

**Wood stork use of fresh
and salt water habitats on
Cumberland Island National Seashore**

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Abstract

A habitat use survey of wading birds conducted at four study areas on Cumberland Island National Seashore collected 1994 observations of individual study sites between January and November, 1987. A total of 133 of these observations included sightings of wood storks (*Mycteria americana*). In addition, Stacia Hendricks made 14 observations of wood storks at Heron Pond and Lake Whitney, and a "wood stork watch" conducted between June and November recorded 32 wood stork sightings. A wood stork roost, used at all four seasons, was documented at South End Ponds, and a nesting area was documented at Heron Pond, on the Ferguson property, north of Stafford. Wood storks tended to be away from the roost in the morning, and in the roost at high tide. Foraging observations documented wood storks feeding in fresh or brackish ponds and lakes, and in estuarine areas. Wood storks will forage in low *Spartina alterniflora*, but were more frequently seen along the banks of larger tidal creeks. Foraging observations were primarily in the early morning. Wood storks foraged in the fresh ponds at low tide, and in the marshes at low to mid-tide. The one feeding observation from Lake Whitney was at high tide. Flock size on Cumberland was small. Most observations away from the roosting or nesting sites were of three birds or less. The data suggest wood storks are resident in the Cumberland Sound area throughout the year.

Introduction

In recent years, wood stork (*Mycteria americana*) populations have greatly decreased in the Florida Everglades, while wood stork numbers have increased in north Florida and Georgia. Unnatural fluctuations in water levels within the Everglades and adjoining wetlands are thought to have decreased wood stork ability to forage successfully (Kushlan 1986). Due to recent population declines, the wood stork is presently federally listed as an endangered species.

Despite establishment of rookeries in Georgia, relatively little is known about the ecology of the wood stork on the Georgia coast. Odum (1978) first reported wood storks nesting in Camden and McIntosh Counties in 1977, and Odum *et al* (1979) reported storks breeding in Glynn County. North central Florida data (Rogers *et al* 1987) indicate northern populations are relatively stable. Commer (1985) studied the movements of three transmittered birds from an inland east-central Georgia colony and found movements between foraging sites were generally less than 50 km. When the birds left the Birdsville rookery for extended periods of time, two traveled 280 km round trip to the Altamaha River, and one made a 660 km round trip journey into Florida. Bryan and Coulter (1987) found over 85% of the wood stork flights from the inland Georgia colony at Birdsville were to foraging sites within 20 kilometers of the colony. Wood storks feed primarily on fish (Kahl 1964, Ogden *et al* 1976).

Allen (1986) reviewed the Georgia literature and investigated wood stork sightings in the neighborhood of Kings Bay Naval Submarine Base, at St. Marys, Georgia. Allen (1986) cited an Audubon census that found a colony of 250 pairs at Dover Bluff in 1986. Allen (1986) also cited an "unconfirmed report" by Shiela Willis of wood storks nesting on Cumberland Island in 1986, and a report by Marlene Finley of a flock of 100-200 birds on Cumberland Island on October 31, 1985. Allen (1986) found no nesting on Kings Bay, but reported nine sightings of wood storks on or near the Navy Base between June 13, 1985 and July 24, 1986. Three of these sightings observed wood storks feeding at two different artificial ponds on the Navy Base.

The purpose of this report is to extract data specifically concerning wood storks from a wading bird survey conducted on Cumberland Island National Seashore between January and November 1987, and to summarize 1987 wood stork sightings by park staff and island residents. Wood storks have previously been considered transient on Cumberland Island, but park staff and visitors frequently report seeing the species. The purpose of this portion of the survey was to discover if wood storks were foraging, roosting or nesting on Cumberland. This report discusses the numbers of wood storks observed on Cumberland during the wading bird survey, the types of habitats used by wood storks, and the implications of this information for wood stork protection.

The wading bird survey as a whole attempted to compare both salt and freshwater habitats at four seasons, at different times of day, and at different tides. Beach Creek marsh and South End Ponds, areas liable to disturbance by dredging to deepen the channels for the Trident submarines, served as key study areas.

