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STATUS of WADING BIRD POPULATIONS
of the
HILLSBOROUGH RIVER WATERSHED

FINAL REPORT

JULY 2003

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OF THE
HILLSBOROUGH RIVER WATERSHED**

**A Report to the Tampa Bay Estuary Program and
The Hillsborough River Greenways Task Force**

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Introduction

The diversity and abundance of bird populations are often proposed as indicators of the quality of their habitats. For wetland systems, considerable attention has been devoted to the use of "colonial waterbirds" as bioindicators (Kushlan 1993, Erwin and Custer 2000).

Waterbirds seem to offer many advantages to observers. Most are large and easily identified, and are active during daylight hours. Many are not secretive, and may become quite tame in areas of chronic human activity like parks and recreation areas. "Colonial" waterbirds offer an additional advantage: they nest in groups. Often colonies are very conspicuous, which allows observers to locate nesting sites and count or estimate numbers more efficiently than if the birds were solitary nesters.

At least 31 species of waterbirds occur within the Hillsborough River Watershed, Florida (hereafter, HRW), including 19 that typically nest in aggregations or colonies and 12 that are solitary nesters (Table 1). Nineteen species nest within the HRW, including 14 "wading birds" (herons, egrets, ibis, spoonbills and storks, plus Sandhill Crane and Limpkin). Ten of the 14 wading birds are colonial. Most of these species feed largely on fish and other aquatic organisms, and therefore forage in coastal waters, lakes, rivers, and other wetland systems. Restated, these species depend importantly on healthy wetland systems. It might be suspected, then, that population estimates or indexes of selected species, if compiled over a period of years, might serve as useful indicators of the health of local wetland systems.

This report summarizes what is known about breeding populations of wading birds within the HRW, evaluates the existing data as a potential indicator of the health of the watershed, and offers suggestions for the design of monitoring programs of breeding or foraging wading birds that might advance ecosystem management goals.

State of the Data

A variety of bird surveys have been carried out within the HRW (Table 2). Some, like the Christmas Bird Counts, are of long duration (>30 years). Most surveys and counts, however, are very small-scale efforts. Usually they are casual lists of bird species present or observed. Even if counts have been made, most surveys cover only small portions of the watershed and the data offer scant opportunity to assess populations, trends, or habitat conditions.

There has been no attempt to systematically census all waterbirds, whether breeding or nonbreeding (and whether colonial or solitary nesters), specifically within the HRW. For

the past few years, our office has carried out direct counts of two nesting colonies in the watershed. This is a narrow effort, aimed at colonies that contain the endangered Wood Stork, are particularly accessible, or for certain reasons have attracted our attention. These counts have the advantage of being fairly accurate, but by themselves may be too limited to be useful as a habitat indicator.

One other data set exists. For three decades there have been statewide aerial surveys of wading bird colonies in Florida (Nesbitt et al. 1982; Runde et al. 1991; Rodgers et al. 2003). Although an unknown number of smaller colonies were doubtless overlooked by these surveys, they offer the best hope of generating comprehensive estimates of wading bird populations in the watershed.

Wading Bird Surveys in the Hillsborough River Watershed, 1970s-1990s

Surveys were carried out in 1976-1978, 1986-1989, and 1999 (Table 3). Twenty-one active colonies were found. Oddly, no colony was active in two of the survey periods. This suggests a significant lack of site fidelity, a great amount of environmental change from decade to decade, and/or perhaps errors or uncertainty in colony location.

Seven colonies were active in the 1970s, ten in the 1980s, and just four in 1999. The latter survey occurred during a major drought that followed the ENSO (El Niño-Southern Oscillation) event of 1997-1998.

1. 1976-1978

Aerial surveys were carried out in April and June/July in each of the three years. In the Hillsborough River watershed, seven colonies were reported as active in the 1970s (Rodgers et al. 2003; see Table 3), but Nesbitt et al. (1982) listed just five. Of these five colonies, four were active in 1976, two in 1977, and none in 1978.

An inspection reveals the data to be inconsistently recorded: numerical estimates were made for most species, but at one site species were indicated only as "present" (+). This commonly indicates very small numbers, or difficulty in estimation. Such difficulties are not surprising in aerial surveys, but they greatly complicate interpretation and use of the data. Further, because of the likelihood that smaller colonies and especially dark-colored herons were missed in these surveys, it should not be concluded that species like Little Blue Heron, Tricolored Heron or the two night-herons were not nesting in the watershed: only that they were not adequately surveyed.

