



# Corkscrew Regional Ecosystem Watershed (CREW) Management Area Wading Bird Nesting Report 2013-2014

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## INTRODUCTION

The Florida Fish and Wildlife Conservation Commission (FWC) conducted its second year of wading bird nest monitoring on Corkscrew Regional Ecosystem Watershed Management Area (CREW) and National Audubon Society's Corkscrew Swamp Sanctuary (CSS). The primary objective was to locate and monitor trends in wading bird nesting colonies by documenting species and nesting effort. Locations of foraging and roosting aggregations on the areas were also identified.

## STUDY AREA

In 1995, the SFWMD established the CREW Management Area as part of the largest intact watershed in southwest Florida encompassing 243 km<sup>2</sup> (60,000 ac) in both Collier and Lee counties. The CREW Management Area spans 127 km<sup>2</sup> (31,550 ac) in north-eastern Collier and south-eastern Lee counties and is cooperatively managed by the FWC ([Figure 1](#)). The CREW Wildlife and Environmental Area is located within the greater CREW Management Area. CSS (including Panther Island Mitigation Bank – PIMB) was included in the surveys as part of the greater Corkscrew watershed bringing the total survey area to 170 km<sup>2</sup> (41,910 ac).

CREW Management Area is divided into 3 units: the Corkscrew Marsh, Flint Pen Strand, and Bird Rookery Swamp. The Corkscrew Marsh management unit (7,177 ac) forms the eastern headwaters of CREW, and flows south to the larger Big Cypress Watershed system. It is located to the southwest of State Road (SR 82) and southeast of County Road 850 (CR 850). The unit is dominated by a 5,000-acre seasonally-wet sawgrass marsh. Hammocks and flatwoods surround the marsh on the eastern, northern, and western boundaries. The southern boundary of the marsh leads into Corkscrew Swamp Sanctuary (CSS).

Flint Pen Strand management unit (17,356 ac) boundaries extend to the south from the Lee County Utilities' Corkscrew well field at Corkscrew and Alico Roads, south to Bonita Springs, and east to the Collier County line. The western boundary extends to within two miles of I-75. Flint Pen strand swamp consists of cypress-dominated communities interspersed with hydric pine flatwoods and swamp hammock.

The Bird Rookery Swamp management unit (7,017 ac) is located to the west and south of CSS, and one half mile west of CR 846 (Immokalee Road). The vegetation consists of strand swamp dominated by cypress and maple. There is a mix of wet flatwoods and dome swamps along the western portion of the property. An area of open marsh, dominated by sawgrass and willow, is found in the center of the tract. A system of logging tram roads and adjacent borrow ditches remain from previous cypress logging operations.

CSS owns or manages approximately 13,000 ac of the Corkscrew watershed. It includes the largest intact virgin bald cypress (*Taxodium distichum*) forest (approximately 700 ac) in the world and is a prime location for foraging, roosting, and nesting avian species within the watershed.

## HYDROLOGY

Timing, depth, and duration of wetland hydroperiods may significantly impact wading bird foraging ability and reproductive success (David 1994). Wading birds require a specific range of water depths (Kushlan 1974, Custer and Osborne 1978) because diminishing water levels before and during nesting concentrate food organisms which results in efficient foraging conditions (Kushlan et al. 1975, Kushlan 1976). Shorter

hydroperiods reduce prey availability (Loftus et al. 1987) and may increase nest predation (Frederick and Collopy 1988). Limited quantity and low frequency of rainfall can delay nesting until later in the year reducing the probability of nest success (Bancroft et al. 1988).

At the CORK water monitoring station (26.422662, -81.578485), June-October 2013 rainfall accumulation totals were the second highest on record at 120.9 cm (47.60 in) (DbHydro 2014, CORK station). Water recession rates, encouraging foraging and nesting, began in September and lasted through April. Stage data indicated that surface water levels peaked in late July and late September leading up to the nesting season (Figure 2). Intense storms and higher than average rainfall in January (>300%) may have caused nest failure in early nesting species such as Wood Storks (WOST) and Roseate Spoonbills (ROSP).

