Wading Bird Colony Location, Size, and Timing on Lake Okeechobee

2011 Annual Report

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EXECUTIVE SUMMARY

This document describes project activities and presents data for the 2011 Lake Okeechobee breeding season, as well as comparisons with historic data. The project objectives are to document and monitor wading bird colony locations, size, and timing and Wood stork and Roseate spoonbill nesting success. From 10 January 2011 to 30 June 2011, twelve colonies were detected (Fig. 1); nine on-lake and three off-lake, with an estimated total of 5,636 nests (Table 1). For historical comparisons, the cumulative total for Great Egrets (GREG), Great Blue Herons (GBHE), White Ibises (WHIB), and Snowy Egrets (SNEG) was 4,167 nests, making 2011 the sixth largest nesting year of the 23 years monitored since 1977 and the eighth largest of the 31 years monitored since 1957 (Fig. 2). The majority of nests (80% excluding Anhinga and Cattle Egret), were detected at the Eagle Bay East colony. The next two largest colonies, Bird Island and Clewiston Channel - both under 300 nests, were primarily inhabited by SNEG and GREG and comprised a mere 8% of the total nesting effort. The remaining colonies were all under 100 nests (excluding Cattle Egret) and were primarily SNEG, GREG and Tricolored Herons. Since 2007, a small colony of Wood Storks (WOST) has developed at an alligator farm about 4 km N of Harney Pond along Highway 21. Although WOST were seen roosting at the site on 24 March, they did not initiate nesting. A flock of roughly 100 mostly sub-adult Roseate spoonbills (ROSP) was seen foraging from Cochran's Pass to Eagle Bay throughout the dry season. In late May a group of 30 ROSP roosted in the Eagle Bay Trail colony. A subsequent ground visit showed no evidence of nesting. The majority of colonies were located on spoil islands covered in Phragmites, a sub-optimal nesting substrate, suggesting that wading birds prefer the safety of surrounding water, and access to nearby foraging sites, over a particular nesting substrate. The birds may be adjusting to the lower Lake levels that have predominated since 2006. Unless the Lake reaches levels near or above 4.6 m (15 ft), historic willow-based colonies deep in the Moorehaven and Moonshine Bay marsh will remain unsuitable for colony formation and wading birds on the Lake will continue to use sub-optimal substrate.

INTRODUCTION

Wading Birds as Performance Measures

Large numbers of colonial wading birds were once a distinctive feature of south Florida wetlands. Anthropogenic changes to the natural hydrologic regime over the last hundred years have

been extensive, altering suitable wading bird habitat at a landscape scale and resulting in nesting declines system-wide (Frederick et al 2009). Restoring wading bird breeding populations to pre-drainage conditions is one of the primary objectives of the CERP. Wading bird population health is assessed using system-wide patterns of nesting and includes measurements of four variables: numbers of nesting birds, locations of nesting colonies, timing of nesting, and frequency of supra-normal events. Supra-normal events are defined as years in which the number of nesting wading birds (all species) is greater than one standard deviation above the long-term mean of nesting. Because much is known of their habitat requirements and historical nesting patterns, wading birds are excellent indicators of the overall health of the Greater Everglades ecosystem and provide suitable performance measures by which to evaluate the CERP (RECOVER 2006).