Can a population estimate be made for the 1970s data? Overlooking the questions raised above, surveys suggest about 1250 pairs of nesting birds of six species, primarily Cattle Egrets, in 1976. Fewer than 300 pairs were found in 1977, and none in 1978 (Table 4). Bird colonies do move in response to habitat changes, but whether any of these surveys reliably indicates all nesting activity in the watershed is unclear. It is certainly not likely that the apparent decline from 1250 pairs to 0 represents a true trend.

2. 1986-1989

Ten active colonies were found in the second set of surveys. Colonies in Hillsborough County were surveyed in 1988, and Pasco colonies in 1989. Twelve nesting species were identified, including two (Double-crested Cormorant, Anhinga) that are not wading birds but were included in the surveys. Overall size “class” of colonies was recorded, e.g., “251-500 birds” (Table 5).

That twelve nesting species were found indicates a much more thorough survey than in the 1970s. However because no estimates of nesting numbers of each species were made it is difficult to compare data from the two decades. By adding the midpoints of the size ranges for each colony and dividing by 2, a crude estimate of the total nesting pairs of all colonies: roughly 2100 pairs. This is about twice as many as the 1976 estimate.

Should we conclude that the nesting population has increased? No. First, survey effort was much greater in the 1980s. Second, the amount of error in aerial estimates of wading birds colonies is quite high (pers. obs.; J. A. Rodgers, pers. comm.). Use (or generation) of numerical estimates is comforting, and has the ring of accuracy, but great caution must be exercised in their interpretation.

3. 1999

In 1999 statewide aerial surveys were flown again (Rodgers et al. 2003). Four active colonies were found in the watershed, three in Hillsborough and one in Pasco Co. Colony size classes were estimated, this time based on a range of nests in each colony, and the *percentage of each species* identified was recorded (Table 6). By multiplying the midpoints of the colony size classes by the percentage of each species found, numerical estimates of the number of each species can be generated. Using this method, the total number of nesting pairs is estimated at 825.

As with the 1980s data, and for the same reasons, it is wise to avoid the temptation to draw conclusions about ‘actual’ population status or trends.

This survey employed global positioning technology to identify the location of colonies. GPS was not available previously, and is a major advance. In the future, GPS data will virtually eliminate errors in colony location, and allow site fidelity (the year-to-year persistence of nesting at a specific colony site) to be monitored with some precision. Colony site fidelity is a useful indicator of environmental conditions, and may be of future use in the HRW.

Audubon Colony Censuses

Earlier it was suggested that the Audubon colony censuses, though not comprehensive, might be useful because they were more accurate than the aerial surveys described previously. We surveyed the Cypress Creek colony (FWC # 611310) from 1998 through 2002 (Table 7). This colony is located just inside the apex of I-75 and I-275 in northern

Hillsborough County, on a forested "island" left during the excavation of a borrow pit. In 1999, our survey was eight days earlier than the FWC survey. Nine nesting species were found versus just three by the aerial observers. That means that the aerial survey missed six of the nine species! We counted 524 nests, while the aerial estimate was 250-500 nests. That sounds like better agreement until the individual species counts are compared to the aerial estimates (Table 6, Table 7).

The Cypress Creek surveys also illustrate the importance of census timing. Species such as Anhingas and Great Egrets nest earlier than Snowy Egrets, Little Blue and Tricolored herons, and especially Cattle Egrets. Earlier surveys generally tallied more of the former species and fewer of the latter, while in later surveys the opposite was true.

We also surveyed the Temple Crest colony, just above the Hillsborough River dam (FWC #611308). This colony varied rather dramatically, from 477 pairs to none (Table 8). Low water levels in the lake during drought years were a primary cause of colony abandonment. Dry conditions allow terrestrial predators easy access to colonies, causing nesting failure or preventing nesting in the first place. Aquatic weed control efforts in early 1998 (and apparently also *during* previous nesting seasons) also affected nesting when the spray teams killed willows and buttonwoods that were the primary nesting substrate for the herons.