Methods

Four major wading bird study areas were selected on Cumberland Island. Two of these, the South End Ponds and Beach Creek marsh, are liable to disturbance by deep dredging of the channel through the St. Marys Entrance. The other two, Lake Whitney ponds and lakes and Table Point marsh, are liable to local human disturbance but do not adjoin any actively dredged channels. In each study area several observation points were chosen, usually based on the presence of representative habitats and breadth of view (Table 1, Figure 1). The survey included a variety of tidal creek and salt marsh habitats as well as freshwater ponds of various sizes. In addition, Stacia Hendricks monitored a pond on private property during the breeding season, and obtained observations of wood storks at that site.

Sampling was conducted at four seasons. Winter sampling was from Jan. 11 to Feb. 3, spring sampling extended from March 30 to May 4, summer sampling extended from June 17 to Sept. 1, and fall sampling extended from Oct. 5 to Nov. 4, 1987. An attempt was made to sample each location three or four times a day for each of two days within a four day period. This was repeated four times for spring and fall and seven times for summer. Efforts were made to repeat this four times for the winter, but access to the South End Ponds was blocked by spring tides. Generally there was a four to six day break between these four day sampling sessions (except during winter). Sampling began in the early morning (an attempt was made to start one half hour after sunrise, but transportation availability and tides sometimes slowed the initiation) and ended about one half hour before sunset. The time taken to complete observations at each station was variable, but the sampling periods (the time taken to visit all locations within a study area) generally lasted about one and a half to two hours each. Observers were required to stay ten minutes at each location even if no birds were present. If birds were present, observers stayed about twenty minutes, recording feeding and other activities. During the winter three sampling periods were undertaken on each survey day: one early in the morning, one at midday, and one in the late afternoon (the light was low for observation by 17:30). During the other four seasons, early morning, late morning, early afternoon and evening sampling periods were completed. The time between sampling periods was shorter in the spring and fall, due to the shorter day length.

Table 1: Study locations

Location 1 - South End Ponds

- Site 1 - The outer most pond (towards Cumberland Sound), blind at the east end, the pond is brackish
- Site 2 - The largest (middle) pond, blind on the west end (entire pond not visible), the pond is fresh
- Site 3 - The mouth of Beach Creek, from a blind near the south west bank, salt water creek and tall *Spartina* marsh

Location 2 - Dungeness shore and Beach Creek marsh

- Site 1 - Dungeness Dock, viewing the shoreline of Cumberland Sound from Racoon Keys to Sea Camp Dock, all tidal flat
- Site 2 - The shore of Beach Creek below the Park Maintenance Building, this has a view of the main branch of Beach Creek with tall *Spartina* and mud banks
- Site 3 - Beach Creek marsh from the high dune just below Dungeness Beach Trail, this has a view of the upper end of the marsh and second and third order creeks, and of the low *Spartina* flats along the east edge of the marsh

Location 3 - Table Point marsh and Hawkins Creek

- Site 1 - Table Point marsh from a blind at the forest edge on the east side, a view of low *Spartina* flats at the south end of the marsh and second and third order tidal creeks of Malkintooh Creek
- Site 2 - A small slough crossed by the Main Road at Red Bridge (the second slough south of South Cut Road), the slough is tidal but has fresh water draining into it
- Site 3 - The Brickhill River from a blind just south of Brickhill Campsite, the shores are lined by mud banks and oyster bars similar to the edge of Cumberland Sound
- Site 4 - Hawkins Creek at the Boat Dock and at a point just to the north of the Dock on a pile of sawdust from an old mill, the view is of tall and short *Spartina*, and the mud banks of a medium sized primary tidal creek

Table 1: Study locations (continued)

Location 4 - Lake Whitney

Site 1 - The small pond at the intersection of South Cut Road and Roller Coaster Trail to the north east of South Cut Road, all these sites are fresh water

Site 2 - A small pond to the east of Roller Coaster Trail before reaching Lake Whitney

Site 3 - The south end of Lake Whitney from a blind just to the west of Roller Coaster Trail the site includes floating mat vegetation

Site 4 - The north end of Lake Whitney from a blind on the dune where Roller Coaster Trail veres away from the Lake edge and heads out into the sand dune area, the site includes floating mat vegetation

On each sampling day, either South End Ponds and Beach Creek were sampled, or Table Point and Lake Whitney were sampled. Thus sampling of freshwater sites was conducted at the same time as estuarine sites. On some occasions, some sample periods were missed because of weather. This happened several times in late afternoon in late summer, due to violent thunderstorms. Sampling was conducted during rain when there was no threat of lightning.