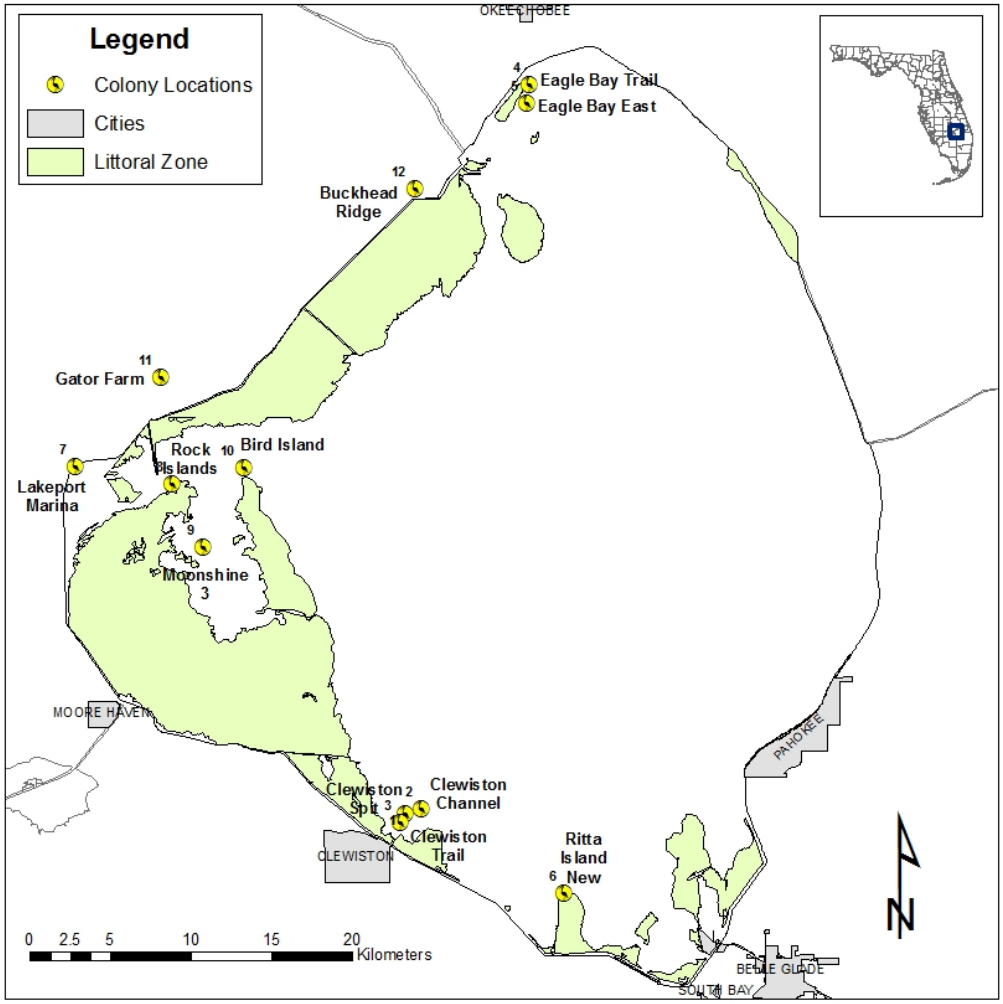

Figure 1. Map of wading bird colonies observed at Lake Okeechobee from January to June 2011.

Table 1. Geographic coordinates (NAD 83) and species-specific peak nest efforts in detected colonies during the 2011 breeding season at Lake Okeechobee. Airboat monitoring only was conducted during January.

Colony	ID	Peak Month[1]	Latitude	Longitude	GREG	GBHE	WHIB	SNEG	LBHE	TRHE	WOST	GLIB	ROSP	CAEG	ANHI	Total[1]
Bird Island	10	APR	26.97199	-81.00917	6	4	---	250	---	20	---	---	---	---	---	**280**
Buckhead Ridge	12	JUN	27.12783	-80.90227	---	---	---	---	---	---	---	---	---	125	---	**---**
Clewiston Channel	2	APR	26.78324	-80.89298	35	---	---	120	---	12	---	---	---	---	---	**167**
Clewiston Spit	1	MAR	26.77658	-80.90914	30	1	---	---[2]	---	---	---	---	---	---	---	**31**
Clewiston Trail	3	APR	26.77278	-80.91111	---	---	---	25	---	75	---	---	---	---	---	**100**
Eagle Bay East	5	APR	27.17987	-80.83080	---	8	1000	2500	10	500	---	500	---	100	1	**4518**
Eagle Bay Trail	4	APR	27.18659	-80.83056	---	2	---[2]	10	---	250	---	---	---[2]	---	---	**262**
Gator Farm	11	APR	27.02278	-81.06084	65	---	---	10	---	---	---[2]	---	---	300	---	**75**
Lakeport Marina	7	APR	26.97260	-81.11440	50	---	---	100	2	10	---	---	---	1000	---	**152**
Moonshine 3	9	JAN	26.92755	-81.03479	---	3	---	---	---	---	---	---	---	---	---	**3**
Ritta Island New	6	FEB	26.73327	-80.80904	---	4	---	---	---	---	---	---	---	---	---	**4**
Rock Islands	8	FEB	26.97021	-81.03683	10	4	---	20	---	---	---	---	---	---	---	**34**