Discussion

Kushlan (1993) has pointed out several drawbacks to the use of wading bird counts as bioindicators of ecological change. First, and as noted above, colony estimates are subject to significant error. Second, counts may not be "representative", or even consistent, samples of the population. Third, wading birds are highly mobile, and local numbers may reflect local environmental conditions, or conditions elsewhere, or both. (This is illustrated in the HRW by the fact that Roseate Spoonbills and very large numbers of White Ibis forage in the watershed, but nest 25 miles away at the Alafia Bank Bird Sanctuary in Hillsborough Bay.) Fourth, even if a population trend is detected, it cannot by itself identify the cause. Additional "causal" studies are necessary.

Despite these concerns, Kushlan (1993) concluded that a carefully constructed survey of wading birds could serve as a valuable indicator of environmental conditions. Erwin and Custer (2000) noted that landscape level surveys have long been a staple form of monitoring that provided significant information, and that some studies have succeeded in relating wetland area and quality to wading bird populations.

The importance of the HRW to wading birds nesting outside the watershed deserves further note. This watershed is the largest tract of publicly owned and protect land in the Tampa Bay area. The Alafia Bank Bird Colony is one of the largest and most diverse in the country, with about 7000-10,000 pairs of nesting birds of 16 species in most years (and up to 18,000 pairs or more in exceptional years, including 1998 and 2003). White Ibis nesting at this colony forage throughout the region, but major flight lines (indicating the direction of key foraging habitats) have shifted at least twice in the last two decades

as development has consumed open lands where ibis foraged. We suspect that the Hillsborough River system may be the last major foraging area remaining to support the Alafia Bank colony. As with any other colony, nesting numbers vary according to wetland conditions both locally and more distant; we suspect that the highest numbers of nesting ibis at Alafia Bank occur in years when they are unable to nest in the Everglades.

A comparison of the Cypress Creek data from the FWC and Audubon surveys suggests that, despite the difficulties in interpreting the FWC data, the rough population estimates discussed here are probably conservative. It is likely that the total breeding population in the HRW is in the range of 2000 nesting pairs of birds in most years, but this represents only the author's "best guess" since the data from 3 decades of aerial surveys are too inconsistent to allow satisfactory tracking of wading bird population trends. Increasing the intensity of aerial survey to locate colonies, and carrying out direct ground counts of nests (assuming all sites are accessible) would generate much more useful data. Such a project would be expensive and time-consuming.

There are other approaches to consider.

First, it may not be necessary to require comprehensive search for wading bird colonies in the entire HRW. Accurate censuses could be conducted at a limited number of colonies chosen for their accessibility, size, or the presence of certain target species. In effect, this is what is done in the Audubon censuses. Such an approach is cheaper and less time-consuming than a comprehensive survey, but is similarly limited in its ability to relate apparent trends to environmental causes.

Another approach would be to count foraging birds in a standard way, and to use trend data as an index. This has some distinct advantages. First, foraging birds are extracting resources directly from the HRW. Numbers of foraging birds, foraging success and efficiency, and even prey density can be used to relate bird populations to habitat conditions. Second, failure to find colonies or dark-colored birds, and other errors associated with aerial surveys are effectively avoided. It would not be difficult to develop a set of transects, both along the river and elsewhere within the watershed, along which foraging wading birds of selected species could be counted. This could be accomplished by almost anyone who can recognize the species, such as agency biologists, Audubon volunteers, canoeists. Transect counts would be carried out year-round, or during specific times of year, according to the goals of the project.

Prey density and foraging success are variables that require intensive study, and could be carried out by graduate students if funds were available. Perhaps a study of the ecology of wading bird foraging in the HRW would be of interest to the Southwest Florida Water Management District, a potential source of funding. Such a study might be used to develop techniques for assessing the quality and productivity of wetland systems, and applied to other WMD properties.

Studies of nesting success, either intensive studies carried out by graduate students or one-time counts of young in active nests ("brood counts") offer additional information that would supplement colony surveys or transect data.

"Presence or absence" surveys also offer some value as an indicator of habitat suitability. Usually, species occur where the habitat is suitable. On the other hand, failure to detect a species does not automatically mean that the habitat is not suitable (Kushlan 1993). One advantage to such a survey is that it is essentially the same as a trip list compiled by casual visitors. Many people enjoy making such lists, and it may be possible to encourage them to contribute their data. Over time the accumulated data set should acquire some value for seasonal or multi-year evaluation.

It may not be necessary, or possible, to monitor all species. Night-herons, for instance, are active primarily at night and therefore often are not included in such programs. Species that are conspicuous, widespread, easily identified, or are of special interest should be chosen. In the HRW, such species include Great Egret, Snowy Egret, White Ibis, Wood Stork, and Roseate Spoonbill.