At each location the observer recorded all species of wading birds present on arrival, and recorded others as they flew in during the first ten minutes. The observers took environmental information, including date, cloud cover, wind direction, wind speed, amount of rainfall in the last twenty four hours, air temperture, water depth (on depth markers placed on the sites), time of day, and time of the next high tide. Water temperature was collected periodically through the season. Each wading bird species noted was recorded by number of individuals present, micro-habitat used, and behavior. Important micro-habitats for wood storks included open water, mud flat, mud bank, low *Spartina*, high *Spartina*, (sitting in) trees, floating mat of vegetation, and open sky. Behaviors included: unknown, inactive, preening, flying, courtship, passive hunting (stationary), active hunting (eg. walking slowly) and aggressive hunting (eg. foot stir, fast walk). Notes were taken on the method of foraging, whenever foraging was observed.

From June through November 1987, the project also ran an island wide "wood stork watch" and collected information sheets from park staff, park residents and park visitors. The sheets requested the date, time, geographic location, number of storks seen and basic behavior.

Data were tabulated by hand and using an IBM-AT computer. Graphics were compiled on an Apple Macintosh micro-computer using "Cricket Graph" programs.

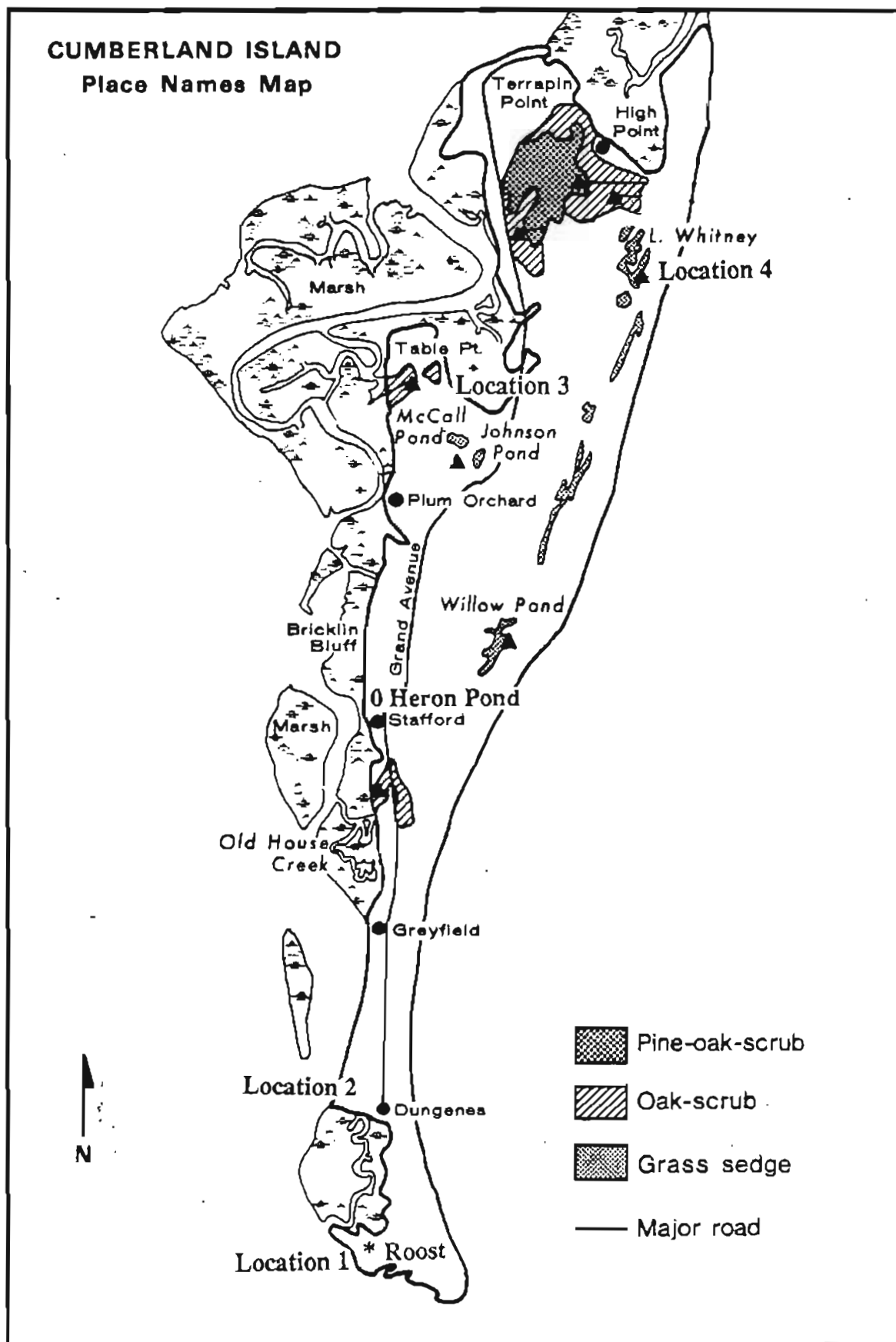


Figure 1: The four major sampling locations, the nesting area at Heron Pond and the roost at South End Ponds.