## **METHODS**

### *Flights*

We performed systematic aerial surveys on approximately the 1<sup>st</sup> of each month from November through July. Transects were spaced 1.48km (0.8 nautical mi) apart and oriented northeast to southwest. A Cessna 182 flew at an altitude of 244m (800ft) above ground level (AGL) with observers on both sides of aircraft. Each succeeding transect was flown in the opposite direction from the previous, adjacent transect. The starting point for each flight was alternated between northeast and southwest to minimize temporal bias in observations. Flight altitude was reduced to 152m (500ft) (AGL) when a nesting colony, foraging aggregation, or roosting colony was observed at which time the colony was circled until an adequate number of photos and observations were recorded for species identification and visual observations. Global Positioning System (GPS) coordinates were collected when a colony or aggregation was located. Digital photos were taken using a Canon EOS 7D with a 70-300mm lens with image stabilization.

### *Analysis*

Each bird photographed was digitally marked using Adobe® Photoshop Elements 9 to avoid double-counting. The number of observed nests, eggs, nestlings, branchlings, and adults present were recorded. Groupings such as small white (SMWH), large white (LGWH), and small dark (SMDA) were used when we could not identify the bird to species. A peak nesting number (PNN) was reported as the highest number of nests observed at one time for the season for each wading bird species within each colony. WOST branchlings were identified as young between 4 and 7 weeks old.

## **RESULTS**

### *Nesting Effort and Species Composition*

We observed a 55% increase in nesting effort between 2013 and 2014. Eleven wading bird colonies (5 described as sub-colonies) contained a combined PNN of 914 (Table 1). Two of the 11 nesting colonies were located on CREW.

WOST comprised 36% of the PNN of nesting wading birds observed in the 2014 nesting colonies followed by Cattle Egrets (CAEG) (28%) and Great Egrets (GREG) (24%). We estimated WOST nest initiation between mid-December and the first of January for all WOST sub-colonies. Other than WOST, the majority of wading bird nesting effort peaked between March and June with GREG, ROSP, and GBHE nesting first and Snowy Egrets (SNEG), Little Blue Herons (LBHE), and CAEG nesting later in the summer (Table 2).

### Wood Stork Nesting Colonies

Five sub-colonies of WOST were identified on CSS and CREW (Figure 3). We created sub-colony descriptions to facilitate accurate location and photographic information. All sub-colonies nested in old growth bald cypress (*Taxodium distichum*) trees with no visual habitat differences among them. Pooled WOST PNN totaled 333 and branchlings totaled 86 (Table 1).

BRS WOST nesting colony is located in north Bird Rookery Swamp (BRS). This sub-colony is part of the larger CSS WOST nesting colony, and was the only WOST nesting colony located on CREW. Nestling and branchling numbers peaked at this colony in March (n=23 and n=6, respectively).

During the months of February and March, we observed the greatest number of nestlings in WOST Subcolonies 1-3 (combined total = 86). Subsequently, the highest number of branchlings detected within these three sub-colonies was during the month of April (combined total = 51). In addition to WOST, GREG began nesting in WOST Subcolony 2 in February with a PNN in March. We also observed 11 nesting ROSP in WOST Subcolony 2. Unfortunately, we did not observe any ROSP nestlings or branchlings during the surveys.

#### Cypress East

Cypress East (CE), Orange Grove (OG), and Sod Farms (SF) colonies nested again this year in the same general locations as 2013 (Figure 1). In CE, GREG PNN (n=90) was significantly higher than in 2013 (n=8) (Table 1). GREG and ROSP nested in approximately 12m (40ft) tall bald cypress (*Taxodium distichum*) trees surrounding an alligator flag (*Thalia geniculata*) depressional marsh. Additionally, CE was only one of two colonies observed to have nesting ROSP (n=7).

