UC-66e

WOOD STORKS OF THE BIRDSVILLE COLONY AND SWAMPS OF THE SAVANNAH RIVER SITE

GENERAL OVERVIEW OF RESEARCH FINDINGS, 1983 - 1990

Malcolm C. Coulter

Savannah River Ecology Laboratory

Division of Wildlife Ecology and Toxicology

Drawer E

Aiken, South Carolina 29802

February, 1993

Graphics: Sylvia Blankenship
Aline Clement
Jean B. Coleman
Mindy Hill
Linda Orebaugh

Work Supported Under Contract
DE-AC09-76SROO-819

OVERVIEW

The U.S. population of Wood Storks (*Mycteria americana*) was listed as endangered by the U.S. Fish and Wildlife Service (USFWS) in 1984 following severe declines in the population over the preceding 50 years. When the U.S. Department of Energy (USDOE) decided to restart L-Reactor, there was concern that the cooling water from this reactor would raise the water level in the Steel Creek Delta and make this area no longer available to foraging Wood Storks. The USDOE began consultation with the USFWS in April, 1984, and agreed to provide alternative foraging ponds to replace the habitat potentially lost in the Steel Creek Delta. It was decided to build the alternative ponds at the site of Kathwood Lake on the National Audubon Society's (NAS) Silver Bluff Plantation Sanctuary. A technical working group was formed with representatives of USDOE, USFWS, E. I. DuPont de Nemours and Company (and later the Westinghouse Savannah River Company), the NAS and the Savannah River Ecology Laboratory (SREL), to make suggestions on the design of the ponds and to review their effectiveness.

The SREL undertook studies of the breeding biology and foraging ecology of Wood Storks at the Birdsville Colony, the closest breeding colony to the Savannah River Swamp System (SRSS), to understand foraging needs of the storks and characteristics of their foraging sites. This information was necessary for the design and management of the ponds.

The Kathwood foraging ponds were to consist of four ponds. Pond 1 was to be left in a natural state, always available to the storks. The other ponds could be manipulated independently. They were to be left full during much of the year, providing optimal conditions for prey (fish) growth and reproduction. When the storks could best benefit from the ponds, one pond would be lowered to an appropriate depth. When the prey had been depleted, that pond would be filled and the next pond would be lowered, until all ponds had been made available.

In order to manage the ponds most effectively for foraging storks, they were stocked with potential prey (Bluegill Sunfish and Brown Bullheads which the storks are known to eat). The water quality has been managed to provide optimal conditions for fish growth and reproduction, and the fish have been fed regularly during the spring, summer and fall months.

The ponds were built during the summer and fall of 1985 and were first made available to the storks in 1986. In that year, the ponds were lowered in early July in anticipation of the storks dispersing from the Birdsville Colony in late July. On July 30, four storks were observed. We counted a maximum of 97 storks in 1986. The numbers of storks have increased in subsequent years and in 1990, we counted a maximum of 250 storks foraging in the ponds.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

The population of Wood Storks (*Mycteria americana*) that breeds in the United States has decreased from an estimated 20,000 breeding pairs in 1930 to just under 5,000 pairs in 1980[1]. Since 1980, the number has remained relatively stable, fluctuating between 3,500 and 5,500 breeding pairs[2]. The decline prompted the U.S. Fish and Wildlife Service (USFWS) to list the United States population of Wood Storks as endangered in 1984[3].

When the U.S. Department of Energy (USDOE) decided to restart L-Reactor on the Savannah River Site (SRS), there was concern that when the reactor was restarted, cooling water flowing into the Steel Creek Delta would raise the water level and the area would become too deep for foraging storks. The potential loss of this area to storks was important because storks had been observed foraging in the Steel Creek Delta[4]. The USDOE began consultation with the USFWS in April, 1984, and the USDOE subsequently agreed to develop and maintain alternative foraging habitat to replace the potential loss[5]. Among alternate sites considered, Kathwood Lake on the National Audubon Society's (NAS) Silver Bluff Plantation Sanctuary was chosen. Storks had been observed feeding at the lake in previous years and Kathwood Lake is within 45 km (28 miles) of the Birdsville Colony, the same distance as the Savannah River Swamp System (SRSS) is from the colony. A technical working group was formed with representatives of USDOE, USFWS, E. I. DuPont de Nemours and Company (and later the Westinghouse Savannah River Company), the NAS and the Savannah River Ecology Laboratory (SREL) to make suggestions on the design of the ponds and to review their effectiveness. It was decided to alter the lake, and to develop four ponds in its place. SREL took responsibility for gathering necessary biological information for the development of the Kathwood ponds and for subsequent management of the ponds.

In order to design and manage the alternate foraging ponds as effectively as possible, it was necessary to understand aspects of the biology of the storks, the characteristics of their foraging sites and the patterns of their use of the SRSS. J. M. Meyers directed this program from June, 1983 through April, 1984; I directed the program from May, 1984 through September, 1991.

Biology of the storks. The SRSS was used as a foraging area by storks breeding nearby as well as storks dispersing after the breeding season from nearby and more distant colonies. The Birdsville Colony near Millen, Jenkins County, Georgia, is the only colony from which storks were likely to visit the SRSS during the breeding season. We studied the breeding of storks at this colony to determine the timing of breeding, the amount of food demand of these birds and the importance of foraging in affecting reproductive success. By comparing the numbers of birds dispersing from this colony and the timing of dispersal, with the numbers of storks in the SRSS and later at the Kathwood ponds, we could develop an understanding of the influx of storks dispersing after the breeding season.

Characteristics of stork foraging sites. We followed storks from the Birdsville Colony to foraging sites. We examined these foraging sites in order to understand stork foraging habitats, the kinds of potential prey at the sites, and their abundance as well as the variation in abundance of prey at the sites.

Stork use of the SRSS. We flew aerial surveys over the SRSS to determine the seasonal pattern of stork use of this area as well as the areas within the SRSS that

were used most. We also sampled foraging sites on the SRSS for comparison with other foraging sites.

A Kathwood Technical Working Group with members representing USDOE, USFWS, E. I. DuPont de Nemours and Company (and later the Westinghouse Savannah River Company), NAS and SREL was formed to make suggestions on the design of the ponds, based on the information collected. This group first met in 1984 and has continued to meet once or twice a year, initially to design the ponds and subsequently to review the effectiveness of the ponds in providing food for storks.

From 1984 through 1989, we carried on intensive studies at the Birdsville Colony and foraging areas around the colony, with regular surveys of stork use of the SRSS. We gathered much of the needed information. By the end of 1989 we had a good understanding of the storks, their feeding requirements and characteristics of their foraging sites. In 1990, we modified the program, collecting only the information needed to modify management of the Kathwood ponds for each year.

This report is a condensed summary of the results of our studies of storks from 1984 through 1989, with some mention of the results of the 1983 study, and of the management of the Kathwood Ponds from 1986 through 1990. Much more information was required to understand the relevance of these findings than is presented in this summary. During each year of the study, SREL has produced an annual report that covers the results of our activities for that year. For more details than are covered here, I recommend these annual reports[6].

II. BREEDING BIOLOGY

The Birdsville Colony is within 45 km of the SRSS. Storks have been followed from the colony to the SRSS where they were observed foraging[7]. It was thought that the SRSS may be an important foraging area for storks from the colony. It was necessary to understand the size of the colony and the amount of food needed by the colony, as well as the timing of this need. It was also important to understand the importance of food limitation (and so the possible importance of the SRSS) in affecting the reproductive success of the colony.

CAPSULE RESULTS:

- Wood Storks from the Birdsville Colony have been followed to the Steel Creek Delta where they have been observed foraging.

- Storks are in the general area from late February through December, and breed from mid-March through early August in most years.

- Reproductive success varies considerably from year to year. Prey availability is one important factor that affects breeding success.

- Storks eat primarily fish (sunfish are most important), but also eat crayfish and, to a lesser extent, tadpoles.

- The period when birds may be under most food stress is probably after June when parents must provide food for their chicks. The period following dispersal may be even more important because the chicks, which are inexperienced at foraging, must provide their own food.

The Birdsville Colony was discovered in 1980[8] and since then the colony has increased from about 60 pairs to 259 pairs in 1990 (Table II.1). The storks first return to the area in late February or early March (Table II.2) and begin arriving in the colony from early through late March (Figure II.1). They lay eggs from late March through late May; after a 30-day incubation period the chicks hatch from late April through late June. The chicks remain in the colony for two to three months and begin dispersing from late June through early September, but in most years the birds have largely left the colony by late July or early August. The overall phenology is summarized in Figure II.2.

Storks usually lay between 2 and 5 eggs, with an average of 2.75 eggs per nest (Table II.3). Some eggs fail to hatch and some of the chicks die. The parents raise from 1 to 4 chicks, with an average of 1.45 fledglings per nest. But reproductive success has varied considerably from year to year (Table II.3). Reproductive success is most strongly affected by three factors: food availability, raccoon predation and intraspecific aggression. The importance of **food availability** is difficult to detect. However, there was a strong relation between average prey density and average reproductive success from 1984 through 1989 ($r = 0.70$, $r^2 = 0.49$, $n = 6$, $p < 0.05$). About 50% of the variation in reproductive success may be explained by variation in prey density at foraging sites. **Raccoons** killed many chicks during some years, such as 1985 and 1988. Storks usually build their nests in trees over standing water. Alligators are a strong deterrent against raccoons entering the colony. During years when it becomes dry under the colony, raccoons entered the colony and did a great deal of damage. The amount of **intraspecific aggression** varies considerably from year to year. During many years there is very little aggression. In 1989, we recorded high levels of aggression: pairs of storks usurping nests and destroying the eggs and chicks of the pairs that had previously occupied the nest. The displaced pairs probably nested again and our measure of reproductive success for 1989 was a low estimate.

We determined the stork prey from regurgitations of the chicks. Fish were the main item, and of these, sunfish were the most important. They also ate crayfish and tadpoles.

The chicks leave the colony when they are 60 to 80 days old. The timing of dispersal from the colony varied from late June in 1985 and 1988, after raccoons destroyed most nests, to early September in 1984 when the birds were in the colony later than usual. In most years the birds dispersed in late July to early August. The birds then stayed in the general area. In some years they remained until November or December while in other years such as 1988 when feeding conditions were poor, they left in early October. There was no apparent pattern as to how long the birds remained in the area, but they probably remained through October and early November in most years.

TABLE II.1. Number of active nests in the Birdsville Colony.

YEAR	NUMBER OF ACTIVE NESTS
1980	about 100[1]
1981	not available
1982	about 60[1]
1983	113[2]
1984	about 100[3]
1985	about 108[4]
1986	160[5]
1987	193[6]
1988	101[7]
1989	126[8]
1990	259[9]

1: Estimated from ground and aerial surveys. From Meyers. 1984. SREL-15/UC-66e.
2: Actual counts from 26 trees. From Meyers. 1984. SREL-15/UC-66e.
3: Estimated number of nests.
4: Number of nests counted on May 7.
5: Maximum number of nests, counted on May 14.
6: Maximum number of nests, counted on May 26.
7: Maximum number of nests, counted on May 31.
8: Maximum number of nests, counted on June 13.
9: Maximum number of nests, counted on June 1.

TABLE II.2. First sightings of Wood Storks in the Birdsville area, 1984-1990.

YEAR	DATE OF FIRST SIGHTING
1984	March 13[1]
1985	February 22
1986	February 27
1987	March 07
1988	March 02
1989	February 17
1990	March 14[1]

1: First aerial survey of the year. The birds may have returned earlier.

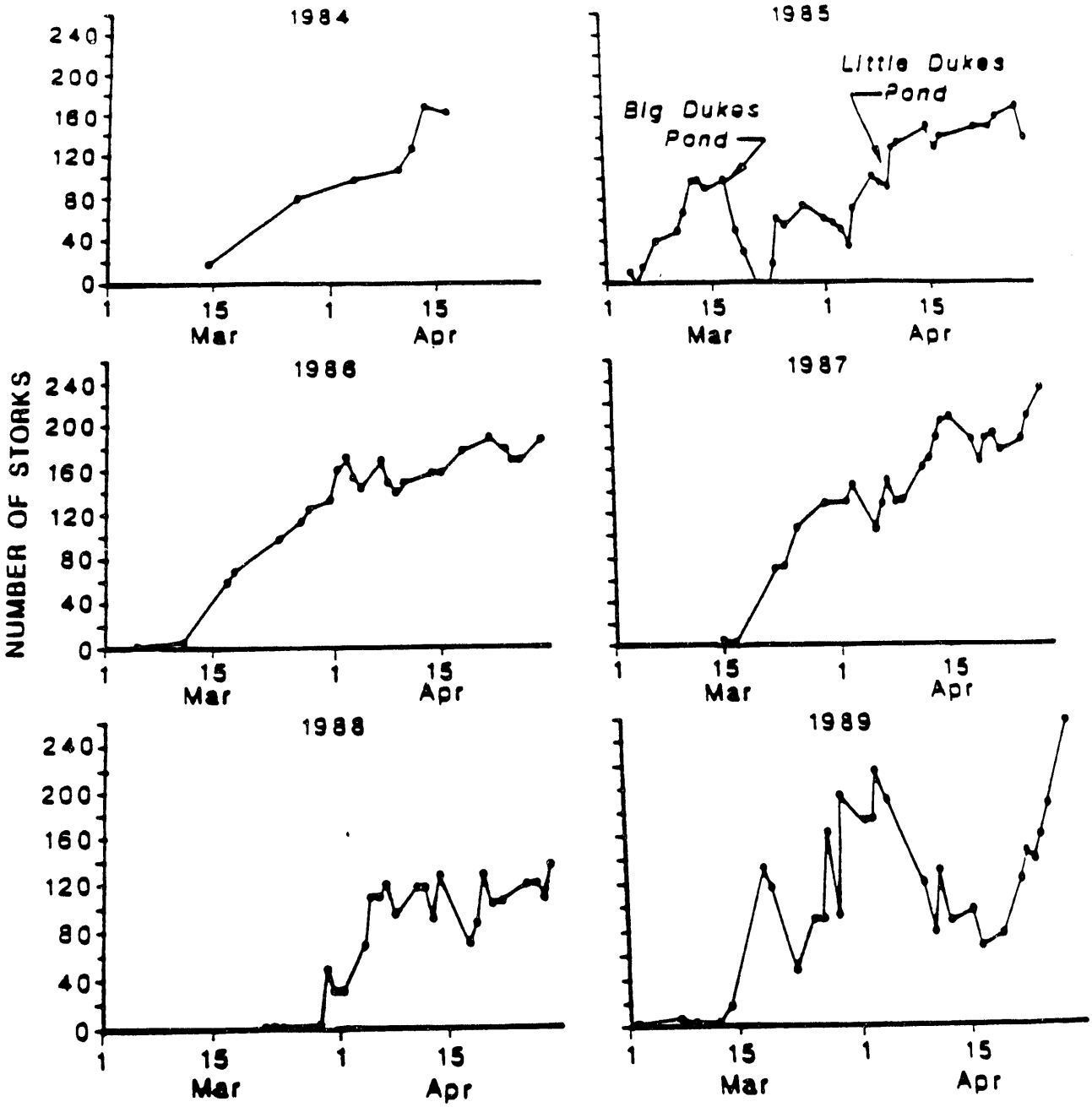

FIGURE II.1. Increase in numbers of storks at the Birdsville Colony, 1984-1989. No data were collected early in 1990.

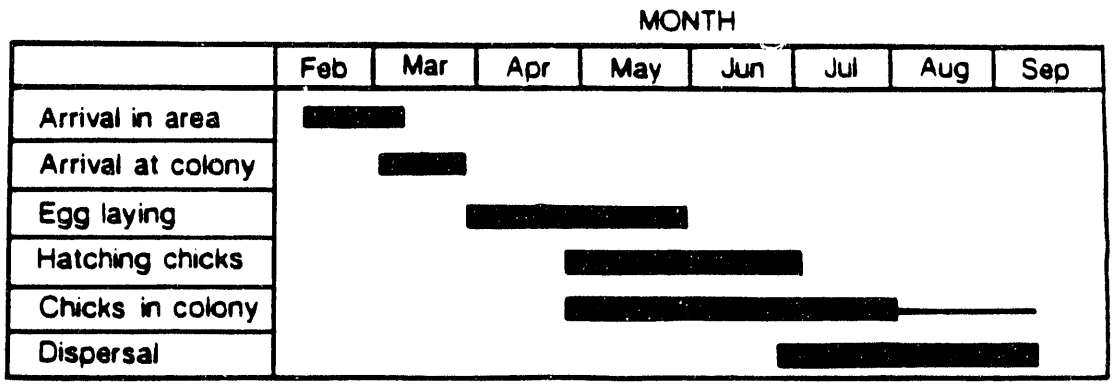

FIGURE II.2. Breeding phenology of Wood Storks at the Birdsville Colony. The horizontal bars represent the period of a particular part of the phenology (eg. egg-laying). Bars are thicker for periods when many birds were involved.

TABLE II.3. Clutch size and reproductive success of Wood Storks at the Birdsville Colony from 1983 through 1990.

YEAR	AVERAGE CLUTCH SIZE (EGGS PER NEST)	REPRODUCTIVE SUCCESS (FLEDGLINGS PER NEST)	PERCENT SUCCESS
1983	na[1]	< 2.19	
1984	3.00	2.04	68%
1985	2.44	0.33	14%
1986	3.08	2.16	70%
1987	2.84	1.96	69%
1988	2.63	0.35	13%
1989	2.38	0.63	26%
1990	2.88	2.67	93%

1: Not available.

III. FORAGING SITES

We followed storks from the Birdsville Colony to foraging sites. We examined the foraging sites in order to gather pertinent information for the development and management of the Kathwood Ponds. At each site we noted the habitat type, and measured habitat characteristics and availability of prey. We chose four sites to visit at three-week intervals to examine the changes of prey availability over time.

CAPSULE RESULTS:

- We followed storks to foraging sites as far as 63 km (40 miles) from the Birdsville Colony. The SRSS is 45 km (28 miles) from the colony, within the flight range of the storks. Most sites were within 20 km (12 miles) of the colony.

- The storks foraged in a wide variety of habitats, including swamps, ponds and marshes. They seemed to prefer more open sites.