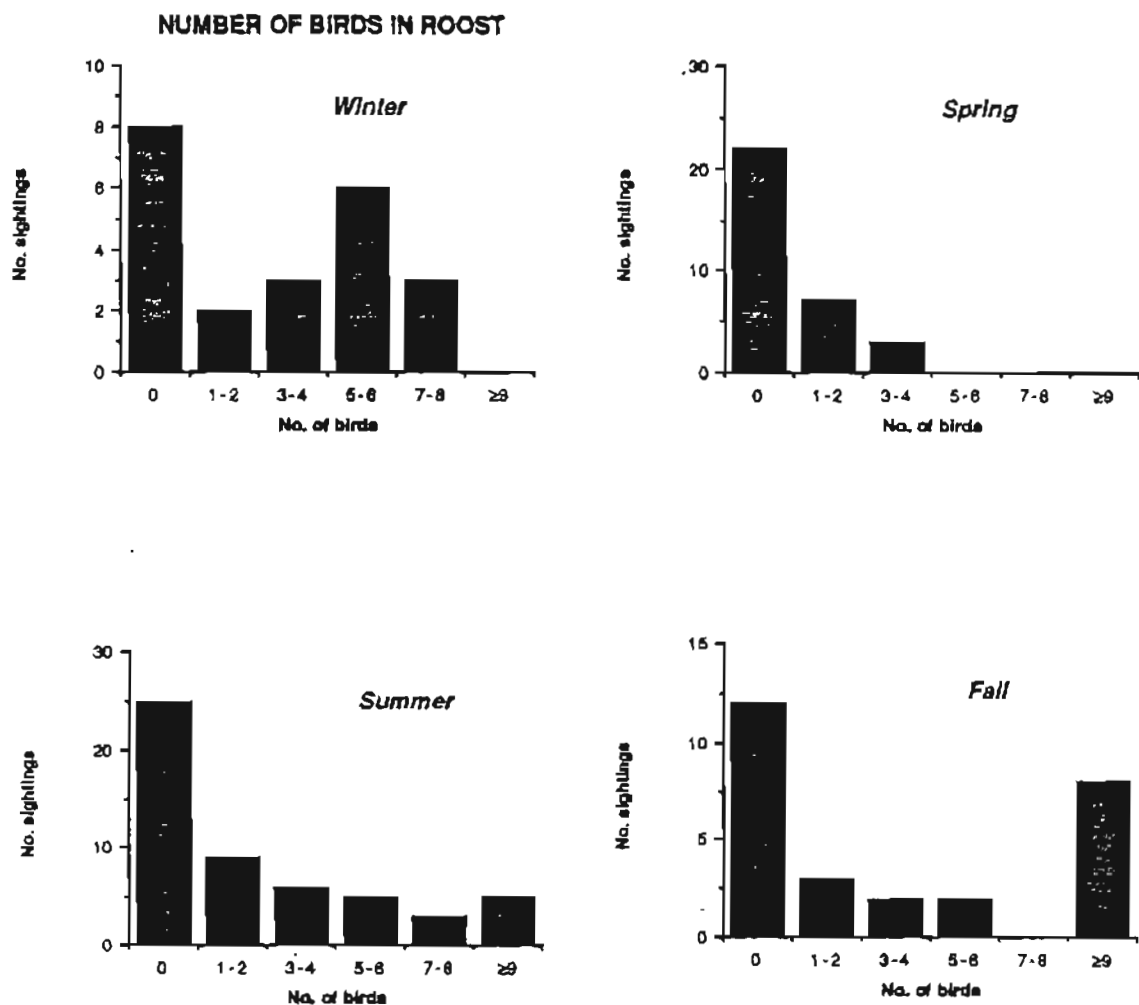


Figure 2: The group size of birds observed in the roost, by season. Note the different scales for the different seasons. Far fewer wood storks were present in the roost in spring, and group size was smaller. There were more large flocks in the fall.

Table 2: Location of wood stork sightings for Cumberland Island and Sound 1987

<i>Location</i>	<i>Fly over</i>	<i>Roost</i>	<i>Rest *</i>	<i>Feed</i>	<i>Nest</i>
Sampling locations					
South Pond one	+	+	+	+	
South Pond two	+	+	+	+	
Mouth of Beach Creek	+			+	
Main branch of Beach Creek	+			+	
Upper Beach Creek and flats	+		+	+	
Table Point marsh	+			+	
Brickhill River	+			+	
Hawkins Creek	+				
Ponds south of Whitney	+				
Lake Whitney	+	+	+	+	
Other sites					
Heron Pond at Serendipity	+	+	+	+	+
South End flats			+		
St. Marys River	+	+	+	+	
Marsh south of Plum Orchard	+				
Tiger Island	+				
Intercoastal north of Ft. Clinch	+				
Burbank Point	+				
Dungeness Dock	+				
Sea Camp Dock	+				
Sweetwater Lakes	+				
Ferguson Farm	+				
Greyfields	+				
Stafford Field	+				

Rest refers to standing on the ground rather than sitting in trees (roosting).*

Table 3: Wood stork roosting at South End Ponds

<i>Season</i>	<i>Percent of observations with storks</i>	<i>Average no. present when observed</i>	<i>Mode</i>	<i>Maximum</i>
<i>Winter</i>	62%	5.1	5	8
<i>Spring</i>	31%	2.2	2	4
<i>Summer</i>	53%	5.1	3 to 6	15
<i>Fall</i>	47%	7.9	10	17

The storks were much less frequently seen in the roost in the early morning than during mid-day or in the afternoon or evening for all seasons except the spring. (Figure 3). Although the relationship of roosting to the tides was not as clear, wood storks were more likely to be at the roost at high tide. (See Appendix I for regressions).

