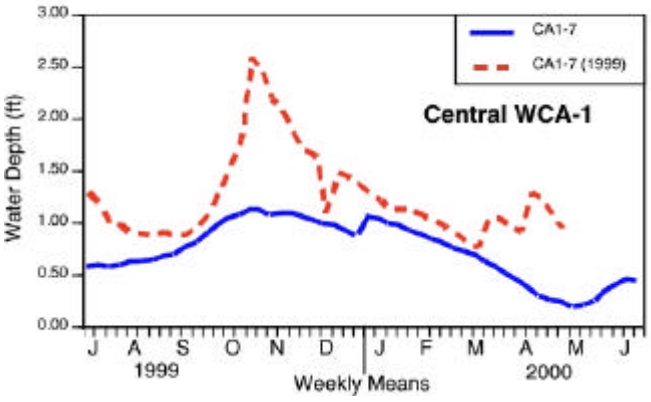
Average water depths (ft) for water-yr 2000 in comparison to 30-yr average water depths. Based on 52 weekly means.

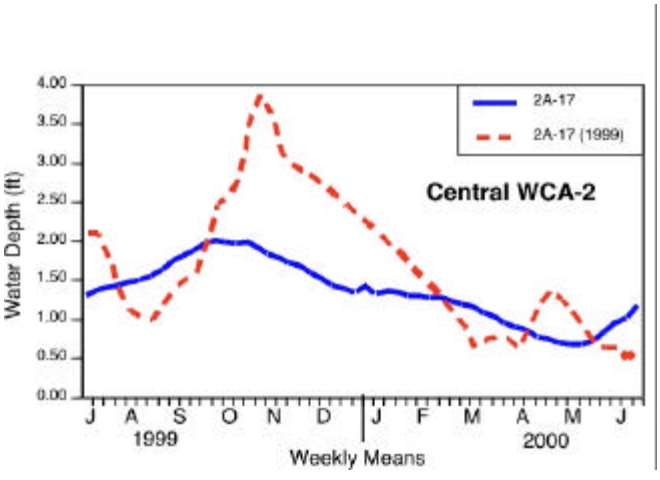
Area (gage)	Average (1970 – 1999)	Average 2000
WCA-1 (1A-7)	0.7	1.3
WCA-2 (2A-17)	1.4	1.7
WCA-3 (3A-NE)	0.1	1.2
Shark Slough (P33)	1.0	1.8

This water depth trend was interesting because rainfall was generally below the 1970-1999 average. Precipitation measurements at the West Palm Beach and Miami airports, indicative of the south Florida rainfall pattern, were 41.2 inches (average = 59.9 inches) and 50.8 inches (average = 56.5 inches), respectively. These high water depth averages appear to reflect the combined effects of Hurricane Irene, high structure inflows to reduce flooding, and water management for slow recession rates (see the 2000 Consolidated Report by the South Florida Water Management District).

According to the table above, the WCA 1 water depth in 2000 was again (as it was last year) almost double the 30-year average. Water in WCA 2A was also above average. This was a departure from last year when WCA 2A was below average. Continued high water in WCA 2A may not be beneficial because the 30-year average trends in WCA 2A are thought to have resulted in the drowning of tree islands and the expansion of cattails in areas receiving agricultural runoff. Just the opposite trend may be needed in the northern section of WCA 3A. The 30-year average at gage 3A-NE represents a period when water management was more concerned with fast drainage to prevent residential flooding or meeting water supply needs rather than meeting ecological needs. As it was last year in the northern sector of WCA 3A (gage 3A-NE), the average water depth for water-yr 2000 was significantly higher than the 30-year average. Data from ENP, showed a similar turn-around in the quantity of water. Depths in Shark Slough were 0.8 ft above average. Last year they were 0.5 ft above average.

The weekly water depths in the WCAs and ENP, in comparison to the 1970-1999 weekly averages (see figures below), indicated that the seasonal hydrologic pattern was significantly pulsed, substantially deeper during the wet season, and slightly higher than average during the dry season. The extreme high water during the wet season was due to Hurricane Irene. Combined with a water management practice to hold water in the WCAs, this altered the typically slow dry-down trends from November until May. In WCA 1, the October Hurricane Irene extreme was quickly reduced to almost average depths in a matter of months due to releases of water to WCA 2. Water was diverted to WCA 2 and the Lake Worth Drainage District canals for local agriculture



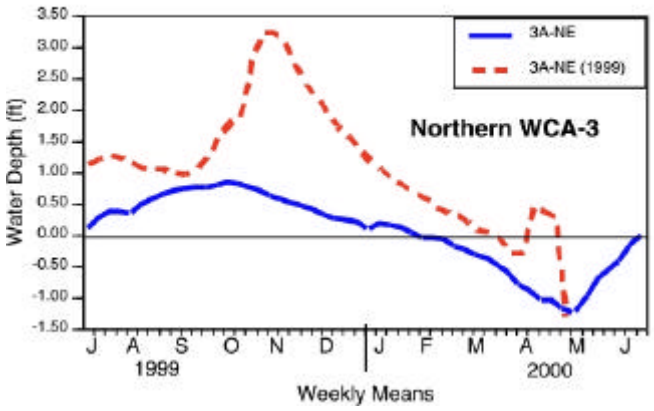


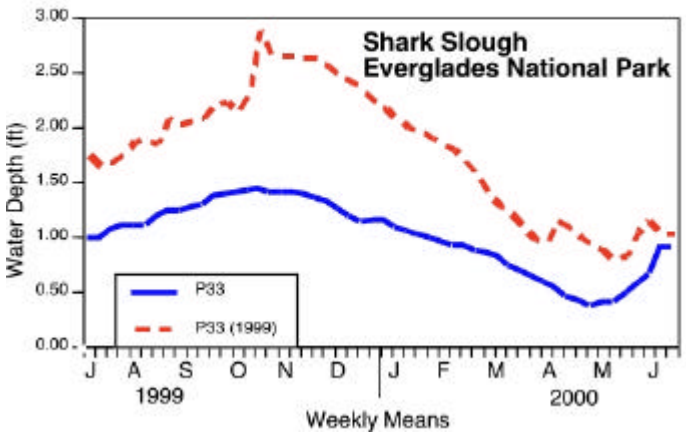
ABBREVIATIONS

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 light herons (SMLH).

Regions and Miscellaneous: Water Conservation Area (WCA), Everglades National Park (ENP), Wildlife Management Area (WMA), A.R.M. Loxahatchee National Wildlife Refuge (LNWR), Solid Waste Authority (SWA), and Systematic Reconnaissance Flights (SRF).

interests and eastern urban areas. This year it appears that less water was removed from LNWR, and in smaller increments that more closely simulating a natural system. A large rain event April 13-16 deposited 6.7" of rain on LNWR and the surrounding area. Water levels in the refuge interior rose greater than 5 inches in 3 days because of rain and water pumped into the refuge to relieve flooding in nearby





agricultural fields. Over all 7.61 inches of rain fell in the LNWR in April. In a multi-agency effort, water managers moved the excess water out of the refuge as soon as was possible, and by mid-May the water level once again followed the regulation water schedule (and higher than average water depths). In May, Lake Okeechobee water levels were lowered approximately 2 feet, but over 90% of the water was released into the Caloosahatchee and St. Lucie Rivers instead of through the LNWR and WCAs.

In WCA 2, the October extreme of 2.5 feet above average was the highest in the region. Discharges to WCA 3, ENP, and to tide reduced this extreme to 0.5 feet below average by March. Were it not for the April storms, WCA 2 would have experienced a typical dry-down by June. In WCA 3, the October extreme receded very slowly and until April looked like a very "natural" Everglades hydropattern. However, the April storms followed by very dry conditions converted this trend in WCA 3 into something of a "pulsed" event. Similar things can be said about the ENP hydropattern. What was significant about ENP water depths, as indicated by the Shark Slough data, was that there were higher than average water depths and relatively smooth changes in water depths despite the Interim Structural and Operation Plan to divert water, from extreme hydrologic events in October and April, away from Cape Sable Seaside Sparrow habitat.

Southwest Coast

To help understand current wading bird nesting, Ted Below (Rookery Bay Sanctuary and the National Audubon Society) compared a 35-year inland water level record at Corkscrew Swamp Sanctuary (CSS) with a 18-yr coastal pond water level record at Rookery Bay (RB). He found that water levels in RB generally fluctuate in unison with the inland ponds at CSS (36 km. N). In the fall of 1999, water levels at both locations were running slightly above the mean. In January they dropped fast and were below the mean by the end of the month. The decline continued; at RB the coastal ponds were dry at the beginning of April, and at CSS the Lettuce Lakes were dry by the beginning of May. These wetlands remained dry until the end of June.

Rainfall for the first 6 months of 2000 at RB was 38% below the 18-year mean. At CSS the drought of 1989-90, when the Lettuce Lakes were dry for 5 months, was the only period when the dry-down lasted longer than this year. Correspondingly, at RB this year's 3-month dry period was longer than anything recorded in the last 18 years (ponds dry 2 months in 1988, 1 month in 1989, and 1 month in 1990). The Rookery Bay Research Reserve staff recorded higher than usual salinities in the area's estuarine bays, which could have been from a lack of fresh water runoff.

Fred H. Sklar
Watershed Research and Planning, Everglades Department
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406
(561) 682-6504
fsklar@sfwmd.gov

REGIONAL NESTING REPORTS

WATER CONSERVATION AREAS 2 AND 3

Methods

Wading bird breeding effort (numbers of nesting attempts) was monitored during Feb - Jun 2000 in WCAs 2 and 3 through a combination of monthly systematic aerial surveys and comprehensive ground surveys carried out from mid-April through mid-June. The integrated survey effort was completed by the end of June.

Results

The 2000 season showed many more wading birds nesting than usual in the central Everglades (see Table). During the spring, we estimated 29,728 nests of all waders (not including Cattle Egrets, Anhingas or cormorants) in WCAs 2 and 3. For comparison, the level of nesting effort in 2000 was 30% greater than in 1999, three times greater than the 10-year running average, and 26% greater than the last banner year, 1992. The level of nesting in 2000 in the WCAs was about half the estimate for the Everglades as a whole during several years in the late 1940's.

The vast majority of the abundance (almost two thirds) was made up by White Ibises, most of which nested at the Alley North colony (approximately 20,000 pairs). However, ibises also nested in several novel locations for ibises, including Hidden colony, Heron Alley colony, and a new colony at the Shark Slough tower. Wood Storks also nested in much larger than normal numbers; over 1,800 pairs either in or immediately adjacent to WCA 3 (Tamiami Trail colonies). This level of nesting effort has not been seen in the Everglades since the mid-1970's, or almost 30 years, and the 2000 nesting was over 15 times the 10-year running average for the Everglades as a whole. Colonies of Wood Storks formed at Tamiami West, Crossover, and a new colony in western WCA 3 immediately east of the jetport. Storks nested relatively early (February), and were able to fledge large numbers of young despite a large rainfall event in April. Summer rains were somewhat late this year, resulting in a protracted drydown. We hypothesize that this further enhanced survival chances for these young storks.

The number of Snowy Egret nests was also up considerably this year, with at least 4 times the 10-year average nesting in 2000. However, the number of Little Blue Herons was less than 68% of the 10-year running average. The numbers of Great Egret nests was similar to the 10-year mean.

The vast majority of nesting was concentrated in WCA 3, with less than 4% of the nesting in WCA 2.

Although we did not measure reproductive success through documentation of individual nest histories, nesting was largely successful throughout WCA 3 and 2. We found no complete failures noted in any colonies, and large numbers of young were produced, particularly at Alley North. This generally successful nesting is an interesting point, because the region experienced a strong rainfall event in April that resulted in rapid increases in surface water levels. Although such events typically precipitate large-scale abandonment events, we did not see such a reaction in 2000. This suggests a resilience to abandonment, although we are not at all sure of the mechanism buffering the birds from abandonment. It may have been that the Everglades simply had high densities of food to begin with, and so factors affecting food availability, like drying pattern were not as dominant as in many years.

By comparing numbers of birds estimated on SRF surveys with our breeding numbers, we found that nearly all of the birds present in the region were breeding this year. This is in stark contrast to previous years, in which only 30% of adults have bred in most years.

The reasons for the large nesting event in 2000 are not completely understood. The hydrological conditions were generally considered favorable, with a long and fairly continuous drydown throughout the spring, beginning from relatively high levels. This apparently created drying and depth conditions that were conducive to making prey animals available to foraging wading birds. However, there are at least two other major environmental conditions that changed in 2000 that also may have strongly affected the size of the nesting event.

The first of these was the extensive drought conditions throughout much of the southeast. This drought resulted in the drying of many marshes, streams and even lakes, that left much of the usual habitat available to wading birds high and dry. In north Florida, most wading bird colonies did not initiate, and those that did were not successful. South Florida was one of the few places in the region that held water during the drought. Thus most of the wading birds in the southeastern U.S. were left with little habitat

Numbers of wading bird nests found in WCAs 2 and 3 from January to July 2000.

Lat.	Long.	Colony	GREG	GBHE	WOST	BCNH	LBHE	SNEG	TRHE	WHIB	YCNH	ROSP	GLIB	CAEG	DCCO	ANHI	Colony total*
26 10.77	80 31.72	Alley North	700			300		2,000	100	20,000		15	30			20	22,145
25 46.36	80 50.24	Hidden	283					1,349	873	142						38	2,647
25 47.65	80 31.85	Heron Alley (3B)				2	22		50	975						10	1,049
25 52.11	80 50.61	Jetport new	25		400											8	425
25 55.51	80 50.10	Crossover	150		100											15	250
26 00.97	80 27.61	Mud Canal	105	12			50	15	30					85		80	212
25 48.08	80 29.40	3B Mud E	177	1			1		9							40	188
26 07.32	80 32.50	Cypress City	138				9										147
26 02.75	80 37.10	Big Melaluca	142														142
26 07.72	80 42.10		140											7			140
26 02.10	80 41.47		125	1												10	126
26 06.11	80 27.27	Holiday Park	50					20									70
25 57.88	80 35.38	Donuthole	56	8												30	64
25 49.37	80 51.79	Big Cypress	60														60
26 08.61	80 44.60		40	1			16									6	57
25 56.45	80 37.34	Starter Mel.	38	16												20	54
26 01.48	80 32.36		50	3												2	53
26 07.39	80 39.29		38	13												2	51
26 07.47	80 30.22		30	12												18	42
26 00.97	80 47.67						20		20								40
Other colonies in WCA 2 and 3, <40 pairs			712	458	0	37	357	4	196	0	2	0	0	151	7	793	1,766
Total nesting pairs			3,064	525	500	339	475	2,388	1,278	21,117	2	15	30	243	7	1,092	29,728

* Totals do not include Anhingas, cormorants, or Cattle Egrets.

during spring 2000, and it is quite likely that the large numbers of birds in south Florida included many birds that typically nest in other states.