- Prey density varied considerably among foraging sites, and densities changed over short periods of time at individual sites. The average density ranged from 6.4 to 21.6 items per square meter among years (average = 12.0 items per square meter).

- Prey density was strongly affected by rainfall during the preceding fall and winter: much rain led to high densities, little rain led to low densities. During drought years many sites became dry.

We followed storks from the colony to 192 foraging sites in the surrounding area (Figure III.1). The sites ranged up to 63 km (40 miles) from the colony. Over 85 % of the sites were within 20 km (12 miles) of the colony (Figure III.2). Storks were followed to the SRSS, 45 km (28 miles) from the colony on two occasions. On July 1, 1983, a stork was followed to Beaver Dam Creek, and on June 6, 1984, another stork was followed to the Steel Creek Delta.

Storks were observed foraging in most wetland habitat types available. Among the 192 sites, 89 (46%) were in swamps, 34 (18%) were in ponds, 18 (9%) were in marshes and 51 (27%) were in other habitats (Table III.1). However, swamps were the most abundant wetland in the area and the storks visited swamps disproportionately less than would be suggested by their availability. Instead, they visited ponds and marshes more frequently than would be expected given their scarcity in the area. Storks seemed to prefer these more open sites.

The vegetation at most foraging sites was open, although the vegetation at different sites ranged from open to very dense. The canopy was open (Figure III.3), emergent and submergent vegetation tended to be sparse (Figure III.4 and III.5), and woody stems tended to be sparse (Figure III.6).

Potential prey was sampled at foraging sites and the Kathwood ponds with a m^2 throw trap[9]. The average density of potential prey [i.e. fish, amphibians and crayfish which are known to be eaten by storks] at all sampled foraging sites varied from 6.44 to 21.61 items per square meter among years (Table III.2). Within a single year, there was considerable variation in prey density among foraging sites. The range over the

six years (1984 - 1989) was 0.00 to 296.75 items per square meter. The prey density changed dramatically at a single site over a short period of time. At the four sites that we sampled regularly, the average change in density was 0.21 items/square meter per day (or 5% of the average density at these sites).

The availability of prey was affected by the rainfall pattern. During drought years many foraging sites dried up. Density of prey at the remaining sites was related to the rainfall of the preceding fall/winter. In 1985 and 1988, following dry falls and winters, prey density was very low; in 1986, following a wet fall and winter, prey density was greatest. Rainfall during the fall and winter sets conditions for prey reproduction and allows prey to recolonize wetlands that may have become dry during the preceding summer.

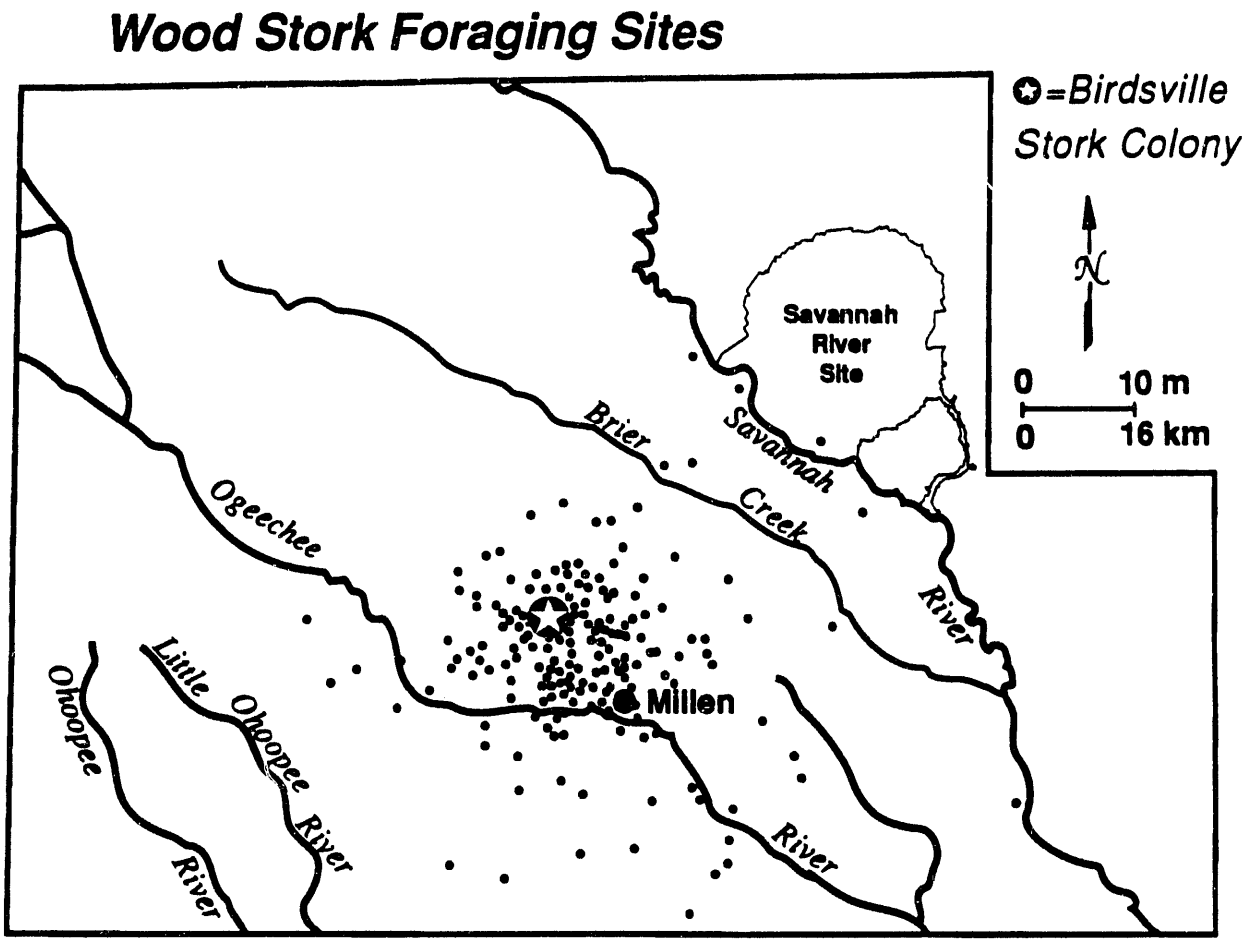

FIGURE III.1. Location of Wood Stork foraging sites around the Birdsville Colony, 1984-1989.

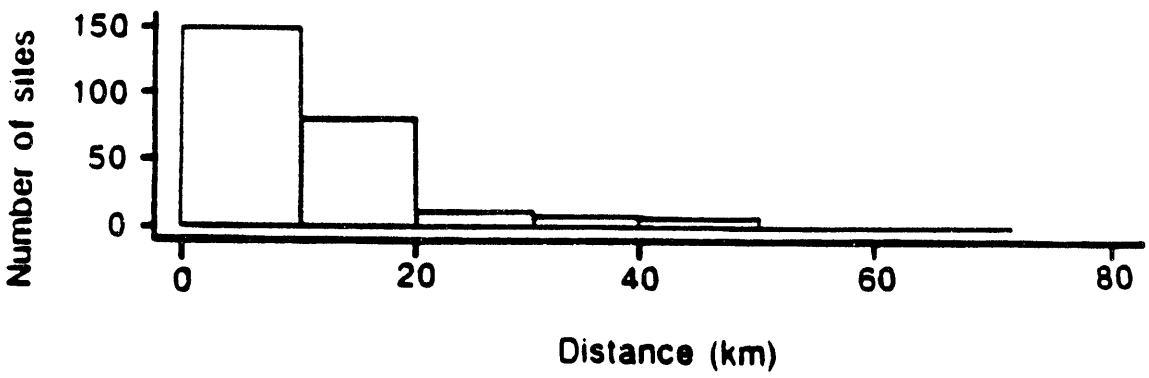

FIGURE III.2. Distances of foraging sites from the Birdsville Colony, 1984-1989.

TABLE III.1. Habitat types at Wood Stork foraging sites around the Birdsville Colony, 1984-1989.

HABITAT TYPE	NUMBER OF SITES	PERCENT
Hardwood swamp	52	27%
Cypress swamp	37	19%
Pond	34	18%
Marsh	18	9%
Other[1]	51	27%
TOTAL	192	100%

1: Including 10 ditches, 10 flooded roads, 7 shrub/scrub swamps, 7 streams, 5 creek floodplains, 5 flooded logging areas, 5 seasonally wet ponds, and 2 flooded woodlands.

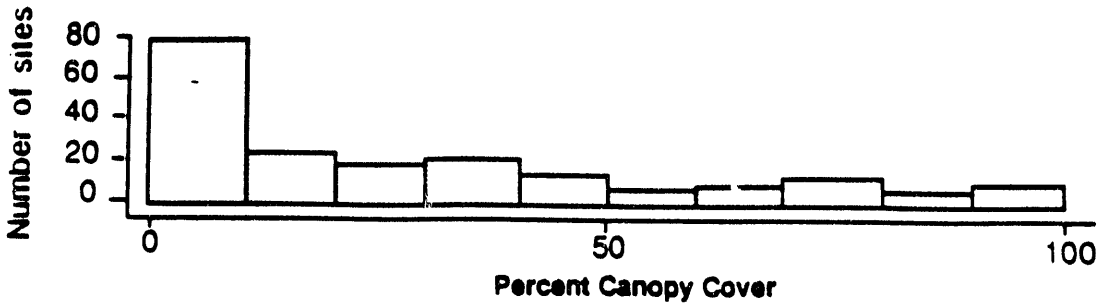

FIGURE III.3. Canopy covers at Wood Stork foraging sites, 1984-1989.

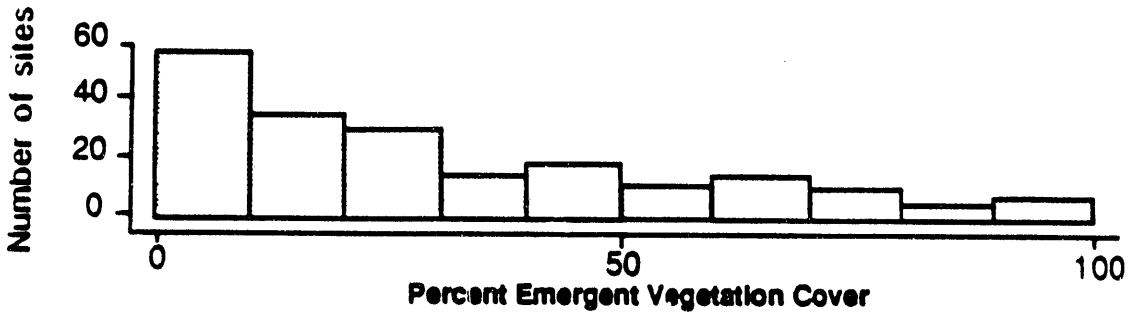

FIGURE III.4. Densities of emergent aquatic vegetation at Wood Stork foraging sites, 1984-1989: percent of points with vegetation.

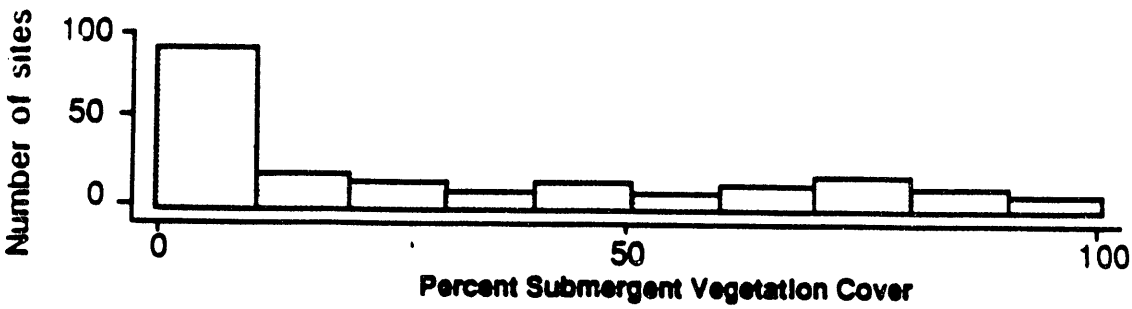

FIGURE III.5. Densities of submergent aquatic vegetation at Wood Stork foraging sites, 1984-1989: percent of points with vegetation.

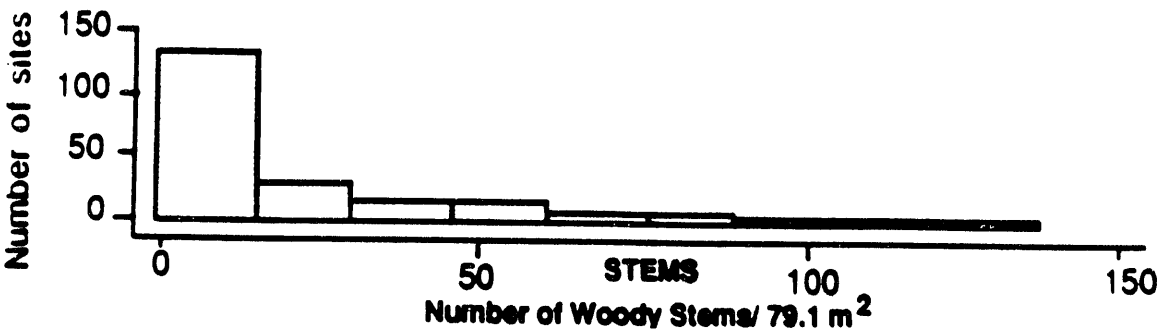

FIGURE III.6. Densities of woody stems at Wood Stork foraging sites, 1984-1989.

TABLE III.2. Average densities and biomass of potential prey at Wood Stork foraging sites, 1983-1989.

YEAR	SAMPLE SIZE	DENSITY[1]	BIOMASS[2]
1983	26	15.6	26.1
1984	47	15.8	25.1
1985	19	9.2	26.0
1986	31	21.6	50.8
1987	20	8.4	14.2
1988	29	6.4	15.1
1989	42	10.3	23.8

1: Individuals per square meter.
2: Grams wet weight per square meter.

IV. SAVANNAH RIVER SWAMP SYSTEM

In order to determine the pattern of stork use of the SRSS, aerial surveys of this wetland were flown from 1983 through 1990. In 1983, J. Meyers followed a stork from the Birdsville Colony to Beaver Dam Creek and in 1984, we followed a stork to the Steel Creek Delta. We sampled these sites as we sampled other foraging sites in 1984 and in subsequent years to understand changes in the delta.

CAPSULE RESULTS:

- Wood Storks have visited the SRSS during each year of the surveys, 1983 - 1990.

- In 1983 and 1984 they used the Steel Creek Delta and Beaver Dam Creek more extensively than other areas.

- Stork use of the SRSS is in part related to water depth. In 1986, when C-Reactor was shut down and the water level dropped in Four Mile Creek, they used the Four Mile Creek Delta extensively.

- Stork use of the SRSS has decreased from 1983 through 1990.

- There has been a decrease in suitability of the habitat in the Steel Creek Delta. Density of aquatic vegetation has increased. Availability of aquatic prey has decreased significantly.

We recorded storks from May through October and in all parts of the SRSS (Figure IV. 1-4). From 1983 through 1990, storks were seen in the SRSS on 128 (17%) of 735 aerial surveys. In 1983 and 1984, most storks were seen in the Steel Creek Delta and Beaver Dam Creek. The storks' use of the SRSS was in part related to water depth. When the water was too deep, storks did not visit the area. In 1986, when C-Reactor was shut down and the water level in Four Mile Creek decreased, large numbers of storks visited the Four Mile Creek Delta. Stork use of the SRSS decreased over the years. In 1989, we recorded storks during only 11 of 95 surveys from February through October (Appendix A).

The decrease in stork use of the SRSS was probably due in part to changes in the habitat, at least in the Steel Creek Delta. At the location in that Delta to which we followed a stork in 1984, there was an increase in the density of aquatic vegetation (Table IV.1). This probably made foraging more difficult. In addition, prey has become less available. In 1984 we found a density of 18.71 potential prey items per square meter at the site in the Steel Creek Delta. In 1989, we found no potential prey in the Steel Creek Delta.

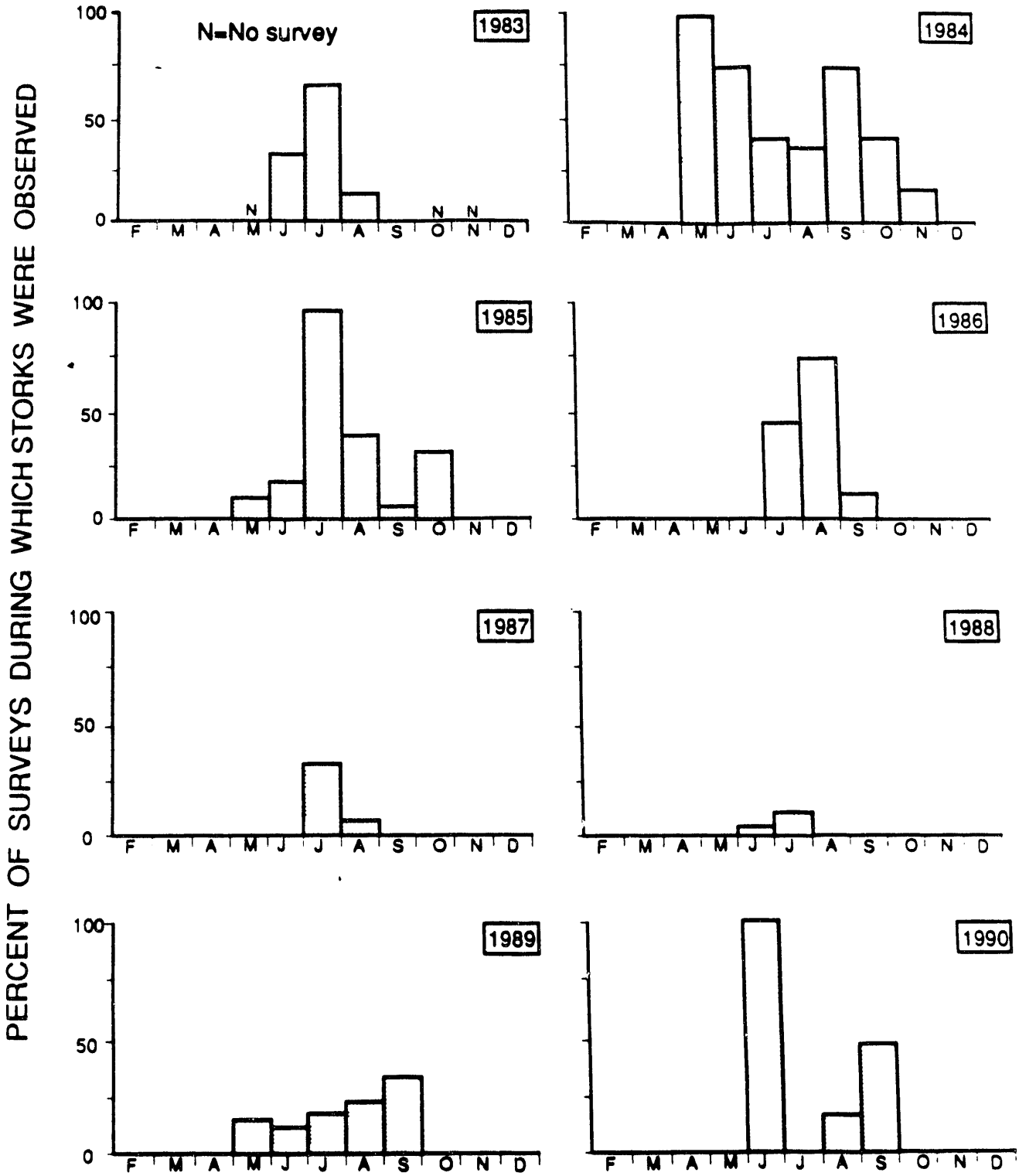

FIGURE IV.1. Percentage of surveys during which Wood Storks were observed in the SRSS by month, 1983 - 1990.

