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SURVEY OF WADING BIRD UTILIZATION OF THE UPPER ST. JOHNS RIVER 1993 - 1995

by

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EXECUTIVE SUMMARY

Wading birds are prominent components of temperate, subtropical, and tropical wetland systems. They often are useful indicators of wetland system health, because they are near the top of the trophic pyramid, and their populations respond to environmental change throughout the system (Hoffman, Bancroft, and Sawicki, 1994; Bancroft et al. 1994). This project was developed to determine numbers of wading birds using the Upper Basin of the St. Johns River, both as foraging habitat and for nesting, and to use these data in assessing the success of the Upper Basin project in restoring productive wildlife habitat.

This report covers aerial surveys of wading bird colonies and foraging distribution in the Upper St. Johns River project marshes in 1993, 1994, and 1995. The study area extended from the Florida Turnpike south of Blue Cypress Lake north to State Road 46, just south of Lake Harney. Systematic surveys of the marsh were conducted monthly from January through September (in 1993 a July survey was not flown). The systematic surveys were composed of 62 east-west transects flown at 200-feet elevation above the marsh. Colony surveys were conducted in association with the systematic surveys in all months. Surveys covered the entire basin, and also included several major colonies just outside the basin boundaries.

A total of 59 active colony sites were located in the study area. Twenty-four were active in 1993, 25 in 1994, and 41 in 1995. These sites were occupied by approximately 7500 nests in 1993, 7200 nests in 1994, and 14,000 nests in 1995. All species nested in larger numbers in 1995 than in the previous years. Most of the nesting wading birds were Cattle Egrets, but Great Blue Herons, Great Egrets, Snowy Egrets, Tricolored Herons, Little Blue Herons, and Wood Storks also were found nesting. The distribution of nesting activity varied greatly among the three years. The 1993 season was dominated by large colonies in Stratum II (Fellsmere Grade to Highway 192). These were mostly inactive in 1994. In 1995, heavy nesting activity returned to this stratum, however locations within the stratum had changed. Nesting activity began earlier for most species in 1995; nesting began in January for Great Blue Herons and Great Egrets, in February for Wood Storks, and in March for Snowy Egrets and small dark herons. Activity peaks also were earlier in 1995 for most species. Great Blue Heron nest numbers peaked in March in 1993 and 1994, and in February in 1995.

Great Egret nest numbers peaked in May in 1993 and 1994, but in April in 1995. Snowy Egret and small dark heron nest numbers peaked in June in 1993 and 1994, but in May in 1995. The exceptions to this pattern were Cattle Egrets and Wood Storks. Cattle Egret nest numbers peaked in June in all three years, and Wood Stork nest numbers peaked in May in 1993 and 1995, but in April in 1994. Earlier nesting is likely to signify better foraging conditions, greater probability of nesting success, and better fledgling survival.

The systematic surveys yielded population estimates for the birds for each survey month, as well as location information suitable for mapping. Overall, the population estimates ranged from a minimum of about 12,100 in May 1993 to over 63,000 in August 1993. White Ibis were the most common birds in January, February, and March, of each year, and in June 1995, with a maximum estimate of 24,000 in July 1995. The small white heron category (numerically dominated by Cattle Egrets) was most abundant in the other months. The maximum estimate was 42,000 in August 1993. Great Egret population estimates ranged from 1133 in September 1994 to 5620 in January 1993. Great Blue Heron estimates ranged from 60 in June 1994 to 433 in January 1994. Glossy ibis estimates ranged from 0 in August 1994 to 1573 in March 1993.

The endangered Wood Stork was present in the study area in all survey months except September 1995. Storks nested in three colonies in or near the study area in 1993 and 1995, and in two of those sites in 1994. All three colonies were on islands left in borrow pits used for highway construction. The practice of leaving spoil piles in borrow pits seems to have benefitted this endangered species, and wading birds in general. In most months the majority of Wood Storks were seen foraging isolated wetlands in the uplands surrounding the marsh.

The five sub-sections, or strata, of the basin differed greatly in abundance of wading birds. Stratum II (extending from Fellsmere Grade to Highway 192) usually supported the most birds, and Stratum IV (extending from just north of lake Winder to SR 520 usually hosted the fewest.

The results of this study need to be interpreted in the context of the dynamic mosaic of regional wetland habitats. Abundance of birds reflects not only local conditions, but also conditions in other parts of the region. Much of the fluctuation in bird numbers in the St. Johns River marshes may be responses to changes in conditions in the Everglades, in Georgia saltmarshes, and in Carolina bays and swamp forests.

Within the St. Johns River Water management District, the two major wetland systems (the St. Johns River marshes; and the coastal lagoon, mangrove, and saltmarsh system) support much wading bird foraging, but smaller wetlands embedded among upland habitats are also extremely important to these birds. The southern end of the study area had much higher numbers of colonies and nests than the northern end, a difference that probably reflects greater abundance and quality of these smaller wetlands in the south.

Four management recommendations are suggested for improving nesting habitat, and three for maintaining and improving foraging habitat.

For nesting habitat:

1) Protect borrow-pit colony sites from disturbance, and design new borrow pits to leave islands.

2) Manage water levels to keep the substrate under willow thicket colonies flooded during the nesting season.

3) Construct artificial islands in areas where tree islands have been killed by flooding.

4) Protect the sites of the major swamp-forest canopy colonies, and manage water levels under them to maintain the health of the forests and to keep the substrate flooded during nesting.

For enhancing foraging habitat:

1) Restoration activities in the Upper Basin Project in southern Brevard County appear to be benefitting wading birds, and should be continued.

2) Protection and proper management of the smaller wetlands surrounding the study area is critical to the success of wading birds in the region.

3) Manage marsh vegetation to maintain relatively open structure, and native oligotrophic plant communities. Prescribed fire is a useful tool. management of nutrient inputs is essential to maintaining marsh communities suitable for foraging habitat.

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INTRODUCTION

Wading birds are prominent components of temperate, subtropical, and tropical wetland systems. They often are useful indicators of wetland system health, because they are near the top of the trophic pyramid, and their populations respond to environmental change throughout the system (Hoffman, Bancroft, and Sawicki, 1994; Bancroft et al. 1994). They show responses in at least three temporal scales. At a daily scale, foraging distributions are the sum of individual responses to constantly changing patterns of food abundance and availability. Seasonally, the timing, magnitude, and success of nesting efforts is a population response to aspects of habitat quality that vary from year to year. These include prey population levels, hydrology, and climatic fluctuations, among others. Over a period of years, wading bird populations may grow or decline, or change patterns of seasonal habitat use, as habitat improves or is degraded. The birds' extreme mobility both enhances and complicates their value as indicators. When conditions are poor, the birds are likely to leave the region entirely, providing a relatively clear indicator of problems. On the other hand, interpretation of their behavior, especially within a small area, must take into account the possibility that responses seen actually are driven by factors outside the study area. Particularly high wading bird numbers in the St. Johns River marshes, for example, might indicate particularly good habitat conditions, or particularly poor conditions in the Everglades and other areas the same birds sometimes use.

This project had two main tasks; a systematic aerial survey of wading bird use of the Upper St. Johns River Basin, and an aerial survey of wading bird colonies in the basin. The purpose of this project was to determine numbers of wading birds using the basin, both as foraging habitat and for nesting, and to use these data in assessing the success of the Upper Basin project in restoring and preserving productive (wetland) wildlife habitat. In 1993, systematic surveys were conducted monthly from January through June and in August and September. Colony surveys were conducted in association with the systematic surveys from January through June. In 1994 and 1995, both the systematic and colony surveys were conducted monthly from January through September. Survey dates are listed in Table 1.

The study area includes the St. Johns River marshes and lakes, and areas to be restored to marsh conditions, from the Florida Turnpike south of Blue Cypress Lake, north to SR 46 northwest of Titusville (Figure 1). The study area was divided into 5 sections (strata) to aid in the density calculations. These strata also were useful in understanding variation in wading bird use of different stretches of the river marshes. The strata are numbered from I

to V, from upstream (south) to downstream (north). Stratum I stretches from the Florida Turnpike south of SR 60 downstream to Fellsmere Grade, and includes Blue Cypress Lake, the Blue Cypress Lake Water Management Areas, and St. Johns Water Management Area (Stick Marsh). Stratum II stretches from Fellsmere Grade to US 192, including Lake Hell-n-Blazes and Sawgrass Lake, and extensive areas of agricultural land being restored to marsh. Stratum III extends from US 192 to just north of Lake Windermere, and includes Lake Washington. Stratum IV extends from just north of Lake Windermere to SR 520 and includes Lake Poinsett. Stratum V runs from SR 520 downstream to SR 46 and includes the St. Johns National Wildlife Refuge, South Lake, Salt Lake, Buck Lake, Loughman Lake, and the Puzzle Lake complex.

This report summarizes the three years' survey results, assesses the importance of Upper St. Johns River marshes to wading birds, and assesses the success to date of the Upper Basin project in restoring productive wading bird habitat. Results for 1993 and 1994 have been described in previous reports (Hoffman 1994, 1995). The report is divided into four text sections, and four appendices. Appendix I provides, in tabular form, the dates of the surveys, and coordinates of the survey transect lines.

The first section describes of the colony survey results. Several colonies located adjacent to, but outside the boundaries of the study area were also surveyed. Estimates of the numbers of active nests are given for each species. Appendix II includes a catalog of colony sites, describing occupancy at each colony site, and provides brief descriptions of the physical sites.

The second section of this report describes the results of the systematic surveys and provides population estimates for wading birds, species by species, and in total. These surveys focused on the colonial, diurnal species, including Great Blue Heron (*Ardea herodias*), Great Egret (*Casmerodias albus)*, Little Blue Heron (*Egretta caerulea*), Tricolored Heron (*Egretta tricolor*), Snowy Egret (*Egretta thula*), Cattle Egret (*Bubulcus ibis*), Wood Stork (*Mycteria americana*), White Ibis (*Eudocimus albus*), and Glossy Ibis (*Plegadis falcinellus*). Three other species (Reddish Egret, *Egretta rufescens*; Great White Heron, *Ardea [herodias] occidentalis*; and Roseate Spoonbill, *Ajaia ajaja*) were counted when encountered, but are quite rare in the marshes. Tricolored Herons and adult Little Blue Herons cannot always be distinguished from the air, and so data for them are combined into a category "small dark herons." Similarly, Cattle Egrets, Snowy Egrets, and juvenile Little Blue Herons cannot always be distinguished, and are reported as "small white herons." A few other waders occur in the marshes but cannot be surveyed effectively with aerial surveys - Least Bittern (*Ixobrychus exilis*), American Bittern (*Botaurus lentiginosus*), Black-crowned Night-Heron (*Nycticorax nycticorax*), Yellow-crowned Night-Heron (*Nyctinassa violacea*), and Green Heron (*Butorides virescens*). These species are nocturnal or are cryptically patterned and skulk in the vegetation. The population estimates have been calculated for the study area as a whole, and separately for five subdivisions, or strata. Copies of the computer data files have been transmitted separately to the SJRWMD.

The report's third section contains species accounts for the main species surveyed. These include brief characterizations of the timing and abundance of nesting, and of the overall abundance in the study area and in the 5 strata. Complete tabulations of the population estimates are provided in Appendix III.

The fourth section is entitled discussion and assessment. In it, the importance of the study area as wading bird habitat is assessed, and the effects to date of the marsh restoration of the Upper Basin Project in improving wading bird habitat. I also provide recommendations for management of the system to maintain and improve habitat quality.