The second condition that has changed during the last several years has been the dramatic reduction in the mercury exposure of birds nesting in the central Everglades. In most colonies sampled during 2000, mercury concentrations in feathers of nestling birds decreased by almost an order of magnitude, compared with samples taken in the same places during 1994 – 1996. Since 1997, mercury concentrations have been plummeting in most colonies. Although the reason for the reduced contaminant exposure is not well understood at this point, mercury has been implicated experimentally in reproductive impairment in ducks, as well as health and appetite in birds; a reduction in mercury could therefore have contributed to the increased reproductive effort and success documented in 2000.

Peter Frederick
Martin Ruane
Becky Hylton
Department of Wildlife Ecology and Conservation
University of Florida
Gainesville, FL 32611-0430
(352) 846-0565
pcf@gnv.ifas.ufl.edu

HOLEY LAND AND ROTENBURGER WMAs

No wading bird colonies were detected again this year, probably because of the continuing dry conditions in both Holey Land and Rotenberger WMAs. There were no formal nesting surveys conducted, but Systematic Reconnaissance Flights of wading bird abundance and distribution were done in both Holey Land and Rotenberger, and nesting activity would likely have been detected during those surveys had it occurred.

Bijaya Kattel
Florida Fish and Wildlife Conservation Commission
11320 Fortune Circle, Suite G-16
Wellington, FL 33414
Phone: (561) 791-4052 Fax: (561) 791-4056
Kattelb@fwc.state.fl.us

A.R.M. LOXAHATCHEE NATIONAL WILDLIFE REFUGE

Methods

In the year 2000, 27 hours over 7 days between 14 April and 8 May were spent on systematic airboat surveys for wading bird nesting colonies. Transects approximately 0.5 miles apart were done by airboat where conditions and vegetation allowed. Generally areas north of 26° 33.00N and west of 80° 24.00W were not covered in the airboat survey because of dense vegetation. Deviations from the transects were made if a colony was suspected or known to be off the transect line. This method covered approximately 60% of the refuge (see Figure).

Additionally, 4 fixed-wing aircraft surveys (March 17, April 25, May 16, and June 13) were conducted. These aerial surveys started at the north end of the refuge and were flown in a progressive southward pattern covering the entire refuge. The transects were flown E to W 1 mile apart, and took an average of 3 hours per survey.

Nest estimates for each species were derived by counting the number of adults flushed, or in the case of Great Blue Herons, many of which had already fledged their young, by counting actual nests.

Results

Between March and June we documented 2604 wading bird nesting attempts, omitting Cattle Egrets and Anhingas (see table). This year's nest count is one of the lowest at LNWR, and was well below the 8-year (1992-1999) average of 5646 nests. This year's nesting attempt is approximately 70% below the banner year of 1999 (10,585 nests).

Approximately 140 colonies, including individual Great Blue Heron nests, were located during survey efforts. Colonies were much smaller, and there were fewer colonies than in other years. Of the 2604 nests found, only 5 colonies composed of over 100 birds were discovered as compared to 19 colonies in 1999.

Number of colonies (5 nests or greater) observed during 4 aerial flights over the entire refuge.

Survey Dates	Number of Colonies
17 March 2000	12
25 April 2000	7
16 May 2000	8
13 June 2000	7

Thirty-five colonies (greater than 5 birds) were identified during 7 days of airboat surveys as compared to 12 colonies identified during the 4 aerial surveys. Colonies identified by air were either Great Egret or White Ibis. Generally, the dark wader colonies are difficult to discern from the air, which resulted in lower identification levels. The number of colonies observed from aerial flights declined after March, which coincides with the heavy rain and pumping event in April (see hydrology section).

Low nest initiation was suspected early as small flocks of mixed species (25-50 individuals) were observed foraging in wet prairies. The size of these flocks was less than is usually observed during the nesting season. Also, low nesting was suspected, perhaps because fish populations had not recovered from the 1999 nesting season. Numbers of nests were further reduced after a large rain event in April.

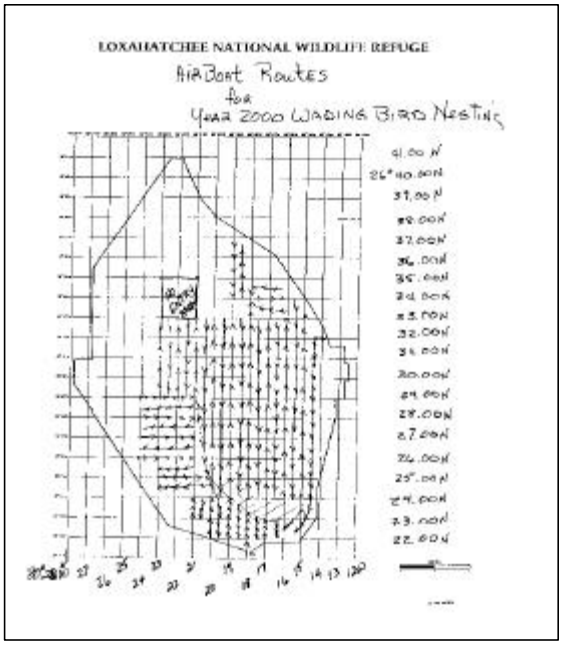
All but 2 species that usually nest in the refuge showed a significant decline in nesting attempts. Great Egrets, Little Blue Herons, Snowy Egrets, and White Ibis attempts were down by one-half the number of the 8-year average. Tricolored Heron nests were down one-third of the 8-year average, and Black-crowned Night-Herons were down two-thirds of the 8-year average. No Wood Storks or Roseate Spoonbills attempted to nest this year.

In contrast, Glossy Ibises increased their nesting attempts; 69 in 2000, up from 49 in 1999. The Glossy Ibis were nesting in mixed colonies and were actually observed on nests because high water levels allowed an airboat approach this year. Great Blue Heron nest attempts were up approximately 60 nests over the 8-year average.

This year's fledglings may have benefited from the steady drying patterns that concentrated the prey base throughout May and June.

Effects of Hydrology on Nesting

The rain during April 13-16 had adverse impacts on wading bird nesting, including nest destruction, nest abandonment, and nestling mortality. Dead chicks were found in nests and hanging from branches directly after the storm. Probably many more chicks and eggs were lost than observers noted. Numerous small colonies were abandoned by adults, leaving exposed eggs and chicks of various ages. This event dramatically reversed the drying process of late spring, dispersed previously concentrated



Number of wading bird nest attempts in A.R.M. Loxahatchee NWR from March to June 2000.

Colony	Lat.	Long.	GBHE	LBHE	TRHE	BCNH	YCNH	GREG	SNEG	WHIB	GLIB	Colony Total
00005	26 30.67	80 21.62		25	7							**32**
00012	26 32.28	80 19.40		45		1			1			**47**
00014	26 35.96	80 18.46		25		2					4	**31**
00015	26 36.91	80 19.27		9								**9**
00016	26 34.64	80 17.48		20	2							**22**
00018	26 34.26	80 16.53	1	5	4							**10**
00019	26 34.28	80 16.38	2					15				**17**
00027	26 33.61	80 14.98		110	10			25	5		20	**170**
00028	26 33.20	80 15.14	4					1				**5**
00032	26 32.74	80 14.52	8									**8**
00052	26 27.61	80 21.17		40	3			48				**91**
00053	26 27.38	80 21.31	1	20								**21**
00067	26 28.72	80 14.12	4									**4**
00068	26 28.05	80 14.49		30								**30**
00069	26 27.48	80 14.35						45				**45**
00070	26 25.46	80 14.55		30	15	65		15		15	30	**170**
00071	26 23.89	80 15.01		18	1	4		5				**28**
00073	26 22.46	80 15.51	1	20	40		1	1	10	5		**78**
00074	26 22.37	80 15.94		8	5			6	1			**20**
00077	26 26.72	80 15.48						8				**8**
00080	26 27.59	80 14.80	5									**5**
00086	26 26.99	80 15.77	1	18								**19**
00096	26 27.08	80 16.50	5									**5**
00098	26 28.90	80 14.73		12	5							**17**
00099	26 26.13	80 23.52						200				**200**
00106	26 32.31	80 16.61		10	3	5		10	1			**29**
00111	26 31.04	80 15.87	8	20	40	35		58	15	900		**1076**
00113	26 30.58	80 15.53				28		80				**108**
00116	26 30.31	80 15.00		6								**6**
00118	26 31.04	80 14.78		4		2						**6**
00121	26 29.91	80 13.39		30	10	1			25		15	**81**
00130	26 23.23	80 20.11		7								**7**
00133	26 22.32	80 18.59						15				**15**
00136	26 22.54	80 18.04	1					3				**4**
00138	26 22.20	80 18.02		45	2							**47**
GBHE colonies less than 4 nests			133									
Species Total			**174**	**557**	**147**	**143**	**1**	**535**	**58**	**920**	**69**	**2604**

fish populations, hindered foraging success for tall waders, and generally prevented foraging by short-legged waders. Two examples of documented nest abandonment are included in this report. After the large rain event, closely observed colony #00111 (26° 31.04N 80°15.87W) went from approximately 3000 birds on nests to 1076 birds, and great egret colony #00099 (26°26.13N 80°23.52W) went from over 350 nests to less than 200.

Special thanks to LNWR staff, interns and volunteers Laura Allishaw, Ashley Traut, Bruce Arrington and Mike Cherkiss whose assistance made gathering the data for this year's report possible.

Bill Thomas, Marian Bailey, and Laura Brandt
A.R.M. Loxahatchee National Wildlife Refuge
10216 Lee Road
Boynton Beach, FL 33437-4796
(561) 732-3684
marian_bailey@fws.gov

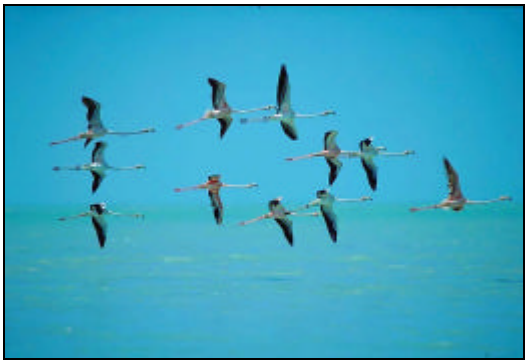
EVERGLADES NATIONAL PARK

Methods

Park biologist flew 3 colony surveys during the 2000 nesting season. Both traditional colony sites as well as new colonies discovered during Systematic Reconnaissance Flights were surveyed. Flights were conducted using a Cessna 182 fixed-wing aircraft. As in the previous year, initiation of nesting began in late February and early March. Overall, water levels began receding in late January and continued through the nesting season.

Results

There was an estimated 3023 wading bird nests (2893 excluding Cattle Egrets) found on the mainland colonies during the 2000 season. This number represents a 63% increase over last year's effort, and more than 4 times the number of wading birds nesting in 1998. Even with the increases over the past 2 years, the number of wading birds nesting in ENP continues to remain low. Species found nesting in ENP colonies included Great Egret, Wood Stork, Little Blue Heron, Snowy Egret, Black-crowned Night-Heron, Tricolored Heron, White Ibis, and Cattle Egret. The most abundant species nesting were the Wood Stork (1592 nests) and Great Egret (1110 nests). A record number of Wood Stork nests (100) was recorded at the Rodgers River Bay rookery. For the first time in 6 years, the East River rookery was active with 30 pairs of Great Egrets. The Lane River rookery remained inactive for the seventh year. As noted in the table, many of the small herons and egrets were observed nesting in many of the colonies, but estimates could not be made from the air.



Sonny Bass and Jason Osborne
South Florida Natural Resources Center
Everglades National Park
40001 State Road 9336
Homestead, FL 33034
(305) 242-7800
sonny_bass@nps.gov

Number of wading bird nests in Everglades National Park, February-April 2000

Colony Name and Location	GREG	WOST	LBHE	TRHE	BCNH	SNEG	WHIB	GWHE	CAEG	Status
Cuthbert Lake 25'13.10 /80'46.50	75							4		
Paurotis Pond 25'16.89/80'48.18	150	125								
East River Rookery 25'16.08/80'52.03	30									
Lane River Rookery 25'18.02/80'53.18										Inactive
Rodgers River Bay 25'33.40/81'04.19	200	100		+						
West of Obsv. Tower 25'39.48/80'47.96	75									
NE Shark Slough 25'42.29/80'35.90	100								100	
Grossman Ridge 25'37.68/80'38.74	250		+		+					
Tamiami East* 25'45.48/80'30.47	40									
Tamiami West* 25'45.47/80'32.69	35	1,347		15	2	150	20		30	
Loop Road 25'33.14/80'50.62	40	20								
25'31.31/80'48.70	40									
25'33.14/80'50.62	75									
Total	**1110**	**1592**	**+**	**15+**	**2+**	**150**	**20**	**4**	**130**	

* Data collected by Frederick et al.
+ Indicates species present but unable to determine numbers

FLORIDA BAY

Methods

Monthly waterbird nesting activity (number of nests or nesting pairs) in Florida Bay is reported for March 1995 - June 2000. Censuses are conducted from an H-65 Dolphin helicopter provided by the Miami Station of the U.S. Coast Guard. Coverage in January, 1998, was incomplete and did not include the western bay (i.e., Derelect to Sandy Keys). Coverage in June, 2000, missed a small section in the central Bay (from Derelict west to Cormorant and south to Rabbit). The census was not conducted in May, 2000, due to temporary Coast Guard cutbacks. The nesting data are for 7 wading bird species (Great White Heron, Great Blue Heron, Great Egret, Snowy Egret, Roseate Spoonbill, White Ibis, Tri-colored Heron), 2 diving bird species (Double-crested Cormorant, Brown Pelican), and 2 raptors (Bald Eagle, and Osprey). All waterbird species seen nesting in the Bay also were seen feeding in the Bay and in the submerged ponds of the Bay's islands.