With all surveys of nesting colonies, it is important to avoid disturbance that might cause mortality of eggs and young. All the species included in this report are protected by state and federal law, and usually receive the greatest protection at nesting sites. The FWC should be consulted when designing a monitoring program to ensure that they are aware of and support the program.

Finally, it must be emphasized that in designing any program to use wildlife as bioindicators, project goals must be identified very clearly. What environmental change is to be monitored? How will counts of a particular wildlife species (or group of species) indicate change? Are other studies necessary to confirm the link between environmental changes and population trends? If volunteer participation is to be encouraged, counts must be direct and simple, and the species should be easily identified by volunteers once they have been trained. All these questions must be considered as a project is planned, and all should help answer the fundamental question: What do you want to know? How that question is answered will determine the project's, design, field methods, and success.

For the HRW, a combination of monitoring activities is recommended. First, foraging birds should be counted along a defined set of transects in the watershed, including both river corridor segments that can be sampled by canoe and forested flood plain. This can be done quarterly, monthly, or more often as funding and volunteer assistance allow. Second, selected nesting colonies should be monitored. Existing information and, as possible, aerial surveys should be used to identify and locate candidate sites. Nests should be counted from the ground (or by boat), not estimated from the air. At least two censuses should be conducted per season at each colony monitored. Additional elements of the monitoring program can be added and supplemental information sought from local agencies as project goals or other needs require, and as funding allows.

Conclusions

1. There are no historical data that allow a reliable estimate of the breeding population of wading birds or colonial waterbirds in the Hillsborough River Watershed. A very tentative estimate can be made, of about 2000 breeding pairs of 14 or so species in the 1970s through the 1990s. In my opinion this is likely to be conservative, but I stress that the data are very incomplete and inconsistent. It is certainly not possible to use the available data to estimate trends for any species, or all species combined.
2. The aerial surveys described here do provide useful information about the locations of bird colonies in the watershed, and some of the nesting species that occur there. More intensive surveys, both from the air and from the ground, are needed just to detect many of the species.
3. Direct counts of nests from the ground or by boat are much more accurate than aerial surveys, and detect species not easily seen from the air.
4. Targeted surveys, i.e. censuses of specific colonies, are more precise and less time consuming, but the questions of interpretation associated with highly mobile species and (probably unknown) variation in sampling remain.
5. Use of GPS technology will greatly enhance the monitoring of wading bird colony site fidelity, one indicator of environmental change.
6. Timing is an important part of planning a survey. Species such as Great Blue Herons, Great Egrets, Roseate Spoonbills, Anhingas and Double-crested Cormorants typically nest early in the year, roughly February through April. Ibis and the smaller herons usually nest later, March or April through May or June. Early surveys may accurately reflect nesting numbers of some species but not others, and vice versa.
7. Transect counts or indices of birds foraging within the watershed offer a more direct means of relating wildlife population trends to environmental change. These can be conducted at any time of year.
8. "Presence/absence" surveys (trip lists) offer some value as well, especially as they accumulate.
9. Project planners must think very clearly about the environmental changes that a project is intended to monitor, identify species whose population trends may logically relate to those changes, and select monitoring techniques that best allow relation of the two. That is: *What is the goal of the project? What do you want to know?*
10. Even clear population trends do not automatically indicate anything by themselves. Other information is needed. Additional studies may be needed to identify causes, or relate trends to environmental change. Therefore a combination of monitoring activities is recommended.

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List of Tables

Table 1. Waterbird species that typically occur within the Hillsborough River Watershed.

Table 2. List of bird surveys that include data on colonial waterbirds in the Hillsborough River Watershed.

Table 3. Wading bird colonies (n=21) in the Hillsborough River Watershed, 1976-1999. Aerial surveys by Florida Fish and Wildlife Conservation Commission and cooperators.

Table 4. Wading bird colony surveys of the Hillsborough River Watershed, 1976-1978.

Table 5. Wading bird colony surveys of the Hillsborough River Watershed, 1986-1989.

Table 6. Wading bird colony surveys of the Hillsborough River Watershed, 1999.

Table 7. Cypress Creek Colony Censuses, 1998-2002.

Table 8. Temple Crest Colony Censuses, 1997-2003.