#### Orange Grove

We observed a 19% decrease in PNN of all species in the OG colony from 2013 with fewer CAEG and GREG. However, slightly higher species richness was seen in 2014 (n=5 vs. 4) with the addition of a Green Heron (GRHE) nest (Table 3). OG had the highest species richness for the second year in a row of all the nesting colonies.

#### Sod Farms

At SF, we documented an 8% decline from 2013 in the number of total nesting wading birds. Declines were observed in nesting SMWH. PNN for CAEG was the highest of all species in any nesting colony (n=251) (Table 1). SF wading birds were nesting primarily in Carolina willow (*Salix caroliniana*) interspersed with Brazilian pepper (*Schinus terebinthifolius*) in an open, shallow, mesic marsh and bordered by bald cypress trees. SF is composed mainly of CAEG and is the only nesting colony we observed with nesting Little Blue Herons (LBHE) and Tricolored Herons (TRHE) (Table 3). In addition, it is only the second colony to observe nesting Snowy Egrets (SNEG).

#### *Foraging and Roosting Effort*

Although our focus was on nesting colonies, we located a total of 81 foraging aggregations and 45 roosting colonies. Thirty-seven of the 81 foraging aggregations were located on CREW, 39 were observed on CSS, and five on private property (Figure 1). Twenty-eight roosting colonies were recorded on CREW, 13 on CSS, and four on private lands (Figure 1).

WHIBs (n=5,831), GREGs (n=1,638), SNEGs (n=165), and WOSTs (n=352) were the most abundant species observed in foraging aggregations with WHIB and GREGs being present in 79-80% of all the aggregations detected. Other species of interest foraging or roosting on CREW WEA include roseate spoonbills (*Platalea ajaja*; ROSP), black-crowned night herons (*Nyctanassa violacea*; BCNH), black-necked stilts (*Himantopus mexicanus*; BNST), and sandhill cranes (*Grus canadensis*; SACR).

## **DISCUSSION**

### *Nesting Effort and Species Richness*

It is likely that the long hydroperiod experienced in 2014 resulted in both improved foraging conditions as well as the dramatic increase in nesting colonies identified throughout the Corkscrew Watershed. For the first time in five years, WOST nested at CSS and on CREW. Water levels were high enough throughout the winter to produce a gradual dry down conducive to shallow-water WOST feeding in water 5-40cm deep (Rodgers et al. 1996). In South Florida, large-scale land use changes combined with the lack of early season foraging opportunities have led to a reduction in the WOST nesting numbers (Jason Lauritsen, CSS, pers comm). This year was an exception. CREW will be treating over 405ha (1,000ac) of coastal plain willow (*Salix caroliniana*) in the CREW marsh that may improve foraging areas for WOST and other wading bird species.

In addition, we observed a total of 18 nesting ROSP in two colonies. ROSP nesting has been limited and scattered in South Florida with the largest nesting populations observed in Loxahatchee National Wildlife Refuge and the Water Conservation Areas (Ogden 1996, P. Fredrick, University of Florida, pers comm). No

ROSP nestlings or branchlings were observed during our surveys; therefore we are unable to determine if any chicks successfully fledged.

Although the number of nesting colonies increased from 2013, we observed some declines in species nesting effort from 2013. Declines of nesting effort in the OG and SF colonies may indicate that wading birds had nesting opportunities elsewhere on the landscape as a result of improved hydrologic conditions in 2014. Higher numbers of wading birds may be seen at OG and SF during years where foraging opportunities are limited. Regardless, OG appears to be an optimal wading bird nesting location. As an island, it deters terrestrial predators and the low-lying power lines limit aerial human disturbance.