[1] Does not include CAEG or ANHI

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

Colony Surveys at Lake Okeechobee

The first aerial surveys conducted on wading bird colonies on Lake Okeechobee (hereafter referred to as the Lake) commenced in 1957 and proceeded until 1976 (David 1994a). Nest counts recorded during these annual surveys ranged from 10,400 nests in 1974 to 130 nests in 1971. These aerial surveys, although beneficial, may have underestimated nest efforts since they were only performed once during the nesting season. In 1977, aerial surveys shifted to systematic monthly surveys in order to more accurately assess the effects of water management on wading bird populations (David 1994b, Smith and Collopy 1995). The five wading bird species historically surveyed were White Ibis (*Eudocimus albus*), Glossy Ibis (*Plegadis falcinellus*), Great Egret (*Ardea alba*), Great Blue Heron (*Ardea herodias*), and Snowy Egret (*Egretta thula*). These species were surveyed each year to detect wading bird responses to water level changes on the Lake.

Current Monitoring Effort

In May of 2005, Florida Atlantic University (FAU) received funding to document the timing, size and location of wading bird colonies at Lake Okeechobee as part of the CERP Monitoring and Assessment Plan (MAP). On June 3, 2005, we conducted a single aerial survey just as the rainy season was beginning and lake levels were rising. From 2006–2011, FAU conducted monthly aerial surveys of breeding wading birds as a performance measure in the MAP. These surveys also provide a measure of the ecological condition of the Lake for routine water management purposes. Herein, we report results from the 2011 colony surveys.

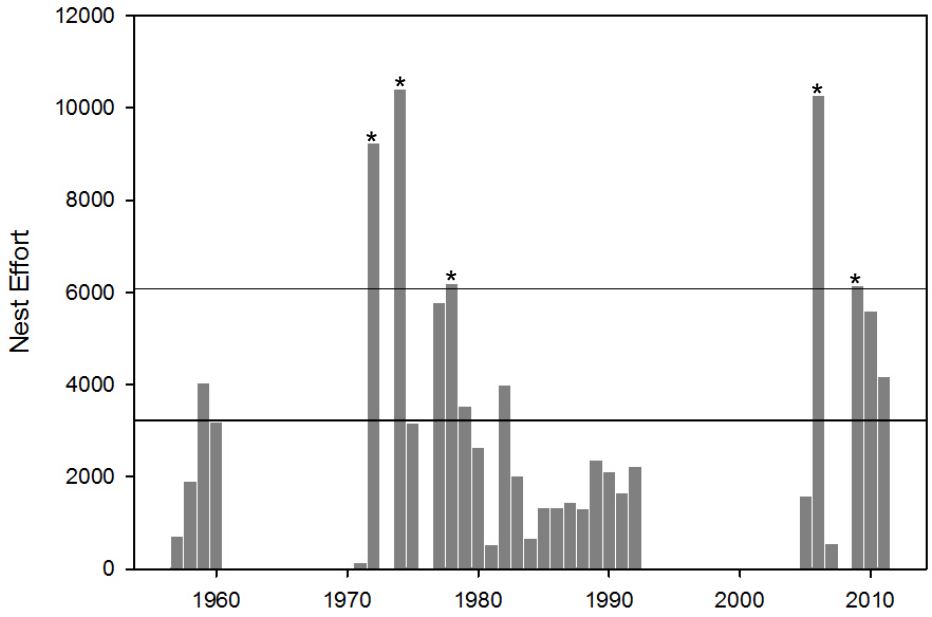

Figure 2. Complete historic record of wading bird nesting on Lake Okeechobee (four species include GBHE, GREG, SNEG, WHIB). Thick horizontal line represents the mean, thin horizontal line represents one standard deviation. *designates a supra-normal nesting event. Data for the following years are not available: 1961-1970, 1973, 1976, and 1993–2004.

METHODS

Colony Surveys

During the dry season of 2011, FAU surveyed wading bird nesting to determine both location and size of colonies on the Lake. The January flight was delayed, so the January count was based on airboat reconnaissance and a flight on 4 February. The February flight was conducted on 27 February. Once a month from February through June, formal aerial surveys were conducted with two dedicated observers surveying wading bird nests along aerial transects flying at an altitude of 244 m and a speed of 185 km/hr. One transect paralleled the eastern rim of the Lake from Eagle Bay Island to the Clewiston Lock. Remaining transects were oriented East-West, spaced at an interval of 3 km and traversed the littoral zone (Fig. 3). A small alligator farm on the west side of the lake by Highway 721 was also included, since the site was known to support nesting Wood Storks since 2007.