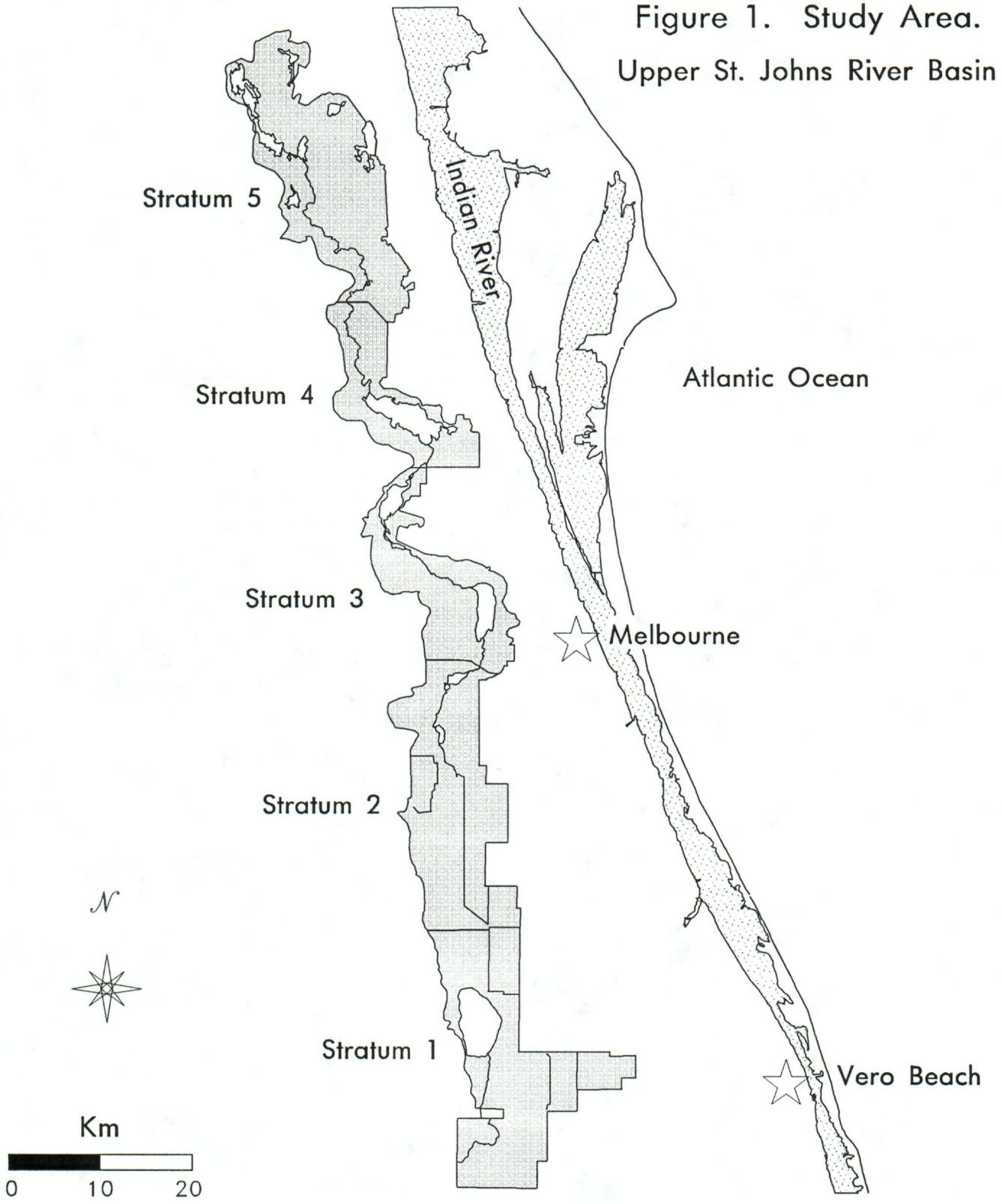
Figure 1. Study Area.
Upper St. Johns River Basin
Stratum 5
Stratum 4
Stratum 3
Stratum 2
Stratum 1
Indian River
Atlantic Ocean
Melbourne
Vero Beach
N
Km
0
10
20

COLONY SURVEYS

METHODS

Wading bird colony surveys were flown monthly from January through June in 1993 and January through September, 1994 and 1995, in conjunction with the systematic surveys of foraging birds in the upper St. Johns River marshes. Survey dates are listed in Table 1. The colony surveys were usually flown following the systematic surveys. Any new colonies encountered during the systematic surveys were recorded for later examination. All previously known colony sites were visited and inspected during each survey. In addition, all potential nesting habitat was inspected visually in each survey. These surveys were flown at an altitude of 800 feet. The survey plane was directed in a zigzag fashion over the marshes, to allow examination of all possible colony sites within the area. When a colony was located (or when known colonies were visited) the plane descended to altitudes of 200 to 500 feet as necessary to determine species composition and numbers, and to describe the sites. Locations were determined with the on-board GPS receiver.

RESULTS

Colony Types. A total of 59 nesting colonies were located and surveyed during the project. These can be grouped into six types based on situation, substrate, and species composition (Table 1). The first type is lone Great Blue Heron nests. Eleven of these were found, situated in isolated trees or trees within forested areas. The second type is tree-island Great Blue Heron Colonies. Nine of these were found. They consisted of clusters of Great Blue Heron nests in isolated clumps of trees (usually cypress). The third type consists of closed-canopy swamp-forest colonies. Nests were dispersed through the crowns of cypress or other swamp-forest trees. The five of these found hosted Great Blue Herons or Great Egrets, or both. Elsewhere in Florida Wood Storks nest in this type of colony, but they did not use the ones in the study area. The fourth type is borrow pit colonies. Five of these were found; they hosted diverse assemblages of small and large herons. All the Wood Storks we found nesting used three of these sites. The fifth type is Flooded Tree-island colonies. Two were found, in impoundments at the south end of the study area. They hosted mixed assemblages of Great Egrets and small herons. The sixth, and most common, is willow-thicket colonies. These were located in willow thickets in sawgrass prairies or on lakeshores or on

islands in lakes. Most of the 27 willow-thicket colonies found were dominated by Cattle Egrets, but some also were used by Snowy Egrets, Little Blue Herons, Tricolored Herons, and Great Egrets, and a few of the smaller ones lacked Cattle Egrets.

Table 1. Colony types found in the St. Johns River marshes.

TYPE	NUMBER	COMPOSITION	SITUATION
Solitary Great Blue Heron nests	11	Great Blue Herons	isolated trees in prairie, or in swamp forests
Tree Island Great Blue Heron colonies	9	Great Blue Heron	isolated tree islands, in prairie or impoundments
Swamp forest colonies	5	Great Blue Herons, Great Egrets	extensive tracts of closed-canopy swamp forest
Borrow pit colonies	5	all heron species, Wood Stork	vegetated islands in borrow pits
Flooded tree island colonies	2	Great Egrets, small herons	drowned tree islands with shrubby undergrowth
Willow thicket colonies	27	Cattle Egrets, other small herons, Great Egrets, White Ibis (once)	willow thickets in wet prairie, sometimes on lake or river shores
Total	59		

Timing and Abundance of Nesting. The timing of nesting activity differed substantially among species and among the three years (Table 2). In 1993, the overall peak in nesting activity was in May and June. Great Blue Heron activity peaked in February, Great Egret and Snowy Egret activity peaked in May, and Cattle Egret activity peaked in June. Two Wood Stork colonies were active from April through August. In 1994, overall activity peaked again in June. Great Blue heron activity peaked in March, and Great Egret activity in April. Snowy Egret, Cattle Egret, and small dark heron activity peaked in June. In 1995, overall activity peaked in April. Great Blue Herons began in earnest in January and continued at a high level through April. Great Egret activity also began in January, and peaked with 9 active colonies in March, April and May. Snowy Egret activity peaked in April, and Cattle Egret activity peaked in June. Wood Storks nested in three colonies, and activity began in February in all three. Thus, in 1995, all species except Cattle Egrets tended to initiate nesting earlier, and nearly all nested in more colonies than in the previous two years.

Table 2. Numbers of colonies active in each survey.

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1993									
Great Blue Heron		8	5	6	4	2			
Great Egret		1	3	4	7	6		2	
Snowy Egret				1	6	4			
Cattle Egret					8	14		6	
Small dark herons				1	4	5			
Wood Stork			1	2	2	2		2	
COLONIES		8	7	8	15	17		8	
1994									
Great Blue Heron	3	6	8	7	5	1			
Great Egret			7	8	7	6	3		
Snowy Egret				2	4	7	2		
Cattle Egret				4	9	10	9	5	4
Small dark herons				5	7	8	3	1	
Wood Stork			1	2	2	2	2		
COLONIES	3	6	10	15	15	16	10	5	4
1995									
Great Blue Heron	12	10	12	14	3				
Great Egret	2	6	9	9	9	6	1	1	
Snowy Egret			5	8	7	3	2		
Cattle Egret				12	15	17	14	6	1
Small dark herons			2	4	3	4	2		
Wood Stork		3	3	3	3	3	1		
COLONIES	12	15	22	29	23	24	23	8	1

Table 3. Numbers of nests found active during the colony surveys in 1993. A plus (+) is used where a species was known to be nesting but an accurate nest count could not be taken. Usually this happened when small numbers of Snowy Egrets and small dark herons were nesting among masses of Cattle Egret nests. A number with a plus (450+) indicates nests could be counted in some but not all colonies where the species was known to nest.

	SPECIES					
MONTH	Great Blue Heron	Great Egret	Snowy Egret	Cattle Egret	Small Dark Herons	Wood Stork
JANUARY						
FEBRUARY	24	18				
MARCH	31	200				+
APRIL	31	340	+		+	45
MAY	22	350	4++	3770	5++	110
JUNE	8	230	130	6000	150	85
AUGUST				1000		
SEPTEMBER						

The numbers of nesting attempts also differed greatly among the three years (Tables 3 - 5). In 1993 the numbers of active Great Blue heron nests found peaked at 31 in March and April. Great Egret nests peaked at 350 and Wood Storks peaked at 100, both in May. Snowy Egrets peaked at 130, Cattle Egrets at 6000, and small dark herons at 150, all in June. In 1994, Great Blue Heron nest numbers peaked (at 49) in March, Wood Stork nests peaked (at 90) in April, and Great Egrets peaked (at 420) in May. Snowy Egrets (330+), Cattle Egrets (5000), and small dark herons (150+) peaked in June.

In 1995, nesting began earlier for most species, involved many more nesting attempts than the previous two years, and peaked earlier for several(Table 5). Great Blue Heron nest numbers (57) peaked in February. Great Egret nest numbers peaked in April at 1540, more than 3 times as many as in the previous years. Snowy Egret numbers (1460 nests) were more than 4 times as many as in 1994, and the May peak was a month earlier. Cattle Egrets peaked in June as in the previous years, but the 9800 nests were nearly twice as many as in 1994, and 3800 higher than in 1993. Wood Stork nest numbers peaked at 296 in May, nearly 3 times as high as in the previous years.

Table 4. Numbers of nests found active during the colony surveys in 1994. Symbols as in Table 3.

	SPECIES					
MONTH	Great Blue Heron	Great Egret	Snowy Egret	Cattle Egret	Small Dark Herons	Wood Stork
JANUARY	5					
FEBRUARY	27					
MARCH	49	357				10
APRIL	26	330	40+	560	70+	90
MAY	20	420	45+	3700	120	30
JUNE	1	53	330+	5000	150+	48
JULY		13		4260	25+	22
AUGUST				1400		
SEPTEMBER				800		

Table 5. Numbers of nests found active during the colony surveys in 1995. Symbols as in Table 3.

	SPECIES					
MONTH	Great Blue Heron	Great Egret	Snowy Egret	Cattle Egret	Small Dark Herons	Wood Stork
JANUARY	47	6				
FEBRUARY	57	770				84
MARCH	46	1330	115		+	172
APRIL	48	1540	840	3000	100	255
MAY	7	950	1460	7650	100+	296
JUNE		280+	630+	9800	80+	186
JULY		40		5600	180	20
AUGUST				1200		
SEPTEMBER				40		

Distribution of colonies among strata. The distribution of colony sites among the five strata of the study area was notably uneven, and also differed among the three years (Table 6). Colonies were most numerous in Stratum I (south of Fellsmere Grade), and their abundance generally declined from south to north. Four of the 5 strata had more colonies in 1995 than in the other years. Only Stratum I had extensive nesting in all three years. It had colonies in a variety of vegetation types, including closed-canopy swamp forest, willow heads in sawgrass prairie, remnant tree islands in impoundments, and borrow-pit islands. Stratum II (Fellsmere Grade to US 192) and Stratum III (US 192 to just north of Lake Windermere) had more nesting activity and larger colonies in 1995. Most of the colonies in Stratum II were large Cattle Egret colonies in willow thickets, but the area also included one borrow-pit colony and one colony in closed-canopy forest. Stratum III had one major Borrow-pit colony, a few willow-thicket colonies, and a Great Blue heron colony in an isolated clump of cypress. Stratum IV (north of lake Windermere to SR 528) contained two major borrow-pit colonies and two intermittent willow-thicket colonies. Stratum V (SR 528 - SR 46) included one major colony in a willow pond within pine flatwoods and a few small Great Blue heron colonies.

Table 6. Distribution of wading bird colonies among the five strata of the study area.

	STRATUM				
YEAR	I	II	III	IV	V
1993	11	3	5	5	0
1994	17	1	2	3	2
1995	16	9	5	8	1
TOTAL	26	12	7	12	2

SYSTEMATIC SURVEYS

METHODS

Systematic surveys were flown monthly from January through September in each year, except that in 1993, as per contract a July survey was not flown. Surveys typically required about one and one-half days to complete. Survey dates are listed in Appendix I. The survey method used is a modification of the systematic survey method used in the Everglades (Bancroft et al. 1994). In the Everglades, the survey area was gridded with east-west surveys 2 km apart. The aircraft maintained an altitude of 200 feet (61m) above the substrate, as determined by a RADAR altimeter. A GPS receiver was used for navigation. Flight speed was maintained at 80kt. Two observers recorded all wading birds seen in 150m-wide bands parallel to the aircraft's course.