#### *Foraging and Roosting*

We recorded several foraging aggregations and roosting colonies on CREW and CSS. The Corkscrew Marsh and Flint Pen Strand areas appear to be important foraging locations for wading birds. WOST, ROSP, YCNH, and BCNH were observed foraging or roosting on CREW property indicating the importance of CREW as a food source prior to and during the breeding season. Ideally, we would like to see more diversity and more threatened and endangered wading birds using CREW as a nesting and foraging area. Implementing the management actions discussed below, we likely can improve nesting habitat at CREW and throughout the watershed.

In summary, the 2014 nesting season produced more nesting colonies and greater PNN than the previous season which likely increased overall nesting success. WOST nested for the first time in five years at CSS. We are cautious about our interpretation of these data due to the lack of long-term monitoring of these colonies. Although trend analysis is not yet possible, we have developed a baseline for wading bird nesting effort and foraging aggregations on the area. With additional years of survey data, we may be able to model the environmental factors such as rainfall and hydroperiod as predictors of the nesting effort and number of foraging birds observed during our flights.

#### **MANAGEMENT IMPLICATIONS**

Habitat improvements, particularly in the CREW marsh, would likely increase the number of foraging birds using the area. A high density of coastal plain willow has invaded the marsh over the last several years and densely covers at least 1,500 ac. Although willow can provide nesting habitat for wading birds, high densities of willow can affect the ability for these birds to forage successfully. Additionally, mature shrubby willow will not burn due to its high moisture content and a reduction of understory vegetation around the shrub (Quintana-Ascencio and Fauth 2010). Fire exclusion from high density willow areas allows willow to spread and prevents a natural fire regime from reaching the area.

Aerial herbicide treatments will be applied to over 405ha (1,000ac) of the CREW marsh in August 2014 to reduce the density and spread of the invasive willow. Land management recommendations include shorter prescribed fire interval, invasive plant reduction in the marsh, and native tree plantings on tree islands to provide wading birds with improved nesting substrate.

Additionally, large-scale land use changes have shortened hydroperiods truncating wading bird foraging opportunities. The Southern CREW hydrologic restoration project scheduled to begin in 2015-16 will focus on restoring the historically longer hydroperiod to the landscape in Flint Pen. This project will likely improve wading bird foraging areas and may contribute to improved nesting success.

Limited rainfall in the future may prove to be an impediment to annual nesting success. Optimal water depth ranges need to be identified and addressed. Future wading bird surveys at CREW may allow us to model optimal water depths with wading bird nesting effort and success. Such models could be instrumental in guiding future management actions.