The wood storks were using a rookery area on the Ferguson Farm at Heron Pond by April 8 and continued to use the site through May. According to observations made by Stacia Hendricks, seven pairs attempted to nest in 1987, but all the nests failed. On April 10 between 17:30 and 18:30, 55 wood storks were observed at the pond. On April 22 at 16:30, 48 wood storks were observed feeding and sitting in trees along with about a hundred white ibis (*Eudocimus albus*). On May 2, at 10:30 there were 20 storks on nests and feeding in the pond. On May 7 at 16:30, six wood storks were observed in conjunction with the seven nests. On May 15, at 13:00 five storks were observed. By May 20, drought conditions had lowered water levels so greatly that the pond was becoming an exposed mud flat, and no wood storks were observed. On May 22, an alligator was seen on the Main Road east of Heron Pond, and was thought (Stacia Hendricks, personal communication) to be moving out of the area due to drought. The drought may also explain wood stork nest failure and abandonment of the site.

Heron Pond rookery was used for nesting the previous year (1986) and produced several wood stork chicks. Survivorship is not known. The absence of birds from the South End Ponds in the spring is probably due to use of the rookery at Serendipity. This would also explain the low number of birds present in the evening in the spring when the rookery was very active. The wood storks shared the roosting area with several other species, particularly great egrets (*Casmerodius albus*), snowy egrets (*Egretta thula*), great blue herons (*Ardea herodias*) and little blue herons

(*Florida caerulea*). During the warm season white ibises and cattle egrets were frequently present. The rookery at Serendipity supported a large number of great egrets, as well as snowy egrets, white ibis, and black crowned night herons (*Nycticorax nycticorax*).