Results

Most wading bird nesting in Florida Bay is concentrated primarily on 3 islands; Tern Key in the northeastern Bay, and Frank and Sandy Keys in the western Bay. Great White Heron nesting is distributed over much of the Bay, and colonies are made up of a few birds (e.g., from 3 or 4 nests to 20 or more). Great Blue Herons nest primarily in the western part of the Bay, but also singly or in small groups, and sometimes with Great White Herons.

Great White Heron nesting activity 1999-2000 was high compared to the previous 2 years, which were substantially lower than the first 2 years of this study. This past year, the main nesting period extending from November-March and was more sustained than in the first 2 years, with 264 active nests counted in December and 269 nests counted in February. Great Blue Heron nesting activity also was slightly higher this year than during the last 2 years. Great White Herons were observed nesting in every one of the months covered from July 1999 - June 2000, and in all but 4 of the 64 months covered by the census.

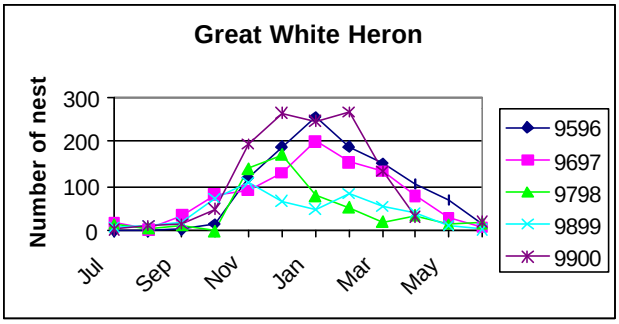
Great Egret nesting in the Bay was sizeable the first year (maximum of 195 nests in March, 1996), minimal the second year, high again in April and June of 1998, and low in 1999. Greater nesting activity by White Ibises and Roseate Spoonbills was seen this year. Observers estimated 200 White Ibis nests at Frank Key and 300 nests at Tern Key in April. They estimated 100 Roseate Spoonbill nests at Tern Key in April. Great Egrets were observed nesting at Tern Key in April (100 nests), Sandy Key in June (100 nests), and Horseshoe Key near Shell Key (off Upper Matecumbe Key) in June.

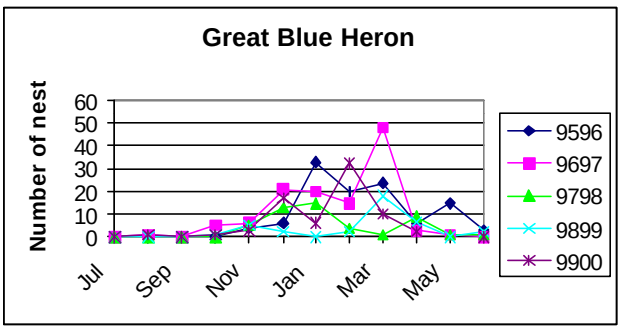
Water bird nesting in Florida Bay may be affected by rainfall and runoff patterns. The year 1995-1996 was the second of 2 unusually wet years. 1996-1997 was moderate. 1997-1998 was the year when the dry down was delayed until late Spring. A severe dry season occurred in 1998-1999, with little rain from February through May. The year 2000 seemed like one of moderate rainfall, but that needs to be confirmed from rainfall data.

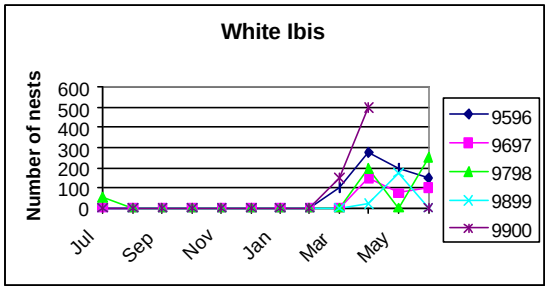
This survey method appears to be excellent for observing nesting by Great White Heron, Brown Pelican, and Double-crested Cormorant, and possibly almost as good for Great Blue Heron. It is less efficient for other water bird species. Observers can often miss nesting by Roseate Spoonbills and Tri-colored Herons because they nest low in the trees. Nevertheless, we detected a great many this year. Although we see many Little Blue Herons and Snowy Egrets feeding in the Bay, particularly in the vicinity of Frank Key, we seldom observe Snowy Egret nesting on islands in the Bay (none this year), and we have no observation of Little Blue Heron nesting in the Bay, although nesting at Frank Key has been reported in the past.

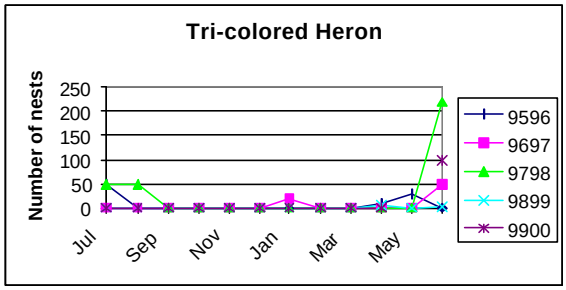
Joan A. Browder[1], Oron Bass[2], Jason Osborne[2], Jennifer Gebelein[3], Lori Oberhoffer[2], Tom Jackson[3], and Michael Hearon[3]

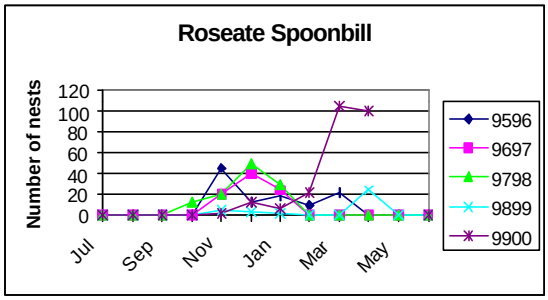
[1]National Marine Fisheries Service/NOAA
75 Virginia Beach Drive
Miami, FL 33149
(305) 361-4270
joan.browder@noaa.gov
[2]Everglades National Park
[3]Rosenstiel School of Atmospheric Science, Univ. of Miami

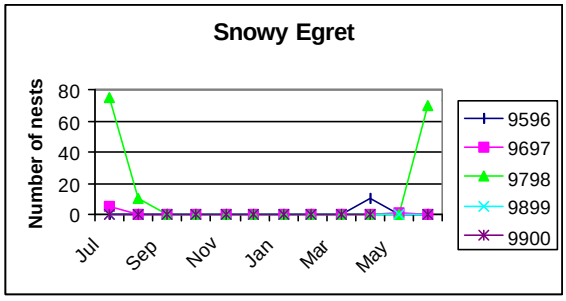


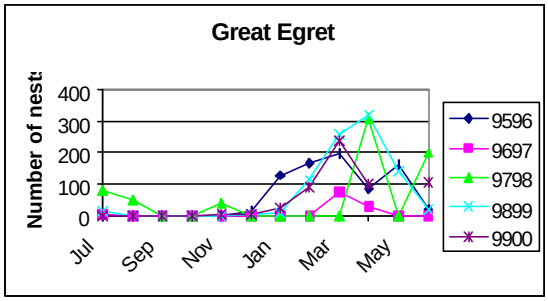


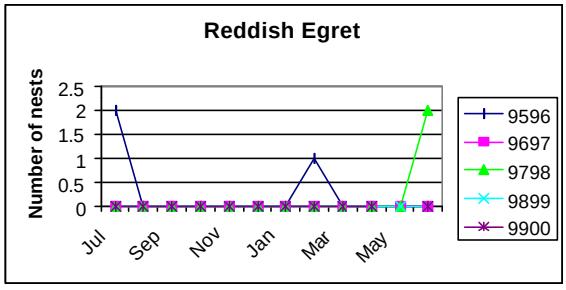












Colonies	GWHE		GBHE		GREG		TRHE		WHIB		ROSP	
	Max Nests	Max Mon.	Max Nests	Max Mon.	Max Nests	Max Mon.	Max Nests	Max Mon.	Max. Nests	Max Mo.	Max Nests	Max Mon.
Sandy	36	Jan	1	Feb			100	Jun			10	Feb
Dildo	23	Feb	8	Feb								
Oyster	7	Jan									1	Jan
Murray	9	Feb										
Clive	7	Feb	8	Feb								
Frank	34	Jan			129	Mar			200	Apr	5	Mar
Palm	8	Feb			5	Feb						
Cormorant	17	Jan	4	Dec								
Catfish					2	Dec						
Buoy	4	Mar	3	Mar	3	Dec						
Pelican					2	Feb						
Umbrella	4	Feb										
Rankin Little	3	Dec	1	Apr	2	Dec						
Roscoe	3	Jan										
Jim Foote					3	Jan						
Dead Terrapin	3	Dec										
Cluett	15	Jan	5	Feb								
Triplet	13	Dec			10	Dec						
Calusa	11	Jan										
Bob Allen	5	Dec										
Pollock	6	Dec									1	Feb
Jimmie N	11	Dec	1	Mar								
Captain	5	Feb	2	Feb								
Park S	5	Feb										
Tern	4	Mar			100	Apr	100	Jun	300	Apr	100	Mar,Apr
Duck	4	Jan,Mar										
Peterson	15	Mar										
Buchanan	5	Feb										
Arsenicker Upper	1	Jan,Jun	1	Feb	3	Jan						
Sunset Cove	20	Feb	1	Mar								
Butternut E	4	Jan									1	Feb
Pigeon	11	Dec										
Bottle	10	Dec										
Crane & East	24	Dec			1	Mar					1	Feb
Cowpens	33	Feb			4	Mar						
Horseshoe	13	Jan			6	Jun						
OtherIslands	4		0		2		0		0		0	
TOTAL	377		35		272		200		500		119	
Note: Total is incomplete for GWHE.												

SOLID WASTE AUTHORITY OF PALM BEACH COUNTY COLONY

Methods

From March – June 2000, Breeding Bird Censuses were conducted in the SWA Colony by 2 observers every 8 weeks, representing approximately 7.5 person-hours. During the census, 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.

The SWA Colony is located on spoil islands in abandoned shell pits that were mined in the early 1960s 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 tree species (all non-native) are Brazilian pepper, Australian pine, and Melaleuca. Local features influencing the colony include: 1) the North County Resource Recovery Facility and landfill and 2) the City of West Palm Beach's Loxahatchee Watershed Preserve (i.e., Water Catchment Area), a 44-km^2 remnant of the Loxahatchee Slough.

Results

These are preliminary data for the 2000 breeding season. Typically, nesting activity at this colony has been observed through September, whereas the surveys reported here are only through the end of June. The estimated peak number of wading bird nests for the SWA Colony is 2584, which represents a 17% decrease from the 1999 season. The number of White Ibis, Great Egret, Cattle Egret, and Snowy Egret nests are lower during this year than the 1999 season. Numbers of Anhinga and Tricolored Heron nests remained about the same. There was over a 100% increase of Wood Stork and Little Blue Heron nests from last year. It should be mentioned that Glossy Ibis nests and young were observed for the first time. However, these nests were not easily identified during the nest surveys, and are not included in the reports.

Mary Beth Mihalik and Todd Sandt
Solid Waste Authority of Palm Beach County
7501 North Jog Road
West Palm Beach, FL 33412
(561) 640-4000 ext. 4613
mmihalik@swa.org

WOOD STORK NESTING IN BIG CYPRESS NATIONAL PRESERVE

Observations of wading bird nesting activity are recorded during routine panther flights done 3 times per week in Big Cypress National Preserve. The flaw in this methodology this year was the fact that no radio-collared panthers are currently monitored south of Highway 41. Sonny Bass (ENP) reported no observations of Wood Stork nesting activity south of the Loop Unit where he conducts wading bird SRF surveys. On 9 June, however, I observed an active Wood Stork colony with an estimated 25 nests (50 nestlings) within the Loop Unit near Sweetwater Strand (25° 47.951 N, 81° 05.854 W). Due to this finding, I conducted a formal survey by helicopter on June 16. I examined 16 of the 20 nesting sites in and near the Loop Unit that had been documented in the May 1996 survey when stork nesting was widespread in the Preserve.

On 16 June, 12 of the estimated 50 nestlings were still in the Sweetwater nests. Based on the presence of nests, only 2 of the 15 other sites examined showed signs of possible nesting activity this year. It is not known whether these nests were those of storks or egrets.

In summary, there was limited wood stork nesting in the Preserve this year, with 1 confirmed site and 2 other possible sites S of Highway 41. A formalized survey of past nesting colonies will be done annually in the future.

Deborah Jansen
HCR 61 Box 110
Ochopee, FL 34141
(941) 695-2000 ext. 335
deborah_jansen@nps.gov

Peak number of wading bird nests in SWA Colony from March to June 2000

Survey Date	GREG	SNEG	TRHE	GBHE	LBHE	WOST	WHIB	ANHI	CAEG	DCCO	Unidentified nests	Total nests
20-Mar-00	74	10	43	0	19	96	844	175	36	0	542	1839
9-May-00	42	11	54	4	99	172	962	330	560	16	334	2584
29-Jun-00	3	0	4	1	19	56	354	26	526	0	181	1170

SOUTHWEST COAST

This year was particularly unusual in that the spring dry-down was severe and rather prolonged (see Hydrology) both inland and on the coast. This apparently affected the estuarine wetlands and wading bird nesting. Nesting was low for the small species, high for Great Egrets, and appeared quite unproductive for all, except Wood Storks, which started early and did well. As far as initiation of nesting there were no surprises. All of the waders I monitored, except storks started at the usual time of year.

Methods

All walk or canoe censuses are conducted during peak nesting, about the beginning of June. This year's censuses of Chokoloskee Bay and Chokoloskee Pass were done in conjunction with CSS aerial censuses.

Rookery Bay (RB): 26°01'51"N 81°44'43"W. Two Red Mangrove islands, 0.22 ha. Nest census conducted 31 May, walk through, complete coverage; 1-person, 1 hour.

Note: at both the RB and ABC colonies, sundown fly-in is censused (23 years, bi-weekly; and 21 years, monthly respectively) to provide an index of the numbers of birds using the roosts at night and thus in the area.

Marco Colony (ABC): 25°57'24"N 81°42'13"W. Three Red Mangrove islands, 2.08 ha.. Nest census conducted 10 April and 1 June, walk through, complete coverage; 1 person, 2 hours.