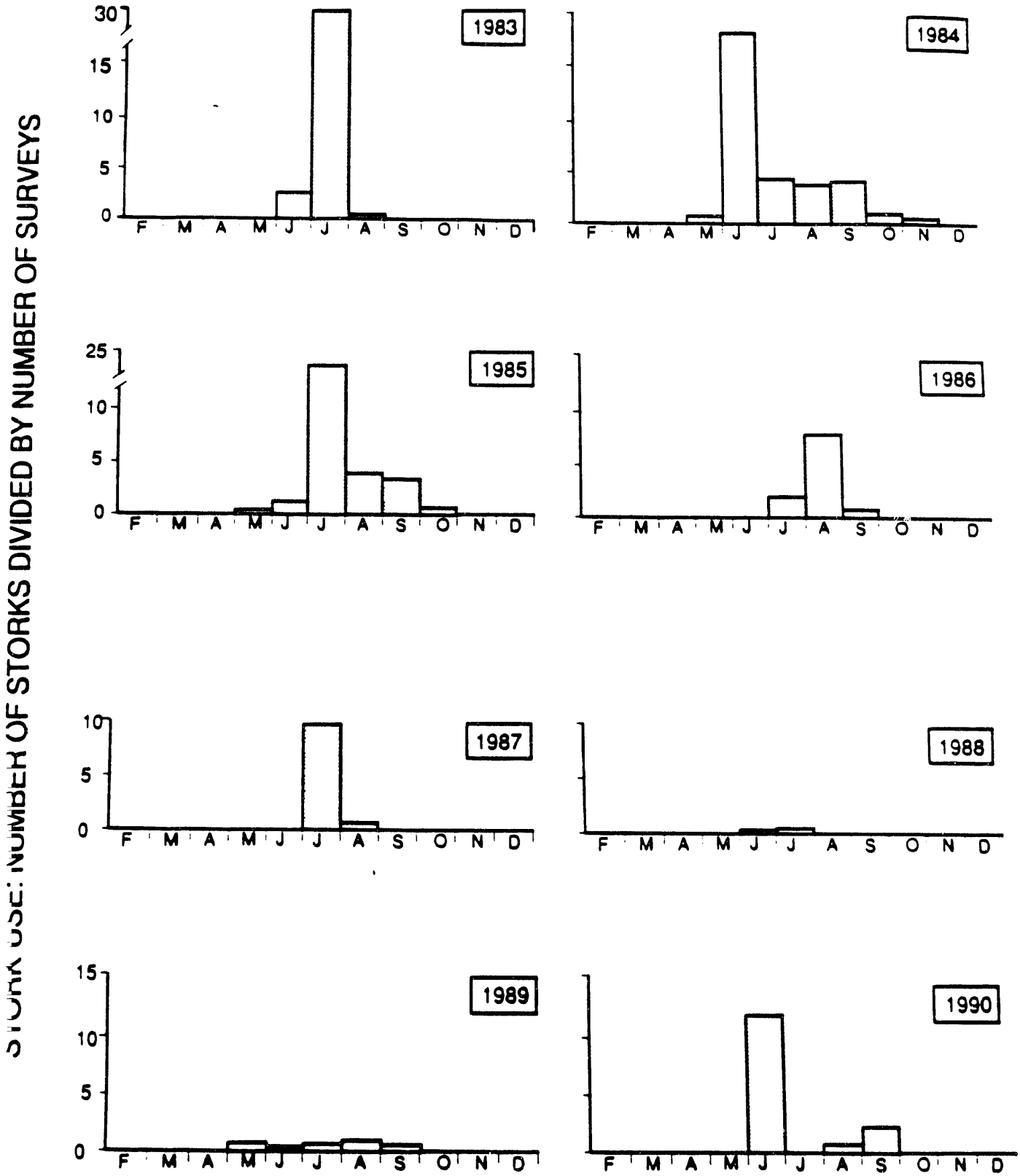

FIGURE IV.2. Wood Stork use of the SRSS by month, 1983 - 1990. Stork use is the total number of storks divided by the number of surveys.

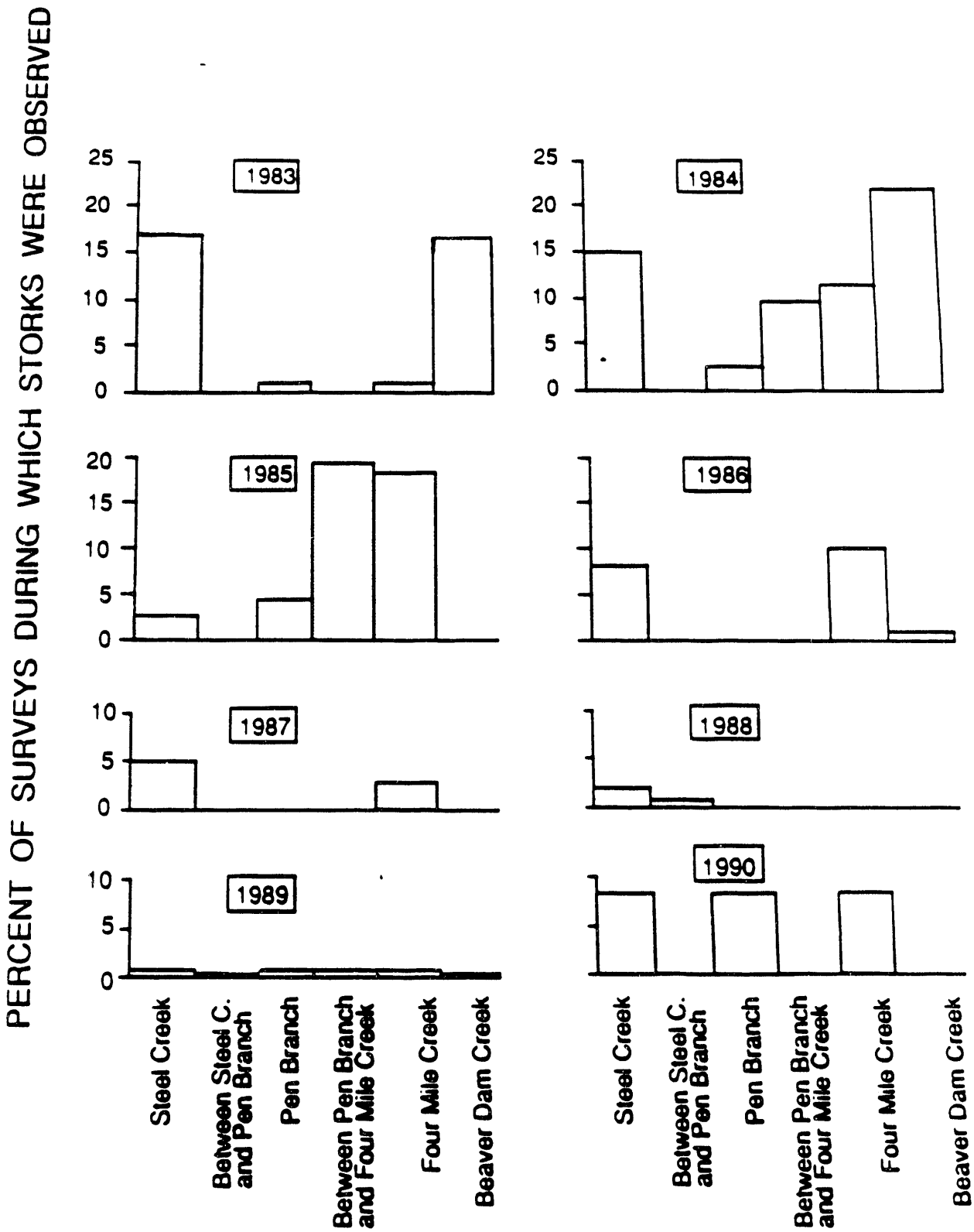

FIGURE IV.3. Percentage of surveys during which Wood Storks were observed in areas of the SRSS, 1983 - 1990.

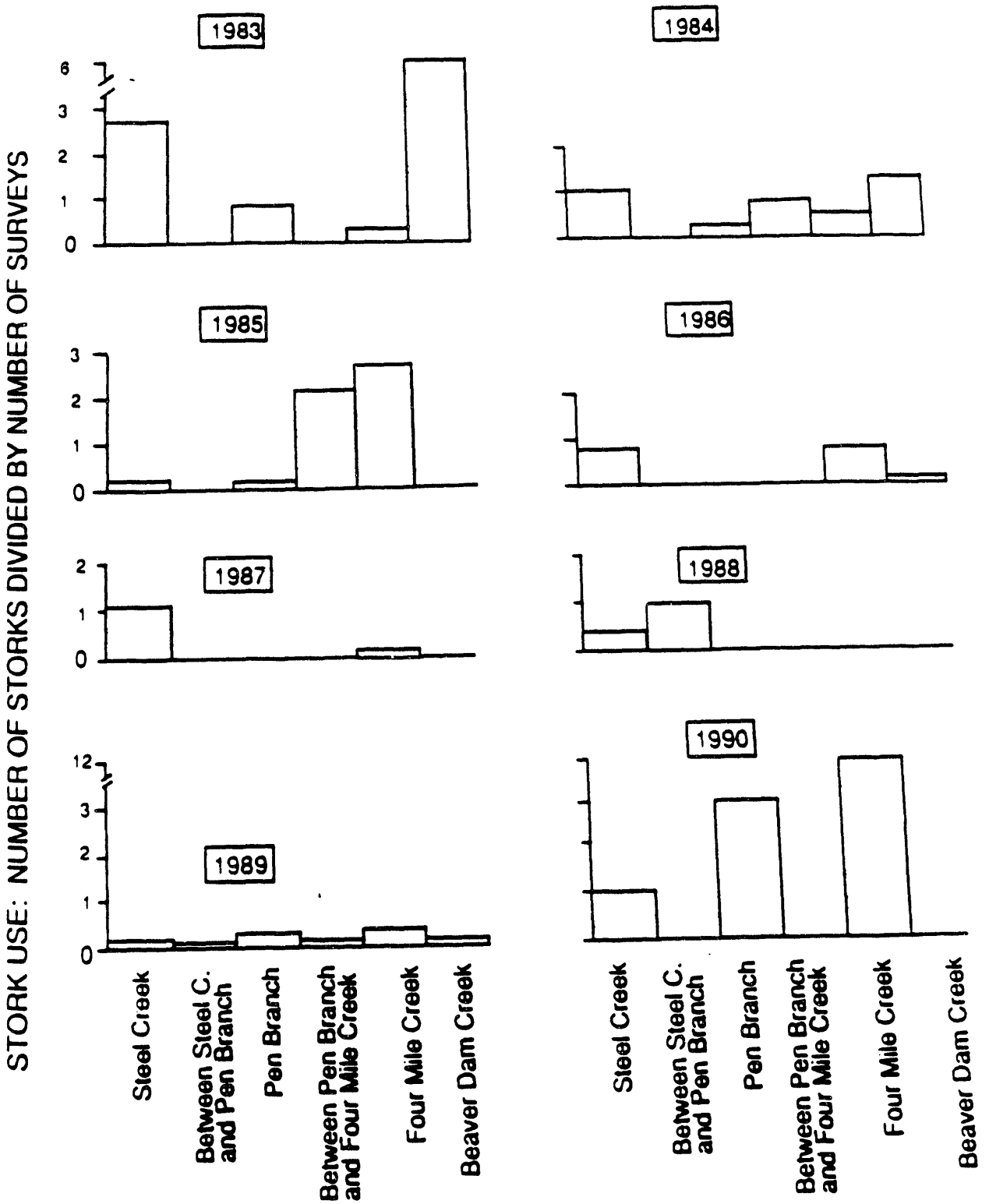

FIGURE IV.4. Wood Stork use of areas of the SRSS, 1983 - 1990. Stork use is the total number of storks divided by the number of surveys.

TABLE IV.1. Percent cover of vegetation sampled at Site 090 in the Steel Creek Delta[1].

	1984	1988	1989
% SUBMERGENT COVER	24	88	100
% LOW COVER	24	86	86
% CANOPY COVER	0	0	0

1: Sampled along two, 12.5 meter transects.

V. KATHWOOD FORAGING PONDS

The Kathwood ponds were designed to replace the foraging habitat potentially lost in the Steel Creek Delta. They were designed and have been managed specifically to provide foraging habitat for Wood Storks. This has involved designing the ponds, stocking the ponds with appropriate potential prey, managing the ponds for growth and reproduction of the prey species and making the ponds available to storks at appropriate times. The ponds were to remain full during most of the year, providing good conditions for fish growth and reproduction. The ponds were constructed in 1985 and have been made available to storks during the summers of 1986 through 1990. It was decided that the NAS would provide maintenance of the ponds and that SREL would monitor the ponds, collect pertinent scientific information and from this information decide when to make the ponds available to the storks[10].

CAPSULE RESULTS:

- The Kathwood ponds were intended to replace the foraging habitat potentially lost to storks in the Steel Creek Delta. They were designed and have been managed specifically for stork foraging.

- The Kathwood ponds were constructed in 1985 and have been available to storks during the summers of 1986 through 1990.

- The ponds were stocked each year with bluegill. In the fall of 1990, golden shiners were added to increase the density of potential prey.

- The ponds have been managed for growth and reproduction of these prey species. Water quality has been checked regularly, and food has been provided for the fish.

- Storks have arrived each year toward the end of July. Some of these birds have come from the Birdsville Colony after dispersal; other storks have arrived after dispersing from more distant colonies.

- The maximum number of storks observed has increased from 97 in 1986 to 250 in 1990. The ponds have been highly successful in fulfilling their intended purpose.

- As the numbers of storks have increased, the ponds have provided adequate food for shorter periods of time each year: from over two months in 1986 to one and a half months in 1990. To compensate for this, we stocked golden shiners into pond 4 in 1990 to increase the amount of potential prey.

Four ponds were constructed at the site of Kathwood Lake. Pond 1 (1.9 ha = 4.7 acres) was not to be managed, but would always be available to the storks (Figure V.1). Ponds 2, 3 and 4 (4.6 ha = 11.4 acres, 4.8 ha = 11.9 acres, and 1.9 ha = 4.7 acres, respectively) were designed so that each pond could be manipulated independently of the others. These ponds would remain full throughout most of the year, providing good conditions for fish growth and reproduction. When we felt that the storks would most benefit from the ponds, we would lower one of the ponds to an appropriate depth for the storks. As the birds depleted the prey in that

pond, the pond could be further lowered concentrating the remaining fish. Once the birds had depleted most of the prey in one pond, we would fill that pond and lower the next pond. We have found it most efficient to lower ponds 4, 3 and 2 in that order.

After the Kathwood foraging ponds were completed in the winter of 1986, they were stocked with potential stork prey: bluegill sunfish and brown bullhead (Table V.1). Grass carp were put into ponds 2, 3, and 4 to control aquatic vegetation. Densities of bluegill were evaluated each year and the ponds were stocked with bluegill during the fall or winter. Additional grass carp were put into ponds 3 and 4 after carp had died in these ponds in 1989. The water quality was checked and chemicals (lime and ammonium nitrate) were added to improve the water quality for the fish. We have continued to examine the water quality in subsequent years and to add chemicals as needed.

We hoped to promote high densities of fish between 5 and 15 cm long (2 to 5 inches). We hoped that high densities would suppress growth much beyond 25 cm. Throughout each spring, summer and fall, the fish were fed regularly and fertilizer was applied to promote algal blooms which were eaten by zooplankton which the fish also eat. During the summers, we monitored water quality regularly to detect critical conditions for the fish (too high or too low pH, or low dissolved oxygen concentrations) and to make corrections as needed. Only once, in 1986, did we record high pH due to fertilization which was quickly remedied. Furthermore, when any pond was lowered for the storks, aerators have been run in that pond during the night when there was the possibility of oxygen stress to the fish.

In 1986, the first year of operating the ponds, the storks bred successfully. We anticipated that the storks would visit the ponds when the birds began dispersing from the colony. We lowered the ponds in early July so that the ponds would be available (Appendix B). On July 30, we saw four storks at the ponds. The numbers of storks rapidly increased to 97, the maximum count for the year (Table V.2, Figure V.2). In addition to the storks, other wading birds have also fed at the ponds: Great Blue Herons, Little Blue Herons, Tricolored Herons, Green Herons, Great Egrets, Snowy Egrets, White Ibises, and Cattle Egrets. The birds fed in the ponds for over two months. On October 6, we felt that the storks would be dispersing from the general area and did not require the ponds. We filled Pond 2 when it still had fish.

Each year we have lowered the ponds in early July so that they would be available when the storks dispersed from the Birdsville Colony and other colonies. In 1989, we also lowered the ponds in April, to see whether the storks might use the ponds earlier. No storks came. We concluded that early July is an appropriate time to lower the ponds.