For the St. Johns River surveys a total of 62 east-west transects were established crossing the study area. Latitudes, lengths, and spacing of the transects are provided in Appendix I. The transects average 2 km apart, but spacing was adjusted to provide maximum coverage of the irregularities of the study area boundaries. Thus, the Blue Cypress Water Management Area is crossed by two transects, less than 2 km apart. Had the transects been spaced exactly 2 km apart only one could have crossed the east unit. All surveys except 2 were flown in a Cessna 206 single-engine fixed-wing aircraft. In August and September a Cessna 182 was used. Wayne Hoffman flew in all surveys, and had at least one assistant on board at all times. Camille Sewell, Katrin Schikorr and/or Richard Sawicki served as assistants on the surveys.

Population estimates, variance estimates, and 95% confidence intervals were calculated with a DBASE III+ program developed by Wayne Hoffman. The program provides population estimates for the study area as a whole and for five subdivisions, or strata. Because the transects nominally cover 15% of the total study area, the population estimates are calculated by linear extrapolation from the survey sample to the whole area:

$$\text{population estimate} = Y = \text{birds counted}/0.15.$$

These population estimates are sensitive to deviations from 15% coverage, and of course to incorrect counts. In this survey, the area covered is probably a bit higher than 15% because the transects were placed to give maximum coverage of the east-west extensions

resulting from the irregular boundaries. In these areas, the band of included habitat containing the transect often is narrower than 2km. However, few birds have been detected in these areas near the transect ends (most tend to be dry) so this deviation from 15% has had minimal effect on the population estimates. The population estimates for small dark herons should be considered a bit less reliable than the rest, because these birds are less conspicuous, and are more likely to be missed in the surveys. Variance estimates for the population estimates are calculated using a formula for systematic surveys from Norton-Griffiths (1978):

$$Var(Y) = (N(N-n)/n)(S_y^2 - 2RS_{zy} + R_2S_z^2)$$

where Var(Y) = the variance for the population estimate, Y. N = number of transects flown, divided by the percent coverage (62 transects/0.15) = 413.333, and n = number of transects flown = 62. S_y^2 = variance in numbers of birds in the transects, S_z^2 is the variance in the areas covered in the transects, and S_{zy} = the covariance between birds counted and area per transect. These variance and covariance terms are calculated across transects (sample size = 62). R = the observed density in the strips censused and is calculated as the total number of birds counted, divided by the area included in the survey strips (for this survey the area included in the strips is about 167.5 km^2).

This variance formula is thus sensitive to intensity of coverage and number of transects. With a higher percent coverage of the area, N (and therefore the variance) decreases. A survey using many short transects would also produce smaller variances than a survey covering the same area with a few long transects. In my experience (in surveys in the Everglades as well as in this project) these formulae are somewhat sensitive to spatial variability in distribution. In particular, distributions where the birds are numerous on some transects but absent from others tend to inflate the variance estimates. Experience shows that the population estimates tend to be somewhat more repeatable than would be expected from the calculated variance estimates.

Ninety-five percent confidence intervals (95% C.I.) around the population estimates are calculated as follows:

$$Y \pm t_{0.05,61\ d.f.}\ [s/sqn]$$

where the t value = 1.999, s = the square root of the variance, and sqn = the square root of n. Since n = 62 transects, sqn = 7.874008.

The relative importance of the five strata as habitat for wading birds were assessed by ranking the population estimates for the strata each month. The stratum with the largest population estimate in a given month was ranked 1, the stratum with the second-largest estimate is ranked 2, and so on. If two or more strata have identical population estimates, they are ranked the same. Thus, for Great Blue Herons in January 1993, Stratum V had the largest population estimate and was ranked 1, Stratum I was ranked 2, strata II and IV were tied and both were ranked 3, and Stratum III, with the fewest, was ranked 5. However, strata with population estimates of 0 (no birds seen) were always ranked 5. The most extreme example is Wood Storks in August 1995 (Appendix IV). The only storks seen were in Stratum

V, and it was ranked 1. All other strata were ranked 5. The mean ranks for each stratum are calculated, and give a general picture of the relative importance of the strata to each species.

POPULATION ESTIMATES

The population estimates calculated for each survey are tabulated in Appendix III. Yearly summaries are presented in Tables 7-9. In 1993 overall population estimates varied from 12,113 in May to 31,927 in January (Table 7). Numbers dropped sharply between January and February, then rose for March nearly back to the January estimate. The estimates in April and May were less than half of the March estimate, then rose moderately in June. The February drop may have resulted from local movements out of the study area into nearby flooded pastures and drainage ditches, in response to very high water levels. The drop after March probably reflects migration of birds toward nesting areas in north Florida and on up the Atlantic seaboard. If nesting birds were added to the estimates, the April-May numbers would be much less dramatically lower than the March numbers, but the migration suggested above is still likely because the species composition changed dramatically. Much of the decline in estimates resulted from a drop in White Ibis numbers, and the bulk of the nesting birds were Cattle Egrets.

In 1994 overall population estimates varied from 14,807 in April to 36,720 in June (Table 8). The January estimate was 17,160. February saw an increase to 23,080, followed by drops to 18,713 for March and 14,807 for April, 14,940 for May, an abrupt increase to 36,720 for June, and drops to 25,280 for July, 19,573 for August, and 15,327 for September. As in 1993, numbers in January through March were dominated by White Ibis, and in April through September by small white herons (which were in fact mostly Cattle Egrets).

The third year, 1995, saw much higher population estimates in February, April, May, June, and July than the previous years (Table 9). The estimates of 51,000+ and 52,000+ in June and July were higher than all other estimates except the 63,000 of August 1993. These, and the estimate of 45,000+ in February 1995 were dominated by large flocks of White Ibis and/or small white herons.

Table 7. Summary of population estimates, by month and species, 1993.

MONTH	GREAT EGRET	GREAT BLUE HERON	SMALL DARK HERONS	SMALL WHITE HERONS	WOOD STORK	WHITE IBIS	GLOSSY IBIS	TOTAL
JAN.	6520	253	2140	6580	193	14920	1320	31927
FEB.	3933	267	767	5786	127	10580	1127	22586
MAR.	3660	187	493	8893	127	13860	1573	28793
APR.	3240	160	273	6820	80	3320	480	14373
MAY	2380	127	953	7347	113	900	293	12113
JUN.	5287	167	340	10033	240	6060	300	22427
AUG.	6167	127	807	42913	653	11980	460	63107
SEP.	2600	153	227	37260	93	5453	33	45820

Table 8. Summary of population estimates, by month and species, 1994.

MONTH	GREAT EGRET	GREAT BLUE HERON	SMALL DARK HERONS	SMALL WHITE HERONS	WOOD STORK	WHITE IBIS	GLOSSY IBIS	TOTAL
JAN.	1933	433	1273	4493	260	8613	153	17160
FEB.	2093	200	187	1987	287	18233	93	23080
MAR.	4093	307	247	4820	253	8873	120	18713
APR.	3380	213	227	7913	167	2553	353	14807
MAY	2727	260	247	10500	180	1007	20	14940
JUN.	3393	60	220	20040	1287	11713	7	36720
JUL.	3513	113	433	15607	107	5480	27	25280
AUG.	2760	80	207	16227	100	200	0	19573
SEP.	1133	100	140	12293	160	1440	60	15327

Table 9. Summary of population estimates, by month and species, 1995.

MONTH	GREAT EGRET	GREAT BLUE HERON	SMALL DARK HERONS	SMALL WHITE HERONS	WOOD STORK	WHITE IBIS	GLOSSY IBIS	TOTAL
JAN.	2747	320	253	3373	320	14387	533	21953
FEB.	5767	240	753	4180	187	33073	1007	45207
MAR.	3087	166	353	5227	540	11307	1187	21867
APR.	5593	260	507	9013	340	4827	313	20853
MAY	2827	140	440	19947	347	7100	347	31147
JUN.	6480	140	1260	20087	133	22747	367	51213
JUL.	2533	153	367	25307	400	23900	13	52673
AUG.	2433	140	447	20807	40	2847	80	25793
SEP.	1627	107	233	19213	0	3293	80	24553

Abundance Rankings Among Strata. Appendix IV tabulates the rankings of the strata as Wading bird habitat. For all species combined, Stratum II was ranked 1 in 17 Of the 26 surveys, and had an average ranking of 1.4. Stratum I averaged 2.8, Stratum V averaged 2.9, Stratum III averaged 3.4, and Stratum IV averaged 4.4. Stratum IV ranked fifth in 15 of the 26 surveys. For Great Egrets, small white herons, and White Ibis, stratum II also had the best ranking (rank means 1.6, 1.6, and 1.8, respectively) and Stratum IV the worst (rank means 4.5, 4.3, and 3.8). Great Blue Herons were most common in Stratum V in 20 surveys (mean ranking 1.2), second in Stratum I, and least common in Stratum III (mean 4.1). Small dark herons and Wood Storks were most common in Stratum V (rank means 1.8 and 2.3) and least common in Stratum IV (rank means 4.0 and 4.2). Glossy Ibises were most common in Stratum II (rank mean 2.5) and least common in Stratum III (rank mean 4.0).

SPECIES ACCOUNTS

This section contains species accounts for the main species and species-groups surveyed. These include brief characterizations of the timing and abundance of nesting, and of the overall abundance in the study area and in the 5 strata.

Great Egret. Great Egrets nested in a total of seven colonies in 1993, eight colonies in 1994, and nine colonies in 1995. They used swamp forest, borrow pit, flooded tree island, and willow thicket colony sites. Numbers of nests increased from year to year through the study period, with 350 active in May 1993, 420 in May 1994, and 1540 in April 1995. In 1993, nesting activity was seen from February through August, and both numbers of colonies and numbers of active nests peaked in May. In 1994, nesting activity was seen from March through July, and again, numbers of colonies and active nests peaked in May. In 1995, nesting activity was seen from January to August. Numbers of colonies maintained a peak (of nine) from March through May, and numbers of active nests peaked in April. Thus in 1995, nesting began and peaked earlier, and involved three times as many birds as in the previous years.

This increase in nesting numbers from year to year was not accompanied by increases in overall population estimates within the marsh, however. Population estimates remained pretty stable, in 1993 varying from 2300 to 6500, in 1994 from 1100 to 4100, and in 1995, from 1600 to 6500. Great Egrets were usually most numerous in Stratum II, between Fellsmere Grade and US 192, and usually least numerous in Stratum IV.

Great Blue Heron. Great Blue Herons nested solitarily, in small monospecific tree-island colonies, and in small numbers in large mixed colonies of all types. Nesting activity was first detected in February in 1993, and in January in 1994 and 1995. In 1993 and 1994, nesting was observed through June, and in 1995, through May. Numbers of sites peaked at 8 in February 1993, at 8 in March 1994, and in 1995 at 12 in January and again at 14 in April. Numbers of nests peaked at 31 in March and April 1993, at 49 in March 1994, and at 57 in February 1995. Thus, 1995 saw an increase in numbers, an increase in early nests, and an earlier end to the nesting season. Single nests and colonies of only Great Blue herons tended to be active early each season, and Great Blue Herons in mixed colonies tended to nest later.

Population estimates in the study varied from a low of 60 in June 1994 to 433 in January 1994, but usually fell between 120 and 280. Numbers were usually higher in the winter months, when some northern migrants were present. Great Blue Herons usually were most abundant in Stratum V, and usually least abundant in strata III and IV.

Small white herons. This category includes Snowy Egrets, Cattle Egrets, and juvenile Little Blue Herons, which sometimes cannot be distinguished in the aerial surveys. In the colony surveys, Cattle Egrets and Snowy Egrets can usually be distinguished, but Snowy Egrets nests often cannot be counted if they are mixed in with much more abundant Cattle Egrets.

In 1993 we found Snowy Egrets nesting from April to June, with a peak of 5 colonies in May. In 1994 they were nesting from April through July, with a peak of 7 colonies in June. In 1995 the nested from March through July, with a peak of 8 colonies in April. Peak numbers of nests were 130 in June 1993, 330+ in June 1994, and 1460 in May 1995. Thus this species also nested earlier and in much larger numbers in 1995 than in the previous years. Snowy Egrets usually nested in mixed colonies with several species of wading birds.