East River (ER): 25°55'39"N 81°26'35"W. Three Red Mangrove islands, 0.25 ha. (about). Nest census conducted 28 May, canoe, complete coverage, 1 person, 1 hour. Like last year, nesting started at least 3 weeks early. When I arrived, there were good numbers of fledglings in the tree tops with very few nest structures left. Numbers of nests in the table are an estimate derived from my guess of productivity. There was a considerable drop (55%) in the number of nests from last year, indicating that this colony was impacted.

Chokoloskee Bay (CHOK): 25°50'43"N 81°24'46"W. Four Red Mangrove islands, 0.2 ha. (about). Aerial censuses, 18 April and 13 June. On 18 April, there were 12, deserted Double-crested Cormorant nests and no wading birds or pelican activity.

Chokoloskee Pass (CHPS): 25°46'48"N 81°24'26"W. One mostly Red Mangrove (2-3 Blacks) island, about 0.5 ha. Nest census 18 April, aerial survey, photographed, 2 people, 0.25 hour. Nest census 13 June, powerboat circling the islands, 2 people 0.5-hour.

Corkscrew Swamp Sanctuary (CSS): 26°20'N 81°30'W. From 14 Jan to 12 May, 9 aerial censuses were conducted. Wood Storks were nesting in the tops of Bald Cypress in 4 sub-colonies that totaled about 40 ha. and were mostly around the Central Marsh of CSS. Nests were photographed from both 150 m. (to count nests) and 60 m. (to ascertain condition of nesting). Results of censuses were later determined from slides. Each census, 2 people, 0.5 hour.

Results

Great Egret: In the 3 coastal colonies used by this species this year (See Table), nesting started in the beginning of March, which is about usual. At ABC during the 10 April ground nest census, I recorded 237 nests; the most ever seen that early. By 26 May, fair numbers of dead chicks were observed in the colony, and not many Great Egrets were seen flying in and out of the islands. This indicated that they were not feeding chicks and I **assumed** that the cause of the chick mortality was starvation. Further support for that idea came from the incessant clamor of the chicks; much more than usual. At CHOK there was no Great Egret nesting. Great Egrets did nest at CHPS in about usual numbers, and seemed to have the same pattern of stress as at ABC. On the 18 April aerial survey, I photographed 86 nests, but by the 13 June powerboat surveys, I recorded a disappointing 15 nests. At CSS a number of Great Egret nests were photographed, but because there were so many storks in the colony, it was impossible to get a reliable number.

Snowy Egret: The number of nests continues to drop slowly at both RB and ABC, as it has for the past 6 years. Interestingly, the numbers of Snowy Egrets coming into both RB and ABC to roost typically increase before there is any fledging. For example, on 7 April, 103 Snowy Egrets came in to roost at RB, which is about the number of adults to account for the 59 nests. By 21 April the number had more than doubled (264), and by 23 June, it was 441. Similar seasonal increases occurred at this time of year for all small herons and egrets (except Cattle Egrets), which suggests that more small species are using the area than just the successful breeders.

Little Blue Heron: The following is what I wrote last year. "A steady decline in nesting over the last 5 years, at both RB and ABC. Over the same period there has been a decline in the numbers coming to roost at night. Numbers of birds in the area are considerable less than reported for

Colony	GBHE	GREG	SNEG	LBHE	TRHE	REEG	CAEG	GLIB	Total
Rookery Bay		6	59	8	26		20		**119**
Marco (ABC)	22	237	60	20	112	5	250	43	**749**
East River			42	7	68		2		**119**
Chokoloskee Bay									**0**
Chokoloskee Pass		86	2						**88**
Total	**22**	**329**	**163**	**35**	**206**	**5**	**272**	**43**	**1075**
Mean (21 year)	**6**	**139**	**227**	**54**	**353**	**2**	**482**	**44**	**1307**

the late 1930s (E. Reimann Audubon Warden)." Although there was a fairly strong increase in June this year the trend is still down.

Tricolored Heron: The drop in nesting has not been as dramatic over the years as for the Little Blue Heron, but there has been a slow general decline both in the number of nests and number of birds at roosts at both RB and ABC. This was the first year since 1981 that Tricolored Herons have not nested on C Island.

Reddish Egret: This species has very slowly increased its nesting effort. This year, nesting was average at ABC, but as in the last 3 years, birds did not attempt to nest at RB.

Cattle Egret: The numbers of nests are down quite a bit from the mean, especially at RB. At RB, there was a downward trend in the numbers of birds coming in to roosts, suggesting a decline in the area.

White Ibis: Last year I wrote, "With 2-3 late nests (this seems to be the norm over the last few years; a few very late nests) at the ABC Colony, I have not put this species in the table". This species is not included in the table. But, as of this writing ,15-20 nests are beginning on A island of ABC. What is significant about this year is that at both of the night roosts, adults and a fair number of fledglings returned to the area early (adults typically decline during nesting, because they nest inland).

Glossy Ibis: This species nested at the ABC Colony again this year in similar numbers as the last 6 years. They fledged an unknown number of chicks. It is interesting that the number coming to roost at ABC has steadily increased (from a mean of 50 to 350 in 19 years).

Roseate Spoonbill: Last year was the first nesting ever recorded at CSS, and probably the first confirmed inland nesting in Southwest Florida. This year, there were less nests than last year but I have no nest estimates or indications of productivity.

Wood Stork: As in historic times, this species starting nesting in December. By 14 March, nesting peaked (1722 nests). By 12 May, most of the storks were gone, and I estimated 2538 chicks had fledged. Two of the sub-colonies started 1 to 2 weeks earlier than the other 2, and they fledged more chicks. A word of caution: Aerial censusing of even big white birds is not totally accurate and so the numbers of nests should be viewed as good estimates. The number of fledglings leaves more to be desired, especially this year, as few of the fledged chicks stayed around the colony as much as they did in previous years.

Theodore H. Below
Rookery Bay Sanctuary, National Audubon Society, and Oystercatchers Ltd.
3697 North Rd.
Naples, FL 34104
(941) 643-2249
roost@gate.net

NORTH FORK OF THE ST. LUCIE RIVER

Methods

A wading bird colony was detected late in the 2000 nesting season on a mangrove island in the North Fork of the St. Lucie River. P. Lynch (SFWMD) reported that the colony was active, albeit smaller, and contained nesting Wood Storks since at least 1998. The colony was situated near the boundary of the St. Lucie River State Buffer Preserve at 27°15.7 N and 80°19.0 W. Jay Anderson (Florida Department of Environmental Protection) and I surveyed the colony on 29 Jun 2000 from a small motorboat and counted all individuals seen.

Results

We observed 10 species on the island, and confirmed that 7 species were breeding. Approximately 26 Wood Stork juveniles were seen flying in and out of the colony and roosting in the canopy. On 3 Jun 2000, after peak nesting, D. Gawlik and P. Lynch visited the colony and estimated the number of active nests for each species as: 200 Cattle Egrets, 120 Little Blue Herons, 70 Wood Storks, 60 Snowy Egrets, 30 Tricolored Herons, and 10 Great Egrets. Few adults of any species, except the Cattle Egret, were observed on 29 Jun 2000. However, due to the advanced stage of nesting, it may be reasonable to assume that most adults were foraging to feed chicks. Many nests, particularly Cattle Egret and Little Blue Heron nests, were situated low in the vegetation within the interior of the island and were difficult to detect.

Number of adults and juveniles and activity observed on 29 Jun 2000 at a colony in the N Fork of the St. Lucie River

Species	Adults	Juveniles	Status
WOST	5	26	Fledged
ANHI	1	6	Fledged
LBHE	8	134	Chicks in nest
CAEG	86	124	Chicks in nest, some fledged
GREG	5	3	Fledged
TRHE	4	20	Fledged
SNEG	2	0	Fledged
DCCO	1	0	No breeding confirmed
BCNH	1	0	No breeding confirmed
BRPE	3	0	No breeding confirmed

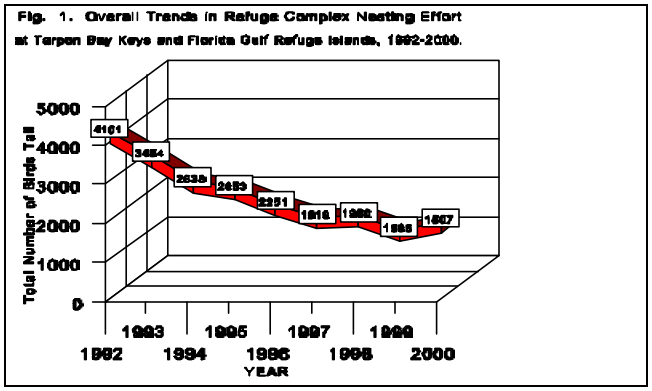
Surveys at this site should be conducted during March or April to obtain a more accurate picture of nesting activity. Due to the accessibility of this site to boats, it is also advisable to post signs around the colony to discourage boaters from approaching too closely. Although the birds did not alert to our presence, even within 5 feet of the island, repeated disturbances are likely to have an overall detrimental impact on this site.

Lara M. Coburn
Florida Fish and Wildlife Conservation Commission
8535 Northlake Boulevard
West Palm Beach, FL 33412
(561) 625-5122
coburnl@fwc.state.fl.us

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

Methods

Colonial nesting bird surveys at J.N. "Ding" Darling National Wildlife Refuge are conducted via motorboat annually (once per month Apr – Aug) at 7 active rookery islands located within Tarpon Bay (Tarpon Bay Keys), Pine Island Sound (Hemp Island, Bird Key and Broken Island) and Matlacha Pass (Lumpkin Island, Upper Bird Island and Lower Bird Island). Broken Island will not be surveyed after the 2000 nesting season because of the relatively low tallies in past years. Total nests are estimated from the maximum total number of nest-tending adult birds tallied for each species during surveys. Surveys are conducted during high tide in the early morning by slowly circling each island and counting all nest-tending adult birds. Immature birds of all species are tallied separately. Pelicans are classified as adults, juveniles, or nestlings. Observers attempt to determine breeding stages (nest building, on nest, feeding young, fledged young). Observers also tally non-breeding birds at colonies and note whether birds are loafing or roosting, feeding, or flying. Estimates are based on all observable birds (i.e., "best guess" estimate). Two observers conducted all surveys (11 Apr , 24 May, 15 Jun, 18 Jul) in 10.1 hours.



Results

This report presents preliminary information because it is based on surveys only through July. The 2000 peak estimate (1,807 birds) was 14% above the 1999 peak estimate (1,585 birds). Trends in the maximum total number of nests indicate a 56% decline in overall nesting effort since 1992 (Fig. 1). I speculate that this continuous downward trend in nesting effort is associated with declining habitat quality and forage availability. Habitats on Sanibel Island have generally become more forested since the 1950's and interior wetlands have been drained, developed or degraded, thereby affecting habitat quality for parents foraging on the island. Other potential deleterious factors include: 1) Potential historic atmospheric mercury deposition associated with an incinerator constructed up-river in the Caloosahatchee River watershed within the city of Ft. Myers; 2) Increasing point-source and non-point source pollution runoff into the estuary resulting from an increasing population in coastal southwest Florida; 3) Disturbance from increasing water craft operators at nesting rookeries in Pine Island Sound and Matlacha Pass.

Tarpon Bay Keys: Maximum total number of nest-tending adults increased by 19% from 1999.

Pine Island Sound: Maximum total number of nest-tending adults increased from 1999 by 59% and 61% at Hemp Island and Bird Key, respectively. The maximum total number of nest-tending adults at Broken Island decreased from 1999 by 63%.

Matlacha Pass: Maximum total number of nest-tending adults decreased from 1999 by 23% and 0.9% at Upper Bird Island and Lower Bird Island, respectively, and increased from 1999 by 13% at Lumpkin Island.

Jorge L. Coppen
J.N. "Ding" Darling NWR
1 Wildlife Dr.
Sanibel, FL 33957
(941) 472-1100 [ext.230]
jorge_coppen@fws.gov

Colonial bird nesting survey peak estimates for J.N. "Ding" Darling National Wildlife Refuge Complex, April-July, 2000. Counts reflect the maximum number of nest-tending adults during four monthly surveys.

	GBHE	LBHE	GREG	SNEG	TRHE	REEG	BCNH	WHIB	GRHE	ANHI	DCCO	BRPE	CAEG	Total
Tarpon Bay Keys	2	2	25	30	16	1	2	0	2	1	76	48	1	**206**
Hemp Isl.	7	0	0	6	15	0	1	107	7	0	174	171	14	**502**
Bird Key	2	3	0	4	3	2	0	20	2	1	155	439	2	**633**
Broken Isl.	2	1	1	1	0	0	0	0	2	0	42	75	0	**124**
Upper Bird Isl.	5	3	8	12	18	3	0	0	5	0	9	57	2	**122**
Lower Bird Isl.	4	2	19	3	3	1	1	0	4	0	20	47	1	**105**
Lumpkin Isl.	2	2	5	4	6	0	0	0	2	24	47	13	10	**115**
TOTAL	**24**	**13**	**58**	**60**	**61**	**7**	**4**	**127**	**24**	**26**	**523**	**850**	**30**	**1807**

WADING BIRD ABUNDANCE (FORAGING & NESTING)

EVERGLADES NATIONAL PARK AREA

Methods
Systematic reconnaissance flights (SRF) were performed monthly Dec 1999 - May 2000. Flights were done over 3 consecutive days using a fixed-wing Cessna 182 at an altitude of 60 m. The area covered included ENP and the southern region of Big Cypress National Preserve (transects 55 to 90). These transects were oriented E to W and separated by 2 km. Wading birds were counted, identified, and geographically located using a GPS unit. Changes in surface water patterns (hydropatterns) were also recorded. Five categories were used to describe hydropatterns:

Estimated abundance of wading birds in Everglades National Park and adjacent areas.