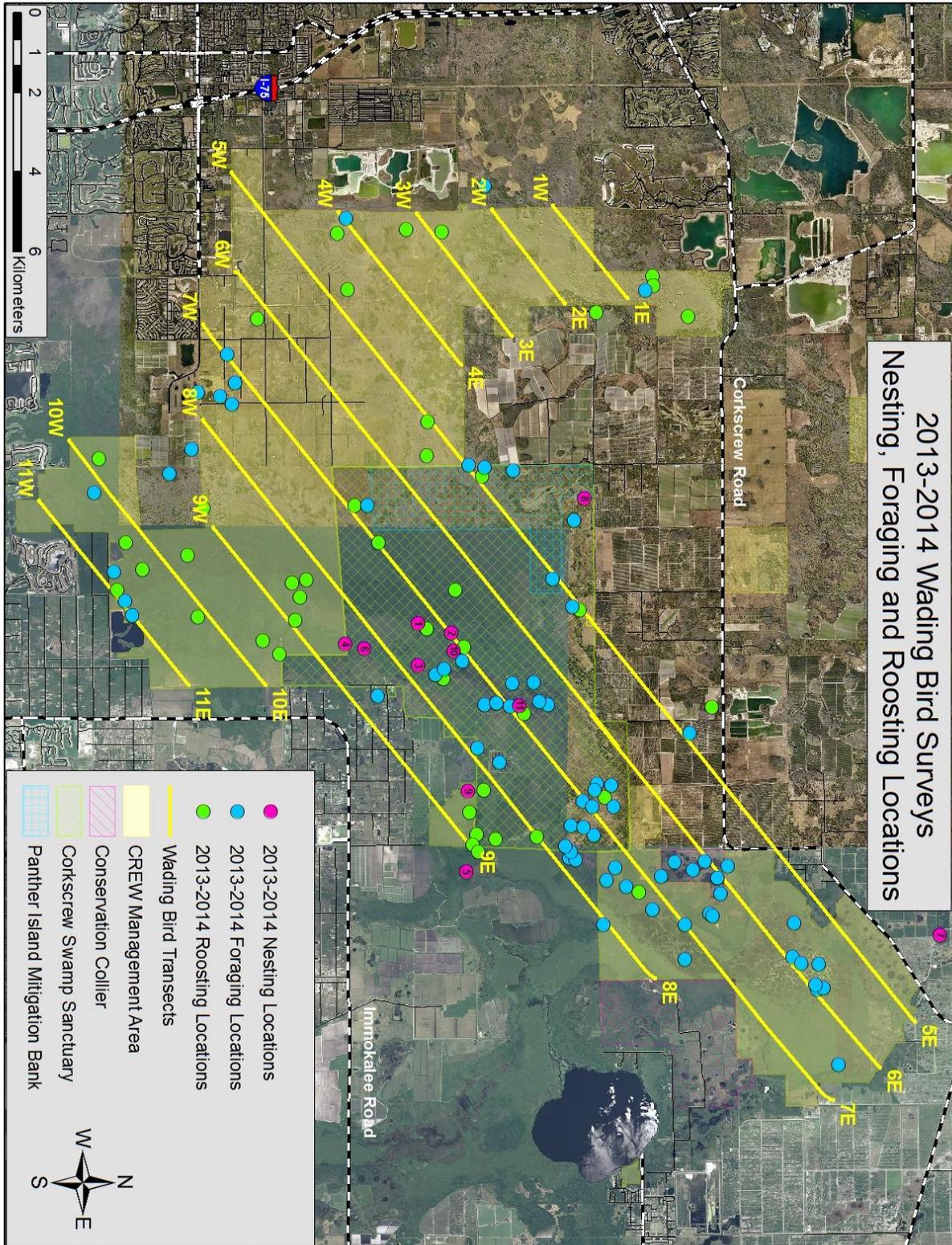
#### **ACKNOWLEDGEMENTS**

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## LITERATURE CITED

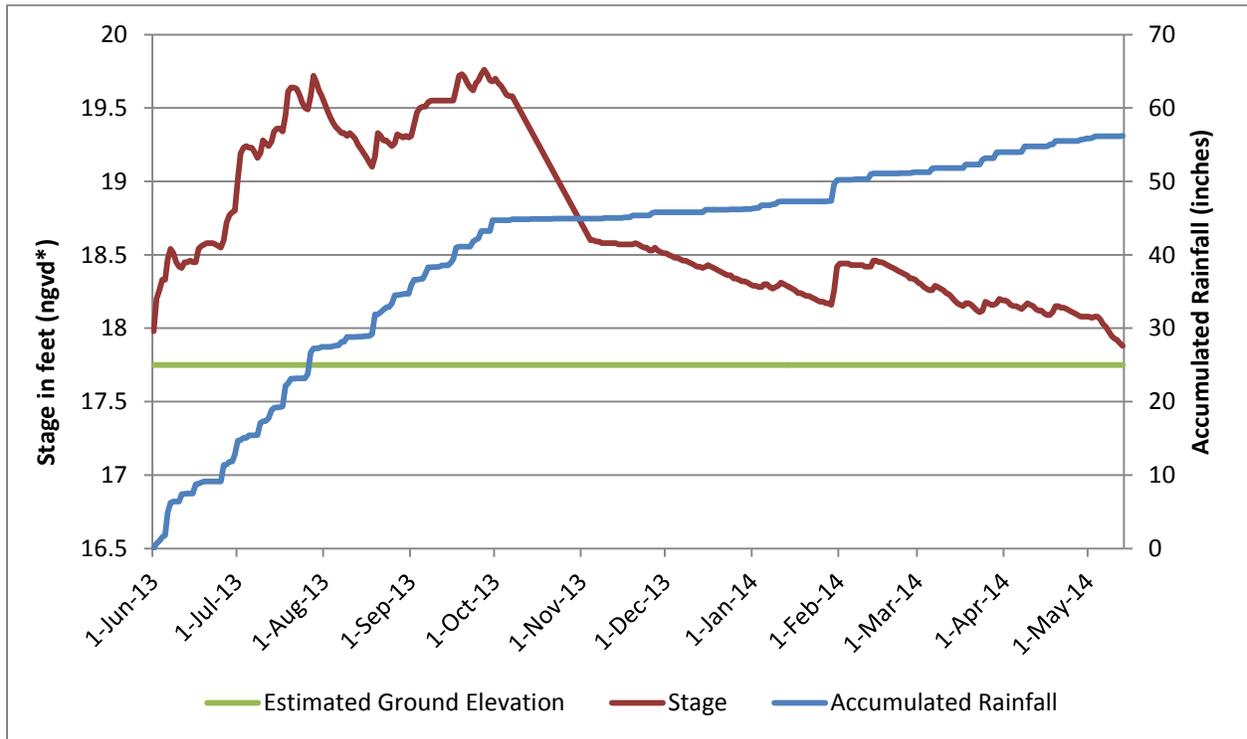
- Bancroft, T.G., J.C. Ogden, and B.W. Patty. 1988. Wading bird colony formation and turnover relative to rainfall in the Corkscrew Swamp area of Florida during 1982 through 1985. *The Wilson Bulletin* 50-59.
- Collier, B.A. and T.W. Schwertner. 2012. Management and analysis of wildlife biology data *In The Wildlife Techniques Manual*. The Johns Hopkins University Press. Baltimore, MD. Vol 1. Pp 61-63.
- Custer, T. W. and R.G. Osborne. 1978. Feeding habitat use by colonially breeding herons, egrets, and ibises in North Carolina. *Auk* 95:733-743.
- David, P.G. 1994. Wading bird use of Lake Okeechobee relative to fluctuating water levels. *The Wilson Bulletin*. 719-732.
- Frederick, P.C. and M.W. Collopy. 1988. Reproductive ecology of wading birds in relation to water conditions in the Florida Everglades: final report. *Tech. report 30*. FL Coop Fish and Wildlife Res. Unit. University of Florida, Gainesville, Florida.