Cattle Egrets were by far the most abundant wading birds in the nesting colonies in all three years. They nested from May through August in 1993, occupying 14 colonies in June. In 1994 they nested from April through September, and occupied 10 colonies in June. In 1995 they nested from April through September and occupied 17 colonies in June. Nest counts peaked at 6000 in June 1993, 5000 in June 1994, and 9800 in June 1995. Like the other herons, Cattle Egret numbers were substantially higher in 1995 than in the previous years, but unlike the other species, they did not appear to begin nesting earlier. Cattle Egrets were the most abundant birds in most of the colonies they occupied, and often nested in large single-species colonies. Most colonies were in willow thickets in sawgrass prairies, but they also occupied the borrow pit colonies.

In the systematic surveys, population estimates for small white herons ranged from under 2000 in February 1994 to 42,000 in August 1993. Numbers generally were lowest in the winter surveys and highest in the summer surveys. This pattern reflects changes in species composition. The great majority of Cattle Egrets migrate south of the United States for the winter, and the winter survey estimates are dominated by snowy Egrets and immature Little Blue Herons. Cattle Egrets return in large numbers in March and April each year, but initially most feed outside the study area. In summer, they feed abundantly in the pasturelands within the study area, and dominate the population estimates. Small white herons were usually most abundant in Stratum II, and least Abundant in Stratum IV. In Stratum II, Snowy Egrets and immature Little Blue Herons were most abundant along the channel of the St. Johns River, in the prairie around lake Hell-n-Blazes, and in the re-flooded pastures on the east side of the area, southwest of Palm Bay. Cattle Egrets were most abundant in the improved pastures, particularly west of the St. Johns River channel.

Small dark herons. This category includes Tricolored Herons and adult Little Blue Herons. These birds are often difficult to distinguish from the air, and so are considered

together. Small dark herons were found nesting from April through June in 1993, occupying 5 colonies in June. In 1994 they nested from April through August, and occupied 8 colonies in June. In 1995 they nested from March to June, and were seen in 4 colonies in April and June. Nests were detected in willow thicket, flooded tree island, and borrow pit colonies.

Population estimates for small dark herons ranged from 140 in September 1994 to 2140 in January 1993. They were usually most abundant in strata V and II, and least abundant in Stratum IV.

Wood Stork. Wood Storks nested in three borrow-pit colonies in and near the study area. These were the two colonies along US 192 west of the St. Johns River, and the colony north of Lake Poinsett. In 1993 they were active from March through August, in 1994 from March through July, and in 1995, from February through July. Nest counts peaked at 110 in May 1993, 90 in April 1994, and 296 in May 1995. Thus Wood Storks, like Great Egrets, Snowy Egrets, and Great Blue Herons, nested earlier and in larger numbers in 1995 than previously. Elsewhere in Florida, Wood Storks often nest in swamp forest colonies, and the larger colonies of this type in the study area should be monitored in the future for wood stork activity.

Population estimates for storks ranged from 0 in September 1995 to almost 1300 in June 1994. in most months more wood storks were seen in the agricultural lands near the study area than actually in the marshes, and it appears that drainage ditches in the fields and groves are preferred feeding habitat. This may well be related to the storks' preference for relatively large fish, and hence a need for relatively permanent bodies of water. Wood Storks were usually most numerous in Stratum V and Stratum II, and least numerous in Stratum IV.

White Ibis. White Ibis were found apparently beginning to nest near Lake Hell-n-Blazes in May 1993, but were absent in June. In 1995, a ground party observed a group of 100+ Ibis nests among the 4000 Cattle Egrets in this colony, but this group was not observed from the air, and probably failed early in the nesting attempt. However, White Ibises nested in all three years on spoil islands in the Indian River lagoon, and birds from these colonies probably foraged in the study area.

White ibis population estimates ranged from 200 in August 1994 to almost 24,000 in July 1995. In all three years, White Ibis were most numerous in winter surveys, and became much less common in late spring, then peaked again sometime in summer. The decrease in numbers in spring probably involves migration to colonies further north or elsewhere in Florida, and the summer peaks may be composed of birds dispersing from colonies elsewhere. White Ibis were usually most numerous in Stratum II, and least numerous in Stratum IV. In Stratum II they tended to be most numerous in the prairies near lake Hell-n-Blazes and in the re-flooded pastures on the east side of the area, north of Fellsmere Grade.

Glossy Ibis. Glossy Ibis were not found nesting in the study area in 1993, 1994 or 1995. Population estimates ranged from 0 in August 1994 to 1500 in March 1993. Glossy

Ibis tended to be most numerous in strata II and V.

DISCUSSION AND ASSESSMENT

In the southeastern United States, wetland habitats that support wading birds are very widespread. Few counties exist in the southeastern coastal plain that lack enough habitat to support at least some wading birds. At the same time, the value of any particular site to these birds is likely to vary rapidly and substantially. The abundance and availability of food varies with seasonal and other changes in hydrology, with weather, and with the recent history of feeding pressure by the birds. The whole region can be considered a dynamic mosaic of habitat patches growing and shrinking in size, increasing and decreasing in value, from month to month, and even from day to day. And of course, the habitat quality to different species of wading birds varies separately: a given site may be suitable for Great Blue Herons at one point, and as water levels drop, become more suitable for Great Egrets, then Wood Storks and small herons, then ibis, then dry up and become unsuitable for all species, until it is re-flooded and prey populations have time to recover.

Colonial wading birds respond to this dynamic mosaic by moving around, searching for suitable habitat, exploiting it, and moving on. They may move about over areas several km across in the course of a day of feeding, or may move over distances of tens of km while "resident" in one wetland system such as the St. Johns River marshes, or may make seasonal movements of hundreds of km among wetland systems. Much of this movement is highly variable from year to year, in response to the dynamic changes of the mosaic. The birds are rather nomadic, and their abundance is regionally determined, on all temporal scales.

The abundance of birds in a particular marsh on a given day is not only a function of conditions in that marsh, but of conditions elsewhere in the region. Abundance indicates better conditions locally than elsewhere; rarity locally suggests better conditions elsewhere. Neither by itself speaks very clearly to absolute habitat quality locally. And in the long term, the regional abundance is a function of the overall quality of the habitat mosaic through time. If too many periods exist when habitat quality is fairly low through the region, populations will decline. If habitat quality remains high enough of the time in enough of the region, populations will increase.

The same pattern is evident at smaller scales. The landscape of the St. Johns River Water Management District also can be considered a dynamic mosaic of wading bird habitat. High-quality habitat is most concentrated in the St. Johns River marshes and the coastal lagoon and marsh system, but smaller patches of wetlands are scattered throughout the

district, and the wading birds range widely among these patches, as well as in and out of the district, in response to foraging conditions.

Nesting imposes some constraints on the birds' ability to respond to the mosaic. While nesting, the birds must limit themselves to an area around the colony site defined by the distance they can feasibly commute on daily feeding trips. These distances can be considerable - 10 km or more for small herons, perhaps 80 km for Wood Storks. Even so, to be successful, they must find a place and time where that section of the dynamic mosaic is consistently suitable for the period necessary to complete the nesting cycle (8 - 15 weeks or more, depending on the species). Periods of area-wide food shortage as brief as a few days may be sufficient to doom a nesting attempt and cause colony abandonment.

One fairly predictable seasonal pattern is imposed on the nomadic movements of the birds. The northern portions of the region (southeastern United States) typically are not very good wading bird habitat in winter, and the bulk of the populations move south at that time. Most of the United States' Wood Stork population winters in central and south Florida. Substantial numbers of small herons, including the majority of eastern Cattle Egrets, migrate south to Cuba and even South America. The bulk of the US populations of White Ibis winter in Florida, and a substantial fraction migrate south to Cuba and perhaps beyond. This pattern of White Ibis movements evident in the population estimates from the systematic surveys. Each year, White Ibis numbers dropped substantially between the March and April surveys, the same period when large numbers of ibis appear in Georgia and the Carolinas.

As winter progresses and spring begins, the wading birds in Florida decide whether conditions appear suitable for nesting, or not. If conditions are good enough, many remain to breed. If not, most move north in hopes of finding better conditions in Georgia, the Carolinas, or elsewhere. The conditions necessary to promote breeding include adequate food availability, adequate and adequately protected nesting sites, freedom from persecution, and perhaps social stimulation. Management to enhance breeding populations of these birds should be directed at assuring these factors. Marsh management can influence productivity of the birds' prey, and vegetation management can influence the availability of the prey to the birds. Protection and management of nest sites can be very effective in enhancing wading bird populations.

It is apparent from examining the numbers of birds nesting and feeding in the study area, that for several species, a majority of the birds breeding in the area are feeding outside the boundaries of the study area. On most surveys, more Wood Storks were seen in agricultural lands east of the survey area, then in the marsh itself. Cattle Egrets nested in large numbers in the marshes, and foraged throughout the region. Thus, the study area provides nesting for birds using a wider area, probably including much of Brevard and Indian River counties.

This study found more colonies and many more birds nesting in the southern strata of the study area than the northern ones (Table 6). The relative scarcity of colonies and birds in the north may be related to land uses and topography outside the study area, rather than conditions within the marsh itself. The landscape surrounding the northern strata is more wooded, and more urban, and also is closer to the Indian River Lagoon (which has many

colony sites) than the southern strata.

Management Recommendations. The results of this study suggest a number of opportunities to integrate management for wading birds into overall management of the Upper St. Johns River marshes. It must be remembered that these marshes are just a part of the larger mosaic, and the birds' responses will be to regional conditions, and not just to the conditions of the areas affected by local management activities. Most of the recommendations here are for actions already contemplated or undertaken by district staff: the current management efforts appear to be aimed in the correct directions. Several opportunities exist for maintaining or improving nesting habitat in the marsh system, and elsewhere in the District as well.

First, islands in borrow pits are very important as nesting sites. The colonies using these sites were among the most diverse found, and all the Wood Storks found nesting in the study used borrow pit sites. Existing borrow-pit colonies need protection from disturbance, and new borrow pits should be designed with islands left (or constructed) to provide new colony sites.

Second, care given to water levels in the marshes during the nesting season can improve nesting intensity and success. Wading bird colonies in Florida depend on water surrounding them or beneath the nesting trees to discourage mammalian predators (especially raccoons). Thus management to maintain adequate water levels under willows through the nesting season (January - July) will greatly benefit the birds. Naturally, this will not be feasible (or necessary) for all sites in all years, but when it can be done, the birds will benefit substantially. When it becomes necessary to draw down areas of the marsh for other management objectives, doing so in discrete units will have smaller effects than doing so system-wide.

Third, a number of tree-islands in the system have been killed by flooding, particularly in the impounded water-storage units. These tend to provide good colony sites for a few years, until the dead trees decay and fall. In areas designated as reservoirs, construction of artificial islands would provide replacement colony sites.

Fourth, the three major colony sites in the canopies of swamp forests are extremely important and need continued protection. These are the sites in the Ft. Drum Creek swamp forest (Colony no. 29), in the forest on the margin of Blue Cypress Lake (no. 17), and in the Jane Green creek swamp forest (no. 44). Number 17 was active but small in 1993 and 1994, and quite large in 1995. Number 29 was active in 1994 and 1995, and much larger in the latter year. Number 44 was active only in 1995. All three were large and apparently very successful in 1995. These colonies contained only Great Egrets and Great Blue Herons, but the sites are very similar to those of many of the traditional Wood Stork colonies in Florida. If these colonies continue to prosper, eventual nesting by Wood Storks is likely. Proper management of these sites will include protection from excessive disturbance (including logging) and maintenance of suitable hydrology. Suitable hydrology will include flooding during the nesting season to prevent access by raccoons, but hydroperiods short enough to avoid drowning the trees.

Opportunities also exist for improving foraging habitat for wading birds in the study area and surrounding region.

First, the ongoing marsh restoration efforts in the Upper Basin in southern Brevard County appear already to be re-creating foraging habitat. Several tracts in this area supported far more birds in the 1995 surveys than in the previous two years. It is not clear how much of this difference is due to differences in weather, but probably the restoration project has made a major contribution.

Second, many of the birds nesting in the marsh feed in small wetlands in the surrounding landscape, and protection of these wetlands remains critical. Restoring and enhancing the river marshes will benefit the birds, but will not replace the contribution of the isolated marshes to their food supply.

Third, management of marsh vegetation can improve foraging habitat. In general, these birds prefer more oligotrophic systems with relatively open vegetation. Prescribed fires can be useful to thin excessively dense vegetation, and plant communities can be managed through manipulation of water depth and hydroperiod. More importantly, control of excessive nutrient loading will benefit the birds by its effects on vegetation community structure. More eutrophic marshes tend to be less useful to wading birds in Florida's subtropical environment than more oligotrophic marshes, for two reasons. First, vegetation typically is more dense in eutrophic marshes, and physically interferes with foraging. Second, in this climate, episodes of anoxia that kill fish and other prey are much more common in eutrophic marshes. In particular, conversion of sawgrass marshes to cattail marshes should be avoided.