Table 1. Waterbird species that typically occur within the Hillsborough River watershed.

Species	State-Listed ¹	Nests within watershed	Foraging: common and widespread in watershed	Wading bird	Colonial or solitary nester
Brown Pelican	SSC				c
Double-crested Cormorant		x	x		c
Anhinga		x	x		c
American Bittern				x	s
Least Bittern		x		x	s
Great Blue Heron		x	x	x	c,s
Great Egret		x	x	x	c
Snowy Egret	SSC	x	x	x	c
Little Blue Heron	SSC	x	x	x	c
Tricolored Heron	SSC	x	x	x	c
Cattle Egret		x	x	x	c
Green Heron		x	x	x	s
Black-crowned Night-Heron		x	x	x	c
Yellow-crowned Night-Heron		x	x	x	c
White Ibis	SSC	x	x	x	c
Glossy Ibis			?	x	c
Roseate Spoonbill	SSC		x	x	c
Wood Stork	E	x	x	x	c
Wood Duck		x	x		s
Mottled Duck		x	x		s
Blue-winged Teal					s
Ring-necked Duck					s
Hooded Merganser					s
Common Moorhen		x	x		s
American Coot					s
Sandhill Crane	T ²	x		x	s
Limpkin	SSC	x	x	x	s
Laughing Gull					c
Ring-billed Gull					c
Forster's Tern					c
Least Tern	T				c

Note: List follows phylogenetic order as in Check-List of North American Birds (AOU 1998).

¹E = Endangered; T = Threatened; SSC = Species of Special Concern (Florida Fish and Wildlife Conservation Commission).

²Nonmigratory Florida subspecies only.

Table 2. List of bird surveys that include data on colonial waterbirds in the Hillsborough River Watershed.

Type or Name of Survey	Includes Nesting Data	Consulted for this report
Christmas Bird Counts		
Breeding Bird Atlas	y	
Breeding Bird Surveys	?	
Consultant studies (misc.)	?	
Private trip lists		
Hillsborough River State Park bird list, counts		
1970s statewide colony survey	y	x
1980s statewide colony survey	y	x
1990s statewide colony survey	y	x
Audubon of Florida surveys	y	x

Table 3. Wading bird colonies (n=21) in the Hillsborough River Watershed, 1976-1999. Aerial surveys by Florida Fish and Wildlife Conservation Commission and cooperators.

Atlas #	Colony Active?			County
	1999	1986-89	1976-78	
611023	No	No	Yes	Pasco
611148	No	Yes	?	"
611149	No	Yes	?	"
611152	No	Yes	?	"
611153	No	No	Yes	"
611154	No	Yes	?	"
611311	Yes	?	?	"
611017	No	No	Yes	Hillsborough
611018	?	No	Yes	"
611020	No	No	Yes	"
611147	No	Yes	?	"
611157	No	Yes	?	"
611158	No	Yes	?	"
611163	?	Yes	?	"
611164	No	Yes	?	"
611169	?	Yes	?	"
611308	Yes	?	?	"
611310	Yes	?	?	"
615330	Yes	?	?	"
611028	No	No	Yes	Polk
612142	No	No	Yes	"
# active	4	10	7	

Data corrected from Rodgers et al. (2003).

? indicates colony not surveyed or not known, so activity not determined.

Table 4. Wading Bird Colony Surveys of the Hillsborough River Watershed, 1976-1978.

Species	Number of Breeding Pairs						
Colony #	611017 ¹	611018 ²		611020	611023 ³	611028 ⁴	Approximate Annual Average ⁵
County	Hillsb	Hillsb		Hillsb	Pasco	Polk	
Date	June 76	April 76	April 77	June 76	April 77	June 76	
Great Blue Heron		10-15	25-30				25
Great Egret	10-20	75		+		50	135
Snowy Egret				+			+
Little Blue Heron				+			+
Tricolored Heron				+			+
Cattle Egret	400-500			500-600	250	200-300	1100
Total							1250+ (?)

¹Colony inactive when checked in April 1977, July 1977, April 1978.

²Colony inactive when checked in April 1978, July 1978.

³Colony inactive when checked in April 1978, July 1978.

⁴Colony inactive when checked in July 1977.

⁵"Annual Average Population" is optimistic and based largely on 1976 surveys. If 1977 and 1978 surveys received equal weight, average populations would be much lower. Note NO active colonies found in 1978.