Species	Dec-99	Jan-00	Feb-00	Mar-00	Apr-00	May-00
GREG	33,602	32,242	30,588	27,535	17,234	18,814
GBHE	1,607	2,187	1,947	3,200	1,233	933
SMDH	953	2,200	1,547	1,947	2,060	1,340
SMWH	207	533	1,980	947	733	1,953
WHIB	15,241	19,521	23,941	33,722	11,647	15,507
GLIB	940	3,827	6,260	1,760	2,327	2,220
WOST	1,653	2,300	3,554	587	8,474	4,247
ROSP	927	393	627	780	887	747
GWHE	127	187	227	67	167	193
Total Abundance	55,256	63,390	70,670	70,544	44,762	45,956

Estimated abundance of wading birds (all species combined) for the different drainage basins in the Everglades National Park, Dec-1999 to May-2000

Month	SBC	BCME	SS	NESS	ES	SSME	NTS	LPK/STS	EP	CS	LPK/STSM	EPME	Total
Dec-99	1,333	17,348	1,940	673	693	6,374	847	4,020	2,600	12,594	5,994	887	55,303
Jan-00	8,314	12,021	5,460	1,287	4,374	10,607	407	2,420	2,727	9,000	5,240	1,807	63,663
Feb-00	5,574	7,174	9,420	1,360	10,801	23,208	333	3,420	1,420	3,994	3,567	907	71,177
Mar-00	4,800	7,394	23,468	1,833	10,661	10,214	2,393	1,793	707	4,094	2,633	660	70,650
Apr-00	4,027	3,874	16,961	2,867	3,527	5,174	233	1,547	427	1,367	4,220	640	44,862
May-00	1,813	2,953	16,487	2,207	3,160	7,100	87	2,433	2,140	2,220	4,574	867	46,042
Total	25,861	50,764	73,736	10,227	33,216	62,677	4,300	15,633	10,021	33,269	26,228	5,768	351,697

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

DD - absence of surface water with 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; WW - continuous surface water.

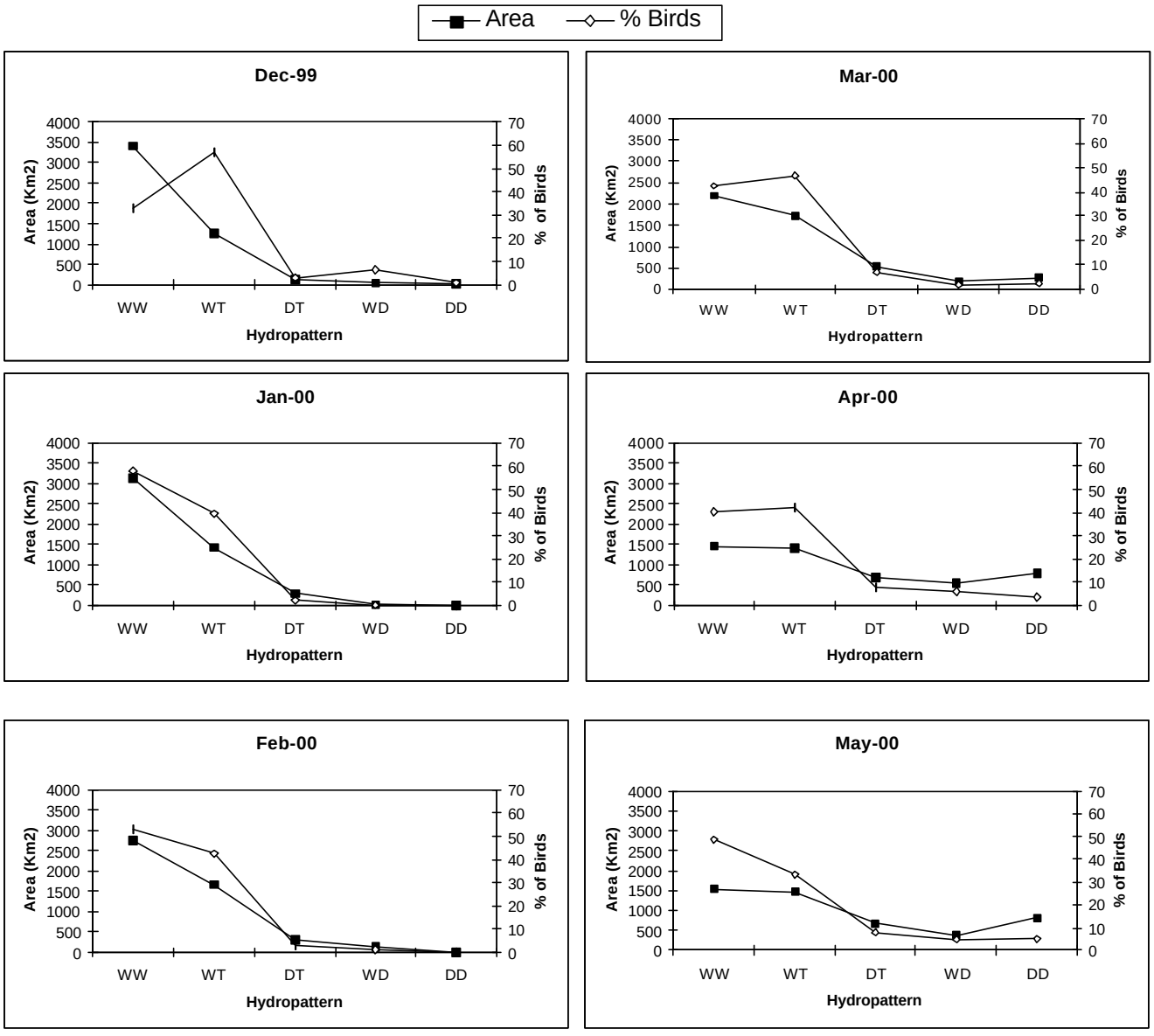
Data obtained during each SRF were entered into a database and checked for errors and analyzed using Excel, Access and ArcView. Densities of birds were estimated using a 2x2-km grid. The number of birds counted during the SRF inside the 300-m strip was extrapolated to the rest of the 4-km^2 cell by dividing the number of birds observed by 0.667.

Results

Peak wading bird density, regardless of species was in February and March. However, there were monthly differences among species. For example, Great Egrets were more abundant at the beginning of the season and started declining toward the end. Some species (Great Blue Heron, White Ibis, Glossy Ibis, Great White Heron, small dark herons, and small white herons) were more abundant during the middle of the season whereas most Wood Storks were seen at the end of the season. The abundance of Roseate Spoonbills varied little throughout the season.

Fifty three percent of all wading birds observed during this period were found in 3 drainages, (Shark Slough, Shark Slough Mangrove Estuary, and Big Cypress Mangrove Estuary south of US 41), respectively. However, the

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.



distribution of birds changed throughout the season.

In December, the maximum concentration of birds occurred in the 2 west coast basins (Big Cypress Mangrove Estuary S of US 41 and Cape Sable). These basins held approximately 54% of all birds during this month. During January, the west coast basins and Shark Slough Mangrove Estuary had the highest densities of birds with approximately half the number of birds observed for that month. In February as the water level receded, approximately one-third of all wading birds observed were in the Shark Slough Mangrove Estuary. Most birds shifted to Shark Slough from March to May, as water levels continued to recede.

Most of the changes in wading bird abundance associated with hydropatterns occurred in the WW and WT categories. In December, when most of the area was covered by water, the greatest number of birds occurred in the areas classified as WT. By January the pattern reversed, and despite a small change in hydropattern, we observed a greater number of wading birds in the WW areas. As the dry season progressed, the area of WW decreased in size and WT increased with a correspondent increase in the number of birds. In April, the area of WW and WT was very similar in size as was the number of birds observed in each. During the last survey, the area of WW and WT was equal in size, but the greatest number of wading birds occurred in the WW areas.

Mario A. Alvarado, Sonny Bass and Khabira Al-Muhyee
Everglades National Park
South Florida Natural Resources Center
40001 State Road 9336
Homestead, FL 33034-6733
Mario_Alvarado@nps.gov
Sonny_Bass@nps.gov
Khabira_Al-Muhyee@nps.gov

UPCOMING MEETINGS

Florida Ornithological Society: 29 Sep – 1 Oct, Tallahassee, Florida.

Florida Chapter of The Wildlife Society: 17 – 18 Oct, Archbold Biological Station, Lake Placid, Florida.

Waterbird Society: 1 – 5 Nov, Plymouth, Massachusetts.

Florida Wading Bird Symposium: 10 Nov, Archbold Biological Station, Lake Placid, Florida.

Greater Everglades Ecosystem Restoration Conference: 11 – 15 Dec, Naples, Florida.

Florida Chapter of The Wildlife Society: 27 – 29 Mar, Gainesville, Florida.

NORTH AMERICAN COLONIAL WATERBIRD CONSERVATION PLAN

The first draft of the North American Colonial Waterbird Conservation Plan will be released for review and comment this October (2000). To facilitate the draft review, an international conference has been organized and will occur just prior to the Waterbird Society Meeting, October 30-31, in Plymouth Massachusetts. The Plan's boundaries are broad and include North America, Middle America, the Caribbean Nations, and Hawaii and the Pacific Islands. Species covered by the Plan include wading birds, gulls, terns, pelicans, and seabirds. The draft continental plan focuses a strategy for waterbird conservation and includes population and habitat goals and objectives, continental-scale research projects, monitoring and information needs, management issues and solutions, and education and outreach needs. Over the next year, more detailed regional plans will be developed by regional working groups. These regional plans will include information on important habitats, species priorities, and potential projects to help colonial waterbird managers within each region. Individuals interested in participating in the Plan's review or a regional working group should contact Melanie Steinkamp (Melanie_Steinkamp@usgs.gov) or Jim Kushlan (James_Kushlan@usgs.gov).

Melanie J. Steinkamp
USGS Patuxent Wildlife Research Center
12100 Beech Forest Rd, STE 4039
Laurel, MD 20708-4039
(301) 497-5753
melanie_steinkamp@usgs.gov

WATER CONSERVATION AREAS & BIG CYPRESS NATIONAL PRESERVE

Methods

Wading bird surveys (SRF) are flown by 2 observers (Dave Nelson, Craig Theriot, or Robert Metzger) monthly from Jan – Jun with a fixed-wing aircraft at an altitude of 60 m. Transects are oriented E and W and spaced every 2 km in the WCAs (50 transects) and Big Cypress (29 transects). The Holey Land WMA and the Everglades Nutrient Removal Project, which are adjacent to the WCAs, also were surveyed monthly. Wading Birds were enumerated and their positions were recorded, entered into a database, and summarized into tables. The density of each species in each 4-km^2 cell was plotted onto maps.

High-resolution digital video linked with GPS was recorded for each transect. The video was archived and can be used to determine vegetation types, algal blooms, and water fluctuations throughout the survey months.

Data were recorded onto Newton palm top computers with touch screen features and linked to a GPS. Once the data were collected, they were downloaded into Excel, proofed, saved in a DBASE format, and analyzed with a DBASE program. With the assistance of C. Dickerson, we plan to run next years data through a program written in Delphi that will require less maintenance and run time.

Results

Water conditions followed a more normal pattern of starting in January at a relatively high level and gradually decreasing through May. However, dry conditions remained throughout June indicating a late start to the rainy season. All months except April showed an increase in wading birds from last year. The number of birds seen in May was extremely high, especially along I-75 where conditions seemed ideal for foraging wading birds. Large flocks of White Ibises and Great Egrets stood within the cattail and sawgrass along the canals adjacent to the highway.

Final reports from 1996-1999 are being placed on CD and the 2000 report should be available within the next few months.

Craig T. Theriot and David A. Nelson
Engineer Research and Development Center
Corps of Engineers / Waterways Experiment Station.
3909 Halls Ferry Road
Vicksburg, MS 39180
(601) 634-3816
nelson@wes.army.mil
therioc@wes.army.mil

Esimated abundance of wading birds (by species) in the Water Conservation Areas, 2000.

Species	Jan	Feb	Mar	Apr	May	Jun
GREG	18,046	20,327	15,188	16,853	48,366	34,466
GBHE	953	1,034	907	801	1,307	640
SMDH	587	806	446	334	486	934
SMWH	599	640	774	434	480	1,167
WHIB	12,800	46,260	45,107	6,580	73,214	36,985
GLIB	460	853	2,220	153	420	87
WOST	980	2,173	267	574	493	847
OTHER*	7	86	73	107	187	326
Total Abundance	**34,432**	**72,179**	**64,982**	**25,836**	**124,953**	**75,452**

*Includes Cattle Egret, Great White Heron and Roseate Spoonbill

Estimated abundance of wading birds (all species combined) in the Water Conservation Areas, 2000.

Month	1	2A	2B	3A	3B	Total
Jan	8,286	4,247	293	20,940	666	**34,432**
Feb	27,093	8,046	47	34,686	2,307	**72,179**
Mar	11,681	2,821	134	48,346	2,000	**64,982**
Apr	2,368	2,167	146	19,967	1,188	**25,836**
May	16,039	2,361	466	103,961	2,126	**124,953**
Jun	31,900	6,774	253	32,939	3,586	**75,452**

STATUS of WADING BIRD RECOVERY – 2000

This is the fifth annual report (1996-2000) on the status of nesting by wading birds in the Everglades basin. Previous annual reports were included in Gawlik & Ogden (1996), and Gawlik (1997, 1998, 1999). The purpose of these reports is to compare the annual nesting patterns of 5 species of wading birds in the Everglades basin with a set of baseline data for nesting patterns by these same species between 1986-1995, and with a wading bird "restoration" target proposed by Ogden et al (1997). For the Everglades basin, restoration targets have been established for 3 nesting parameters (numbers of nesting birds, seasonal timing of nesting, and locations of colonies) and for 5 common species in the mainland Everglades colonies (Great Egret, Snowy Egret, Tricolored Heron, White Ibis, and Wood Stork). It is intended that these annual wading bird reports will become part of the system-wide "report card" for tracking the success of the south Florida ecosystem restoration programs including the Comprehensive Everglades Restoration Plan (CERP; Ogden & McLean 1999, Science Subgroup 1997).

Results

Numbers of Nesting Birds: In 2000, the combined nesting numbers (total of maximum estimates of nesting pairs for each reported colony) for LNWR, WCAs 2 & 3, and mainland ENP was 4,744 pairs of Great Egrets, 2,596 pairs of Snowy Egrets, 1,440 of Tricolored Herons, 22,000 pairs of White Ibises, and 2,092 pairs of Wood Storks. The total number of nesting pairs for the 5 species combined was about 32, 872, compared to 8,012 pairs in 1996, 8,301 in 1997, 6,936 in 1998, and 21,590 pairs in 1999.