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APPENDIX I

SURVEY DOCUMENTATION

Table I-1. Wading bird survey dates in the upper St. Johns River marshes, 1993 - 1995.

SYSTEMATIC SURVEY DATES	COLONY SURVEY DATES
10-11 JANUARY 1993	11 JANUARY 1993
11-12 FEBRUARY 1993	10 FEBRUARY 1993
8-9 MARCH 1993	9 MARCH 1993
5-6 APRIL 1993	6 APRIL 1993
6-7 MAY 1993	7 MAY 1993
15-16 JUNE 1993	16 JUNE 1993
9-10 AUGUST 1993	10 AUGUST 1993
8-9 SEPTEMBER 1993	9 SEPTEMBER 1993
24-25 JANUARY 1994	25 JANUARY 1994
19-20 FEBRUARY 1994	19-20 FEBRUARY 1994
12-13 MARCH 1994	13 MARCH 1994
16-17 APRIL 1994	17 APRIL 1994
7-8 MAY 1994	8 MAY 1994
18-19 JUNE 1994	19 JUNE 1994
23-24 JULY 1994	24 JULY 1994
17 AUGUST 1994	16 AUGUST 1994
9-10 SEPTEMBER 1994	10 SEPTEMBER 1994
21-22 JANUARY 1995	22 JANUARY 1995
25-26 FEBRUARY 1995	26 FEBRUARY 1995
25-26 MARCH 1995	26 MARCH 1995
22-23 APRIL 1995	23 APRIL 1995
20-21 MAY 1995	21 MAY 1995
17-18 JUNE 1995	18 JUNE 1995

15-16 JULY 1995	16 JULY 1995
17-18 AUGUST 1995	18 AUGUST 1995
16-17 SEPTEMBER 1995	17 SEPTEMBER 1995

Table I-2. Latitudes, lengths, and spacing of transects

TRANSECT	LATITUDE	SPACING	LENGTH
11	27° 33.90′	---	9.1
12	27° 34.74′	0.96′	9.1
13	27° 35.70′	0.96′	9.8
14	27° 36.76′	1.06′	9.8
15	27° 37.79′	1.03′	9.9
16	27° 39.27′	1.48′	11.5
17	27° 40.76′	1.49′	18.9
18	27° 41.51′	0.75′	19.1
19	27° 42.81′	1.30′	6.6
20	27° 44.06′	1.25′	8.4
21	27° 45.23′	1.07′	8.3
22	27° 46.30′	1.08′	8.7
23	27° 47.38′	1.08′	9.1
24	27° 48.50′	1.12′	9.8
25	27° 49.87′	1.37′	10.9
26	27° 51.01′	1.14′	10.2
27	27° 51.73′	1.68′	10.3
28	27° 53.41′	1.68′	10.3
29	27° 54.85′	1.44′	11.0
30	27° 56.05′	1.20′	11.9
31	27° 56.95′	0.90′	11.1
32	27° 57.79′	0.84′	10.9
33	27° 59.00′	1.21′	8.5
34	28° 00.38′	1.38′	7.5
35	28° 01.79′	1.41′	9.6
36	28° 02.58′	0.79′	10.3

37	28° 03.73′	1.15′	7.4
38	28° 04.66′	0.93′	7.7
39	28° 05.60′	0.94′	6.4
40	28° 06.18′	0.58′	6.2
41	28° 07.09′	0.91′	9.3
42	28° 08.02′	0.93′	10.0
43	28° 09.44′	1.42′	9.5
44	28° 10.36′	0.92′	13.9
45	28° 11.39′	1.03′	11.9
46	28° 12.64′	1.25′	3.6
47	28° 14.08′	1.44′	7.0
48	28° 15.40′	1.32′	3.4
49	28° 16.60′	1.20′	3.8
50	28° 17.71′	1.11′	7.2
51	28° 18.81′	1.10′	11.5
52	28° 19.68′	0.87′	11.6
53	28° 20.70′	1.08′	11.7
54	28° 21.74′	1.18′	5.8
55	28° 23.45	1.51′	4.8
56	28° 25.08′	1.63′	5.3
57	28° 26.10′	1.02′	8.3
58	28° 27.00′	0.72′	8.8
59	28° 28.07′	1.25′	7.4
60	28° 29.27′	1.20′	6.6
61	28° 30.37′	1.10′	8.4
62	28° 31.48′	1.11′	11.7
63	28° 32.77′	1.29′	12.0
64	28° 33.89′	1.12′	11.8

65	28° 34.94′	1.05′	12.3
66	28° 36.07′	1.13′	13.9
67	28° 37.15′	1.08′	13.8
68	28° 38.15′	1.00′	13.5
69	28° 39.35′	1.20′	11.8
70	28° 40.69′	1.34′	7.4
71	28° 41.66′	0.97′	8.9
72	28° 42.73′	1.07′	6.4
Total = 62	--	1° 8.95′	591.6
		1.11	9.54

APPENDIX II

COLONY DESCRIPTIONS

This appendix provides brief descriptions of the colony sites. Occupancy is detailed, month by month. The colony sites are presented in the order they were located.

Colonies located in 1993:

1. Location: 28°10.14'N, 80°47.38'W. This is a group of Great Blue Heron nests occupying a clump of bald cypress trees just west of the main channel of the St. Johns River, downstream of Lake Washington.

   1993 status: active February- June; maximum 8 Great Blue Heron nests.

   1994 status: active March and April, maximum 4 nests.

   1995 status: active January through April, maximum 10 nests.

2. Location: 28°23.47'N, 80°53.19'W. This was a single Great Blue Heron nest in a lone cypress tree.

   1993 Status: Active 10 February; 9 March the nest appeared empty.

   1994 Status: not located.

   1995 Status: not located.

3. Location: 28°11.32'N, 80°49.05'W. This was a single Great Blue Heron nest in a willow thicket.

   1993 Status: active 10 February; not relocated.

   1994 Status: not located.

   1995 Status: not located.

4. Location: 28°06.05'N, 80°46.43'W. This is a well-known traditional site, in a borrow pit southwest of Lake Washington, north of Highway 192.

   1993 Status: Active February - August, included Great Blue Herons, Great Egrets, Wood Storks, Cattle Egrets, Snowy Egrets; totals 500+ nests.

   1994 Status: Active March - September, maximum 60 Wood Stork, 200 Great Egret, 7 Great Blue Heron, 2000 Cattle Egret nests, Snowy Egrets, Little Blue Herons, and Tricolored Herons nesting.

   1995 Status: Active January through August, maximum 180 Wood Stork nests, 350 great Egret nests, 3 Great Blue Heron nests, 1000 small white heron nests (including at least 400 Snowy Egret nests), Tricolored Herons present.

5. Location: 28°32.86'N, 80°58.0'W. Single Great Blue Heron nest, in cypress tree in a strand just west of the St. Johns River marshes.

   1993 Status: located February.

   1994 Status: no activity.

   1995 Status: no activity.

6. Location: 28°17.32'N, 80°45.02'W. 1993 Status: Colony occupies two islands in a borrow pit along Interstate 95 just south of Rockledge.

   1993 Status: Active February-August. Total near 500 nests, mostly Cattle Egrets, also Great Egrets, Great Blue Herons. Snowy Egrets and Little Blue herons present, nesting not confirmed.

   1994 Status: Active January - July, maximum 1300 Cattle Egret, 7 Great Blue Heron, Great Egrets, Little Blue Herons present. Between The July and August surveys, most of the vegetation was cleared from the islands.

   1995 Status: no activity.

7. Location: 27°39.27'N, 80°44.83'W. Single Great Blue Heron nest in a wax-myrtle bush between SR 60 and Blue Cypress Lake.

   1993 Status: Active February 1993, not relocated subsequently.

   1994 Status: not located.

   1995 Status: not located.

8. Location: 27°39.11'N, 80°40.16'W. Flooded cypress dome in the Blue Cypress Water Management Area (West).

1993 status: active February-April; maximum 4 Great Blue Heron nests.

1994 Status: Active February-April; maximum 13 Great Blue Heron nests.

1995 Status: Active January - April; maximum 15 Great Blue Heron nests.

9. Location: 27°36.38'N, 80°40.03'W. Colony occupied several drowned tree islands in a private impoundment on the eastern boundary of the study area, south of SR 60.

   1993 Status: Active April-June; included Great Egrets and Cattle Egrets, maximum 80 nests.

   1994 Status: Active April-September, maximum 24 Great Egret, 230 Cattle Egret nests, Little Blue Herons present.

   1995 Status: Active January -July; maximum 1 Great Blue Heron nest, 47 Great Egret nests, 60 Cattle Egret nests, Little Blue herons present.

10. Location: 27°40.31'N, 80°35.32'W. Silver Spring colony site, in the Blue Cypress Water Management Area, East unit.

    1993 Status: Active March-June; included Great Blue Herons, Great Egrets, Cattle Egrets, Little Blue Herons. Maximum 625 nests.

    1994 Status: active February - September; maximum 6 Great Blue Heron, 150 Great Egret, 550 Cattle Egret, 200 Snowy Egret, 25 small dark heron nests.

    1995 Status: Active January - September; maximum 15 Great Blue Heron nests, 80 Great Egret nests, 20 Snowy Egret nests, 500 Cattle Egret nests, Little Blue Herons present.

11. Location: 27°47.23'N, 80°44.27'W. Great Blue Heron colony in a drowned tree island on the western edge of the St. Johns Water Management Area, just south of the S-96 structures.

    1993 Status: Active March-June, maximum 16 nests.

    1994 status: active January - May; maximum 11 Great Blue Heron nests.

    1995 Status: Active January - May; maximum 4 Great Blue Heron nests.

12. Location: 28°21.56'N, 80°48.53'W. Colony occupies a group of small islands in a borrow pit north of SR 520, north of Lake Poinsett.

    1993 status: Active March-August 1993, included Great Egrets, Wood Storks; Snowy Egrets, and Tricolored and Little Blue herons were present.

1994 Status: active March - August; maxima 30 Wood Stork, 100+ Great Egret, 400 small white heron, 1 Great Blue Heron nests.

1995 Status: active February - August; maximum 150 Great Egret nests, 100 Wood Stork nests, 70 Snowy Egret nests, Little Blue Herons present.

13. Location: 28°10.14'N, 80°44.07'W. Colony of small herons in willow clumps in a pond just east of the north end of Lake Washington.

    1993 Status: Active May-June; included Snowy Egrets and small dark herons (both Tricolored and Little Blue herons were present). Maximum 80 nests.

    1994 Status: no activity.

    1995 Status: no activity.

14. Location: 28°04.02'N, 80°47.02'W. Large Cattle Egret colony in willow thickets on a sort of peninsula extending into the south side of Sawgrass Lake, just east of the mouth of the St. Johns River.

    1993 Status: Active May-August; maximum 1200 Cattle Egret nests, Snowy Egrets and Tricolored Herons seen in the colony but nesting not confirmed.

    1994 Status: no activity.

    1995 Status: no activity.

15. Location: 28°00.42'N, 80°47.47'W. Large Cattle Egret colony in willow thickets just south of Lake Hell-n-Blazes.

    1993 Status: Active May-August; had Cattle Egrets, Great Egrets. Little Blue Herons, Tricolored Herons and Snowy Egrets present. White Ibises appeared to be initiating nests in May, but were gone by June. Maximum 1100+ nests.

    1994 Status: no activity.

    1995 Status: Active April - August; maximum 4000 Cattle Egret nests (NOTE: 100+ White Ibises seen on nests by ground party).

16. Location: 27°53.42'N, 80°47.02'W. Heron colony occupying a long, narrow strip of willow thicket that paralleled the channelized course of the St. Johns River through the St. Johns Marsh Conservation Area.

    1993 Status: Active May-August, contained Cattle Egrets, Snowy Egrets, Great Egrets; White Ibis, Tricolored Herons, and Little Blue Herons were present (nesting unlikely for ibis). Maximum 1200+ nests.

1994 Status: no activity.

1995 Status: no activity.

17. Location: 27°43.58'N, 80°46.45'W. Heron colony in a gap in the closed-canopy cypress swamp on the west side of Blue Cypress Lake.

    1993 status: Active May-June; 30 Great Egret, 2 Great Blue Heron nests.

    1994 status: active March-June; 1 Great Blue Heron, 35 Great Egret nests.

    1995 Status: Active January - June: maximum 5 Great Blue Heron nests, 150+ Great Egret nests.

18. Location: 27°40.76'N, 80°42.19'W. Cattle Egret colony in a willow thicket in the brushy prairie southeast of Blue Cypress Lake, north of State Road 60.

    1993 Status: Active May-June 1993, maximum 350 nests.

    1994 Status: Active April - June; maximum 1 Great Egret nest, 20 Little Blue Heron nests, 50 Snowy Egret nests, Tricolored Herons present.