Foraging

Foraging observations were made during all seasons except the winter. This author and Shiela Willis (personal communication) both saw wood storks landing or standing along the bank of Beach Creek on at least three occasions during December 1986. A majority of the feeding observations were made during the summer (possibly due to the more intensive survey). The summer observations showed a strong diurnal pattern of morning and, to a lesser extent, evening foraging activity. Observations of wood storks remaining stationary or sitting in trees were more common at mid-day (Figure 4). Due to the small number of foraging observations, extracting diurnal and tidal patterns by season is not possible. There is a general trend, however, of morning foraging, which is supported by the data indicating the wood storks are not roosting in the early morning, and by observations of stationary or resting wood storks (Figure 5). Seven summer foraging observations were before 9:00, one between 9:00 and 10:00, two between 12:00 and 18:45 and four at 18:45 hours or later.

Foraging appears to be strongly related to the tidal cycle. Wood storks were observed feeding in salt marshes at low to mid tide almost exclusively, with mid-tide preferred. A review of the marsh feeding observations found almost all were on the incoming tide. One foraging observation (at mid-tide) was on the out-going tide, as was one observation of wood storks landing on the bank of a tidal creek. All the observations of feeding at South End Ponds were very near to ebb tide, while the one observation of feeding at Lake Whitney, during the habitat use survey, was very close to high tide (Figure 6). In addition, Stacia Hendricks made three observations of wood storks feeding at Heron Pond and two observations of feeding at Lake Whitney, all of which were within an hour and a half of high tide.

About a third, (37%) of the foraging sightings (from the habitat survey) were in fresh or brackish ponds or lakes. The remainder were in tidal marshes. About 23% of the salt marsh sightings were in low *Spartina* areas, while the remainder were on mud flats, creek banks, and in tall *Spartina* (Figure 7). Actual use of larger creek branches surrounded by tall *Spartina* was probably under-estimated due to poorer visibility. On a number of occasions wood storks were seen flying into the main branches of tidal creeks, but could not be seen once they landed. Wood storks used a variety of foraging techniques including probing with the bill, and "groping". Stationary, slow walking, and more aggressive active hunting methods were noted.