Ogden et al. (1997) recommended using 3-year running averages of numbers of nesting pairs as a means for measuring long-term trends in nesting effort. The attached table shows the highest and lowest values from among the 3-year running averages for the base years 1986-1995, the 3-year running averages for the 5 recent annual assessments, and the recommended restoration targets for the 3-year running averages of nesting pairs for the 5 species (Snowy Egret & Tricolored Heron are combined).

Seasonal Timing of Nesting: The restoration target is to shift the timing of nesting to earlier in the dry season, which more closely matches pre-C&SF project patterns (Ogden et al. 1997). The 2 species that have shown altered timing patterns concurrently with the implementation of the C&SF Project (i.e., since the 1950s) are the White Ibis and Wood Stork. The current reporting method used in the South Florida Wading Bird Report does not provide much information on the timing of nesting by wading birds in the Everglades in 2000. Most colony surveys are conducted between February and June, the months when most waders are expected to be nesting. Differences among years in colony initiation dates, if not large, likely are not detected. The only comments on timing in the 2000 regional reports reveal that storks initiated nesting early at Corkscrew (December) and in WCA-3 (February). Elsewhere, nesting was initiated during late-February and early March in ENP, and during March in LNWR.

Location of Colonies: The restoration target is the recovery of large, sustainable colonies in the area of the traditional marsh-mangrove ecotone nesting sites generally located downstream from the major freshwater Everglades flows. In most years prior to the C&SF Project, an estimated 75-95% of all birds of these 5 species nested in the southern ecotone region.

The number of wading birds that nested in the southern mainland Everglades ecotone region in 2000 (1,340 pairs; I include the Tamiami Trail colonies as part of the cluster of central Everglades colonies) was 4.0% of the total number that nested in the Everglades basin. The number of birds nesting in the southern ecotone region averaged 26% of the total during the baseline years, 1986-1995 (range = 6-58%). The number from previous assessment years was 11% in 1996, 2% in 1997, 4.6% in 1998, and 3.5% in 1999. In 2000, most birds nested in WCA-3 (90%).

Discussion

The number of pairs of wading birds nesting in the Everglades basin in 2000 (32,872 pairs) was much greater than for any baseline year (maximum 25,800 pairs in 1992) or for any assessment year (21,590 in 1999). The 3-year running average for total nesting in 1998-2000 (20,465 pairs) was greater than the maximum 3-year running average for the baseline years (13,400 for 1992-1994), or for any previous 3-year running average during the 5 assessment years (maximum 12,325 for 1997-1999).

The unexpectedly large nesting effort in 2000 is not fully understood. Three possible contributing factors (unusually steep and prolonged drying rate following Hurricane Irene;

Species	Base high/low	1994-96	1995-97	1996-98	1997-99	1998-00	Target
GREG	1,163/3,843	4,043	4,302	4,017	5,084	5,544	4,000
SNEG/TRHE	903/2,939	1,508	1,488	1,334	1,862	2,788	10,000-20,000
WHIB	2,107/8,020	2,172	2,850	2,270	5,100	11,270	10,000-25,000
WOST	130/294	343	283	228	279	863	1,500-2,500

extensive drought in other parts of the southeastern U.S.; drop in levels of mercury in the Everglades) are proposed by Frederick, Ruane & Hylton elsewhere in this Year 2000 Wading Bird Report. Although the number of birds nesting in 2000 was substantially higher than for any year since the 1970s (Ogden 1994), there was no improvement this year in the percentage of birds nesting in the southern Everglades ecotone region. Southern Everglades National Park continues to have remarkably few nesting wading birds compared to the number nesting in the WCAs.

The selection of key indicators of ecological conditions in the Everglades basin is an essential process for measuring the progress and success of regional restoration programs such as CERP. Opinion has been almost unanimous that wading birds are one of the important indicators of Everglades "health." Once an indicator is selected, and a restoration target (or targets) for that indicator have been decided, the annual monitoring program must determine the baseline condition, and the annual changes in the status and trends for that indicator (Ogden & Davis 1999, Adaptive Assessment Team 2000).

The challenge for the wading bird monitoring program is to correctly interpret the year-to-year changes in nesting patterns. What year-to-year changes fall within the expected range of baseline variability, and what changes reflect real shifts in wading bird patterns? Is what we are now measuring each year helping us to improve our understanding of the range of variability in patterns of nesting that characterizes the currently degraded ecosystem (i.e., the baseline condition)? Being able to determine that range of variability assumes that the currently degraded system has stabilized, and that wading bird nesting patterns have settled around that long-term mean condition. In actuality, we have no reason to be confident that wading bird nesting patterns have "stabilized" around some long-term set of conditions in the Everglades. Therefore, while it may be true that measures of nesting effort during the assessment period may be helping us to further refine our understanding of baseline variability (after all, no large scale restoration projects have been implemented yet), these measures may just as well be revealing an evolution of conditions in an ever-changing Everglades, which may continue regardless of whether a restoration program is implemented or not. If the latter is the case, then it may be some time before we can say that we are seeing nesting patterns that are responses to changes in hydropatterns that have been brought about by the implementation of the restoration plan (i.e., patterns that we are confident are outside the expected range of variability in the degraded system).

The point of this discussion is to set a basis for asking the question, how should we interpret the increased nesting effort of the past 2 years? Do the numbers of nesting birds in 1999 and 2000 simply represent the upper limit of nesting effort for a 1980s-1990s baseline condition, or are they an indication of a real increase in nesting effort during the 1990s? In general, the number of wading birds nesting in the freshwater/estuarine Everglades was larger during the early/mid 1970s and during the 1990s than during the 1980s (Ogden 1994, Ogden et al. 1997, Gawlik & Ogden 1996, Gawlik 1997, 1998, 1999). Should we re-adjust our baseline years to only include the decade of the 1980s, and treat the numbers of the 1990s as indicative of an increase in nesting effort in response to improvements in habitat and food conditions that are occurring for reasons other than planned restoration? Time will tell!

Recommendations

In so far as I know, the three major recommendations in my 1999 annual report (Gawlik 1999; the need for cypress basin surveys; the need for a fresh review of wading bird targets; the need for increased ground surveys) have not been addressed, or resulted in improved survey protocols. So without repeating them, I suggest that they remain valid for this year 2000 annual report.

Literature Cited

Adaptive Assessment Team. 2000. An adaptive management strategy for the Comprehensive Everglades Restoration Plan. RECOVER. South Florida Water Management District, West Palm Beach, FL. 27 March 2000.

Gawlik, D.E. 1997. South Florida wading bird report. South Florida Water Management District, West Palm Beach, FL. Vol. 3(1).

Gawlik, D.E. 1998. South Florida wading bird report. South Florida Water Management District, West Palm Beach, FL. Vol. 4(1).

Gawlik, D.E. 1999. South Florida wading bird report. South Florida Water Management District, West Palm Beach, FL. Vol. 5 (1).

Gawlik, D.E. & J.C. Ogden. 1996. 1996 late-season wading bird nesting report for south Florida. South Florida Water Management District, West Palm Beach, FL.

Ogden, J.C. 1994. A comparison of wading bird nesting colony dynamics (1931-1946 and 1974-1989) as an indication of ecosystem conditions in the southern Everglades. Pp. 533-570 In Everglades. The ecosystem and its restoration (S.M. Davis & J.C. Ogden, eds.). St. Lucie Press, Delray Beach, FL.

Ogden, J.C. & S.M. Davis. 1999. The use of conceptual ecological landscape models as planning tools for the south Florida ecosystem restoration programs. South Florida Water Management District, West Palm Beach, FL. June 29, 1999.

Ogden, J. & A. McLean. 1999. Base line report for the Comprehensive Everglades Restoration Plan. 1999. South Florida Water Management District, West Palm Beach, FL.

Ogden, J.C., G.T. Bancroft and P.C. Frederick. 1997. Ecological success indicators: reestablishment of healthy wading bird populations. In Ecologic and precursor success criteria for south Florida ecosystem restoration. A Science Subgroup report to the South Florida Ecosystem Restoration Working Group.

Science Subgroup. 1997. Ecologic and precursor success criteria for south Florida ecosystem restoration. Report to the Working Group of the South Florida Ecosystem Restoration Task Force. U.S. Army Corps of Engineers, Jacksonville, FL.

John C. Ogden

Water Supply Division
South Florida Water Management District
O.E. 148, University Park
Florida International University
Miami, FL 33199
(561) 906-9277
jogden@sfwmd.gov

A Summary of Historic Wading Bird Nesting Effort in South Florida, 1903-2000

Methods

Wading bird nest numbers were compiled from published literature, reports, government documents, and unpublished data for 1903-2000 for different regions in southern Florida. The goal was to assemble a comprehensive historic nesting database for the Everglades watershed because the existing information was scattered among a variety of published and unpublished sources. This database builds on previous nesting compilations (Robertson and Kushlan 1974, Kushlan and Frohring 1986, Powell et al. 1989, Ogden 1994). However, it is more comprehensive than previous efforts in that it covers more regions within the Everglades watershed over a longer time period, includes data from more sources, and contains data on more wading bird species. A similar exercise by ENP staff is underway for ENP data only. In this report, all nest estimates are pooled within ENP and therefore it is impossible to distinguish between coastal and freshwater nesting regions. The thorough compilation of ENP data that is currently underway should allow for more detailed spatial resolution and a differentiation between coast and freshwater nesting. The combination of the 2 databases will provide the most comprehensive summary of wading bird nesting in south Florida to date. Revised nest estimates for the Everglades will undoubtedly emerge in the future as new records come to light, and as old records are revisited. This should be a continual process that will provide an increasingly reliable database.

In the process of reviewing literature and data, occasional discrepancies were found in the number of nests for a species or region. We used our best judgement to determine which source was the most reliable and accurate. To maintain consistency in the database, the Tamiami Trail colonies were included in ENP and excluded from WCA3. Frank Key was included in Florida Bay and excluded from ENP. If more than 1 survey was conducted within a season, we used the maximum count.

To the best of our knowledge, WCA 2 was not formally surveyed for wading bird nests until 1989, with the exception of surveys from 1974-1982, of which we only have information for Wood Storks (Kushlan and Frohring 1986). However, interviews with people that were in WCA2 in the 1970s and 1980s indicate that there were no noticeable wading bird colonies in WCA2 from 1974-1980, and it is unlikely that there were nests from 1971-1973 and 1981-1988 (J. Milleson and T. Reagan, FFWCC, personal communication).

To clarify some symbols used in the table, a 'P' represents nests were present but no numbers are available and a '+' means that the numbers given are underestimates. The SMHE column refers to unidentified small herons (i.e., Tricolored Herons, Snowy Egrets, Little Blue Herons). If the data in a row come from 2 sources, the data from the second source have an asterisk. The superscript numbers in the table refer to the footnotes located at the end of the table. If a range of nest numbers were given for a species for a particular year, the mid-point was used in the graphs.

Results

In general, numbers of wading bird nests have decreased rather dramatically across south Florida over the past 100 years (See figures). Wood Stork nests have plummeted to extremely low numbers as compared to historic accounts. White Ibis nests have also drastically declined over the past 70 years with numbers documented in the tens of thousands historically and nests currently in the thousands. We can be certain that Wood Stork and White Ibis nest numbers have decreased region-wide over the past 70-100 years because although the historical data may only reflect the coastal colonies in the ENP, these nest numbers are much larger than the current numbers that come from the entire Everglades ecosystem. Thus, the magnitude of that decrease is a minimum estimate. Contrasting with this, numbers of Great Egret nests have increased over the past 25 years exceeding historic levels. However, we only have historic information for Great Egrets from the coastal colonies in the ENP so, although they have clearly exceeded their historic numbers in that region, the degree to which they have increased system-wide may be less.

Although not listed in the database because no estimates of numbers of nests were available, Wood Storks were documented as nesting in the ENP in 1880, 1883, 1888, 1891-92, 1895, 1901, 1910, 1915, 1923, 1925-26, 1928-30, 1947, 1949, 1951, and 1953-56 and in Big Cypress/Corkscrew in 1892, 1895, 1926, 1932, 1935, 1939, 1950, 1952, 1955-56, and 1978 (Kushlan and Frohring 1986). Great Blue Herons were recorded as nesting in WCA1 in 1955, 1974-75, and 1982-83 (LNWR Annual Reports). Great Egrets nested in WCA1 in 1955 and 1972. Tricolored Herons were recorded as nesting in WCA1 in 1955, 1972, 1978, and 1982. White Ibises were documented as nesting in WCA1 in 1978 and 1981. Cattle Egrets and Little Blue Herons were recorded as nesting in WCA1 in 1972, 1978, and 1981-83 (LNWR Annual Reports).