    1995 Status: Active April - July; maximum 600 Cattle Egret nests, Little Blue Herons present.

19. Location: 27°39.16'N, 80°41.97'W. Cattle Egret colony in a willow thicket in the brushy prairie southeast of Blue Cypress Lake, north of State Road 60.

    1993 Status: Active May-June 1993; maximum 500 Cattle Egret nests. A few Snowy Egrets and Little Blue Herons present.

    1994 Status: Active April - July; 300 Cattle Egret nests, Great Egrets, White Ibis, Snowy Egrets, and Glossy Ibis present in small numbers but not seen nesting.

    1995 Status: Active April - June; Maximum 35 Little Blue Heron nests.

20. Location: 28°26.46'N, 80°53.54'W. Cattle Egret colony in a willow thicket between two channels of the St. Johns River, just south of SR 528.

    1993 Status: Active June-August; maximum 60 Cattle Egret nests. Great Egrets and cormorants were also present in the colony.

    1994 status: no activity.

    1995 Status: Active March (20 Snowy Egrets on territory), May - August; maximum 250 Cattle Egret nests.

21. Location: 28°08.07'N, 80°45.19'W. Cattle Egret colony in the extensive band of willow thickets along the west bank of Lake Washington.

    1993 Status: Active June-August; maximum 800 nests.

    1994 Status: no activity.

    1995 Status: Active June, with 200 Cattle Egret nests; site shifted a few hundred feet west, to: 28°08.02'N, 80°45.50'W. Only 25-30 Cattle Egrets present in July, indicating failure.

22. Location: 27°41.22'N, 80°43.50'W. Cattle Egret colony in a willow thicket in the brushy prairie southeast of Blue Cypress Lake, north of State Road 60.

    1993 Status: Active June-August: maximum 40 Cattle Egret nests.

    1994 Status: no activity.

    1995 Status: no activity.

23. Location: 27°40.95'N, 80°43.45'W. Cattle Egret colony in a willow thicket in the brushy prairie southeast of Blue Cypress Lake, north of State Road 60.

    1993 Status: Active June; maximum 100 Cattle Egret nests.

    1994 Status: no activity.

    1995 Status: no activity.

24. Location: 27°39.86'N, 80°42.02'W. Cattle Egret colony in a willow thicket in the brushy prairie southeast of Blue Cypress Lake, north of State Road 60.

1993 Status: Active June 1993; maximum 120 Cattle Egret nests, and Little Blue Herons were present.

1994 status: Active April - June; maximum 25 Little Blue Heron nests, 1 Tricolored Heron nest, 20 Snowy Egret nests.

1995 Status: no activity.

Colonies first located in 1994:

25: Location: 27°35.70'N, 80°40.20'W. This is a single Great Blue heron nest in a wax-myrtle bush.

1994 status: located January, not relocated.

1995 Status: not relocated.

26: Location: 27°42.81'N, 80°38.96'W. This is a single Great Blue heron nest in a cypress tree.

1994 Status: located February, not relocated.

1995 Status: not relocated.

27: Location: 27°36.76'N, 80°40.28'W. This is a single Great Blue heron nest in a shrub in prairie habitat.

1994 Status: located February; not relocated.

1995 Status: not relocated.

28: Location: 27°41.28'N, 80°37.76'W. This is a single Great Blue heron nest in a shrub in prairie habitat.

1994 status: located March; not relocated.

1995 Status: not relocated.

29: Location: 27°36.31'N, 80°43.12'W. This colony occupies a closed-canopy cypress swamp, part of the swamp forest along Ft. Drum creek.

1994 status: active March - June; maximum 100 Great Egret nests.

1995 Status: Active January - June; maximum 6 Great Blue Heron nests, 450+ Great Egret nests.

30: Location: 28°05.21'N, 80°49.14'W. This is a well-known traditional site in a borrow pit along Highway 192.

1993 Status: not censused because it was considered too far outside the study area, but active, with Great Egrets, Cattle Egrets, Wood Storks, and likely other species.

1994 Status: We expanded the study area in this area, and censused the colony. Active March - July; maximum 1 Great Egret nest, 100+ Cattle Egret nests.

1995 Status: Active February - July 1995; maximum 16 Wood Stork nests, 10 Great Egret nests, 100 small white heron nests (incl. 60+ Cattle Egret nests).

31. Location: 28°41.50'N, 80°56.40'W. In willow thicket in gap in pine flatwoods east of Buck Lake.

1994 Status: active April - July; maximum 350 Cattle Egret nests, 20 Little Blue Herons, 50 Snowy Egrets nests, 15 Tricolored Heron nests.

1995 Status: Active March - July; maximum 1200 small white heron nests (majority are Snowy Egrets but Cattle Egrets also present), 100 Little Blue Heron nests, Little Blue Herons, Tricolored Herons, Black-crowned Night-Herons all present.

32. Location: 28°31.50'N, 80°56.21'W. Great Blue Heron colony in dead cypress trees in center of a cypress dome west of the St. Johns River.

1994 Status: active April - May; 5 active Great Blue Heron nests.

1995 Status: Active - April; maximum 3 Great Blue Heron nests.

33. Location: 27°48.15'N, 80°46.01'W. Located in an extensive willow thicket west of the St. Johns Water Management Area.

    1994 Status: Active May - June: When found, contained 200 Cattle Egret nests, 40+ small dark heron nests (Both Little Blue Herons and Tricolored Herons were nesting), and Snowy Egrets were present. In June, had 2 Little Blue Heron nests, 30 nests unattended, many with eggs.

    1995 Status: no activity.

34. Location: 27°47.33'N, 80°45.34'W. Located in willow thickets on the edge of a small rectangular borrow pit, adjacent to improved pasture.

    1994 Status: Active May - June; when found, it contained 120 Cattle Egret nests, and 40+ small dark heron nests.

    1995 Status: no activity.

35. Location: 27°33.41'N, 80°44.58'W. Located on brushy island in a shallow pond just north of the Florida Turnpike.

    1994 Status: Active June. When discovered, contained 2 nests of Little Blue Herons and 15 of small white herons.

    1995 Status: Active March - July; maximum 5 Great Blue Heron nests, 45 Cattle Egret nests.

36. Location: 27°40.24'N, 80°45.54'W. Located in a willow clump in brushy prairie south of Blue Cypress Lake.

    1994 status: Active June; 200 Cattle Egret nests.

    1995 Status: Active April - August; maximum 500 Cattle Egret nests, 10 Great Egret nests.

37. Location: 28°39.05'N, 80°57.45'W. Located in a willow thicket in an area of grassy marsh between two stands of slash pine.
    1994 status: active July - September; maximum 400 Cattle Egret nests.

    1995 Status: no activity.

Colonies first located in 1995:

38. Location 28°18.61'N, 80°48.37'W. Single Great Blue Heron nest in willow clump. Located January, not relocated.

39. Location 28°16.22'N, 80°50.39'W. Single Great Blue Heron nest in willow clump. Located January, not relocated.

40. Location 27°36.94'N, 80°40.00'W. 2 Great Blue Heron nests in cypress clump in private reservoir. Located January, active through April.

41. Location 27°54.54'N, 80°48.02'W. Clump of willows in the center of a round depression in a pasture. Active February - July; maximum 30 Snowy Egret nests, Little Blue Herons present. Also contained 15 Black-crowned Night-Heron nests.

42. Location 28°21.72'N, 80°50.15'W. 2 Great Blue Heron nests in willow thicket off Lake Poinsett. Located in February, not relocated.

43. Location 28°19.14'N, 80°48.34'W. Located in willow thickets at south end of Lake Poinsett. Active February through July; maximum 200 Cattle Egret nests, 100 Snowy Egret nests, 15 Great Egret nests, 4 Great Blue Heron nests.

44. Location 28°02.27'N, 80°48.86'W. Large colony in the crowns of cypress trees in strand of Jane Green Creek (or branch) just west of the study area, southwest of Sawgrass Lake. Active March - June; maximum 400 Great Egret nests.

45. Location 27°55.68'N, 80°48.20'W. Colony in willow clumps near the confluence of an east-west ditch coming from the west, and the channelized course of the St. Johns River, approx. 2.2 miles due north of colony 16. Active March - May, maximum 55 Snowy Egret nests, Little Blue Herons present.

46. Location approx. 27°55.00'N, 80°46.80'W. Located in March, failed before April survey. Single Great Blue Heron nest in compact clump of maples and bays, east side of river marsh. 6 Great Egrets, 10 Snowy Egrets in trees, nests not seen.

47. Location 27°48.00'N, 80°47.45'W. Colony in cypress clumps in an area formerly of pasture, now flooded all spring. Active March - April, maximum 5 Great Blue Heron nests, but 20+ cormorant nests and some Anhingas also nested, and the latter were active through June.

48. Location 27°39.66'N, 80°39.25'W. Colony in cypress clump in impoundment. Active March - April; 3 Great Blue Heron nests.

49. Location 28°25.74'N, 80°54.70'W. Colony in Cypress Strand just west of St. Johns River marshes. Located in April, with large young present, 9 Great Blue heron nests. Nesting apparently complete by May.

50. Location 28°28.07'N, 80°53.50'W. Colony in big Live Oak tree between channels of the St. Johns River. 3 Great Blue Heron nests. Active April and May.

51. Location 28°32.77'N, 80°57.71'W. Colony in Cypress forest at west edge of study area. 4 Great Blue heron nests. Located in April, canopy closed over the site before the May survey.

52. Location 27°51.90'N, 80°47.89'W. Colony in willow thicket between 2 east-west ditches. 600 Cattle Egret nests. Located April, abandoned by May survey.

53. Location 27°51.90'N, 80°48.10'W. Colony in willow thicket between 2 east-west ditches. Located April, active through June, maximum 250 Cattle Egret nests.

54. Location 28°04'N, 80°48'W. Colony on willows on island at upper end of Sawgrass Lake (near site of colony 14). Active April - July; maximum 50 Cattle Egret nests.

55. Location 28°12.42'N, 80°50.68'W. Colony in willow thickets on west side of St. Johns River below Lake Washington. Active May - August; maximum 2500 Cattle Egret nests, Snowy Egrets and Little Blue Herons present.

56. Location 27°40.40'N, 80°38.80'W. Colony in willow thicket along flooded fencerow in impounded area. (thicket oriented north-south). Active May - August; maximum 300 Cattle Egret nests.

57. Location 28°00.86'N, 80°47.71'W. Colony on tiny island in Lake Hell-n-Blazes. Active June - August; maximum 120 Cattle Egret nests.

58. Location 27°48.50'N, 80°44.91'W. Colony in willow thicket west of the St. Johns Water Management Area. Found June, with 45 Little Blue Heron nests, with large young, no activity in July.

59. Location 27°41.10'N, 80°35.32'W. Colony in brushy fencerow north of Silver Springs colony: Located July with 180 Little Blue Heron fledglings, site was empty in August.