The numbers of storks feeding in the ponds have increased each year. In 1990, we counted 250 storks feeding in the ponds on July 24. This is the greatest number counted at the ponds. As the numbers of storks visiting the ponds have increased, we have been able to provide food for a shorter period each year, from over two months in 1986 to about one and a half months in 1990. In the fall of 1990, we stocked Pond 4 with golden shiners in an attempt to increase the food available in the ponds and to increase the period during which the storks could feed at the ponds.

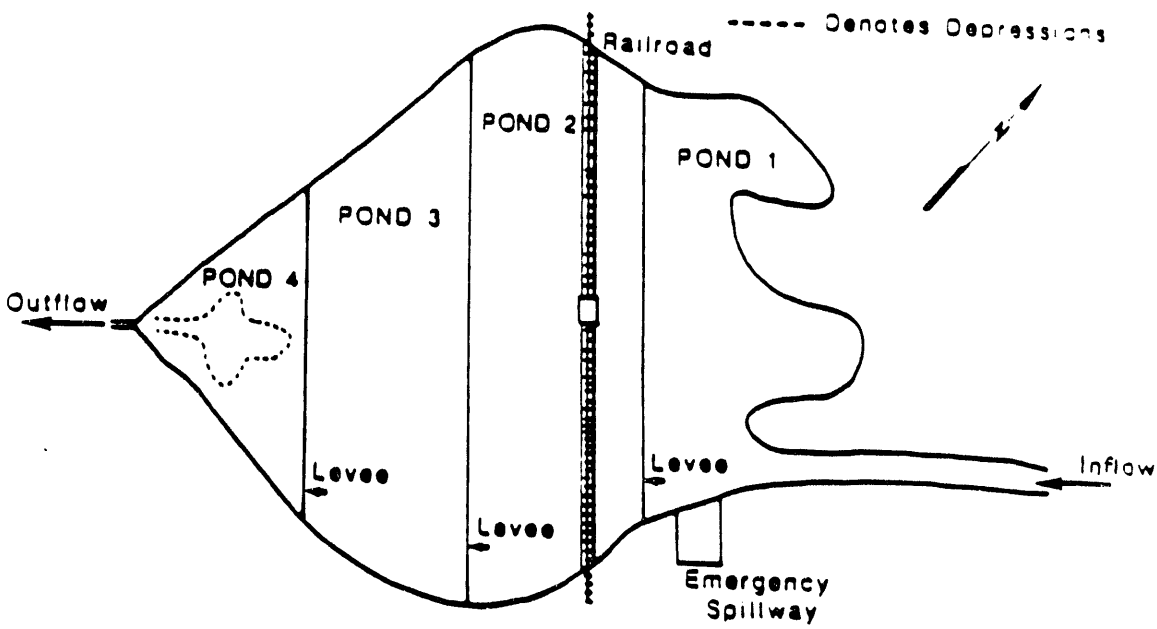

FIGURE V.1. The Kathwood foraging ponds.

TABLE V.1. Fish stocking rates[1] for the Kathwood foraging ponds.

YEAR SPECIES[2]	POND 1[3]	POND 2	POND 3	POND 4
Before the 1986 Season				
Bluegill	2,550	8,000	8,000	21,300
Bullheads	250	2,000	2,000	2,000
Grass Carp	0	5	5	5
Before the 1987 Season				
Bluegill	0	0	3,000	3,000
Before the 1988 Season				
Bluegill	0	5,000	2,000	2,000
Before the 1989 Season				
Bluegill	0	5,000	2,000	1,000
Before the 1990 Season				
Bluegill	0	1,000	0	0
Grass Carp	0	0	0.8	0.2
Before the 1991 Season				
Bluegill	0	5,000	2,000	2,000
Golden Shiners	0	0	0	12,500

1: Individuals stocked per acre of pond.
2: Species: Bluegill Sunfish, Brown Bullheads, Grass Carp, and Golden Shiners.
3: Pond 1 was left as a natural area and was not stocked after 1986.

TABLE V.2. Numbers of sightings of Wood Storks and other wading birds at the Kathwood foraging ponds.

	WOOD STORKS				OTHER WADING BIRDS[1]		
YEAR	NO. DAYS STORKS WERE RECORDED	- NUMBER OF SIGHTINGS - TOTAL	MAXIMUM	AVERAGE[2]	NO. DAYS BIRDS WERE RECORDED	NUMBER OF SIGHTINGS TOTAL	AVERAGE[2]
1986	68	3,057	97	45.0	105	5,185	49.4
1987	63	3,338	151	53.0	77	4,413	57.3
1988	73	4,193	212	57.4	69	3,771	54.7
1989	42	4,599	223	109.5	43	1,830	42.6
1990	34	3,444	250	101.3	34	2,354	69.2

1: The other wading birds include Great Blue Herons, Little Blue Herons, Tricolored Herons, Green Herons, Great Egrets, Snowy Egrets, White Ibises, and Cattle Egrets.
2: The averages are calculated for days when birds were observed.

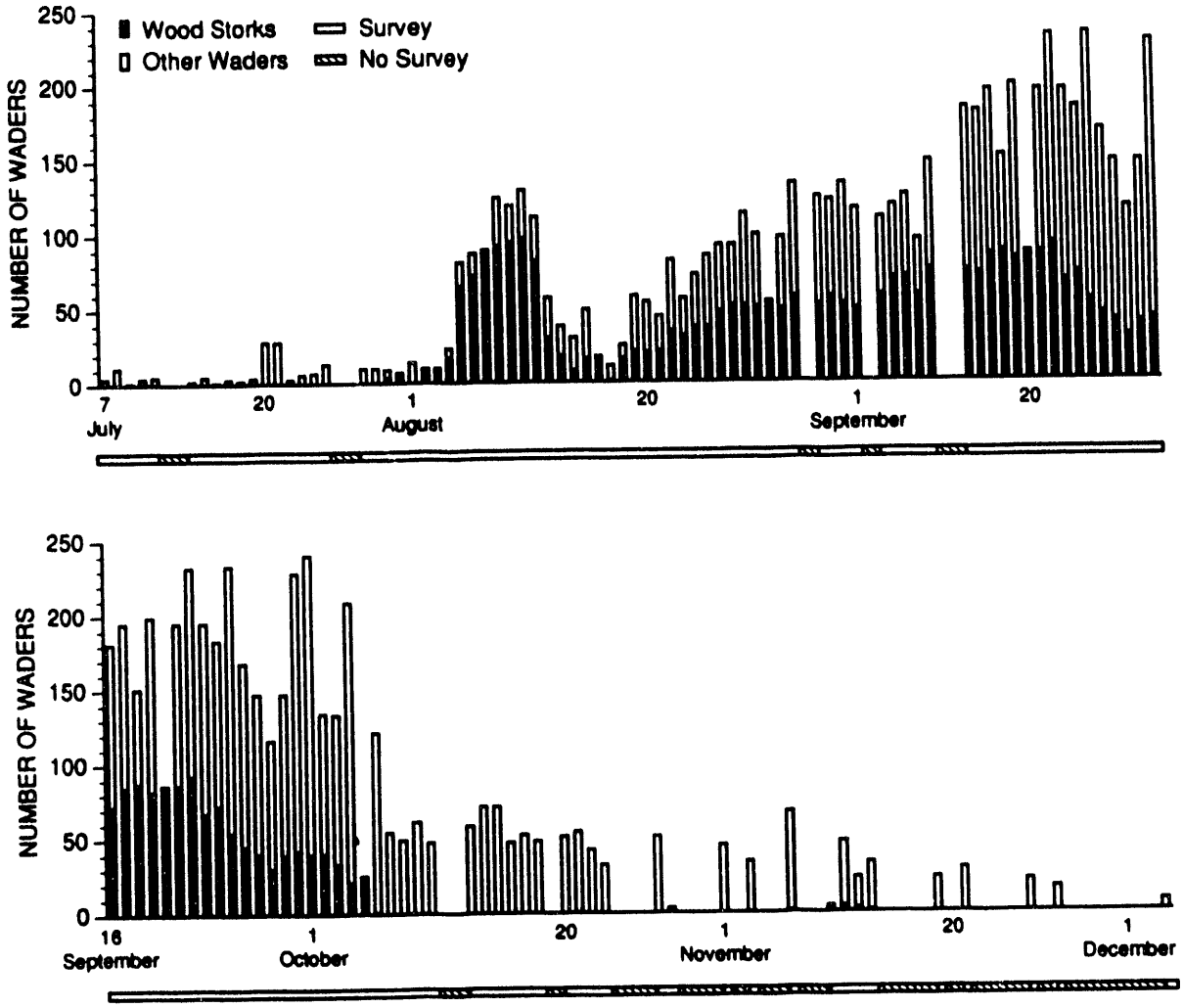

FIGURE V.2. Numbers of Wood Storks and other wading birds at the Kathwood foraging ponds in 1986.

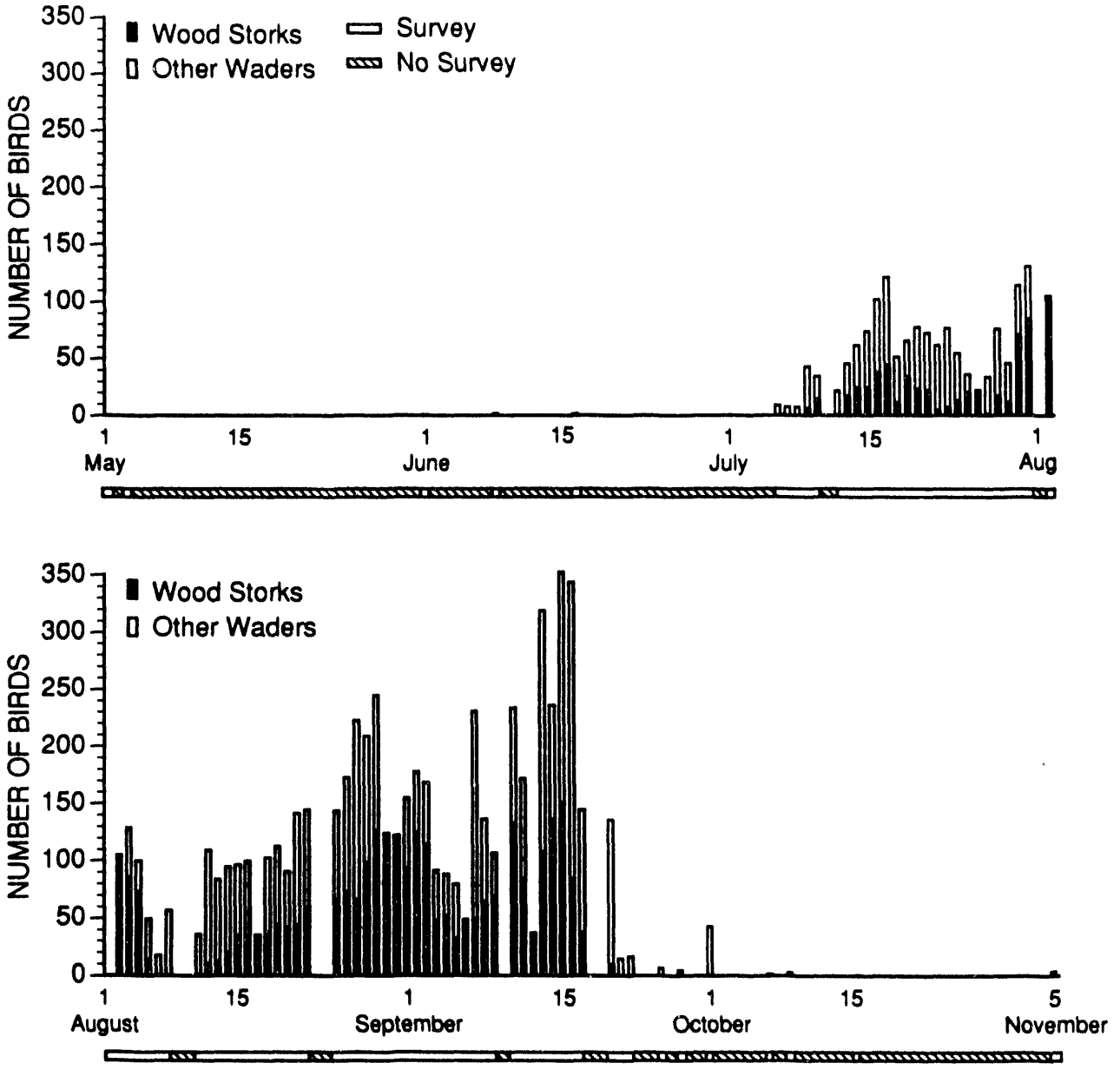

FIGURE V.3. Numbers of Wood Storks and other wading birds at the Kathwood foraging ponds in 1987.

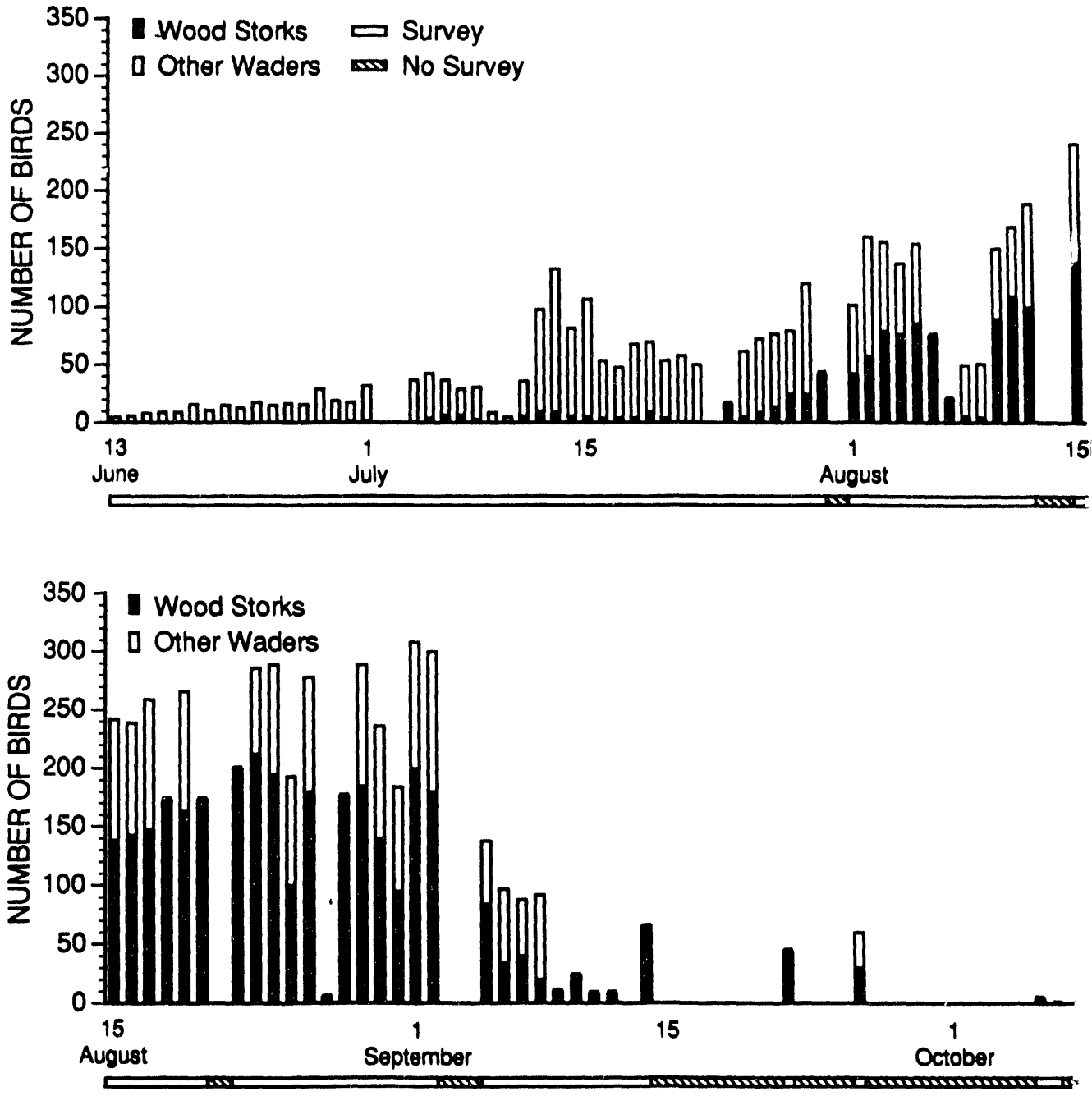

FIGURE V.4. Numbers of Wood Storks and other wading birds at the Kathwood foraging ponds in 1988.