Limitations of the database have to be recognized to ensure proper use of the data. Often the geographical area surveyed within a region changes over the years. For example as was stated earlier, the nesting data for the ENP from 1931-1946 covers historical coastal colonies (the interior portions of the ENP are not well documented),

NUMBER OF WADING BIRD NESTS IN SOUTH FLORIDA (1903-1999)

Year	Region	GBHE	GREG	WHIB	GLIB	WOST	SMHE	TRHE	LBHE	SNEG	CAEG	ROSP	BCNH	YCNH	ANHI	Source
1903	Portion ENP					20[1]										E
1911	Part of Big Cypress/Corkscrew					500[2]										E
1912	Part of Big Cypress/Corkscrew					8000[2]										E
1913	Part of Big Cypress/Corkscrew					5000[2]										E
1924	Portion ENP					230[1]										E
1927	Portion ENP					300[1]										E
1931	Portion of ENP[3]		500+[4]	50000+[5]		P[6]	2000+[7]									G
1932	Portion of ENP[8]		P+[9]	12500-15000[10]		1000[6]	3500+[7]									G
1933	Portion of ENP		750+[11]	75000-100000[10]		3000[12]	13350-15850[7]									G
1934	Portion of ENP		1300[11]	87700-112700[12]		4000[12]	6250[7]									G
1935	Portion of ENP		P[10]			2000+[12]	P[13]									G
mid-30's	Interior of ENP		12500	210000			45000									J
	Southern Coast/Florida Bay		150	750			500									J
1936	Portion of ENP		4000+[11]	7500[10]		2000+[12]	16000[4]									G
	Florida Bay[54]											15				I
1937	Portion of ENP[14]		P+[10]	2500-20000[10]		1500+[12]	250+[5]									G
	Florida Bay											5				I
1938	Portion of ENP		250[10]			100+[6]										G
	Florida Bay											6				I
1939	Florida Bay											16				I
1940	Portion of ENP		750+[9]	45000-50000[10]		P+[12]	500+[5]									G
	Part of WCA3		1750													G
	Florida Bay											15				I
1941	Portion of ENP			17000-52000[5]		P*[1]	500+[5]									G, E*
1942	Portion of ENP		100+[12]	5000+[5]		3250[12]	P+[5]									G
1943	Portion of ENP[15]		P+[11]	P+[13]		300*[16]	P+[17]									G, E*
1944	Portion of ENP[18]		250+[11]	P+[9]		1500+-2000+[12]	1000+[11]									G
1945	Portion of ENP		P+[11]	P[10]		P+[12]	50+[5]									G
1946	Portion of ENP[19]		P+[10]	12500[10]		P+[12]	P+[5]									G
1949	Florida Bay											100				I
1950	Portion of ENP					3525+[20]										E
1951	Florida Bay											64				I
1952	Portion of ENP					250+[21]										E
	Florida Bay											80				I
1953	Florida Bay											66				I
1954	Portion of WCA1[22]	10				0										F
	Florida Bay											81				I
1955	Florida Bay											174				I
1956	Florida Bay											214				I
1957	ENP					1040[23]										J
	Part of Big Cypress/Corkscrew					0[2]										E
	Florida Bay											183				I
1958	Portion of ENP					610[20]										E
	Part of Big Cypress/Corkscrew					1640[24]										E
	Florida Bay											92				I
1959	Portion of ENP					1450[16]										E
	Part of Big Cypress/Corkscrew					4655[2]										E
	Florida Bay											145				I
1960	Portion of ENP					1900[16]										E
	Part of Big Cypress/Corkscrew					6635[2]										E
	Florida Bay											119				I
1961	ENP					3100										J
	Part of Big Cypress/Corkscrew					6000[2]										E
	Florida Bay											125+				I
1962	Portion of ENP					150[20]										E
	Part of Big Cypress/Corkscrew					0[2]										E
	Florida Bay											76				I
1963	Portion of ENP					1600[20]										E
	Part of WCA1	150	500	100		0		150	150	40	350		400		500	F
	Part of Big Cypress/Corkscrew					3000[2]										E
	Florida Bay											266				I
1964	ENP					1500										J
	Part of Big Cypress/Corkscrew					0[2]										E

Year	Region	GBHE	GREG	WHIB	GLIB	WOST	SMHE	TRHE	LBHE	SNEG	CAEG	ROSP	BCNH	YCNH	ANHI	Source
1965	Portion of ENP					1650[25]										E
	Part of WCA1	125	200			0		130	200	70	300		450		200	F
	Corkscrew Swamp					1300										J
mid-60's	Interior of ENP	0-100	250-2500	0-2500			500-3750									J
	Southern Coast/Florida Bay	550	1250	1750			2500									J
1966	Portion of ENP					1600[25]										E
	Part of WCA1	150	225			0		150	225	50	200		400		100	F
	Part of Big Cypress/Corkscrew					3000[2]										E
1967	Portion of ENP					2125+[25]										E
	Part of WCA1	80	50			0		100	250	25	150		150		90	F
	Part of Big Cypress/Corkscrew					7300[2]										E
	Florida Bay											368				I
1968	Portion of ENP					1027[25]										E
	Part of WCA1	90	50			0		120	250	25	100		75		90	F
	Part of Big Cypress/Corkscrew					5000[2]										E
1969	Portion of ENP					278[25]										E
	Part of WCA1	60	30			0		100	250				60	1	80	F
	Part of Big Cypress/Corkscrew					3500[2]										E
	Florida Bay											272+				I
1970	Portion of ENP					169[25]										E
	Part of WCA1	50	20	350	75	0		100	175		100		45	5	70	F
	Part of Big Cypress/Corkscrew					1900[2]										E
	Florida Bay											255+				I
1971	Portion of ENP					458[25]										E
	Part of WCA1	12	25	125	27	0			15		50		20	5	30	F
	Part of Big Cypress/Corkscrew					3000[2]										E
1972	Portion of ENP					333[25]										E
	Part of Big Cypress/Corkscrew					1500[2]										E
1973	Portion of ENP					888[25]										E
	Part of Big Cypress/Corkscrew					0[2]										E
1974	Portion of ENP		1025[11]	650[9]		950*[25]	2650[4]									G, E*
	Portion of WCA 1-3					0										E
	Part of WCA3		P	8500			P									G
	Part of Big Cypress/Corkscrew					1900[24]										E
1975	Portion of ENP[26]	1	909	923		1335		1583	6	2162	1630	3			81	D
	Portion of WCA 1-3					0										E
	Portion of WCA3[27]	36	1990	11001				1318	72	2312	1		P+		26	D
	Big Cypress Swamp/Corkscrew[28]		575	12000		3027			25	150	8000				40	D
	Florida Bay[29]	442+	602	885				1081	37	176	12	497+	P+		240+	D
	Biscayne Bay[30]	13	19	106				25	19	2	879				2	D
	Southwest Coast[31]		280					694	7	29	277				3	D
	J.N. Ding Darling NWR[32]	1														D
	Estero Bay	1	2					27	2	8	12		P		1	D
1976	Portion of ENP		675[11]	3400[9]		1310*[25]	2025[33]									G, E*
	Portion of WCA 1-3					0										E
	Part of WCA3		600	14500			2500									G
	Part of Big Cypress/Corkscrew					2300[24]										E
	Florida Bay											802+				I
1977	Portion of ENP		800[11]	1800[9]		715*[25]	1550[9]									G, E*
	Portion of WCA 1-3					0										E
	Part of WCA3		1600	8000			5700									G
	Part of Big Cypress/Corkscrew					200[24]										E
1978	Portion of ENP		775[11]	400[9]		19*[25]	1300[11]									G, E*
	Portion of WCA 1-3					0										E
	Part of WCA3		1500	300												G
	Florida Bay											619+				I
1979	Portion of ENP		1350[11]	300[9]		1350*[25]	4425[11]									G, E*
	Portion of WCA 1-3					0										E
	Part of WCA3		1050				250									G
	Part of Big Cypress/Corkscrew					915[24]										E
	Florida Bay											1254+				I
1980	Portion of ENP		650[11]	250[34]		81*[25]	1800[9]									G, E*
	Portion of WCA 1-3					0										E
	Part of WCA3		500													G
	Part of Big Cypress/Corkscrew					1175[24]										E
1981	Portion of ENP		650[11]	465[9]		381*[25]	265[9]									G, E*
	Portion of WCA 1-3					297										E
	Part of WCA3		450	2000			500									G
	Part of Big Cypress/Corkscrew					1500[24]										E
1982	Portion of ENP		525[12]	150[34]		670*[25]	800[12]									G, E*

Year	Region	GBHE	GREG	WHIB	GLIB	WOST	SMHE	TRHE	LBHE	SNEG	CAEG	ROSP	BCNH	YCNH	ANHI	Source
1982	Portion of WCA 1-3					549										E
	Part of WCA3		400	6250												G
	Part of Big Cypress/Corkscrew					18[24]										E
1983	Portion of ENP		1450[11]	200[34]			300[9]									G
	Part of WCA3		175													G
1984	Portion of ENP		1950+[11]			650[12]	250[10]									G
	WCA1[35]	28+	6+			0		33	68+		P				103+	F
	Part of WCA3		400													G
1985	Portion of ENP		50+[11]			125[10]	P+[9]									G
	WCA1[36]	41				0		23+	25+	P	P				53	F
	Part of WCA3		300	1500												G
	Florida Bay											448				I
1986	Portion of ENP[37]		370-670	550-1050		275	52	783	151	350-1250	300-500	15				A
	WCA1[38]	56	11			0		3+	5+				21		123+	F
	Majority of WCA3	54	1081	942-1442	30	1	38	350	286	69	188		66			A
	Florida Bay											590				I
1987	Portion of ENP	0*	502	30		100		690	194	405	300					A, C*
	WCA1[39]	111	14++	800		0		P	P						P	F
	Majority of WCA3	250*	1503	4100	50	0*	155	693	529	132	290		360			A, C*
	Florida Bay											527				I
1988	ENP	1	795	300	30	220	674	393	112	723	3270					C
	WCA1[40]	44	103	8912		0		359	850	84	38				278	F
	WCA3	37	2527	1670		0		416	23	600	0					C
	Florida Bay											493				I
1989	ENP	0	558	100		275		240	35	176	2000					C
	WCA1[41]	5				0		12	19	5	40				15+	F
	WCA2	0	0	0	0	0		0	0	0	0					H
	WCA 3	75	1293	1535		235		250	100	310	300					C
1990	ENP	13	517	650		0		301	0	0	800					C
	WCA1[42]	13	54	4300*		13*		52	340	47	800				P*	C, F*
	WCA2	0	0	0	0	0		0	0	0	0					H
	WCA3		342	0		165		40	0	97						C
1991	ENP	0	655	400		150	0	124	14	580	223		5			C
	WCA1	32	181	300		0	267	404	1134	0						C
	WCA2	125	30													H
	WCA3	173	976	900		0	8	516	169	354	0		3			C
1992	ENP[43]	24	960	5100	0	409		450	100	900	200		50			B
	WCA1	87	239	2761	65*	0*	0	520	938	97	1408		34*			Q, B*
	WCA 2-3	120	3268	8600	30	158	8*	1193	943	1291	0		77			B, C*
1993	ENP	0	970	600	0	40		575		650	605		0			B
	WCA1	73	328	218	0*	0*	378	173	673	4	728		0*			Q, B*
	WCA 2-3	325	1944	0	0	0		368	594	723	945		166			B
1994	ENP	0	671	300	0	230		215	0	150	1200*		0		0	B, C*
	WCA1	73	396	1849	0	0		103	1333	21	1051	0	0		0	P
	WCA 2-3	348*	2381	100	3	0		1028	764	287	345		112		556	B, C*
1995	ENP	0	1087	250	0	113		50	0	140	750*		0		60	B, O*
	WCA1	82	610	2249	0	0		343	1153	59	729	0	0		0	P
	WCA 2-3	503	2827	780	40	0		629	479	369	2176	12	174		818	P
	Florida Bay	6	27	40				50		0		45				K
	Part Holey Land/Rotenburger[44]							30			150				160	Q
1996	ENP		896	5		575		0		100	1200		0			Q
	WCA1	118	837	800			0	197	1372	28	2403					Q
	WCA 2-3[45]	253	2421	1013	19	100		749*	678	539	100	15	22		926	Q,C*
	Florida Bay	33	195	275				29		10		40				K
	Southwest Coast[46]	6	235	8	108			366	18	202	469				25	Q
	Part Holey Land/Rotenburger[44]	0	0	0	0	0	0	0	0	0	0	0	0	0		Q
1997	ENP		359-372	100		215-245				0	305-350	0	0			K
	WCA1	95	516	1095			0	254	1311	73	1028					K
	WCA 2-3	122	2365	2055	0	5	15*	604	47	280	120	15	38		318	K, C*
	Florida Bay	48	75	100				50		75		50				L
	Southwest Coast[47]		58	26				307	5	130	457					K
	Part of Big Cypress[48]								20							K
	Part Holey Land/Rotenburger[49]	0	0	0	0	0	0	0	0	0	0	0	0	0		K
1998	ENP		607			25					120					L
	WCA1	123	828	873			37	352	1036	15	1682					L
	WCA 2-3	180	2672	535				803	209	226	615	10	16		787	L
	Florida Bay	15	308	250				220		70		30				M
	Southwest Coast[50]	22	326	0	36			475	38	347	331					L
	Part of Big Cypress[51]	P	P			3										L
	Part Holey Land/Rotenburger[49]							5						5		L

Year	Region	GBHE	GREG	WHIB	GLIB	WOST	SMHE	TRHE	LBHE	SNEG	CAEG	ROSP	BCNH	YCNH	ANHI	Source
1998	J.N. Ding Darling NWR[52]	13	25	26				135	3	21	25		4	2	21	L
1999	ENP		1371	150		215		8	6	15	285		10			M
	WCA1	217	2037	5780	P	12	0	489	1592	470	831		411	7		M
	WCA 2-3	528	4373	4474		260		1226	503	725	490	47	241		2181	M
	Florida Bay	19	106	1				5		0		881				M
	Southwest Coast[46]	17	225	3	46			342	34	191	315					M
	Holey Land/Rotenburger[47]	0	0	0	0	0	0	0	0	0	0	0	0	0		M
	J.N. Ding Darling NWR[52]	15	21	25				46	8	30	18		2		15	M
	Corkscrew Swamp[53]					900						6				M
2000	ENP		1110	20		1592		15+	P	150	130		2+			N
	WCA1	174	535	920	69	0		147	557	58		0	143	1		N
	WCA2-3	525	3059	21117	30	500		1278	475	2388	243	15	339	2	1092	N
	Southwest Coast[46]	22	329	20	43			206	35	163	272					N
	Big Cypress					25										N
	Holey Land/Rotenburger	0	0	0	0	0	0	0	0	0	0	0	0	0		N
	J.N. Ding Darling NWR[52]	12	29	64				31	7	30	15		2		13	N
	Corkscrew Swamp[53]					1722										N

[1] Data from the Cape Sable region. All the data from source E are compiled from 1903 - 1973 and collected from 1974-1982.

[2] Data from the Corkscrew Swamp and northern Big Cypress Swamp.

[3] In addition to what is listed here, several thousand egrets, herons, and ibises combined were recorded nesting. All the data from source G are compiled.

[4] Data from the lower Ten Thousand Islands, north-western Florida Bay, and headwaters.

[5] Data from the lower Ten Thousand Islands and headwaters.

[6] Data from the southern mainland.

[7] Data from the lower Ten Thousand Islands, north-western Florida Bay, southern mainland, and headwaters.

[8] In addition to what is listed here, 750 nesting pairs of GREG and SMHE combined were recorded.

[9] Data from the north-western Florida Bay and headwaters.

[10] Data from the headwaters.

[11] Data from the north-western Florida Bay, southern mainland, and headwaters.

[12] Data from the southern mainland and headwaters.

[13] Data from the lower Ten Thousand Islands.

[14] In addition to what is listed here, approximately 2500-5000 nesting pairs of GREG and SMHE combined were recorded.

[15] In addition to what is listed here, roughly 2500-5000 nesting pairs of SMHE and WHIB combined were recorded.