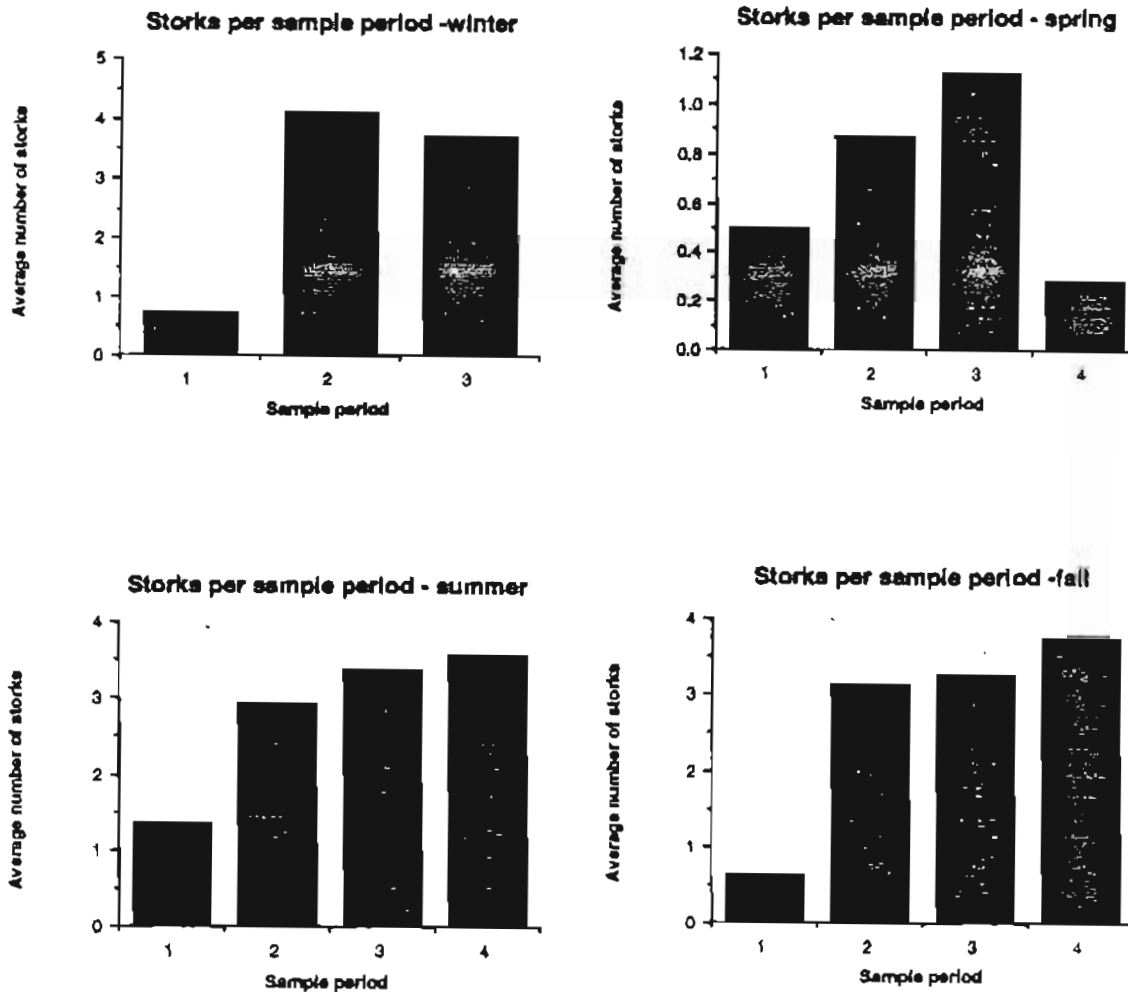


Figure 3: The average number of storks present in the roost by time of day. Period one ends before 10:00. Period two is about 11:00 to 13:30 with some seasonal variation. Period three began about 14:30 to 15:00 in the summer, and somewhat later in winter (ending about 17:30 in winter). Period four began about 18:30 in summer.