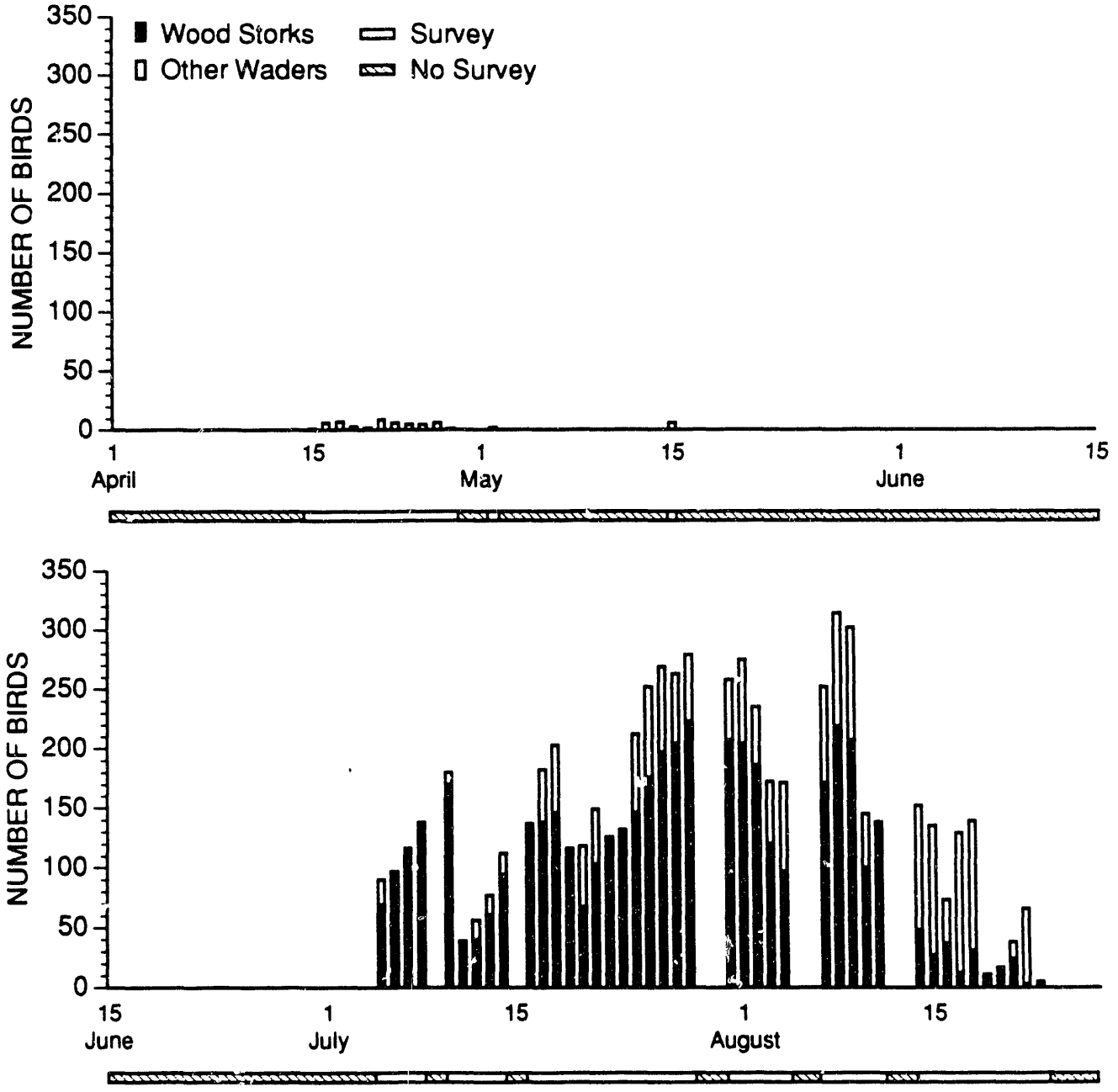

FIGURE V.5. Numbers of Wood Storks and other wading birds at the Kathwood foraging ponds in 1989.

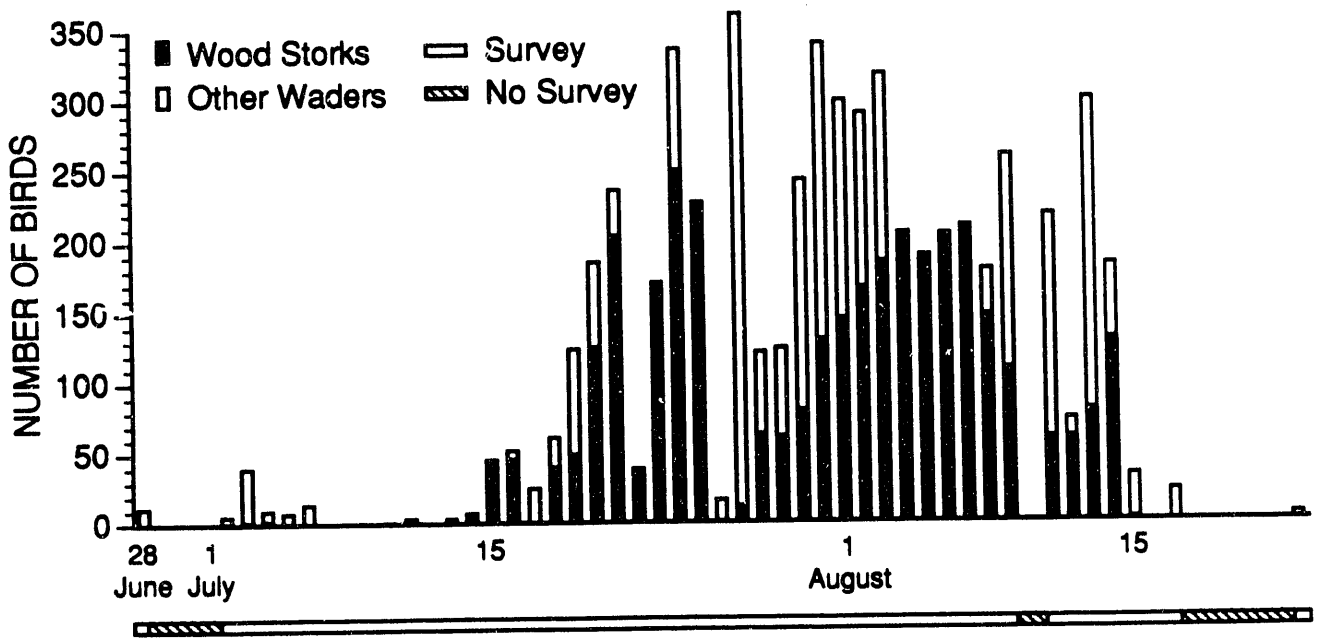

FIGURE V.6. Numbers of Wood Storks and other wading birds at the Kathwood foraging ponds in 1990.

VI. DISCUSSION

The Wood Stork Program has been a large program requiring basic research for the design and subsequent management of the Kathwood ponds. The program began in 1983 and continues in 1991. The ponds were built in 1985 and were first made available in 1986. In all respects, we can say that the Kathwood ponds have successfully provided additional foraging habitat for Wood Storks.

The ponds will be managed to provide stork foraging habitat in the future. While the needed background information on stork biology has been collected, a limited amount of additional information should be collected each year in order manage the ponds most effectively in response to changing conditions. Water depth at the colony and the presence of water at a few known foraging sites provide a good indication of the hydrologic condition of foraging areas around the Birdsville Colony. This will suggest whether the birds may be under food stress and whether lowering the ponds would benefit the storks. In addition, a small amount of information on timing and reproductive success of the birds at the colony may suggest when the ponds should be lowered and how many birds we might expect at the Kathwood ponds. Continued surveys of storks in the SRSS will provide a good comparison with numbers of birds at Kathwood. Finally, basic monitoring of fish densities, water quality and numbers of storks should continue at the Kathwood ponds for most effective management and continuing evaluation of the success of the ponds.

Although the management of the ponds has gone quite well, the management could be refined with some additional work:

1. The bluegill in the Kathwood ponds seem to be concentrated in schools and are in low densities outside the schools. As a result, there is a large variation in the measured densities of fish. It would be helpful to develop an alternative method for determining fish density that could avoid this problem of variation.

2. Wood Storks share the Kathwood ponds with other wading bird species. How is their foraging behavior affected by competition among these various species?

3. We have demonstrated that the rainfall/evapotranspiration regime is critical in affecting reproductive success. It is likely that the rainfall/evapotranspiration regime also affects the timing of dispersal of the birds from the colony and where they move to. For instance, in 1986 and 1987 large numbers of storks remained in the Birdsville area into November and December, but after a rainy period following the 1988 summer drought, the birds had largely departed by early October. A better understanding of the relationship between the rainfall/evapotranspiration regime and dispersal of storks from the colony would allow predictions about the number of birds in the area and the number that might visit Kathwood. It would be helpful to understand the factors that affect the numbers of storks foraging at the Kathwood ponds.

The success of the Kathwood ponds would not have been possible without the very positive cooperation among individuals and among many organizations including the U.S. Department of Energy, the U.S. Fish and Wildlife Service, the National Audubon Society, E.I. DuPont de Nemours and Company, Westinghouse Savannah River Company, and the University of Georgia's Savannah River Ecology Laboratory.

FOOTNOTES

1. National Audubon Society survey data; Ogden, J.C. & S.A. Nisbett. Wils. Bull. 91,512-523 (1979); Ogden, J.C. & B.W. Patty. in *Proceedings of the Nongame Endangered Wildlife Program*, eds. Odom, R.R. & J.W. Guthrie (Ga. Dept. of Nat. Res. Atlanta, 1981) pp. 97-101; though also see Kushlan, J.A. & P. Frohring. Wils. Bull. 98,368-386 (1986).

2. Ogden, J.C. et al. Condor 89,752-759 (1987).

3. Bentzein, M.M. Federal Register 49(40),7332-7335 (1984).

4. Murphy, T. South Carolina Wildlife and Marine Resources Department Wildlife Biologist, pers. com.; Meyers, J.M. SREL-15/UC-66e Savannah River Ecology Laboratory, Aiken, SC (1984).

5. Mackey, H.E., Jr. *Proceedings of the Fifth DOE Environmental Protection Information Meeting,* Albuquerque, NM (1985) pp. 737-745.

6. Meyers, J.M. SREL-15/UC-66e. Savannah River Ecology Laboratory, Aiken, SC (1984); Coulter, M.C. SREL-20/UC-66e. Savannah River Ecology Laboratory, Aiken, SC (1986); Coulter, M.C. SREL-21/UC-66e. Savannah River Ecology Laboratory, Aiken, SC (1986); Coulter, M.C. SREL-24/UC-66e. Savannah River Ecology Laboratory, Aiken, SC (1986); Coulter, M.C. SREL-31/UC-66e. Savannah River Ecology Laboratory, Aiken, SC (1987); Coulter, M.C. SREL-33/UC-66e. Savannah River Ecology Laboratory, Aiken, SC (1988); Coulter, M.C. SREL-34/UC-66e. Savannah River Ecology Laboratory, Aiken, SC (1988); Coulter, M.C. SREL-37/UC-66e. Savannah River Ecology Laboratory, Aiken, SC (1989); Coulter, M.C. SREL-38/UC-66e. Savannah River Ecology Laboratory, Aiken, SC (1990).

7. Meyers, J.M. SREL-15/UC-66e. Savannah River Ecology Laboratory, Aiken, SC (1984); Coulter, M.C. SREL-20/UC-66e. Savannah River Ecology Laboratory, Aiken, SC (1986); Coulter, M.C. SREL-24/UC-66e. Savannah River Ecology Laboratory, Aiken, SC (1986).

8. Tate, A.L. & R.L. Humphries. Oriole 45:34-35 (1980).

9. Kushlan, J.A. Trans. Am. Fish Soc. 103:348-352 (1981).

10. McCort, W.D., et al. *Kathwood Lake Wood Stork Management Plan*, Savannah River Ecology Laboratory, Aiken, SC (1986).

LIST OF APPENDICES

APPENDIX A. NUMBERS OF WOOD STORKS RECORDED DURING AERIAL SURVEYS OF THE SAVANNAH RIVER SWAMP SYSTEM AND AT THE KATHWOOD FORAGING PONDS, 1983-1990.

TABLE A.1. NUMBERS OF WOOD STORKS COUNTED DURING AERIAL SURVEYS OF THE SAVANNAH RIVER SWAMP SYSTEM IN 1983.

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL
JUNE							
21	0	0	0	0	0	0	0
22	2	0	0	0	0	0	2
29	0	0	0	0	0	0	0
30	23	0	0	0	0	0	23
JULY							
01	20	0	0	0	0	28	48
02	0	0	0	0	0	0	0
11	35	0	0	0	0	0	35
12	5	0	3	0	0	9	17
13	0	0	0	0	0	91	91
14	0	0	0	0	0	30	30
22	0	0	0	0	0	0	0
25	0	0	0	0	0	1	1
27	2	0	0	0	0	0	2
28	0	0	0	0	0	0	0
30	0	0	3	0	0	0	3
AUGUST							
01	0	0	0	0	0	11	11
03	0	0	0	0	0	0	0
04	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0

TABLE A.1. CONTINUED

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL
SEPTEMBER							
06	0	0	0	0	0	0	0
08	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0
TOTAL	87	0	6	0	0	170	263

TABLE A.2. NUMBERS OF WOOD STORKS COUNTED DURING AERIAL SURVEYS OF THE SAVANNAH RIVER SWAMP SYSTEM AND KATHWOOD LAKE IN 1984.

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
MAY								
20	0	0	0	0	0	0	0	ns
JUNE								
09	8	0	10	0	0	38 +	56 +	ns
12	5	0	0	14	0	0	19	ns
14	0	0	0	5	4	0	9	ns
18	0	0	0	0	0	0	0	ns
19	0	0	0	0	0	0	0	ns
20	0	0	0	0	18	0	18	ns
29	0	0	0	0	2	0	2	ns
JULY								
03	2	0	10	0	0	1	13	0
04	0	0	0	0	0	0	0	ns
05	0	0	0	0	0	0	0	ns
06	1	0	0	0	0	0	1	0
09	0	0	0	0	0	0	0	ns
10	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
16	29	0	0	0	0	0	29	0
17	10 +	0	0	0	0	0	10 +	0
20	0	0	0	0	1	1	2	0
24	0	0	0	0	0	0	0	0
25	3	0	0	0	0	0	3	0
26	0	0	0	0	0	0	0	0
27	2	0	0	0	10	1	13	0
28	0	0	0	0	0	0	0	0

ns: no survey

TABLE A.2. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
AUGUST								
03	0	0	0	0	0	0	0	2
05	0	0	0	0	0	0	0	0
09	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
20	5	0	0	0	0	0	5	0
21	0	0	0	12	0	0	12	0
22	0	0	0	0	0	0	0	0
23	7	0	0	16	0	0	23	0
25	0	0	0	30	0	0	30	0
26	0	0	0	0	0	0	0	0
27	0	0	0	0	1	0	1	0
28	0	0	0	0	0	0	0	0
29	0	0	0	10	0	0	10	0
30	0	0	0	0	0	0	0	0
31	1	0	0	0	0	0	1	0
SEPTEMBER								
04	5	0	0	0	0	1	6	0
05	14	0	0	0	0	1	15	0
06	3	0	0	0	1	15	19	0
07	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
17	0	0	0	6	0	0	6	0
18	0	0	0	6	0	0	6	0
19	0	0	0	1	0	7	8	0
20	0	0	0	0	0	1	1	0
21	0	0	1	0	0	0	1	0
22	0	0	0	0	0	3	3	0
24	0	0	0	0	0	1	1	0
25	0	0	0	1	1	0	2	0
26	0	0	0	0	0	6	6	0

TABLE A.2. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
SEPTEMBER								
27	0	0	0	0	0	2	2	0
28	0	0	0	0	0	8	8	0
OCTOBER								
03	0	0	0	0	0	0	0	0
04	0	0	0	0	0	0	0	0
05	0	0	0	0	0	0	0	0
08	0	0	0	1	0	0	1	0
09	0	0	0	0	0	0	0	0
10	0	0	0	0	1	0	1	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	2	0	2	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	1	1	0
18	0	0	0	0	2	0	2	0
19	0	0	0	0	3	0	3	0
22	0	0	0	0	0	3	3	0
24	0	0	0	0	0	15	15	0
25	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0
NOVEMBER								
01	0	0	0	0	0	0	0	0
02	0	0	0	0	0	1	1	0
05	0	0	0	0	0	0	0	0
06	0	0	0	0	0	0	0	0
07	0	0	0	0	0	0	0	0
08	0	0	0	0	0	0	0	0
09	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
TOTAL	95+	0	21	102	46	106+	370+	2

TABLE A.3. NUMBERS OF WOOD STORKS COUNTED DURING AERIAL SURVEYS OF THE SAVANNAH RIVER SWAMP SYSTEM AND KATHWOOD LAKE IN 1985.

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
MARCH								
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
APRIL								
01	0	0	0	0	0	0	0	0
02	0	0	0	0	0	0	0	0
03	0	0	0	0	0	0	0	0
04	0	0	0	0	0	0	0	0
05	0	0	0	0	0	0	0	0
08	0	0	0	0	0	0	0	0
09	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
MAY								
01	0	0	0	0	0	0	0	0
02	0	0	0	0	0	0	0	0
03	0	0	0	0	0	0	0	0
06	0	0	0	0	0	0	0	0
07	0	0	0	0	0	0	0	0

TABLE A.3. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
MAY								
08	0	0	0	0	0	0	0	0
09	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
13	0	ns	ns	ns	ns	0	0	0
14	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
22	0	0	0	ns	ns	ns	0	ns
23	1	0	0	0	0	0	1	0
24	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	ns
30	0	0	0	0	0	0	0	0
JUNE								
03	0	0	0	0	0	0	0	0
04	0	0	0	0	0	0	0	0
05	0	0	0	0	0	0	0	0
07	0	0	0	3	0	0	3	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
18	1	0	0	0	0	0	1	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0
26	3	0	0	16	0	0	19	0
27	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
JULY								
01	0	0	0	8	0	0	8	0
02	0	0	0	5	7	0	12	0
03	0	0	0	0	4	0	4	0
04	4	0	0	0	51	0	55	0

ns: no survey

TABLE A.3. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
JULY								
05	0	0	0	32	0	0	32	0
08	0	0	0	5	50	0	55	0
09	0	0	0	2	20	0	22	0
10	0	0	0	21	0	0	21	0
11	0	0	0	18	5	0	23	0
12	0	0	0	15	0	0	15	0
15	0	0	0	4	0	0	4	0
16	0	0	1	30	14	0	45	0
17	0	0	0	0	0	0	0	0
18	0	0	0	30	38	0	68	0
19	0	0	0	7	0	0	7	0
22	0	0	0	0	15	0	15	0
23	0	0	0	4	8	0	12	0
24	0	0	0	8	23	0	31	ns
25	0	0	0	0	0	0	0	ns
26	0	0	ns	ns	ns	ns	0	ns
30	0	0	0	1	0	0	1	0
31	0	0	0	0	0	0	0	0
AUGUST								
01	0	0	0	0	0	0	0	0
05	0	0	0	0	0	0	0	0
06	0	0	0	0	13	0	13	0
07	0	0	0	0	0	0	0	0
09	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	11	0	11	0
15	0	0	0	0	0	0	0	ns
16	0	0	0	2	0	0	2	0
19	0	0	0	0	0	0	0	ns
20	0	0	7	5	0	0	12	0
21	0	0	0	0	1	0	1	0
22	0	0	0	0	21	0	21	0
23	0	0	0	20 +	6	0	26 +	0
26	0	0	0	0	3	0	3	ns
27	0	0	1	0	1	0	2	0
28	0	0	0	0	0	0	0	ns
29	0	0	0	0	0	0	0	ns

ns: no survey

TABLE A.3. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
SEPTEMBER								
03	0	0	0	0	0	0	0	ns
04	0	0	0	0	0	0	0	ns
05	0	0	0	0	0	0	0	ns
06	0	0	0	0	0	0	0	ns
11	0	0	0	0	0	0	0	ns
13	0	0	0	0	0	0	0	ns
16	0	0	0	0	0	0	0	ns
18	0	0	0	0	0	0	0	ns
20	0	0	0	0	0	0	0	ns
25	0	0	0	0	50 +	0	50 +	ns
30	0	0	0	0	0	0	0	ns
OCTOBER								
07	0	0	0	0	0	0	0	ns
10	0	0	0	0	0	0	0	ns
14	0	0	0	0	1	0	1	ns
17	0	0	0	0	0	0	0	ns
24	0	0	0	0	0	0	0	ns
29	0	0	0	0	4	0	4	ns
NOVEMBER								
05	0	0	0	0	0	0	0	ns
07	0	0	0	0	0	0	0	ns
11	0	0	0	0	0	0	0	ns
18	0	0	0	0	0	0	0	ns
TOTAL	9	0	9	236 +	346 +	0	600 +	0

ns: no survey

TABLE A.4. NUMBERS OF WOOD STORKS COUNTED DURING AERIAL SURVEYS OF THE SAVANNAH RIVER SWAMP SYSTEM AND THE KATHWOOD PONDS IN 1986.