[16] Data from the Hells Bay region.

[17] Data from the lower Ten Thousand Islands and the north-western Florida Bay.

[18] Three times as many GREG in East River portion of the headwaters than in 1943. In addition to what is listed there were several thousand WOST in the southern mainland.

[19] Largest nesting of GREG in years in the Headwaters.

[20] Data from the Hells Bay, Southeastern Florida coast, and Southern Everglades regions.

[21] Data from the Hells Bay and Southern Everglades regions.

[22] The sampling effort and sampling area for the source F data is unknown and suspected to be miniumal for most years.

[23] All the data from source J are compiled.

[24] Data from the Corkscrew Swamp, and northern and southern Big Cypress Swamp.

[25] Data from the Cape Sable, Hells Bay, Southeastern Florida coast, and Southern Everglades regions.

[26] Data from Madiera, Cuthbert, East River, Lane River, Rodgers River Bay, Rookery Brach, Taylor Slough, and Hole-in-Donut. All data from source D are original and thorough.

[27] Data from Alligator Alley East, Alligator Alley West, and L-67-A.

[28] Data from Sunniland Grade, Okaloacoochee, Sadie Cypress, and Corkscrew.

[29] Data from Porjoe, Nest, Tern, Palm, Frank, Oyster, Catfish, Sandy, Upper Arsnicker, Green Mangrove, Buchanan, Cowpens, Bottle, Stake, and Florida Bay's other Keys.

[30] Data from Cutler, Arsenicker Keys, and Rookery Keys.

[31] Data from Big Marco Pass and Chokoloskee.

[32] Data from Tarpon Bay.

[33] Data from north-western Florida Bay and southern mainland.

[34] Data from north-western Florida Bay.

[35] Data from 29 rookeries.

[36] Data from 55 rookeries. In addition to what is listed here, 25 nests of LBHE and TRHE combined and 200 nests of LBHE and CAEG combined were found.

[37] All data from source A are original and thorough.

[38] Data from 84 rookeries. In addition to what is listed here, 64 nests of LBHE and TRHE combined were found.

[39] Data from 105 rookeries.

[40] Surveys covered about 20-30% of the rookeries in WCA1

[41] No rookery surveys were conducted because only 1 rookery was established according to the Annual Reports.

[42] This is the first year WOST nests were found in WCA1 since 1951 according to Annual Reports.

[43] All data from source B are original and thorough.

[44] No formal nest surveys were conducted, however, nesting data were recorded during wading bird foraging surveys that covered 10% of the area.

[45] The numbers of GBHE and LBHE may be under-estimates (probably not by more than 10%) because surveys were stopped in certain areas as the result of the Valu-Jet crash.

[46] Data from 5 rookeries.

[47] Sampling effort unclear.

[48] No formal nesting surveys, however, known areas of previous wading bird use were checked during pather flights.

[49] No nest surveys were conducted, however, no colonies were seen during wading bird foraging, deer, and vegetation surveys which cover roughly 30% of the area.

[50] Data from 6 rookeries.

[51] No nest surveys were conducted.

[52] Surveyed 7 active rookery islands.

[53] Surveyed for WOST.

[54] All data from source I are compiled and from Bottle, Stake, Cowpens, Cotton, West, Low, Manatee, Crab, East, Crane, East and Middle Butternut, East Bob Allen, Pigeon, Jimmie Channel, Tern, North and South Nest, Projoe, North and South Park, Pass, East and West Buchanan, Barnes, Frank, Oyster, and Sandy Keys.

whereas current nesting data for the ENP covers both historical nesting sites, as well as any new nesting colonies in the interior. On a shorter time scale, the subregions within an area (such as the interior of ENP or LNWR) may not be consistently surveyed from year to year causing artificial drops in nest numbers for some years.

Other limitations, some of which persist today, are a lack of standardization in sampling effort and technique among regions and years. Sampling techniques ranged from haphazard counts of nests from the air to systematic surveys from both ground and air. Sampling effort was often not recorded. Lack of sampling effort in the interior freshwater portions of many areas in the historic data may have caused an underestimate of nesting numbers. In contrast, wardens wishing to prove how important the Everglades was to wading birds, may have overestimated nest numbers in the earlier data for job security, and to get government and public support for conservation efforts (Kushlan and Frohring 1986).

As a result of these limitations, precise species-specific nest estimates from the earlier years (approximately 1903-1974) are not as reliable as in the more current data. It is likely, however, that nest locations and dominant nesting species were accurately recorded. Nest estimates from 1986-2000 have been reviewed rather extensively, and we have more confidence in their reliability. But, because the sources of variation for the earlier years can not be quantified, we caution against comparing between specific colonies or individual years. Rather, we suggest that the full data set be used to identify general patterns and a range of variability in nesting effort.

The context in which to view trends over time for any historical data set in a fluctuating wetland is recognize that these ecosystems have high natural variability from hurricanes, floods, and droughts on decadal time scales, and that there is additional error from survey methodology and observer bias (Kushlan and Frohring 1986). Overlay on that extensive natural variation, additional variation and perhaps, a trend in the averages from human-related activities such as market hunting and hydrologic changes to the system. There is no reason to think that any animal population is ever in equilibrium, and therefore, no brief snapshot in time can provide an absolute benchmark for population size. Rather, the goal of analyzing historic data should be to separate the natural variation from the total variation, presumably that which is driven by human-related events, and to identify trends in the average if they exist. "Restoration", therefore, is simply returning population fluctuations to their natural variation, including similar high and low levels.

Our wading bird data go back to the 1930s for coastal ENP, which is after bird populations were reduced by plume hunters and the first major hydrologic changes were initiated, but before the extensive flood control system was in place. Thus, although these data do not represent only "natural" fluctuations, we believe historic estimates of nesting populations for coastal ENP are a reasonable approximation of natural population fluctuations, that provide some idea of what constitutes "high" and "low" abundance for the more conspicuous species.

Data spanning a long time period in the same spatial area before significant anthropogenic disturbance provide some indication of natural variation for that region (such as coastal ENP), but possibly not for the entire ecosystem. Because birds range beyond the boundaries of any single population survey or region, annual variation in nest estimates for a region may vary more than the total population size because birds are simply shifting nesting locations. If we restrict our inferences only to that area where we have historic data (coastal ENP) we can identify population characteristics for that region with a fair degree of confidence, but less so for that of the entire ecosystem. The 2 cases in which we can have the greatest confidence in our ecosystem inferences are for the Wood Stork and White Ibis, whose populations have decreased even though spatial coverage of surveys has increased to system-wide.

It is obvious from the South Florida Wading Bird Report that there is great value in simply bringing together data for such a large spatial area. If standardized methodologies and survey effort are adopted for all regions, and the limitations are recognized during interpretation, this remarkable data set will be one of the most powerful tools used to guide the Everglades restoration effort.

Literature Cited

[A] Frederick, P. C., and M. W. Collopy. 1988. Reproductive ecology of wading birds in relation to water conditions in the Florida Everglades. Florida Coop. Fish and Wildl. Res. Unit, Sch. For. Res. And Conserv., Univ. of Florida. Tech. Rept. No. 30.

[B] Frederick, P. C. 1995. Wading bird nesting success studies in the Water Conservation Areas of the Everglades, 1992-1995. Final Report for South Florida Water Management District.

[C] Frederick, P.C. unpublished data.

[D] Kushlan, J. A., and D. A. White. 1977. Nesting wading bird populations in southern Florida. Florida Scientist 40:65-72.

[E] Kushlan, J. A., and P. C. Frohring. 1986. The history of the southern Florida Wood Stork population. Wilson Bulletin 98:368-386.

[F] Loxahatchee National Wildlife Refuge, U.S. Fish and Wildlife Service, Annual Reports 1951-1990.

[G] Ogden, J. C. 1994. A comparison of wading bird nesting colony dynamics (1931-1946 and 1974-1989) as an indication of ecosystem conditions in the southern Everglades. Pages 533-570 *in* Everglades: the ecosystem and its restoration (S. M. Davis, and J. C. Ogden, Eds.). St. Lucie Press, Delray Beach, Florida.

[H] Ogden, J. C. unpublished data.

[I] Powell, G.V.N., R.D. Bjork, J.C. Ogden, R.T. Paul, A.H. Powell, and W.B. Robertson. 1989. Population trends in some Florida Bay wading birds. Wilson Bulletin 101(3):436-457.

[J] Robertson, W. B., and J. A. Kushlan. 1974. The southern Florida avifauna. Pages 219-257 *in* Environments of south Florida present and past II (P. J. Gleason, Ed.). Miami Geological Society, Memoir II, Miami, Florida.

[K] South Florida wading bird report (D. E. Gawlik, Ed.), Vol 3, Issue 1, Sep 1997. South Florida Water Management District, West Palm Beach, Florida.

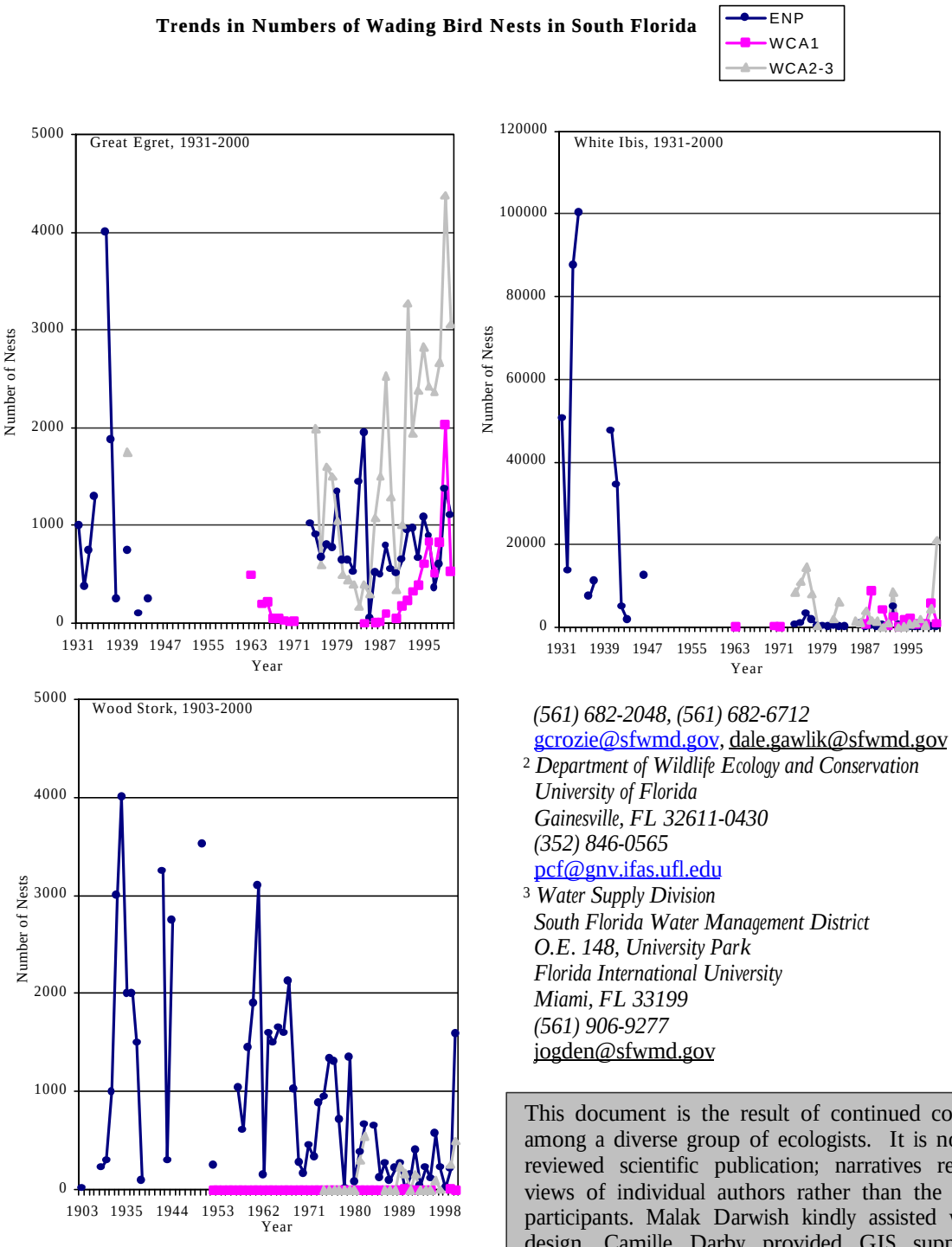
[L] South Florida wading bird report (D. E. Gawlik, Ed.), Vol 4, Issue 1, Sep 1998. South Florida Water Management District, West Palm Beach, Florida.

[M] South Florida wading bird report (D. E. Gawlik, Ed.), Vol 5, Issue 1, Oct 1999. South Florida Water Management District, West Palm Beach, Florida.

[N] South Florida wading bird report (D. E. Gawlik, Ed.), Vol 6, Issue 1, Sep 2000. South Florida Water Management District, West Palm Beach, Florida.

[O] 1995 Mid nesting-season wading bird status report for the Everglades (D.E. Gawlik, Ed.). South Florida Water Management District, West Palm Beach, Florida.

Trends in Numbers of Wading Bird Nests in South Florida



[P] 1995 Summary and late season wading bird nesting report for the Everglades (D. E. Gawlik, Ed.). South Florida Water Management District, West Palm Beach, Florida.

[Q] 1996 Late-season wading bird nesting report for south Florida (D. E. Gawlik, Ed.). South Florida Water Management District, West Palm Beach, Florida.

Gaea E. Crozier[1], Dale E. Gawlik[1], Peter C. Frederick[2], and John C. Ogden[3]

[1] *Everglades Department*
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406
(561) 682-2048, (561) 682-6712
gcrozie@sfwmd.gov, dale.gawlik@sfwmd.gov

[2] *Department of Wildlife Ecology and Conservation*
University of Florida
Gainesville, FL 32611-0430
(352) 846-0565
pcf@gnv.ifas.ufl.edu

[3] *Water Supply Division*
South Florida Water Management District
O.E. 148, University Park
Florida International University
Miami, FL 33199
(561) 906-9277
jogden@sfwmd.gov

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Dale E. Gawlik, Ph.D.
Everglades Department
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406
(561) 682-6712
dale.gawlik@sfwmd.gov