During surveys, two observers searched for groups of large white wading birds, one from each side of a Cessna 182. Once a colony was observed, it was circled at a lower altitude of 122 m to enable researchers to estimate the number of nests of each species present within the colony, as

well as to record photographs and geographic coordinates of the colony. These were then mapped to specific stands of vegetation or islands on 1-m resolution digital ortho quarter quadrangles (DOQQ). Ground verification was performed by airboat to improve colony counts and species composition estimates. Small dark-colored wading birds were exceedingly difficult to survey so the focus was on white wading birds. Colonies were defined post-hoc as any assemblage of ≥ 2 nests that were separated by ≥200 m (Erwin et al 1981, Smith and Collopy 1995). Distances between colonies were calculated using ArcGIS.

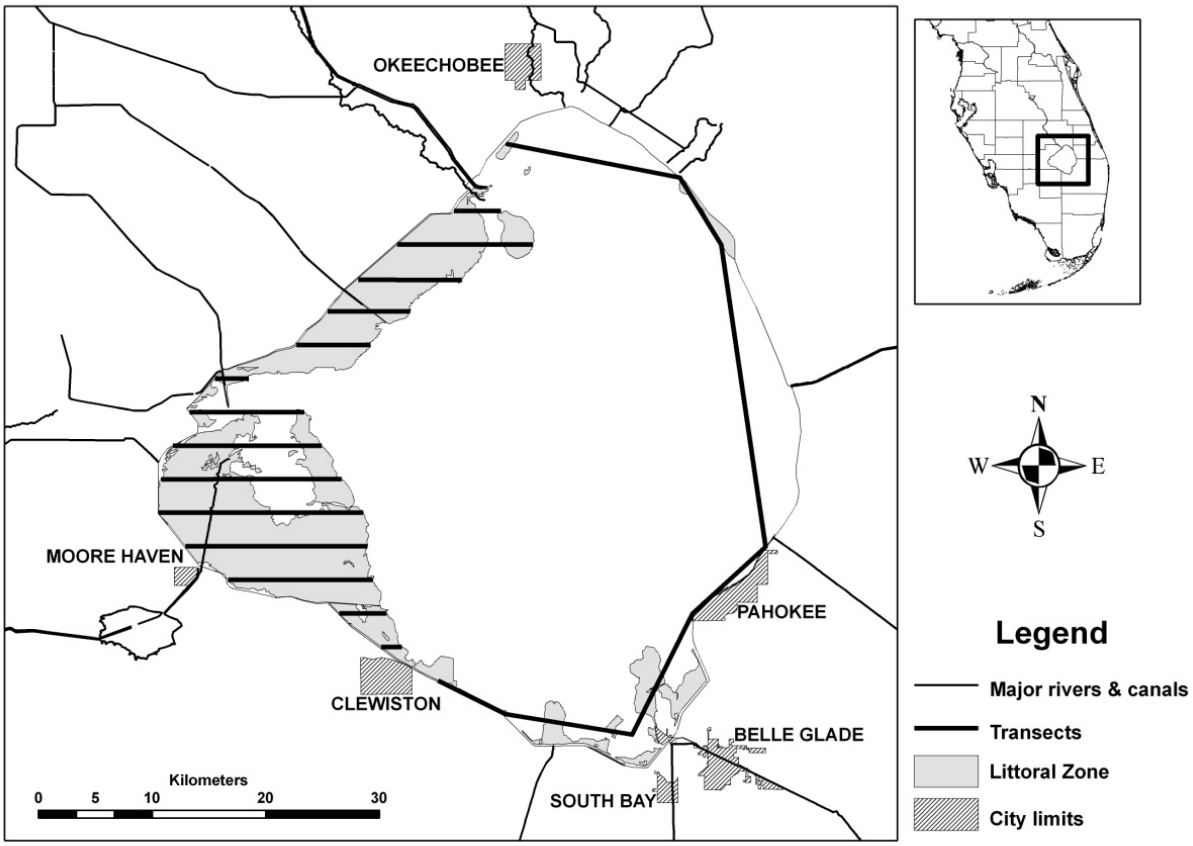

Figure 3. Map of systematic aerial transects flown over Lake Okeechobee during 2011.

Hydrology

Rainfall and hydrology data were obtained from the South Florida Water Management District's DBHydro database. Lake stage was calculated as the mean of four principle gauges located in the limnetic zone of the Lake (L001, L005, L006, and LZ40). Historical mean Lake stage data are from 1977 to the present, which corresponds to the time period of systematic aerial surveys.