- Kushlan, J. A. 1974. The ecology of the white ibis in southern Florida: a regional study. Ph.D. diss., Univ. of Miami, Coral Gables, Florida.
- Kushlan, J. A. 1976. Wading bird predation in a seasonally fluctuating pond. *Auk* 93:86-94.
- Kushlan, J. A., J. C. Ogden, and J. L. Tilmant. 1975. Relation of water level and fish availability to wood stork reproduction in the southern Everglades, Florida. U.S. Geological Survey Report 75-434.
- Loftus, W.P, J. D. Chapman, and R. Conrow. 1990. Hydroperiod effects on Everglades marsh food webs, with relation to marsh restoration efforts. Proc. of 4th Triennial Conf. Sci. Nat. Parks Equiv. Reserves, Ft. Collins, Colorado, July 1986.
- Quintana-Ascencio, Pedro, and John E. Fauth. 2010. Ecological Studies of Willow (*Salix caroliniana*): Final Report–Year 2.
- Ogden, J.C. 1996. Rare and Endangered Biota of Florida (Birds). Ed. J.A. Rodgers, H.W. Kale II, and H.T. Smith. University Press of Florida. Gainesville, FL. Pp 35.

Figure 1. Locations of nesting, foraging, and roosting wading birds on CREW Management Area and Corkscrew Swamp Sanctuary, November 2013 through July 2014.