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
MARCH								
04	0	0	0	0	0	0	0	0
06	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0
APRIL								
01	0	0	0	0	0	0	0	0
02	0	0	0	0	0	0	0	0
03	0	0	0	0	0	0	0	0
04	0	0	0	0	0	0	0	0
07	0	0	0	0	0	0	0	0
08	0	0	0	0	0	0	0	0
09	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	ns
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
MAY								
01	0	0	0	0	0	0	0	0
02	0	0	0	0	0	0	0	0

ns: no survey

TABLE A.4. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
MAY								
05	0	0	0	0	0	0	0	0
09	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
JUNE								
04	0	0	0	0	0	0	0	0
05	0	0	0	0	0	0	0	0
06	0	0	0	0	0	0	0	0
09	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
JULY								
01	0	0	0	0	0	0	0	0
02	0	0	0	0	0	0	0	0
03	0	0	0	0	0	0	0	0
04	0	0	0	0	0	0	0	0
07	0	0	0	0	0	0	0	ns
08	0	0	0	0	0	0	0	0
09	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	ns
11	0	0	0	0	0	0	0	ns
14	0	0	0	0	0	0	0	ns
15	0	0	0	0	0	0	0	0

ns: no survey

TABLE A.4. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
JULY								
17	0	0	0	0	0	0	0	ns
18	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	25	0	0	0	4	0	29	0
25	0	0	0	0	0	0	0	0
28	0	0	0	0	4	ns	4	ns
29	0	0	0	0	6	15	21	ns
30	0	0	0	0	15	0	15	4
31	0	0	0	0	1	0	1	0
AUGUST								
01	0	0	0	0	40	0	40	0
02	0	0	0	0	19	0	19	6
04	0	0	0	0	2	0	2	0
05	0	0	0	0	0	0	0	0
06	0	0	0	0	2	0	2	58
08	0	0	0	0	1	0	1	ns
11	3	0	0	0	0	0	3	30
12	8	0	0	0	0	0	8	26
13	25	0	0	0	0	0	25	0
15	1	0	0	0	0	0	1	0
18	1	0	0	0	0	0	1	19
19	0	0	0	0	0	0	0	18
25	0	0	0	0	0	0	0	ns
26	0	0	0	0	0	0	0	25
27	8	0	0	0	0	0	8	24
28	0	0	0	0	0	0	0	40
SEPTEMBER								
03	0	0	0	0	0	0	0	48
05	0	0	0	0	0	0	0	50
08	0	0	0	0	0	0	0	48
10	0	0	0	0	0	0	0	48
15	10	0	0	0	0	0	10	45
17	0	0	0	0	0	0	0	75

ns: no survey

TABLE A.4. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
SEPTEMBER								
19	0	0	0	0	0	0	0	76
22	ns	ns	ns	ns	ns	ns	ns	64
24	0	0	0	0	0	0	0	63
26	0	0	0	0	0	0	0	45
29	0	0	0	0	0	0	0	32
OCTOBER								
03	0	0	0	0	0	0	0	23
06	0	0	0	0	0	0	0	0
08	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
NOVEMBER								
03	0	0	0	0	0	0	0	0
06	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	2
14	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
DECEMBER								
03	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
TOTAL	81	0	0	0	94	15	190	869

ns: no survey

TABLE A.5. NUMBERS OF WOOD STORKS COUNTED DURING AERIAL SURVEYS OF THE SAVANNAH RIVER SWAMP SYSTEM AND THE KATHWOOD PONDS IN 1987.

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
MARCH								
03	0	0	0	0	0	0	0	0
06	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
APRIL								
01	0	0	0	0	0	0	0	0
02	0	0	0	0	0	0	0	0
06	0	0	0	0	0	0	0	0
07	0	0	0	0	0	0	0	0
08	0	0	0	0	0	0	0	0
09	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0

TABLE A.5. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
MAY								
01	0	0	0	0	0	0	0	0
04	0	0	0	0	0	0	0	0
05	0	0	0	0	0	0	0	0
06	0	0	0	0	0	0	0	0
08	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	ns
25	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
JUNE								
01	0	0	0	0	0	0	0	0
05	0	0	0	0	0	0	0	0
08	0	0	0	0	0	0	0	0
09	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
JULY								
02	0	0	0	0	0	0	0	0
03	0	0	0	0	0	0	0	0
06	0	0	0	0	0	0	0	0
07	0	0	0	0	0	0	0	0
08	0	0	0	0	0	0	0	0
09	0	0	0	0	0	0	0	1
10	0	0	0	0	0	0	0	3
13	0	0	0	0	0	0	0	ns
14	15	0	0	0	0	0	15	0
16	70	0	0	0	0	0	70	30

ns: no survey

TABLE A.5. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
JULY								
17	40	0	0	0	0	0	40	20
20	9	0	0	0	0	0	9	5
21	0	0	0	0	11	0	11	9
24	0	0	0	0	0	0	0	1
29	4	0	0	0	0	0	4	ns
31	0	0	0	0	0	0	0	10
AUGUST								
06	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	12
13	0	0	0	0	0	0	0	15
17	0	0	0	0	0	0	0	39
18	0	0	0	0	0	0	0	ns
19	0	0	0	0	0	0	0	15
20	0	0	0	0	0	0	0	ns
21	1	0	0	0	0	0	1	38
25	0	0	0	0	0	0	0	53
26	0	0	0	0	0	0	0	60
27	0	0	0	0	0	0	0	10
28	0	0	0	0	0	0	0	1
SEPTEMBER								
01	0	0	0	0	0	0	0	50
02	0	0	0	0	0	0	0	22
03	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	60
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	90
16	0	0	0	0	0	0	0	10
17	0	0	0	0	0	0	0	35
18	0	0	0	0	0	0	0	1

ns: no survey

TABLE A.5. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
SEPTEMBER								
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
OCTOBER								
02	0	0	0	0	0	0	0	0
06	0	0	0	0	0	0	0	0
09	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
NOVEMBER								
03	0	0	0	0	0	0	0	0
06	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
DECEMBER								
01	0	0	0	0	0	0	0	0
04	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
TOTAL	139	0	0	0	11	0	150	590

TABLE A.6. NUMBERS OF WOOD STORKS COUNTED DURING AERIAL SURVEYS OF THE SAVANNAH RIVER SWAMP SYSTEM AND THE KATHWOOD PONDS IN 1988.

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
JANUARY								
05	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
FEBRUARY								
25	0	0	0	0	0	0	0	ns
MARCH								
02	0	0	0	0	0	0	0	0
03	0	0	0	0	0	0	0	0
07	0	0	0	0	0	0	0	0
08	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	ns
14	0	0	0	0	0	0	0	0
15	ns	ns	0	ns	0	0	0	ns
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	ns
23	0	0	0	0	0	0	0	ns
24	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	ns
30	0	0	0	0	0	0	0	ns
31	0	0	0	0	0	0	0	ns
APRIL								
01	0	0	0	0	0	0	0	0
04	0	0	0	0	0	0	0	0
05	0	0	0	0	0	0	0	0
06	0	0	0	0	0	0	0	0
07	0	0	0	0	0	0	0	ns
08	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	ns

ns: no survey

TABLE A.6. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
APRIL								
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	ns
18	0	0	0	0	0	0	0	ns
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	ns
26	0	0	0	0	0	0	0	ns
27	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
MAY								
02	0	0	0	0	0	0	0	ns
03	0	0	0	0	0	0	0	ns
04	0	0	0	0	0	0	0	ns
05	0	0	0	0	0	0	0	0
06	0	0	0	0	0	0	0	0
09	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	ns
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	ns
27	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0

ns: no survey

TABLE A.6. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
JUNE								
01	0	0	0	0	0	0	0	0
02	0	0	0	0	0	0	0	0
03	0	1	0	0	0	0	1	0
06	0	0	0	0	0	0	0	0
07	0	0	0	0	0	0	0	0
08	0	0	0	0	0	0	0	0
09	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	2
JULY								
01	0	0	0	0	0	0	0	0
04	0	0	0	0	0	0	0	0
05	0	0	0	0	0	0	0	0
06	0	0	0	0	0	0	0	0
07	0	0	0	0	0	0	0	5
08	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	1
12	0	0	0	0	0	0	0	8
13	2	0	0	0	0	0	2	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
18	3	0	0	0	0	0	3	0
19	1	0	0	0	0	0	1	0
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	ns

ns: no survey

TABLE A.6. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
JULY								
27	0	0	0	0	0	0	0	13
28	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
AUGUST								
01	0	0	0	0	0	0	0	ns
02	0	0	0	0	0	0	0	24
03	0	0	0	0	0	0	0	36
04	0	0	0	0	0	0	0	58
05	0	0	0	0	0	0	0	72
09	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	1
12	0	0	0	0	0	0	0	60
15	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	ns
23	0	0	0	0	0	0	0	20
24	0	0	0	0	0	0	0	126
25	0	0	0	0	0	0	0	20
26	0	0	0	0	0	0	0	70
29	0	0	0	0	0	0	0	153
30	0	0	0	0	0	0	0	151
SEPTEMBER								
01	0	0	0	0	0	0	0	103
02	0	0	0	0	0	0	0	85
08	0	0	0	0	0	0	0	12
13	0	0	0	0	0	0	0	23
14	0	0	0	0	0	0	0	69
15	0	0	0	0	0	0	0	50
16	0	0	0	0	0	0	0	36
19	0	0	0	0	0	0	0	19
20	0	0	0	0	0	0	0	1
21	0	0	0	0	0	0	0	18
22	0	0	0	0	0	0	0	30
23	0	0	0	0	0	0	0	13
27	0	0	0	0	0	0	0	36
29	0	0	0	0	0	0	0	35
30	0	0	0	0	0	0	0	23

ns: no survey

TABLE A.6. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
OCTOBER								
05	0	0	0	0	0	0	0	4
06	0	0	0	0	0	0	0	6
11	0	0	0	0	0	0	0	4
13	0	0	0	0	0	0	0	2
18	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
NOVEMBER								
02	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
TOTAL	6	1	0	0	0	0	7	1394

TABLE A.7. NUMBERS OF WOOD STORKS COUNTED DURING AERIAL SURVEYS OF THE SAVANNAH RIVER SWAMP SYSTEM AND THE KATHWOOD PONDS IN 1989.

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
FEBRUARY								
17	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
MARCH								
01	0	0	0	0	0	0	0	0
07	0	0	0	0	0	0	0	ns
13	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	ns
31	0	0	0	0	0	0	0	0
APRIL								
03	0	0	0	0	0	0	0	0
04	0	0	0	0	0	0	0	0
05	0	0	0	0	0	0	0	0
06	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0

ns: no survey

TABLE A.7. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
MAY								
01	ns	ns	ns	ns	ns	ns	ns	0
02	0	0	0	0	0	0	0	0
03	0	0	0	0	0	0	0	0
04	0	0	0	0	0	0	0	0
08	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	ns
11	0	0	0	0	0	0	0	0
12	0	0	3	0	0	0	3	0
15	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
29	0	0	0	6	0	0	6	0
30	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0
JUNE								
01	0	0	0	0	0	0	0	ns
02	0	0	0	0	0	0	0	0
05	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	ns
15	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	ns
23	0	0	0	0	0	0	0	0
26	0	0	0	0	2	0	2	0
27	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
JULY								
03	0	0	0	0	0	0	0	0
05	0	0	0	0	0	0	0	31
06	0	0	0	0	0	0	0	90
07	0	0	0	0	0	0	0	48

ns: no survey

TABLE A.7. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
JULY								
10	0	0	0	0	0	0	0	97
11	3	0	0	0	0	0	3	0
12	0	0	0	0	0	0	0	19
13	0	0	0	0	0	0	0	44
17	0	0	0	0	0	0	0	85
20	0	0	0	0	0	0	0	95
24	0	0	0	0	0	0	0	97
26	0	0	1	0	0	0	1	105
28	0	0	0	0	0	0	0	115
31	0	0	0	0	0	0	0	91
AUGUST								
01	0	0	0	0	1	0	1	180
02	0	0	0	0	1	0	1	43
03	0	0	0	0	0	0	0	79
04	0	0	0	0	0	0	0	75
07	0	0	0	0	0	0	0	125
08	0	0	0	0	0	0	0	172
10	0	0	0	0	0	0	0	50
11	0	0	0	0	0	0	0	110
14	0	0	0	0	0	0	0	20
16	6	0	0	0	0	0	6	0
17	0	0	0	0	0	0	0	9
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
25	0	1	1	0	0	2	4	0
29	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0
SEPTEMBER								
01	0	0	0	0	1	0	1	0
04	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
18	0	0	0	0	1	0	1	0
28	0	0	0	0	0	0	0	0

TABLE A.7. Continued

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
OCTOBER								
04	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
TOTAL	9	1	5	6	6	2	29	1780

TABLE A.8. NUMBERS OF WOOD STORKS COUNTED DURING AERIAL SURVEYS OF THE SAVANNAH RIVER SWAMP SYSTEM AND THE KATHWOOD PONDS IN 1990.

DATE	STEEL CREEK DELTA	SWAMP BETWEEN PEN BRANCH AND STEEL CREEK	PEN BRANCH	SWAMP BETWEEN FOUR MILE CREEK AND PEN BRANCH	FOUR MILE CREEK	BEAVER DAM CREEK	SRSS TOTAL	KATHWOOD
JUNE								
19	0	0	0	0	12	0	12	0
JULY								
16	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
AUGUST								
15	0	0	0	0	0	0	0	0
17	1	0	0	0	0	0	1	0
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
SEPTEMBER								
05	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
TOTAL	1	0	0	0	12	0	13	0

APPENDIX B. OVERVIEW OF MANAGEMENT AND OBSERVATIONS AT THE KATHWOOD FORAGING PONDS, 1986 THROUGH 1990.

TABLE B.1. OVERVIEW OF MANAGEMENT AND OBSERVATIONS AT THE KATHWOOD FORAGING PONDS IN 1986.

POND 2	POND 3	POND 4
July 3 began lowering pond 2		
July 4 pond 2 available to storks		
July 7 put decoys into ponds 1 and 2		
July 9 began filling pond 2 to alleviate dissolved oxygen problems		
Mid-July Birdsville colony began dispersal		
		July 14 began lowering pond 4 began running water through ponds 3 and 4 to alleviate pH problems caused by fertilization
		July 20 pond 4 available to storks
		July 20-25 3 - 28 waders/census no storks
July 24 moved decoys out of ponds 1 and 2		July 24 moved decoys into pond 4

TABLE B.1. Continued

POND 2	POND 3	POND 4
		July 30 4 juvenile Wood Storks August 1 fish density = 14.7/m^2 August 6 72 storks fish density = 8.3/m^2
August 8 began lowering pond 2 pond 2 available to storks fish density = 9.8/m^2		
		August 10 97 Wood Storks (1986 maximum count) August 12 fish density = 3.4/m^2
August 15 Wood Storks foraging in pond 2 (but many also foraging in pond 1)		
	August 18 began lowering pond 3	August 18 began filling pond 4
August 21 21 Wood Storks in pond 2	August 20 pond 3 available to storks	
August 22 began filling pond 2	August 22 Wood Storks foraging in pond 3	
	September 9 fish density = 25.8/m^2	

TABLE B.1. Continued

POND 2	POND 3	POND 4
	September 23 fish density = 15.7/m^2	
September 25 began lowering pond 2		
September 26 Wood Storks foraging in pond 2		
	October 1 began filling pond 3	
October 6 fish density = 12.2/m^2 began filling pond 2		

TABLE B.2. OVERVIEW OF MANAGEMENT AND OBSERVATIONS AT THE KATHWOOD FORAGING PONDS IN 1987.

POND 2	POND 3	POND 4
Early July Birdsville colony began dispersing		
July 6 began lowering pond 2		
July 7 pond 2 available to storks		
July 8 fish density = 1.4/m^2 8 Wood Storks circling		
July 9 7 Wood Storks in pond 2		
July 12 0 Wood Storks		
		July 13 began lowering pond 4
July 14 began filling pond 2		July 14 pond 4 available to storks 25 Wood Storks pond 4 fish density = 212/m^2 small fish kill
		July 21 fish density = 57.2/m^2 23 Wood Storks
		July 27 fish density = 56.5/m^2 2 Wood Storks
		July 30 lowered pond 4 an additional 4 inches 71 Wood Storks (Large influx of storks through Aug 4)

TABLE B.2. Continued

POND 2	POND 3	POND 4
	August 6 began lowering pond 3	
	August 7 pond 3 available to storks	August 7 began raising pond 4
	August 10 fish density = 74.6/m^2	
	August 11 water level down on pond 3 11 Wood Storks	
	August 18 fish density = 31.3/m^2 44 Wood Storks	
	August 25 fish density = 43.6/m^2 73 Wood Storks	
September 3 began lowering pond 2	September 3 fish density = 32.3/m^2 48 Wood Storks low foraging success rates	
September 4 pond 2 available to storks 52 Wood Storks		
September 5 water level of pond 2 down 33 Wood Storks		
September 16 fish density = 1.1/m^2 151 Wood Storks (1987 maximum count)		

TABLE B.2. Continued

POND 2	POND 3	POND 4
September 21 begin raising pond 2 10 Wood Storks		
September 22 pond 2 up no Wood Storks		

TABLE B.3. OVERVIEW OF MANAGEMENT AND OBSERVATIONS AT THE KATHWOOD FORAGING PONDS IN 1988.