RESULTS

Environmental Conditions

Water levels in the 2011 dry season were extremely low (Fig. 4). During a normal dry season, Lake levels start high (average 4.42 m; 14.5 ft) in January and recede during the following months until the start of the next wet season. In 2011, Lake levels began low, at approximately 3.8 meters (12.5 ft) in January, and combined with below normal rainfall, proceeded to drydown particularly fast in April once evapotranspiration began. In late March storms occurred throughout the system and caused a slight increase in water levels, peaking at approximately 3.54 m (11.6 ft) on 30 March. Thereafter water levels receded steadily, reaching the lowest point on 24 June at 2.89 m (9.5 ft) and producing lower than average water levels throughout the dry season.

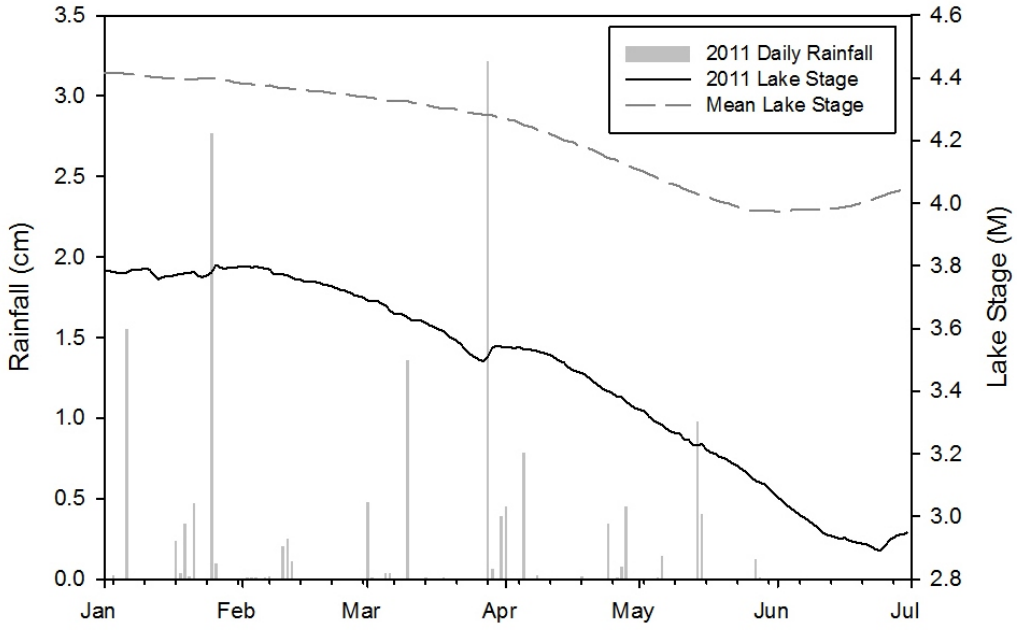

Figure 4. Comparisons of 2011 lake stage (meters) and daily precipitation totals (cm) with the mean daily lake stage from 1977 to the present.

Location and Size

Twelve colonies were detected (Fig. 1); nine on-lake and three off-lake, with an estimated total of 5,636 nests. This number was derived by summing the peak nesting month for each species except Anhingas (ANHI) and Cattle Egrets (CAEG; Table 1). A new off-lake CAEG colony was detected in Buckhead Ridge during the June survey. For historical comparisons, the combined total for Great Egrets (GREG), Great Blue Herons (GBHE), White Ibises (WHIB), and Snowy Egrets

(SNEG) was 4,167 nests, making 2011 the sixth largest nesting year of the 23 years monitored since 1977 and the eighth largest of the 31 years monitored since 1957 (Fig. 2). Bird Island is a historical nesting site but has not been used since 2007 (Smith and Collopy 1995, Marx and Gawlik 2007). All other colony locations were at established sites, and were detected in 2010, except for Ritta Island New, a small colony with only 4 GBHE nests.