APPENDIX III

POPULATION ESTIMATES

Table III-1. Population estimates from systematic surveys, January 1993.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	280.	746.67	980.	840.	3673.33	6520.	2606-10434
Great Blue Heron	53.33	40.	33.33	40.	86.67	253.33	184-323
Small dark herons	700.	513.33	460.	66.67	400.	2140.	1086-3194
Small white herons	1026.67	1620.	1513.33	1313.33	1106.67	6580.	4921-8239
Wood Stork	6.67	40.	20.	106.67	20.	193.33	61-325
White Ibis	180.	2553.33	3086.67	2466.67	6633.33	14920.	9595-20245
Glossy Ibis	0.	1166.67	0.	26.67	126.67	1320.	261-2379
All species combined	2246.67	6680.	6093.33	4860.	12046.67	31926.67	23265-40588

Table III-2. Population estimates from systematic surveys, February 1993.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	820.	700.	933.33	553.33	926.67	3933.33	3349-4517
Great Blue Heron	106.67	33.33	26.67	46.67	53.33	266.67	193-341
Small dark herons	80.	133.33	80.	26.67	446.67	766.67	454-1079
Small white herons	593.33	1406.67	1906.67	773.33	1106.67	5786.67	4396-7178
Wood Stork	0.	20.	13.33	0.	93.33	126.67	35-218
White Ibis	1020.	3466.67	1033.33	1006.67	4053.33	10580.	6576-14584
Glossy Ibis	106.67	773.33	106.67	26.67	113.33	1126.67	239-2014
All species combined	2726.67	6533.33	4100.	2433.33	6793.33	22586.67	17364-27809

Table III-3. Population estimates from systematic surveys, March 1993.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	906.67	1200.	566.67	473.33	513.33	3660.	3053-4267
Great Blue Heron	46.67	26.67	6.67	53.33	53.33	186.67	118-256
Small dark herons	93.33	206.67	33.33	53.33	106.67	493.33	307-680
Small white herons	2920.	3713.33	693.33	933.33	633.33	8893.33	5653-12134
Wood Stork	13.33	80.	6.67	13.33	13.33	126.67	67-186
White Ibis	5886.67	3113.33	1273.33	1706.67	1880.	13860.	8936-18784
Glossy Ibis	600.	740.	193.33	0.	40.	1573.33	918-2229
All species combined	10466.67	9080.	2773.33	3233.33	3240.	28793.33	22074-35513

Table III-4. Population estimates from systematic surveys, April 1993.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	1033.33	826.67	346.67	400.	633.33	3240.	2366-4114
Great Blue Heron	40.	6.67	13.33	20.	80.	160.	114-206
Small dark herons	26.67	153.33	6.67	0.	86.67	273.33	71-476
Small white herons	2300.	3100.	273.33	466.67	680.	6820.	4293-9347
Wood Stork	0.	20.	26.67	13.33	20.	80.	40-120
White Ibis	493.33	953.33	913.33	406.67	553.33	3320.	2309-4331
Glossy Ibis	233.33	6.67	26.67	0.	213.33	480.	116-843
All species combined	4126.67	5066.67	1606.67	1306.67	2266.67	14373.33	11079-17668

Table III-5. Population estimates from systematic surveys, May 1993.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	520.	880.	120.	180.	680.	2380.	1826-2934
Great Blue Heron	13.33	20.	0.	20.	73.33	126.67	79-174
Small dark herons	6.67	80.	346.67	266.67	253.33	953.33	331-1575
Small white herons	2920.	2273.33	480.	700.	973.33	7346.67	4899-9794
Wood Stork	66.67	6.67	0.	0.	40.	113.33	19-208
White Ibis	200.	146.67	140.	26.67	386.67	900.	565-1235
Glossy Ibis	240.	0.	6.67	0.	46.67	293.33	36-551
All species combined	3966.67	3406.67	1093.33	1193.33	2453.33	12113.33	9328-14899

Table III-6. Population estimates from systematic surveys, June 1993.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	873.33	2440.00	1100.	160.	713.33	5286.67	3174-7399
Great Blue Heron	66.67	6.67	13.33	0.	80.	166.67	107-226
Small dark herons	66.67	133.33	26.67	26.67	86.67	340.	238-442
Small white herons	1693.33	5473.33	1480.	713.33	713.33	10033.33	7060-13006
Wood Stork	20.00	146.67	66.67	0.	6.67	240.	29-451
White Ibis	853.33	3906.67	426.67	6.67	866.67	6060.	4036-8084
Glossy Ibis	13.33	246.67	0.	0.	40.	300.	(-36)-636
All species combined	3586.67	12353.33	3113.33	866.67	2506.67	22426.67	16970-27883

Table III-7. Population estimates from systematic surveys, August 1993.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	3226.67	1353.33	540.	286.67	760.	6166.67	2435-9898
Great Blue Heron	0.	20.	20.	33.33	53.33	126.67	80-173
Small dark herons	260.	226.67	40.	13.33	266.67	806.67	368-1246
Small white herons	17353.33	10206.67	5360.	926.67	9066.67	42913.33	24033-61794
Wood Stork	6.67	146.67	0.	0.	500.	653.33	107-1200
White Ibis	4626.67	1273.33	1760.	620.	3700.	11980.	8743-15217
Glossy Ibis	200.	0.	0.	0.	260.	460.	22-898
All species combined	25673.33	13226.67	7720.	1880.	14606.67	63106.67	43415-82798

Table III-8. Population estimates from systematic surveys, September 1993.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	660.	473.33	213.33	126.67	126.67	2600.	2009-3191
Great Blue Heron	20.	26.67	6.67	13.33	86.67	153.33	94-213
Small dark herons	13.33	33.33	46.67	13.33	120.	226.67	163-291
Small white herons	7366.67	17606.67	5106.67	2286.67	4893.33	37260.	17730-56790
Wood Stork	0.	46.67	6.67	0.	40.	93.33	23-164
White Ibis	106.67	4360.	260.	40.	686.67	5453.33	1635-9272
Glossy Ibis	6.67	26.67	0.	0.	0.	33.33	(-6)-72
All species combined	8173.33	22573.33	5640.	2480.	6953.33	45820.	22972-68668

Table III-9. Population estimates from systematic surveys, January 1994.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	487	593	140	180	533	1933	1540-2326
Great Blue Heron	173	47	60	67	87	433	291-575
Small dark herons	87	93	227	273	593	1273	790-1756
Small white herons	1413	933	640	153	1353	4493	3338-5648
Wood Stork	0	127	13	7	113	260	74-445
White Ibis	4927	2093	87	60	1447	8613	2860-14366
Glossy Ibis	67	73	0	13	0	153	22-285
All species combined	7153	3960	1167	753	4127	17160	11106-23214

Table III-10. Population estimates from systematic surveys, February 1994.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	807	567	200	100	420	2093	1709-2478
Great Blue Heron	80	27	33	27	33	200	143-257
Small dark herons	33	20	0	7	127	187	93-280
Small white herons	393	700	300	313	280	1987	1417-2556
Wood Stork	133	140	0	0	13	287	98-476
White Ibis	1600	10593	800	273	4967	18233	8536-27930
Glossy Ibis	0	0	87	0	7	93	5-181
All species combined	3046	12047	1420	720	5487	23080	13164-32996

Table III-11. Population estimates from systematic surveys, March 1994.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	1513	1486	473	140	480	4093	3099-5087
Great Blue Heron	60	60	53	40	93	307	217-397
Small dark herons	147	33	7	27	33	247	77-416
Small white herons	1893	1087	893	433	513	4820	3382-6258
Wood Stork	80	40	20	7	107	253	79-427
White Ibis	1413	6506	27	247	680	8873	4309-13438
Glossy Ibis	0	40	0	33	47	120	28-212
All species combined	5107	9253	1473	927	1953	18713	12546-24880

Table III-12. Population estimates from systematic surveys, April 1994.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	720	1427	133	180	920	3380	2666-4094
Great Blue Heron	27	47	13	13	113	213	152-274
Small dark herons	67	20	0	47	93	227	152-301
Small white herons	873	1407	3353	127	2153	7913	3892-11935
Wood Stork	0	40	73	13	40	167	94-240
White Ibis	1667	713	7	80	87	2553	847-4260
Glossy Ibis	13	0	0	7	333	353	118-588
All species combined	3367	3653	3580	467	3740	14807	10257-19356

Table III-13. Population estimates from systematic surveys, May 1994.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	1000	1080	87	87	473	2727	1623-3830
Great Blue Heron	33	13	67	20	127	260	161-358
Small dark herons	0	60	27	0	160	247	111-381
Small white herons	1940	1793	5760	100	907	10500	4547-16453
Wood Stork	20	120	7	0	33	180	60-300
White Ibis	127	773	47	13	47	1007	422-1591
Glossy Ibis	0	13	7	0	0	20	3-41
All species combined	3120	3853	6000	220	1747	14940	8854-21026

Table III-14. Population estimates from systematic surveys, June 1994.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	460	1080	67	80	1707	3393	1284-4963
Great Blue Heron	27	0	0	0	33	60	30-90
Small dark herons	20	120	40	0	40	220	103-337
Small white herons	3327	6473	7267	600	2373	20040	14625-25455
Wood Stork	7	1140	7	0	133	1287	0-2447
White Ibis	2347	7913	0	40	1413	11713	4052-19374
Glossy Ibis	7	0	0	0	0	7	0-16
All species combined	6193	16727	7380	720	5700	36720	25589-47851

Table III-15. Population estimates from systematic surveys, July 1994.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	1753	700	313	147	600	3513	1365-5661
Great Blue Heron	13	13	0	33	53	113	69-158
Small dark herons	33	340	27	13	20	433	166-700
Small white herons	4040	7827	2253	747	740	15607	9406-21808
Wood Stork	0	13	0	0	93	107	0-232
White Ibis	1887	2893	413	7	280	5480	2810-8150
Glossy Ibis	0	0	0	13	13	27	4-50
All species combined	7727	11787	3007	960	1800	25280	17110-33450

Table III-16. Population estimates from systematic surveys, August 1994.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	1433	480	147	333	367	2760	1186-4333
Great Blue Heron	0	27	0	13	40	80	121-293
Small dark herons	20	67	53	0	67	207	121-293
Small white herons	2280	7547	4493	1047	860	16227	11031-21422
Wood Stork	0	7	80	0	13	100	0-216
White Ibis	80	0	80	0	40	200	58-342
Glossy Ibis	0	0	0	0	0	0	-----
All species combined	3813	8127	4853	1393	1387	19573	14170-24977

Table III-17. Population estimates from systematic surveys, September 1994.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	193	400	167	87	287	1133	899-1367
Great Blue Heron	40	13	7	13	27	100	67-133
Small dark herons	7	87	0	27	20	140	79-201
Small white herons	1513	5200	1593	3360	627	12293	6994-17593
Wood Stork	0	0	133	0	27	160	0-352
White Ibis	47	1353	20	20	0	1440	226-2654
Glossy Ibis	0	60	0	0	0	60	0-136
All species combined	1800	7113	1920	3507	987	15327	9823-20830

Table III-18. Population estimates from systematic surveys, January 1995.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	507	1040	613	53	533	2747	2155-3338
Great Blue Heron	100	80	47	13	80	320	242-398
Small dark herons	7	67	47	33	100	253	173-334
Small white herons	220	687	580	387	1500	3373	2517-4230
Wood Stork	87	80	133	0	20	320	101-539
White Ibis	1153	6593	1067	3753	1820	14387	8281-20493
Glossy Ibis	33	60	133	100	227	553	257-850
All species combined	2007	8607	2620	4346	4280	21953	15607-28301

Table III-19. Population estimates from systematic surveys, February 1995.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	293	2800	1573	280	820	5767	3169-8364
Great Blue Heron	80	60	20	20	60	240	167-313
Small dark herons	307	113	73	27	233	753	422-1084
Small white herons	1053	720	687	433	1287	4180	2664-5696
Wood Stork	0	100	40	27	20	187	84-288
White Ibis	873	15793	5907	3773	6727	33073	17866-48279
Glossy Ibis	0	447	153	207	200	1007	367-1647
All species combined	2607	20033	8453	4767	9347	45207	27733-62679

Table III-20. Population estimates from systematic surveys, March 1995.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	493	820	640	533	600	3087	2385-3788
Great Blue Heron	40	27	7	7	87	166	106-226
Small dark herons	40	80	33	40	160	353	228-479
Small white herons	1087	2100	267	680	1093	5227	3882-6572
Wood Stork	7	0	80	293	160	540	219-861
White Ibis	1840	2747	360	3520	2840	11307	7568-15105
Glossy Ibis	127	613	47	140	260	1187	668-1705
All species combined	3633	6380	1433	5213	5200	21867	16756-26978

Table III-21. Population estimates from systematic surveys, April 1995.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	567	2220	687	193	1927	5593	2668-8499
Great Blue Heron	47	67	27	7	133	260	168-351
Small dark herons	113	133	0	27	233	507	307-707
Small white herons	447	3840	1387	613	2727	9013	6346-11680
Wood Stork	73	207	20	0	40	340	37-643
White Ibis	353	993	287	1300	1893	4827	3462-6191
Glossy Ibis	80	207	0	0	27	313	47-616
All species combined	1680	7667	2407	2140	6960	20853	14940-26767

Table III-22. Population estimates from systematic surveys, May 1995.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	493	1007	573	187	567	2827	2215-3438
Great Blue Heron	7	7	27	27	73	140	98-182
Small dark herons	27	113	140	13	147	440	265-615
Small white herons	647	14160	3133	420	1587	19947	2495-37398
Wood Stork	13	173	160	0	0	347	118-575
White Ibis	193	3726	240	600	2340	7100	3253-10947
Glossy Ibis	20	167	0	47	113	347	67-626
All species combined	1400	19353	4273	1293	4827	31147	13144-49149

Table III-23. Population estimates from systematic surveys, June 1995.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	667	2473	1173	507	1660	6480	4243-8717
Great Blue Heron	40	20	7	13	60	140	95-185
Small dark herons	27	767	120	160	187	1260	291-2228
Small white herons	927	5727	5253	2013	6167	20087	14332-25841
Wood Stork	0	13	47	0	73	133	48-219
White Ibis	7693	11373	2293	647	740	22747	12115-33379
Glossy Ibis	0	340	0	20	7	367	19-714
All species combined	9353	20713	8893	3360	8893	51213	37332-65094

Table III-24. Population estimates from systematic surveys, July 1995.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	527	707	253	313	733	2533	2065-3001
Great Blue Heron	40	7	0	27	80	153	101-2005
Small dark herons	27	153	113	7	67	367	238-495
Small white herons	6927	10827	3493	607	3453	25307	16308-34305
Wood Stork	273	27	0	67	33	400	17-783
White Ibis	19273	2880	873	20	853	23900	3609-44191
Glossy Ibis	0	0	13	0	0	13	2-147
All species combined	27066	14600	4747	1040	5520	52673	31482-73865

Table III-25. Population estimates from systematic surveys, August 1995.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	513	867	260	60	733	2433	1636-3230
Great Blue Heron	20	33	7	7	73	140	94-185
Small dark herons	40	253	53	53	47	447	227-666
Small white herons	5067	8860	4160	500	2220	20807	14809-26804
Wood Stork	0	0	0	0	40	40	0-97
White Ibis	47	933	187	7	673	2847	976-2718
Glossy Ibis	0	67	7	0	7	80	0-176
All species combined	5687	11013	4673	627	3793	25793	19292-32295

Table III-26. Population estimates from systematic surveys, September 1995.