\*Numbers in nesting location icons correspond to Table 1.

Figure 2. Surface water stage and accumulated rainfall from the CORK\*\* water monitoring station near CREW Management Area and Corkscrew Swamp Sanctuary, 2014.



\*NGVD stands for National Geodetic Vertical Datum which is a set of constants that defines a system for comparing elevations.  
 \*\*CORK (26.422662, -81.578485) water monitoring station is located 0.92 miles southwest of the CREW Management Area field office.  
 CORK water monitoring station was taken offline in May 2014; therefore no data were able to be graphed for June 2014.

Table 1. Peak numbers of wading bird nests found in and around CREW Management Area and Corkscrew Swamp Sanctuary, January through July 2014.

Colony #	Colony/ Sub-colony Name	Owner	Latitude (NAD 83)	Longitude (NAD 83)	WOST	GREG	SNEG	CAEG	WHIB	ROSP	GRHE	GBHE	TRHE	LBHE	ANHI	LGWH	SMWH	Total
1	CSS WOST 1*	CSS	26.3816	-81.6193	37	0	0	0	13	0	0	0	0	0	0	0	0	50
2	CSS WOST 2*	CSS	26.3892	-81.6170	125	70	0	0	0	11	0	0	0	0	0	12	0	218
3	CSS WOST 3*	CSS	26.3816	-81.6086	73	5	0	0	0	0	0	0	0	0	0	0	0	78
4	BRS WOST*	CREW/CSS	26.3651	-81.6139	59	0	0	0	0	0	0	0	0	0	0	0	0	59
5	Cypress East	Private	26.3929	-81.5568	0	90	0	0	0	7	0	0	0	0	0	0	0	97
6	HQ WOST*	CSS	26.3695	-81.6128	39	0	0	0	0	0	0	0	0	0	0	0	0	39
7	Orange Grove	Alico	26.5004	-81.5444	0	49	1	1	0	0	1	0	0	0	6	0	5	63
8	Panther Island	CSS	26.4192	-81.6508	0	2	0	0	0	0	0	1	0	0	0	0	0	3
9	Sod Farms	CREW	26.3931	-81.5771	0	0	1	251	0	0	0	0	1	18	0	0	33	304
10	CSS SMWH	CSS	26.3897	-81.6123	0	0	0	1	0	0	0	0	0	0	0	0	0	1
11	CSS GREG	CSS	26.4047	-81.5986	0	2	0	0	0	0	0	0	0	0	0	0	0	2
<b>Total</b>					<b>333</b>	<b>218</b>	<b>2</b>	<b>253</b>	<b>13</b>	<b>18</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>18</b>	<b>6</b>	<b>12</b>	<b>38</b>	<b>914</b>

\*Sub-colonies are part of the main Corkscrew Swamp WOST nesting colony.  
Colony # corresponds to nest location icons in Figure 1.

Table 2. Months of observed nesting effort by species for CREW Management Area and Corkscrew Swamp Sanctuary, 2014.

<b>Species</b>	<b>Months of Peak Nesting Effort</b>	<b>Months of Observed Nesting Effort</b>
WOST	January and February	January - June
GREG	March and April	February - July
ROSP	March	March
GBHE	March	March
ANHI	April	March - June
SNEG	May and June	May - June
LBHE	June	May - June
CAEG	June	May - July

Table 3. Species composition of nesting wading birds in and around CREW Management Area and Corkscrew Swamp Sanctuary, January through July 2014.