The majority of nests (80% excluding ANHI and CAEG), were detected at the Eagle Bay East colony. This multi-species colony was comprised of willow and bulrush surrounded by water, which is the typical structure favored by wading birds for nesting on the Lake (David 1994). The next two largest colonies, Bird Island and Clewiston Channel - both under 300 nests, were covered with Phragmites, inhabited primarily by SNEG and GREG, and comprised a mere 8% of the total nesting effort. During routine airboat reconnaissance, both Moonshine Bay 3 and Ritta Island New were found with <5 nesting GBHE, but were inaccessible after February due to dry conditions and were never detected during aerial surveys. The five remaining colonies all had fewer than 100 nests (excluding ANHI and CAEG) and were primarily SNEG, GREG and TRHE.

Timing

With the lake stage around 3.7 m (12.4 ft) during the first two months of the dry season, most of the traditional marsh colony locations were surrounded by little or no water, making them unattractive to wading birds. Wading birds prefer nesting habitat surrounded by water not only to reduce the risk of predation but to ensure there will be suitable foraging habitat throughout the nesting season. High lake stages inundate the marsh and allow small fish and macroinvertibrates to disperse and proliferate throughout the littoral zone. Airboat surveys during January detected only GBHE nests (Table 2). In late February, GREG began their nesting displays at Clewiston Spit and the Rock Islands. Both Clewiston Spit and the Rock Islands are spoil islands with minimal vegetation surrounded by water. Bird Island, a natural island located in Fish Eating Bay, was first detected during the late February aerial survey with 13 SNEG roosting in the Phragmites.

In March there was a marked increase in nest effort with the initiation of Eagle Bay East, estimated at 1250 nests of primarily SNEG and WHIB. Additional ground visits confirmed the initiation of nesting by all focal species except GREG in Eagle Bay East. The Clewiston Channel colony, also on a spoil island, was first detected in March as well. Storms with high winds and heavy rain in late March knocked down all the GREG nests on the Rock Islands and the majority of the GREG nests on Clewiston Spit, leaving only 12 nests in a lone Australian pine.

Table 2. Timing and nest effort for species breeding in wading bird colonies during 2011 at Lake Okeechobee. Peak nest effort for each species denoted in italics and included in grand total. Airboat monitoring only was conducted during January.

Month	GREG	GBHE	WHIB	SNEG	LBHE	TRHE	WOST	GLIB	ROSP	CAEG	ANHI	Peak nest effort[1]
January	---	*26*	---	---	---	---	---	---	---	---	---	26
February	20	8	---	---	---	---	---	---	---	---	---	28
March	*196*	5	150	1255	5	275	---[2]	100	---	---	---	1986
April	85	4	*1000*	*3035*	*12*	*867*	---	*500*	---	170	1	5503
May	62	2	725	2749	10	600	---	375	---[2]	1198	1	4523
June	13	---	100	300	---	---	---	50	---	1525	---	463

[1] Does not include CAEG or ANHI

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

By early April, all the colonies around Clewiston, Fish Eating Bay, and Eagle Bay contained active nests. CAEG began invading the Lakeport Marina colony in April and the Gator Farm and Eagle Bay East colonies in May. A new CAEG colony was detected in Buckhead Ridge during the June survey. Despite low lake levels and minimal rain with an extended recession, the majority of nests monitored on our colony transects fledged at least one chick by the end of May. Given how little of the littoral zone was available during such dry conditions, there may have been a considerable amount of foraging off-Lake. On-Lake foraging was limited to the periphery of the littoral zone along the receding edge of the water. By late May and June, the birds were feeding in the open limnetic zone.

Wood Storks and Roseate Spoonbills Reproductive Success

Since 2007, a small colony of Wood Storks (WOST) has developed at an alligator farm about 4 km N of Harney Pond along Highway 21. Although WOST were seen roosting at the site on 24 March, they did not initiate nesting. A flock of roughly 100 mostly sub-adult Roseate Spoonbills (ROSP) was seen foraging from Cochran's Pass to Eagle Bay throughout the dry season. In late May a group of 30 ROSP roosted in the Eagle Bay Trail colony. A subsequent ground visit showed no evidence of nesting.

DISCUSSION

In January, we anticipated meager amounts of nesting on the Lake for 2011. This year had water levels similar to three of the five worst nesting years on record (1971, 1981 and 2007; Fig. 5), yet this year's nest effort fell within the top ten on record (Fig. 3). Similar hydrology was also seen in 1990, but produced only half the nest effort. We are currently developing predictive models that link nesting and hydrology on the Lake but at this point we can only speculate as to why this year's

nesting was higher than expected. The long, uninterrupted water level recession may have played a key role in augmenting nest effort. As many of the surrounding wetlands dried up, the Lake remained as a last resort, providing at least sub-optimal foraging when no other foraging habitat was available. Another possibility is that vegetation and aquatic fauna are adjusting to the lower Lake levels that have predominated in recent years.