	STRATUM						
Species	I	II	III	IV	V	TOTAL	95% CONFIDENCE INTERVAL
Great Egret	367	673	233	47	307	1627	1164-2089
Great Blue Heron	20	27	13	0	47	107	67-146
Small dark herons	27	47	40	33	87	233	177-288
Small white herons	8560	7193	2820	313	327	19213	10374-28054
Wood Stork	0	0	0	0	0	0	---
White Ibis	7	3213	13	7	53	3293	1172-5414
Glossy Ibis	0	80	0	0	0	80	0-164
All species combined	8980	11233	3120	400	820	24553	15128-33978

APPENDIX IV

RELATIVE IMPORTANCE OF THE STRATA

Table IV-1. Relative importance of the five strata to all species combined.

	STRATUM				
SURVEY	I	II	III	IV	V
JANUARY 1993	5	2	3	4	1
FEBRUARY 1993	4	2	3	5	1
MARCH 1993	1	2	5	4	3
APRIL 1993	2	1	4	5	3
MAY 1993	1	2	5	4	3
JUNE 1993	2	1	3	5	4
AUGUST 1993	1	3	4	5	2
SEPTEMBER 1993	2	1	4	5	3
JANUARY 1994	1	3	4	5	2
FEBRUARY 1994	3	1	4	5	2
MARCH 1994	2	1	4	5	3
APRIL 1994	4	2	3	5	1
MAY 1994	3	2	1	5	4
JUNE 1994	4	1	2	5	3
JULY 1994	2	1	3	5	4
AUGUST 1994	3	1	2	4	5
SEPTEMBER 1994	4	1	3	2	5
JANUARY 1995	5	1	4	2	3
FEBRUARY 1995	5	1	3	4	2
MARCH 1995	4	1	5	2	3
APRIL 1995	5	1	3	4	2
MAY 1995	4	1	3	5	2
JUNE 1995	2	1	3	5	3
JULY 1995	1	2	4	5	3
AUGUST 1995	2	1	3	5	4
SEPTEMBER 1995	2	1	3	5	4
MEANS	2.8	1.4	3.4	4.4	2.9

Table IV-2. Relative importance of the five strata to Great Egrets.

	STRATUM				
SURVEY	I	II	III	IV	V
JANUARY 1993	5	4	2	3	1
FEBRUARY 1993	3	4	1	5	2
MARCH 1993	2	1	3	5	4
APRIL 1993	1	2	5	4	3
MAY 1993	3	1	5	4	2
JUNE 1993	3	1	2	5	4
AUGUST 1993	1	2	4	5	3
SEPTEMBER 1993	1	2	3	4	4
JANUARY 1994	3	1	5	4	2
FEBRUARY 1994	1	2	4	5	3
MARCH 1994	1	2	4	5	3
APRIL 1994	3	1	5	4	2
MAY 1994	2	1	4	4	3
JUNE 1994	3	2	5	4	1
JULY 1994	1	2	4	5	3
AUGUST 1994	1	2	5	4	3
SEPTEMBER 1994	3	1	4	5	2
JANUARY 1995	4	1	2	5	3
FEBRUARY 1995	4	1	2	5	3
MARCH 1995	5	1	2	4	3
APRIL 1995	4	1	3	5	2
MAY 1995	4	1	2	5	3
JUNE 1995	4	1	3	5	2
JULY 1995	3	2	5	4	1
AUGUST 1995	3	1	4	5	2
SEPTEMBER 1995	2	1	4	5	3
MEANS	2.7	1.6	3.5	4.5	2.9

Table IV-3. Relative importance of the five strata to Great Blue Herons.

	STRATUM				
SURVEY	I	II	III	IV	V
JANUARY 1993	2	3	5	3	1
FEBRUARY 1993	1	4	5	3	2
MARCH 1993	3	4	5	1	1
APRIL 1993	2	5	4	3	1
MAY 1993	4	2	5	2	1
JUNE 1993	2	4	3	5	1
AUGUST 1993	5	3	3	2	1
SEPTEMBER 1993	3	2	5	4	1
JANUARY 1994	1	5	4	3	2
FEBRUARY 1994	1	4	2	4	2
MARCH 1994	2	2	4	5	1
APRIL 1994	3	2	4	4	1
MAY 1994	3	1	2	4	1
JUNE 1994	2	5	5	5	1
JULY 1994	3	3	5	2	1
AUGUST 1994	5	2	5	3	1
SEPTEMBER 1994	1	3	5	3	2
JANUARY 1995	1	2	4	5	2
FEBRUARY 1995	1	2	4	4	2
MARCH 1995	2	3	4	4	1
APRIL 1995	3	2	4	5	1
MAY 1995	4	4	2	2	1
JUNE 1995	2	3	5	4	1
JULY 1995	2	4	5	3	1
AUGUST 1995	3	2	4	4	1
SEPTEMBER 1995	3	2	4	5	1
MEANS	2.5	3.0	4.1	3.5	1.2

Table IV-4. Relative importance of the five strata to small dark herons.

	STRATUM				
SURVEY	I	II	III	IV	V
JANUARY 1993	1	2	3	5	4
FEBRUARY 1993	3	2	3	5	1
MARCH 1993	3	1	5	4	2
APRIL 1993	3	1	4	5	2
MAY 1993	5	4	1	2	3
JUNE 1993	3	1	4	4	2
AUGUST 1993	2	3	4	5	1
SEPTEMBER 1993	4	3	2	4	1
JANUARY 1994	5	4	3	2	1
FEBRUARY 1994	2	3	5	4	1
MARCH 1994	1	2	5	4	2
APRIL 1994	2	4	5	3	1
MAY 1994	5	2	3	5	1
JUNE 1994	4	1	2	5	2
JULY 1994	2	1	3	5	4
AUGUST 1994	4	1	3	5	1
SEPTEMBER 1994	4	1	5	2	3
JANUARY 1995	5	2	3	4	1
FEBRUARY 1995	1	3	4	5	2
MARCH 1995	3	2	5	3	1
APRIL 1995	3	2	5	4	1
MAY 1995	4	3	2	5	1
JUNE 1995	5	1	4	3	2
JULY 1995	4	1	2	5	3
AUGUST 1995	5	1	2	2	4
SEPTEMBER 1995	5	2	3	4	1
MEANS	2.8	2.0	3.5	4.0	1.8

Table IV-5. Relative importance of the five strata to small white herons.

	STRATUM				
SURVEY	I	II	III	IV	V
JANUARY 1993	5	1	2	3	4
FEBRUARY 1993	5	2	1	4	3
MARCH 1993	2	1	4	3	5
APRIL 1993	2	1	5	4	3
MAY 1993	1	2	5	4	3
JUNE 1993	2	1	3	4	4
AUGUST 1993	1	2	4	5	3
SEPTEMBER 1993	2	1	3	5	4
JANUARY 1994	1	3	4	5	2
FEBRUARY 1994	2	1	4	3	5
MARCH 1994	1	2	3	5	4
APRIL 1994	4	3	1	5	2
MAY 1994	2	3	1	5	4
JUNE 1994	3	2	1	5	4
JULY 1994	2	1	3	4	5
AUGUST 1994	3	1	2	4	5
SEPTEMBER 1994	4	1	3	2	5
JANUARY 1995	5	2	3	4	1
FEBRUARY 1995	2	3	4	5	1
MARCH 1995	3	1	5	4	2
APRIL 1995	5	1	3	4	2
MAY 1995	4	1	2	5	3
JUNE 1995	5	2	3	4	1
JULY 1995	2	1	3	5	4
AUGUST 1995	2	1	3	5	4
SEPTEMBER 1995	1	2	3	5	4
MEANS	2.7	1.6	2.9	4.3	3.4

Table IV-6. Relative importance of the five strata to Wood Storks.

	STRATUM				
SURVEY	I	II	III	IV	V
JANUARY 1993	5	2	3	1	3
FEBRUARY 1993	5	2	3	5	1
MARCH 1993	2	1	5	2	2
APRIL 1993	5	2	1	4	2
MAY 1993	1	3	5	5	2
JUNE 1993	3	1	2	5	4
AUGUST 1993	3	2	5	5	1
SEPTEMBER 1993	5	1	3	5	2
JANUARY 1994	5	1	3	4	2
FEBRUARY 1994	2	1	5	5	3
MARCH 1994	2	3	4	5	1
APRIL 1994	5	2	1	4	2
MAY 1994	3	1	4	5	2
JUNE 1994	3	1	3	5	2
JULY 1994	5	2	5	5	1
AUGUST 1994	5	3	1	5	2
SEPTEMBER 1994	5	5	1	5	2
JANUARY 1995	2	3	1	5	4
FEBRUARY 1995	5	1	2	3	4
MARCH 1995	4	5	3	1	2
APRIL 1995	2	1	4	5	3
MAY 1995	3	1	2	5	5
JUNE 1995	5	3	2	5	1
JULY 1995	1	4	5	2	3
AUGUST 1995	5	5	5	5	1
SEPTEMBER 1995	-	-	-	-	-
MEANS	3.6	2.6	3.1	4.2	2.3

Table IV-7. Relative importance of the five strata to White Ibis.

	STRATUM				
SURVEY	I	II	III	IV	V
JANUARY 1993	5	3	2	4	1
FEBRUARY 1993	4	2	3	5	1
MARCH 1993	1	2	5	4	3
APRIL 1993	4	1	2	5	3
MAY 1993	2	3	4	5	1
JUNE 1993	3	1	4	5	2
AUGUST 1993	1	4	3	5	2
SEPTEMBER 1993	4	1	3	5	2
JANUARY 1994	1	2	4	5	3
FEBRUARY 1994	3	1	4	5	2
MARCH 1994	2	1	5	4	3
APRIL 1994	1	2	5	4	3
MAY 1994	2	1	3	5	3
JUNE 1994	2	1	5	4	3
JULY 1994	2	1	3	5	4
AUGUST 1994	1	5	1	5	3
SEPTEMBER 1994	2	1	3	3	5
JANUARY 1995	4	1	5	2	3
FEBRUARY 1995	5	1	3	4	2
MARCH 1995	4	3	5	1	2
APRIL 1995	4	3	5	2	1
MAY 1995	5	1	4	3	2
JUNE 1995	2	1	3	5	4
JULY 1995	1	2	3	5	4
AUGUST 1995	4	1	3	5	2
SEPTEMBER 1995	4	1	3	4	2
MEANS	2.8	1.77	3.58	3.81	2.54

Table IV-8. Relative importance of the five strata to Glossy Ibis.

	STRATUM				
SURVEY	I	II	III	IV	V
JANUARY 1993	5	1	5	3	2
FEBRUARY 1993	3	1	3	5	2
MARCH 1993	2	1	3	5	4
APRIL 1993	1	4	3	5	2
MAY 1993	1	5	3	5	2
JUNE 1993	3	1	5	5	2
AUGUST 1993	2	5	5	5	1
SEPTEMBER 1993	2	1	5	5	5
JANUARY 1994	2	1	5	3	5
FEBRUARY 1994	5	5	1	5	2
MARCH 1994	5	2	5	3	1
APRIL 1994	2	5	5	3	1
MAY 1994	5	1	2	5	5
JUNE 1994	1	5	5	5	5
JULY 1994	5	5	5	1	1
AUGUST 1994	-	-	-	-	-
SEPTEMBER 1994	5	1	5	5	5
JANUARY 1995	5	4	2	3	1
FEBRUARY 1995	5	1	4	2	3
MARCH 1995	4	1	5	3	2
APRIL 1995	2	1	5	5	3
MAY 1995	4	1	5	3	2
JUNE 1995	5	1	5	2	3
JULY 1995	5	5	1	5	5
AUGUST 1995	5	1	2	5	2
SEPTEMBER 1995	5	1	5	5	5
MEANS	3.6	2.5	4.0	3.8	2.6