Colonies **611153** and **612142** were not included in Nesbitt et al. 1982, but were listed as active in 1976-78 in Rodgers et al. 2003. No population estimates were available.

Table 5. Wading Bird Colony Surveys of the Hillsborough River Watershed, 1986-1989.
(data are from Runde et al., 1991)

Species	Active Colonies Surveyed										
Colony #	611148	61149	611152	611154	611147	611157	611158	611163		611164	611169
County	Pasco	Pasco	Pasco	Pasco	Hillsb	Hillsb	Hillsb	Hillsb		Hillsb	Hillsb
Date	4-18-89 4-24-89	6-12-89	4-24-89	4-18-89 4-24-89	5-5-88	6-14-88 6-21-88	6-14-88 6-21-88	6-30-87	5-27-88 6-7-88	6-7-88	5-5-88 5-9-88 5-18-88
Double-crested Cormorant							x				x
Anhinga	x				x	x	x			x	x
Great Blue Heron	x		x		x		x				x
Great Egret	x			x		x	x			x	x
Snowy Egret				x		x	x			x	x
Little Blue Heron		x		x			x			x	x
Tricolored Heron				x			x			x	x
Cattle Egret				x		x	x			x	x
Green Heron						x				x	x
Black-crowned Night-Heron							x			x	x
White Ibis							x			x	
"Large White"					x						
"Small White"		x									
Wood Stork	x							x	x		
Colony size class	C	G	A	C	C	G	C	C	A	G	E,B,D

Colony abundance codes (from Runde et al. 1991)

A = 1-10 birds	E = 501-750
B = 11-100	F = 751-1000
C = 101-250	G = >1000
D = 251-500	H = >5000

Double-crested Cormorants and Anhingas were included in surveys, so are included here even though they are not wading birds.

Table 6. Wading Bird Colony Surveys of the Hillsborough River Watershed, 1999.

Data are from Rodgers et al. (2003), and are expressed as *percentages of total birds or nests present*.

Species	Active Colonies Surveyed			
Colony #	611311	611308	611310	615330
County	Pasco	Hillsb	Hillsb	Hillsb
Date	5-19-99	5-18-99	5-18-99	5-6-99
Double-crested Cormorant				10
Anhinga		40		
Great Blue Heron				
Great Egret		60	33	
Snowy Egret				
Little Blue Heron				10
Tricolored Heron				
Cattle Egret	100		33	80
Green Heron				
Black-crowned Night-Heron				
White Ibis				
Wood Stork			33	
Colony size class (Nests)	50-250	50-250	250-500	50-250

Double-crested Cormorants and Anhingas were included in FWC surveys, so are included here even though they are not wading birds.

Table 7. Cypress Creek Colony Censuses, 1998-2002.

Species	1998	1999	2000	2001	2002
Date	6-26	5-10	4-27	5-7	4-25
Double-crested Cormorant		1		2	4
Anhinga	21	36	38	45	79
Least Bittern					1
Great Egret	9	26	11	4	54
Snowy Egret	5	29	26	20	15
Little Blue Heron	14	37	12	14	28
Tricolored Heron	4	9	7	10	7
Cattle Egret	349	319	273	337	272
Green Heron	1	1			
White Ibis	12				
Wood Stork	5	66	45		118
Totals	420	524	412	432	570

= FWC colony #611310

Surveys carried out by Ann F. Paul of Audubon of Florida and volunteer collaborators.

All data represent direct counts of nests from a boat that circled the island.

Table 8. Temple Crest Colony Censuses, 1997-2003.

Species	1997	1998	1999	2000	2001	2002	2003
Date	5-3	6-21-98			6-23		6-7
Double-crested Cormorant							
Anhinga	9	5	colony	colony		colony	3
Least Bittern		+					
Great Egret	14	10					12
Snowy Egret	35	32	not	not		inactive	12
Little Blue Heron	61	48					10
Tricolored Heron	42	40			1		15
Cattle Egret	316	141	surveyed	surveyed			57
Green Heron	1+	+					
Black-crowned Night-Heron		1					
Totals	477	277	n.d.	n.d.	1	0	109

= FWC colony #611308

River level low and colony area virtually dry, 2000-2002.

Surveys carried out by A. F. Paul and R. T. Paul of Audubon of Florida, with the assistance of volunteers.

All data represent direct counts of nests from a boat that circled the island.