POND 2	POND 3	POND 4
Early June Birdsville colony began dispersing		
		June 8 began lowering pond 4
		June 10 pond 4 available to storks
		June 14 lowered pond 4 an additional 10 inches
		June 23 fish density = 44.7/m^2
		June 26 1 Wood Stork in pond 4 (first Wood Stork observed at the ponds in 1988)
		June 30 fish density = 74.0/m^2
		July 2 lowered pond 4 an additional 3 inches
		July 7 fish density = 109.0/m^2
		July 14 fish density = 96.7/m^2 6 Wood Storks
		July 28 fish density = 79.8/m^2 25 Wood Storks lowered pond 4 an additional 3 inches
		July 30 44 Wood Storks

TABLE B.3. Continued

POND 2	POND 3	POND 4
		August 5 86 Wood Storks fish density = 41.0/m^2
	August 8 began lowering pond 3	August 8 fish density = 25.3/m^2 began raising pond 4
	August 9 pond 3 available to storks	
	August 10 90 Wood Storks	
	August 11 fish density = 25.0/m^2	
	August 17 fish density = 10.1/m^2	
	August 23 212 Wood Storks (1988 maximum count)	
	August 24 fish density = 10.2/m^2 lowered pond 3 an additional 3 inches	
August 26 began lowering pond 2	August 26 began filling pond 3	
August 27 pond 2 available to storks		
August 28 178 Wood Storks		
August 31 fish density = 35.6/m^2		

TABLE B.3. Continued

POND 2	POND 3	POND 4
September 6 34 Wood Storks lowered pond 2 an additional 6 inches		
September 7 fish density = 21.6/m^2 40 Wood Storks		
September 9 12 Wood Storks		
September 12 began filling pond 2		

TABLE B.4. OVERVIEW OF MANAGEMENT AND OBSERVATIONS AT THE KATHWOOD FORAGING PONDS IN 1989.

POND 2	POND 3	POND 4
		April 14 began lowering pond 4 (to see whether storks would use the ponds during the breeding season)
		May 1 began filling pond 4 (no storks visited the ponds)
Early July Birdsville colony began dispersing		
		July 3 began lowering pond 4
		July 4 pond 4 available to storks
		July 5 69 Wood Storks (first storks observed at the ponds in 1989)
		July 6 fish kill (lost about 2000 bluegill)
		July 7 fish density = 27.2/m^2
		July 12 fish density = 20.4/m^2
	July 18 began lowering pond 3	July 18 fish density = 11.9/m^2 began filling pond 4 146 Wood Storks

TABLE B.4. (Continued)

POND 2	POND 3	POND 4
	July 20 pond 3 available to storks 67 Wood Storks fish density = 16.5/m^2 lowered pond an additional 3 inches	
	July 24 146 Wood Storks	
	July 26 small fish kill fish density = 9.8/m^2	
	July 28 223 Wood Storks (1989 maximum count)	
	August 1 fish density = 5.2/m^2	
August 3 began lowering pond 2	August 3 began filling pond 3 120 Wood Storks	
August 4 pond 2 available to storks 97 Wood Storks		
August 7 171 Wood Storks fish density = 2.9/m^2		
August 8 219 Wood Storks		
August 11 fish density = 1.6/m^2		
August 14 lowered pond an additional 3 inches		

TABLE B.4. (Continued)

POND 2	POND 3	POND 4
August 15 fish density = 10.0/m^2		
August 17 12 Wood Storks		
August 18 began filling pond 2		

TABLE B.5. OVERVIEW OF MANAGEMENT AND OBSERVATIONS AT THE KATHWOOD FORAGING PONDS IN 1990.

POND 2	POND 3	POND 4
Early June Birdsville colony began dispersing		
		June 27 began lowering pond 4
		June 28 pond 4 available to storks
		July 2 fish density = 29.0/m^2
		July 3 1 Wood Stork in pond 4 (first Wood Stork observed at the ponds in 1990)
		July 9 fish density = 34.2/m^2
		July 14 7 Wood Storks
		July 16 fish density = 35.7/m^2 46 Wood Storks
		July 21 204 Wood Storks
		July 23 fish density = 23.8/m^2
		July 24 250 Wood Storks (1990 maximum count)

TABLE B.5. Continued

POND 2	POND 3	POND 4
	July 26 began lowering pond 3	July 26 fish density = 8.4/m^2 began raising pond 4
	July 27 pond 3 available to storks 12 Wood Storks	
	July 30 fish density = 20.7/m^2 80 Wood Storks	
	August 2 fish density = 28.3/m^2 167 Wood Storks	
	August 4 205 Wood Storks	
August 7 began lowering pond 2	August 7 210 Wood Storks began raising pond 3	
August 8 pond 2 available to storks 147 Wood Storks		
August 9 fish density = 16.5/m^2		
August 14 fish density = 8.4/m^2 130 Wood Storks		
August 15 2 Wood Storks lowered pond 2 an additional 2 inches		
August 16 no Wood Storks began filling pond 2		

APPENDIX C. DAILY COUNTS OF WOOD STORKS AND OTHER WADING BIRDS AT THE KATHWOOD FORAGING PONDS, 1986 - 1990.

TABLE C.1. DAILY COUNTS OF WOOD STORKS AND OTHER WADING BIRDS AT THE KATHWOOD FORAGING PONDS IN 1986.

DATE	WOOD STORKS	GREAT EGRET	SNOWY EGRET	CATTLE EGRET	LITTLE BLUE HERON	GREAT BLUE HERON	GREEN-BACKED HERON	WHITE IBIS	TOTAL OTHER WADERS	TOTAL ALL WADERS
JULY										
7	0	2	0	0	1	1	0	0	4	4
8	0	10	0	0	1	0	0	0	11	11
9	0	0	0	0	0	1	0	0	1	1
10	0	1	0	0	2	1	0	0	4	4
11	0	2	0	0	0	3	0	0	5	5
14	0	0	0	0	0	2	0	0	2	2
15	0	3	0	0	0	2	0	0	5	5
16	0	0	0	0	0	1	0	0	1	1
17	0	2	0	1	0	0	0	0	3	3
18	0	1	0	0	0	1	0	0	2	2
19	0	2	0	0	0	2	0	0	4	4
20	0	27	0	0	0	1	0	0	28	28
21	0	27	0	0	0	1	0	0	28	28
22	0	1	0	0	0	1	1	0	3	3
23	0	4	0	0	1	1	0	0	6	6
24	0	6	0	0	0	1	0	0	7	7
25	0	8	0	0	2	2	1	0	13	13
28	0	7	0	0	1	1	1	0	10	10
29	0	2	0	0	2	2	4	0	10	10
30	4	3	0	0	1	1	0	0	5	9
31	4	2	0	0	1	0	0	0	3	7
AUGUST										
1	0	10	0	0	3	0	1	0	14	14
2	10	nr	nr	nr	nr	nr	nr	nr	nr	nr
3	10	nr	nr	nr	nr	nr	nr	nr	nr	nr
4	17	5	0	0	0	1	0	0	6	23
5	65	10	0	0	5	1	0	0	16	81
6	72	11	0	0	2	2	0	0	15	87
7	86	1	0	0	1	1	0	0	3	89
8	92	20	0	0	7	5	0	0	32	124
9	94	17	0	0	1	7	0	0	25	119
10	97	21	0	0	0	11	0	0	32	129
11	82	13	0	3	9	2	1	1	29	111
12	30	9	0	10	5	2	1	0	27	57
13	18	12	0	0	5	1	1	1	20	38
14	8	11	0	1	5	4	1	0	22	30
15	16	21	0	2	6	4	0	0	33	49

nr: not recorded

TABLE C.1. Continued

DATE	WOOD STORKS	GREAT EGRET	SNOWY EGRET	CATTLE EGRET	LITTLE BLUE HERON	GREAT BLUE HERON	GREEN-BACKED HERON	WHITE IBIS	TOTAL OTHER WADERS	TOTAL ALL WADERS
AUGUST										
16	17	nr	nr	nr	nr	nr	nr	nr	nr	nr
17	1	6	0	0	2	2	0	0	10	11
18	16	3	0	0	4	2	0	0	9	25
19	21	26	0	1	5	4	1	0	37	58
20	20	28	0	0	3	3	0	0	34	54
21	21	16	0	0	6	1	0	0	23	44
22	34	35	0	1	7	4	1	0	48	82
23	31	25	0	0	0	0	0	0	25	56
24	37	31	0	0	3	0	0	1	35	72
25	37	43	0	0	2	3	0	0	48	85
26	47	35	0	0	5	4	1	0	45	92
27	51	31	0	0	6	4	0	0	41	92
28	51	40	0	2	10	10	0	0	62	113
29	50	35	0	0	11	3	0	0	49	99
30	54	nr	nr	nr	nr	nr	nr	nr	nr	nr
31	49	33	0	0	10	5	0	0	48	97
SEPTEMBER										
1	57	56	0	0	14	6	0	0	76	133
2	0	nr	nr	nr	nr	nr	nr	nr	nr	nr
3	52	50	0	0	15	6	1	0	72	124
4	57	49	0	0	15	1	0	0	65	122
5	52	55	0	0	19	7	0	0	81	133
6	49	53	0	0	11	3	0	0	67	116
8	58	33	0	0	5	7	7	0	52	110
9	69	41	0	0	4	3	1	0	49	118
10	70	36	0	0	15	4	0	0	55	125
11	58	31	0	0	0	6	0	0	37	95
12	75	62	0	0	9	2	0	0	73	148
15	74	89	1	3	10	6	0	0	109	183
16	72	68	0	0	35	6	0	0	109	181
17	85	90	0	0	13	7	0	0	110	195
18	87	54	0	0	7	3	0	0	64	151
19	82	101	0	0	9	7	0	0	117	199
20	86	nr	nr	nr	nr	nr	nr	nr	nr	nr
21	86	109	0	0	0	0	0	0	109	195
22	92	118	0	0	15	7	0	0	140	232
23	67	122	0	1	2	3	0	0	128	195
24	72	88	0	0	17	6	0	0	111	183
25	54	107	0	0	65	7	0	0	179	233

nr: not recorded

TABLE C.1. Continued

DATE	WOOD STORKS	GREAT EGRET	SNOWY EGRET	CATTLE EGRET	LITTLE BLUE HERON	GREAT BLUE HERON	GREEN-BACKED HERON	WHITE IBIS	TOTAL OTHER WADERS	TOTAL ALL WADERS
SEPTEMBER										
26	45	106	0	0	6	11	0	0	123	168
27	40	101	0	0	3	3	0	0	107	147
28	30	70	0	0	1	15	0	0	86	116
29	39	101	0	0	1	6	0	0	108	147
30	42	86	0	79	10	11	0	0	186	228
OCTOBER										
1	40	100	0	100	0	0	0	0	200	240
2	40	80	0	0	11	2	0	1	94	134
3	33	89	0	0	1	9	0	1	100	133
4	21	69	0	110	8	0	0	0	187	208
5	25	nr	nr	nr	nr	nr	nr	nr	nr	nr
6	1	67	0	47	0	6	0	0	120	121
7	0	45	0	0	0	9	0	0	54	54
8	0	42	0	0	0	6	1	0	49	49
9	0	53	0	0	0	8	0	0	61	61
10	0	41	0	0	0	6	0	0	47	47
11	0	nr	nr	nr	nr	nr	nr	nr	nr	nr
12	0	nr	nr	nr	nr	nr	nr	nr	nr	nr
13	0	49	0	0	0	9	0	0	58	58
14	0	62	0	0	0	9	0	0	71	71
15	0	63	0	0	0	8	0	0	71	71
16	0	45	0	0	0	2	0	0	47	47
17	0	44	0	0	0	8	0	0	52	52
18	0	48	0	0	0	0	0	0	48	48
19	0	nr	nr	nr	nr	nr	nr	nr	nr	nr
20	0	48	0	0	0	3	0	0	51	51
21	0	49	0	0	0	5	0	0	54	54
22	0	36	0	0	0	6	0	0	42	42
23	0	27	0	0	0	5	0	0	32	32
27	0	48	0	0	0	3	0	0	51	51
28	0	3	0	0	0	0	0	0	3	3
NOVEMBER										
1	0	32	0	0	0	13	0	0	45	45
3	0	34	0	0	0	0	0	0	34	34
6	1	51	0	0	0	14	0	1	66	67
10	4	36	0	0	1	6	0	0	43	47

nr: not recorded

TABLE C.1. Continued

DATE	WOOD STORKS	GREAT EGRET	SNOWY EGRET	CATTLE EGRET	LITTLE BLUE HERON	GREAT BLUE HERON	GREEN-BACKED HERON	WHITE IBIS	TOTAL OTHER WADERS	TOTAL ALL WADERS
NOVEMBER										
11	2	21	0	0	0	0	0	0	21	23
12	1	12	0	0	0	20	0	0	32	33
17	0	13	0	0	0	10	0	0	23	23
19	0	21	0	0	0	8	0	0	29	29
24	0	13	0	0	0	8	0	0	21	21
26	0	9	0	0	0	7	0	0	16	16
DECEMBER										
2	0	nr	nr	nr	nr	nr	nr	nr	nr	nr
4	0	2	0	0	0	5	0	0	7	7

nr: not recorded.

TABLE C.2. DAILY COUNTS OF WOOD STORKS AND OTHER WADING BIRDS AT THE KATHWOOD FORAGING PONDS IN 1987.

DATE	WOOD STORKS	GREAT EGRET	SNOWY EGRET	CATTLE EGRET	LITTLE BLUE HERON	GREAT BLUE HERON	GREEN-BACKED HERON	WHITE IBIS	TOTAL OTHER WADERS	TOTAL ALL WADERS
MAY										
2	0	0	0	0	0	0	0	0	0	0
JUNE										
1	0	0	0	0	0	0	1	0	1	1
8	0	2	0	0	0	0	0	0	2	2
16	0	1	0	0	0	1	0	0	2	2
JULY										
6	0	4	0	0	2	1	2	0	9	9
7	0	6	0	0	1	1	0	0	8	8
8	0	3	0	0	4	1	0	0	8	8
9	7	15	0	0	18	1	0	2	36	43
10	15	12	0	2	5	1	0	0	20	35
12	0	20	0	0	1	1	0	0	22	22
13	18	19	0	0	6	2	1	0	28	46
14	25	24	0	0	7	4	0	2	37	62
15	25	26	0	0	19	1	0	3	49	74
16	39	44	0	0	12	4	0	3	63	102
17	45	43	0	0	22	9	0	3	77	122
18	12	32	0	0	3	2	0	3	40	52
19	35	25	0	0	5	1	0	0	31	66
20	24	32	2	0	12	8	0	0	54	78
21	23	38	1	1	7	2	1	0	50	73
22	5	26	3	15	5	8	0	0	57	62
23	8	24	0	15	26	4	0	0	69	77
24	14	28	0	0	10	3	0	0	41	55
25	21	5	0	0	8	2	0	0	15	36
26	22	nr	nr	nr	nr	nr	nr	nr	nr	nr
27	2	14	0	4	11	3	0	0	32	34
28	18	15	1	22	16	4	0	0	58	76
29	12	16	1	0	12	5	0	0	34	46
30	71	18	3	1	14	4	3	0	43	114
31	85	20	1	9	12	4	0	0	46	131
AUGUST										
2	105	nr	nr	nr	nr	nr	nr	nr	nr	nr
3	86	14	0	8	18	3	0	0	43	129
4	73	15	1	2	2	7	0	0	27	100
5	14	14	0	5	9	7	1	0	36	50

nr: not recorded

TABLE C.2. Continued

DATE	WOOD STORKS	GREAT EGRET	SNOWY EGRET	CATTLE EGRET	LITTLE BLUE HERON	GREAT BLUE HERON	GREEN-BACKED HERON	WHITE IBIS	TOTAL OTHER WADERS	TOTAL ALL WADERS
AUGUST										
6	0	7	0	4	3	3	1	0	18	18
7	0	10	0	37	5	4	1	0	57	57
8	0	nr	nr	nr	nr	nr	nr	nr	nr	nr
10	1	13	0	12	7	2	1	0	35	36
11	11	15	0	67	9	8	0	0	99	110
12	13	25	1	29	5	10	1	0	71	84
13	20	50	0	0	21	4	0	0	75	95
14	35	31	0	26	0	4	0	1	62	97
15	35	52	0	0	7	6	0	0	65	100
16	35	18	nr	nr	nr	nr	nr	nr	nr	nr
17	38	48	0	5	10	1	1	0	65	103
18	44	47	0	5	8	5	1	3	69	113
19	42	35	0	0	7	7	0	0	49	91
20	45	75	0	0	12	8	2	0	97	142
21	56	64	0	0	16	8	0	1	89	145
24	66	63	3	0	3	9	0	0	78	144
25	73	76	0	0	9	14	1	0	100	173
26	67	94	0	49	5	8	0	0	156	223
27	99	101	0	0	4	5	0	0	110	209
28	127	111	0	0	0	7	0	0	118	245
29	124	23	nr	nr	nr	nr	nr	nr	nr	nr
30	122	nr	nr	nr	nr	nr	nr	nr	nr	nr
31	93	20	0	30	4	8	0	0	62	155
SEPTEMBER										
1	125	38	0	0	7	8	0	0	53	178
2	115	39	0	0	6	9	0	0	54	169
3	48	14	0	8	18	4	0	0	44	92
4	52	24	0	0	7	6	0	0	37	89
5	33	39	0	0	5	3	0	0	47	80
6	49	42	nr	nr	nr	nr	nr	nr	nr	nr
7	50	46	2	57	64	12	0	0	181	231
8	65	33	0	28	11	0	0	0	72	137
9	68	25	0	0	13	1	0	0	39	107
11	133	84	0	0	9	4	0	4	101	234
12	84	68	0	0	13	0	0	7	88	172
13	37	nr	nr	nr	nr	nr	nr	nr	nr	nr
14	108	90	2	87	14	11	1	6	211	319
15	137	70	5	8	3	11	2	0	99	236
16	151	44	2	153	0	3	0	0	202	353

nr: not recorded

TABLE C.2. Continued

DATE	WOOD STORKS	GREAT EGRET	SNOWY EGRET	CATTLE EGRET	LITTLE BLUE HERON	GREAT BLUE HERON	GREEN-BACKED HERON	WHITE IBIS	TOTAL OTHER WADERS	TOTAL ALL WADERS
SEPTEMBER										
17	85	43	1	200	6	8	1	0	259	344
18	38	42	2	56	1	6	0	0	107	145
21	10	25	0	90	0	11	0	0	126	136
22	0	12	0	0	1	2	0	0	15	15
23	0	13	0	0	0	4	0	0	17	17
26	0	4	0	0	0	3	0	0	7	7
28	0	2	0	0	0	3	0	0	5	5
OCTOBER										
1	0	2	0	39	1	1	0	0	43	43
6	0	0	0	0	0	0	0	0	0	0
7	0	1	0	0	0	1	0	0	2	2
9	0	1	0	0	0	2	0	0	3	3
16	0	0	0	0	0	1	0	0	1	1
NOVEMBER										
5	0	0	0	0	0	4	0	0	4	4

TABLE C.3. DAILY COUNTS OF WOOD STORKS AND OTHER WADING BIRDS AT THE KATHWOOD FORAGING PONDS IN 1988.