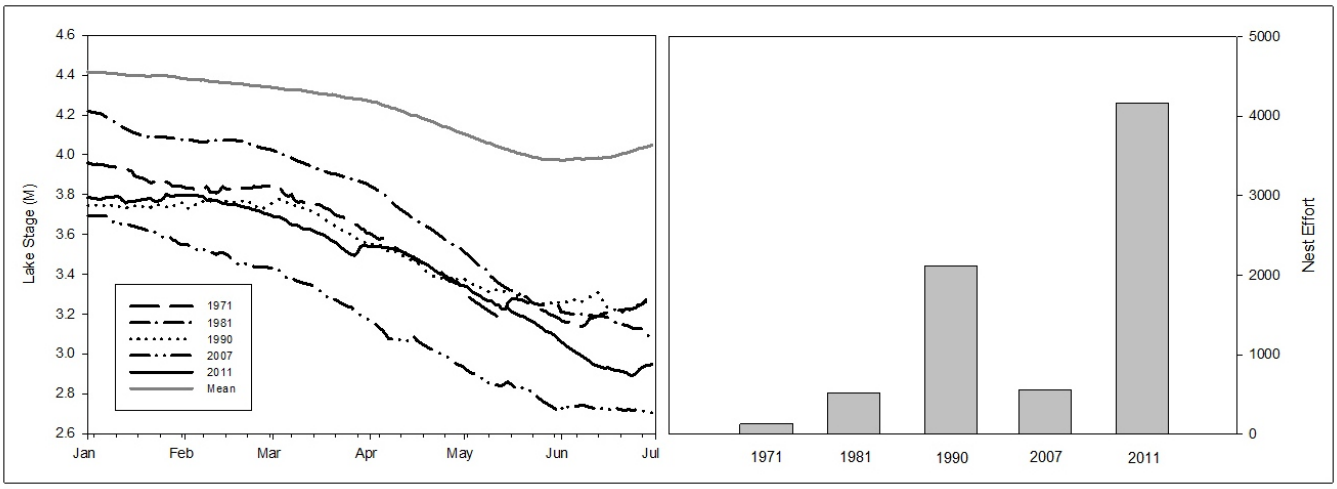

Figure 5. Comparisons of years with hydrographs similar to 2011 and their respective nest efforts with the mean daily lake stage from 1977 to the present.

Wading bird monitoring under the MAP supports total system performance measures. We evaluated two MAP performance measures (timing of Wood Stork nesting, and frequency of supra-normal events) that are informative for the Lake as well as the total system. We also evaluated the interval between exceptional White ibis nesting events; an additional performance measure described in Frederick et al. (2009) that accentuates the dynamic and pulsed functions of wetland ecosystems.

We examined the timing of Wood Stork nest-initiation dates from 2007 to 2011 (Table 3). In two of the five years, storks began nesting in early March. However, WOST preformed best when they initiated nesting in mid-February. This year was the worst on record; after establishing a colony for the last four consecutive years, they did not initiate nesting this year.

Supra-normal events are defined as years in which the number of nesting wading birds (all species) is greater than one standard deviation above the long-term mean of nesting (RECOVER 2006). Using a record of nesting from 1957 to the present, we documented the occurrence of five supra-normal events; three during the 1970s and two during the 2000s (Fig. 2). However, many

gaps exist in this dataset and early surveys may have underestimated peak nest efforts since they were only performed once during the nesting season. This year was not a supra-normal nesting event.

Table 3. Complete record of Wood Stork nesting on Lake Okeechobee.

Year	Initiated	Peak Month	Peak Nests	No. Fledged
2007	Early March	April	12	22
2008	Late April	May	8	6
2009	Mid-February	March	35	55
2010	Early March	March	7	12
2011	—	—	0	0

Years with exceptionally large ibis nesting totals, defined as the 70th percentile of all estimates of annual ibis nesting in the period of record (Frederick et al. 2009), occurred almost every year during the 1970s on Lake Okeechobee (Fig. 6). That number dropped to one nesting event during the 1980s, resulting in an average of 2.75 years between exceptional nesting events from 1971 to 1992. During the next period for which data was collected, 2005 through 2011, the average interval between exceptional nesting events was two years. As mentioned before, many gaps exist in this dataset and early surveys may have underestimated peak nest efforts since they were only performed once during the nesting season. This year was not an exceptionally large WHIB nesting event.