Colony/Sub-colony Name	Owner	Latitude (NAD 83)	Longitude (NAD 83)	Species Richness**	Species Composition	Date
CSS WOST Subcolony 1*	CSS	26.3816	-81.6193	1	WOST	8-Jan-14
CSS WOST Subcolony 1*	CSS	26.3816	-81.6193	1	WOST	10-Feb-14
CSS WOST Subcolony 1*	CSS	26.3816	-81.6193	1	WOST	3-Mar-14
CSS WOST Subcolony 1*	CSS	26.3816	-81.6193	2	WOST, WHIB	1-Apr-14
CSS WOST Subcolony 1*	CSS	26.3816	-81.6193	1	WOST	6-May-14
CSS WOST Subcolony 2*	CSS	26.3892	-81.6170	1	WOST	8-Jan-14
CSS WOST Subcolony 2*	CSS	26.3892	-81.6170	3	WOST, GREG, RO SP, LGWH	10-Feb-14
CSS WOST Subcolony 2*	CSS	26.3892	-81.6170	2	WOST, GREG	3-Mar-14
CSS WOST Subcolony 2*	CSS	26.3892	-81.6170	2	WOST, GREG	1-Apr-14
CSS WOST Subcolony 2*	CSS	26.3892	-81.6170	2	WOST, GREG	6-May-14
CSS WOST Subcolony 2*	CSS	26.3892	-81.6170	1	WOST	3-Jun-14
CSS WOST Subcolony 3*	CSS	26.3816	-81.6086	1	WOST	8-Jan-14
CSS WOST Subcolony 3*	CSS	26.3816	-81.6086	2	WOST, GREG	3-Mar-14
CSS WOST Subcolony 3*	CSS	26.3816	-81.6086	2	WOST, GREG	1-Apr-14
CSS WOST Subcolony 3*	CSS	26.3816	-81.6086	1	WOST	6-May-14
CSS WOST Subcolony 3*	CSS	26.3816	-81.6086	1	WOST	3-Jun-14
BRS WOST*	CREW/CSS	26.3651	-81.6139	1	WOST	8-Jan-14
BRS WOST*	CREW/CSS	26.3651	-81.6139	1	WOST	10-Feb-14
BRS WOST*	CREW/CSS	26.3651	-81.6139	1	WOST	3-Mar-14
Cypress East	Private	26.3929	-81.5568	1	GREG	10-Feb-14
Cypress East	Private	26.3929	-81.5568	2	GREG, RO SP	3-Mar-14
Cypress East	Private	26.3929	-81.5568	1	GREG	1-Apr-14
HQ WOST*	CSS	26.3695	-81.6128	1	WOST	10-Feb-14
Orange Grove	Alico	26.5004	-81.5444	1	GREG	10-Feb-14
Orange Grove	Alico	26.5004	-81.5444	2	GREG, ANHI	3-Mar-14
Orange Grove	Alico	26.5004	-81.5444	2	GREG, ANHI, SMWH	1-Apr-14
Orange Grove	Alico	26.5004	-81.5444	5	GREG, ANHI, SNEG, CAEG, GRHE, SMWH	6-May-14
Orange Grove	Alico	26.5004	-81.5444	3	GREG, ANHI, CAEG	3-Jun-14
Orange Grove	Alico	26.5004	-81.5444	1	GREG	7-Jul-14
Panther Island	CSS	26.4192	-81.6508	2	GREG, GBHE	3-Mar-14
Sod Farms	CREW	26.3931	-81.5771	3	LBHE, TRHE, CAEG, SMWH	6-May-14
Sod Farms	CREW	26.3931	-81.5771	4	SNEG, LBHE, TRHE, CAEG, SMWH	3-Jun-14
Sod Farms	CREW	26.3931	-81.5771	2	LBHE, CAEG, SMWH	7-Jul-14
CSS SMWH	CSS	26.3897	-81.6123	1	CAEG	3-Jun-14
CSS SMWH	CSS	26.3897	-81.6123	***	***	7-Jul-14
CSS GREG	CSS	26.4047	-81.5986	1	GREG	7-Jul-14

\*Sub-colonies are part of the main Corkscrew Swamp WOST nesting colony.

\*\*Species richness count does not include SMWH and LGWH since those individuals were not identified to species.

\*\*\*5 LBHE suspected nesting, but unable to confirm from photos.