DATE	WOOD STORKS	GREAT EGRET	SNOWY EGRET	CATTLE EGRET	LITTLE BLUE HERON	GREAT BLUE HERON	GREEN-BACKED HERON	WHITE IBIS	TOTAL OTHER WADERS[1]	TOTAL ALL WADERS
JUNE										
13	0	2	0	0	1	0	2	0	5	5
14	0	2	0	0	1	2	1	0	6	6
15	0	2	0	0	1	2	3	0	8	8
16	0	3	0	0	1	2	3	0	9	9
17	0	4	0	0	1	2	2	0	9	9
20	0	11	0	0	1	3	1	0	16	16
21	0	5	0	0	1	2	3	0	11	11
22	0	6	0	0	2	3	4	0	15	15
23	0	8	0	0	1	3	1	0	13	13
24	0	14	0	0	1	2	1	0	18	18
25	0	11	0	0	1	1	2	0	15	15
26	1	13	0	0	1	1	1	0	16	17
27	1	10	0	0	2	2	1	0	15	16
28	1	12	0	12	1	2	1	0	28	29
29	2	11	0	2	1	2	1	0	17	19
30	2	11	0	1	1	2	1	0	16	18
JULY										
1	2	12	0	11	1	3	3	0	30	32
2	0	nr	nr	nr	nr	nr	nr	nr	nr	nr
3	1	nr	nr	nr	nr	nr	nr	nr	nr	nr
4	1	29	0	2	1	2	2	0	36	37
5	4	20	0	14	1	2	2	0	39	43
6	7	20	0	0	2	2	1	5	30	37
7	7	18	0	0	1	2	1	0	22	29
8	3	23	0	0	1	3	1	0	28	31
9	0	6	0	1	1	0	1	0	9	9
10	1	0	0	0	1	1	2	0	4	5
11	6	15	0	12	1	1	1	0	30	36
12	10	78	0	0	7	1	0	2	88	98
13	9	53	2	64	1	2	2	0	124	133
14	6	49	2	18	1	5	1	0	76	82
15	6	69	2	22	1	5	2	0	101	107
16	4	45	1	0	0	2	2	0	50	54
17	4	40	1	0	0	2	1	0	44	48
18	4	50	1	7	1	5	0	0	64	68
19	10	40	0	16	0	4	0	0	60	70
20	4	29	1	16	1	3	0	0	50	54
21	0	39	0	13	1	5	0	0	58	58

1: Least Bitterns were observed on six days, June 20 and August 1 through 5, but are not included in this chart.

nr: not recorded

TABLE C.3. Continued

DATE	WOOD STORKS	GREAT EGRET	SNOWY EGRET	CATTLE EGRET	LITTLE BLUE HERON	GREAT BLUE HERON	GREEN-BACKED HERON	WHITE IBIS	TOTAL OTHER WADERS	TOTAL ALL WADERS
JULY										
22	0	33	1	12	1	3	0	0	50	50
23	0	nr	nr	nr	nr	nr	nr	nr	nr	nr
24	18	nr	nr	nr	nr	nr	nr	nr	nr	nr
25	5	40	0	14	1	2	0	0	57	62
26	9	45	0	14	1	3	1	0	64	73
27	14	44	0	15	1	3	0	0	63	77
28	25	35	0	15	1	4	0	0	55	80
29	25	32	0	60	1	3	0	0	96	121
30	44	nr	nr	nr	nr	nr	nr	nr	nr	nr
AUGUST										
1	43	53	0	0	1	3	2	0	59	102
2	58	46	0	51	1	4	1	0	103	161
3	80	47	0	24	1	4	1	0	77	157
4	77	43	1	14	0	3	0	0	61	138
5	86	47	0	13	3	6	0	0	69	155
6	77	nr	nr	nr	nr	nr	nr	nr	nr	nr
7	23	nr	nr	nr	nr	nr	nr	nr	nr	nr
8	6	31	0	9	2	2	0	0	44	50
9	5	26	0	16	1	2	1	0	46	51
10	90	45	0	8	1	5	0	2	61	151
11	110	45	0	8	1	5	0	1	60	170
12	100	77	0	9	4	0	0	0	90	190
15	139	84	2	11	3	3	0	0	103	242
16	143	80	1	10	3	2	0	0	96	239
17	148	78	1	20	6	4	1	1	111	259
18	175	nr	nr	nr	nr	nr	nr	nr	nr	nr
19	163	84	1	11	6	1	0	0	103	266
20	175	nr	nr	nr	nr	nr	nr	nr	nr	nr
22	201	nr	nr	nr	nr	nr	nr	nr	nr	nr
23	212	31	0	39	1	2	0	1	74	286
24	195	63	0	27	1	2	0	1	94	289
25	100	51	0	38	2	2	0	0	93	193
26	180	63	0	29	1	4	1	0	98	278
27	7	nr	nr	nr	nr	nr	nr	nr	nr	nr
28	178	nr	nr	nr	nr	nr	nr	nr	nr	nr
29	185	86	0	0	10	6	1	1	104	289
30	140	79	0	0	6	8	2	1	96	236
31	95	75	0	0	12	0	1	1	89	184

nr: not recorded

TABLE C.3. Continued

DATE	WOOD STORKS	GREAT EGRET	SNOWY EGRET	CATTLE EGRET	LITTLE BLUE HERON	GREAT BLUE HERON	GREEN-BACKED HERON	WHITE IBIS	TOTAL OTHER WADERS	TOTAL ALL WADERS
SEPTEMBER										
1	200	98	0	0	4	1	2	3	108	308
2	180	101	0	0	5	8	1	5	120	300
5	84	42	0	0	2	6	0	4	54	138
6	34	49	0	0	3	7	1	3	63	97
7	40	45	0	0	0	3	0	0	48	88
8	20	46	0	8	2	13	1	2	72	92
9	12	nr	nr	nr	nr	nr	nr	nr	nr	nr
10	25	nr	nr	nr	nr	nr	nr	nr	nr	nr
11	10	nr	nr	nr	nr	nr	nr	nr	nr	nr
12	10	nr	nr	nr	nr	nr	nr	nr	nr	nr
14	67	nr	nr	nr	nr	nr	nr	nr	nr	nr
22	46	nr	nr	nr	nr	nr	nr	nr	nr	nr
26	30	30	nr	nr	nr	nr	nr	nr	nr	nr
OCTOBER										
6	6	nr	nr	nr	nr	nr	nr	nr	nr	nr
7	2	nr	nr	nr	nr	nr	nr	nr	nr	nr
8	0	nr	nr	nr	nr	nr	nr	nr	nr	nr

nr: not recorded

TABLE C.4. DAILY COUNTS OF WOOD STORKS AND OTHER WADING BIRDS AT THE KATHWOOD FORAGING PONDS IN 1989[1].

DATE	WOOD STORKS	GREAT EGRET	SNOWY EGRET	CATTLE EGRET	LITTLE BLUE HERON	GREAT BLUE HERON	GREEN-BACKED HERON	WHITE IBIS	TOTAL OTHER WADERS[1]	TOTAL ALL WADERS
APRIL										
15	0	1	0	0	0	0	0	0	1	1
16	0	4	1	0	0	1	0	0	6	6
17	0	6	0	0	0	1	0	0	7	7
19	0	3	0	0	0	0	0	0	3	3
20	0	1	0	0	0	1	0	0	2	2
22	0	2	1	1	3	2	0	0	9	9
24	0	4	1	0	0	1	0	0	6	6
25	0	3	0	1	0	1	0	0	5	5
26	0	3	0	0	0	1	1	0	5	5
27	0	3	0	0	0	2	1	0	6	6
29	0	1	0	0	0	0	0	0	1	1
MAY										
2	0	2	0	0	0	0	0	0	2	2
15	0	4	0	0	0	2	0	0	6	6
JULY										
5	69	20	0	0	1	0	0	0	21	90
6	97	nr	nr	nr	nr	nr	nr	nr	nr	nr
7	116	nr	nr	nr	nr	nr	nr	nr	nr	nr
8	138	nr	nr	nr	nr	nr	nr	nr	nr	nr
10	170	10	0	0	0	0	0	0	10	180
11	39	0	0	0	0	0	0	0	0	39
12	40	8	0	0	2	5	1	0	16	56
13	61	11	0	0	1	3	1	0	16	77
14	94	13	0	0	2	3	0	0	18	112
16	137	nr	nr	nr	nr	nr	nr	nr	nr	nr
17	138	15	0	16	5	7	1	0	44	182
18	146	15	0	24	9	8	1	0	57	203
19	116	nr	nr	nr	nr	nr	nr	nr	nr	nr
20	67	24	0	15	5	6	1	0	51	118
21	103	24	0	11	6	4	1	0	46	149
22	126	nr	nr	nr	nr	nr	nr	nr	nr	nr
23	132	nr	nr	nr	nr	nr	nr	nr	nr	nr
24	146	56	0	0	6	3	1	0	66	212
25	176	58	0	0	9	7	2	0	76	252

1: A Tri-colored Heron was observed on eight days from July 20 through August 15, and a Yellow-crowned Night Heron was observed on August 1; these birds are not included in this table.

nr: not recorded

TABLE C.4. Continued

DATE	WOOD STORKS	GREAT EGRET	SNOWY EGRET	CATTLE EGRET	LITTLE BLUE HERON	GREAT BLUE HERON	GREEN-BACKED HERON	WHITE IBIS	TOTAL OTHER WADERS[1]	TOTAL ALL WADERS
JULY										
26	197	55	0	7	6	3	1	0	72	269
27	204	48	0	0	4	6	1	0	59	263
28	223	35	0	11	3	7	0	0	56	279
31	207	41	0	4	1	5	0	0	51	258
AUGUST										
1	204	49	0	17	1	3	1	0	71	275
2	186	21	1	22	2	3	0	0	49	235
3	120	16	0	31	0	5	0	0	52	172
4	97	51	0	16	0	6	1	0	74	171
7	171	74	0	0	1	6	0	0	81	252
8	219	77	1	0	7	9	1	0	95	314
9	207	85	1	0	3	6	0	0	95	302
10	100	36	1	0	4	3	1	0	45	145
11	138	nr	nr	nr	nr	nr	nr	nr	nr	nr
14	48	48	1	33	7	12	1	2	104	152
15	27	39	1	56	5	6	1	0	108	135
16	37	19	1	8	1	4	3	0	36	73
17	12	21	4	77	6	8	1	0	117	129
18	31	22	2	66	3	14	1	0	108	139
19	11	nr	nr	nr	nr	nr	nr	nr	nr	nr
20	17	nr	nr	nr	nr	nr	nr	nr	nr	nr
21	24	14	0	0	0	0	0	0	14	38
22	3	11	0	45	2	4	1	0	63	66
23	5	nr	nr	nr	nr	nr	nr	nr	nr	nr
24	0	0	0	0	0	0	0	0	0	0

1: A Tri-colored Heron was observed on eight days from July 20 through August 15, and a Yellow-crowned Night Heron was observed on August 1; these birds are not included in this table.

nr: not recorded.

TABLE C.5. DAILY COUNTS OF WOOD STORKS AND OTHER WADING BIRDS AT THE KATHWOOD FORAGING PONDS IN 1990.

DATE	WOOD STORKS	GREAT EGRET	SNOWY EGRET	CATTLE EGRET	LITTLE BLUE HERON	GREAT BLUE HERON	GREEN-BACKED HERON	WHITE IBIS	TOTAL OTHER WADERS	TOTAL ALL WADERS
JUNE										
28	0	10	0	0	0	0	2	0	12	12
JULY										
2	0	5	0	0	0	1	0	0	6	6
3	1	2	0	35	1	0	0	1	39	40
4	1	1	0	3	3	2	0	0	9	10
5	1	2	0	4	0	1	0	0	7	8
6	0	3	0	10	1	0	0	0	14	14
7	0	nr	nr	nr	nr	nr	nr	nr	nr	nr
8	0	nr	nr	nr	nr	nr	nr	nr	nr	nr
9	0	0	0	0	0	0	0	0	0	0
10	0	1	0	0	0	0	0	0	1	1
11	0	4	0	0	0	0	0	0	4	4
12	0	0	0	0	0	0	0	0	0	0
13	0	1	0	0	0	2	1	0	4	4
14	7	nr	nr	nr	nr	nr	nr	nr	nr	nr
15	45	nr	nr	nr	nr	nr	nr	nr	nr	nr
16	46	6	0	0	0	0	0	0	6	52
17	0	7	0	17	1	0	0	0	25	25
18	40	20	0	0	0	1	0	0	21	61
19	49	29	9	9	9	1	9	9	75	124
20	125	59	0	0	0	1	0	0	60	185
21	204	25	2	0	0	5	0	0	32	236
22	38	nr	nr	nr	nr	nr	nr	nr	nr	nr
23	170	nr	nr	nr	nr	nr	nr	nr	nr	nr
24	250	76	2	0	0	6	0	2	86	336
25	227	nr	nr	nr	nr	nr	nr	nr	nr	nr
26	1	11	1	0	1	1	1	0	15	16
27	12	26	0	320	0	3	0	0	349	361
28	63	52	0	0	0	6	0	0	58	121
29	61	63	0	0	0	0	0	0	63	124
30	80	141	0	0	15	7	0	0	163	243
31	130	178	0	0	23	9	0	0	210	340
AUGUST										
1	145	125	0	0	19	10	0	0	154	299
2	167	105	0	0	11	7	0	0	123	290
3	185	115	0	0	11	7	0	0	133	318
4	205	nr	nr	nr	nr	nr	nr	nr	nr	nr
5	189	nr	nr	nr	nr	nr	nr	nr	nr	nr
6	204	nr	nr	nr	nr	nr	nr	nr	nr	nr
7	210	nr	nr	nr	nr	nr	nr	nr	nr	nr

nr: not recorded.

TABLE C.5. Continued

DATE	WOOD STORKS	GREAT EGRET	SNOWY EGRET	CATTLE EGRET	LITTLE BLUE HERON	GREAT BLUE HERON	GREEN-BACKED HERON	WHITE IBIS	TOTAL OTHER WADERS	TOTAL ALL WADERS
AUGUST										
8	147	32	0	0	0	0	0	0	32	179
9	109	133	0	0	11	7	0	0	151	260
11	60	146	0	0	0	0	0	12	158	218
12	60	0	0	0	0	0	0	13	13	73
13	80	196	0	0	15	0	0	9	220	300
14	130	15	0	0	18	0	0	20	53	183
15	2	20	0	0	0	1	0	10	31	33
16	0	nr	nr	nr	nr	nr	nr	nr	nr	nr
17	0	20	0	0	0	0	0	2	22	22
22	0	nr	nr	nr	nr	nr	nr	nr	nr	nr
23	0	3	0	1	0	1	0	0	5	5

nr: not recorded.

ACKNOWLEDGMENTS

I am grateful to the Savannah River Ecology Laboratory for its support throughout this work. I am lucky to have have worked with a dedicated, enthusiastic and hard-working crew: A.L. Bryan, Jr. (1984-1990), S.L. Coe (1986-1988), F.C. Depkin (1986-1988), T.L. Gentry (1988-1989), L.C. Huff (1984-1986), S.D. Jewell (1984-1985), W.B. Lee (1984), L.S. McAllister (1984), D.E. Manry (1989), K.L. Montgomery (1988-1989), L.A. Moreno (1988), M.A. Rubega (1986), D.J. Stangohr (1987), W.J. Sydeman (1985), N.K. Tsipoura (1987), J.M. Walsh (1985-1987), B.E. Young (1986) and D.P. Young (1989). J. Meyers who directed the stork project from June, 1983, through April, 1984, laid the groundwork for many of the foraging site sampling methods that were used. Research in the Birdsville Colony could not have been accomplished without the cooperation of I.T.T. Rayonier, Inc., who graciously granted our personnel unlimited access to the colony site which is on their property. D. Alexander, B. Beaushears, P.J. Clark, L. Hall, E. Johnson, and M. Wease of Augusta Aviation piloted the airplanes during the aerial surveys over the years. I thank the other members of the Kathwood Technical Working Group for their advice: D.M. Connelly, A.B. Gould, Jr., J. Knox, H.E. Mackey, Jr., W.D. McCort, N.A. Murdock and J.C. Ogden. I also thank M.H. Smith, J.W. Gibbons, and W.D. McCort for their indispensable support throughout this project. I am grateful to Marie Roberts and Debbie Reese for typing this report. This research was supported by the United States Department of Energy, Savannah River Operations contract DE-AC09-76SROO-819 with the University of Georgia, Institute of Ecology, Savannah River Ecology Laboratory.

SAVANNAH RIVER ECOLOGY LABORATORY

Principal Investigator

Malcolm C. Coulter

Technical Staff

A. Lawrence Bryan, Jr.

NATIONAL AUDUBON SOCIETY

Silver Bluff Plantation Sanctuary Manager

Daniel M. Connelly

Support Staff

Paul Koehler

END

DATE
FILMED
9/8/93