Collectively the performance measures suggest that wading birds on the Lake are in moderate condition. Although nesting effort in 2011 was not a good year by historic standards, the overall improvements in nesting since 2006 give reason to believe that nesting effort will be strong when hydrologic conditions are good. With the exception of Eagle Bay East, which was a willow head on the edge of the littoral marsh, the majority of colonies were located on spoil islands covered with Phragmites, a sub-optimal nesting substrate, suggesting that wading birds prefer the safety of surrounding water, and access to nearby foraging sites, over a particular nesting substrate. Unless the Lake reaches levels near or above 4.6 m (15 ft), historic willow-based colonies deep in the Moorehaven and Moonshine Bay marsh will remain unsuitable for colony formation and wading birds will continue to use sub-optimal substrate.

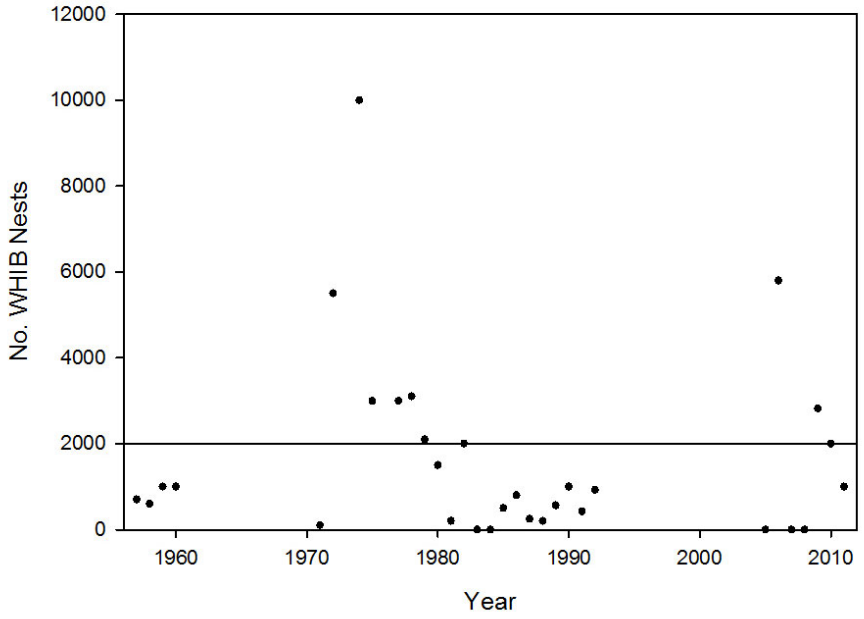

Figure 6. Numbers of White ibis nests on Lake Okeechobee, 1957–2011, with horizontal line representing 70th percentile of nesting events in the entire period. This threshold (2,000 nests annually) was used to identify exceptionally large WHIB nesting years. Data for the following years are not available: 1961-1970, 1973, 1976, and 1993–2004.

Developing predictive models requires information on the mechanisms and pathways by which hydrology acts to influence wading bird nesting patterns. This year as part of a separate study, we began intensive throw-trapping throughout the littoral zone to advance our understanding of the relationship between Lake hydrology and wading bird prey (i.e. small fish and macroinvertebrates) communities. This study will also explore the connection between habitat conditions (hydrology and prey availability), physiological condition of chicks, and nesting productivity. Understanding these relationships will significantly increase our ability to predict how wading birds will respond to changes in hydrology.

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APPENDIX 1

ACRONYMS AND ABBREVIATIONS

CAEG – Cattle Egret

CERP – Comprehensive Everglades Restoration Plan

DOQQ – Digital Orthophoto Quarter Quadrangles

FAA – Federal Aviation Administration

FAU – Florida Atlantic University

GBHE – Great Blue Heron

GLIB – Glossy Ibis

GREG – Great Egret

LBHE – Little Blue Heron

NAVD88 – North American Vertical Datum 1988

NGVD29 – National Geodetic Vertical Datum 1929

MAP – Monitoring and Assessment Program

RECOVER – Restoration, Coordination and Verification program

SFWMD – South Florida Water Management District

SNEG – Snowy Egret

TRHE – Tricolored Heron

USACE – United States Army Corps of Engineers

WHIB – White Ibis

WOST – Wood Stork