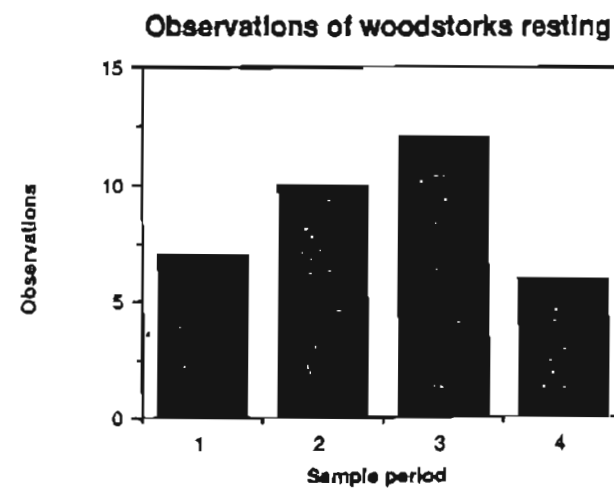
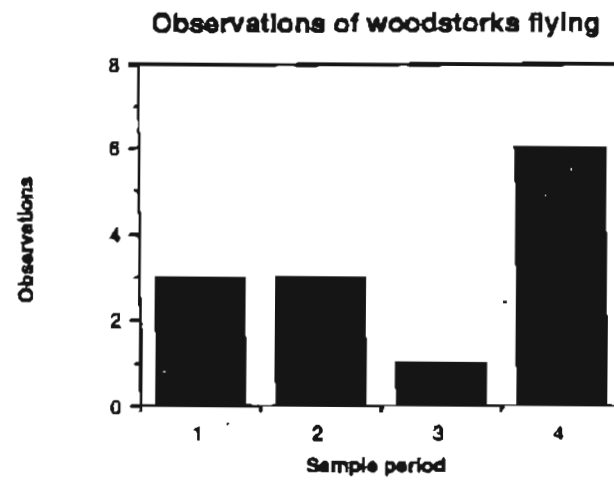
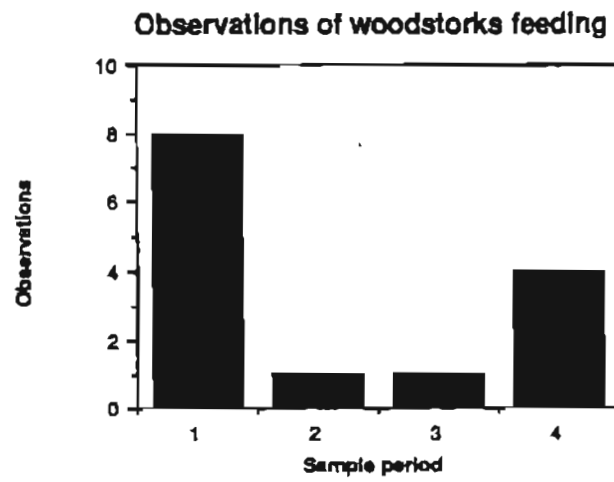
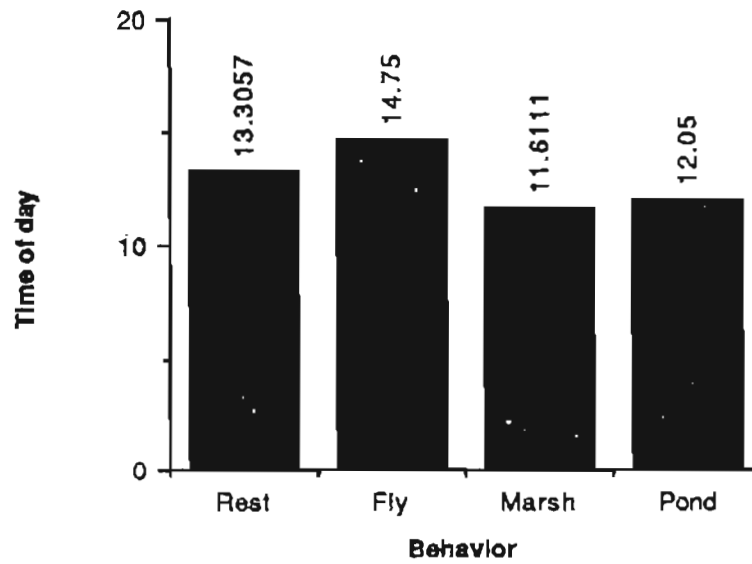


Figure 4: Observations of wood stork activity in summer by sample period.

Woodstork behavior by average time



Woodstork behavior by average tide

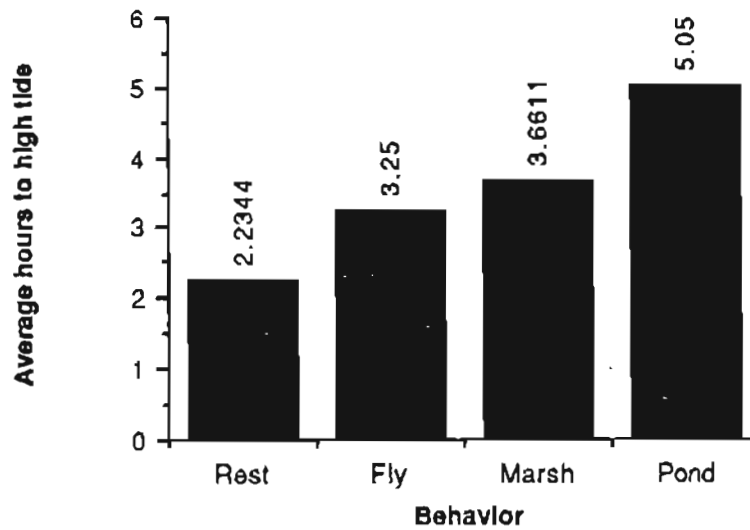


Figure 5: Observations of wood stork behavior in summer by average time and average time to the next high tide. Marsh indicates feeding in salt marshes, and pond indicates feeding in fresh water or brackish ponds.

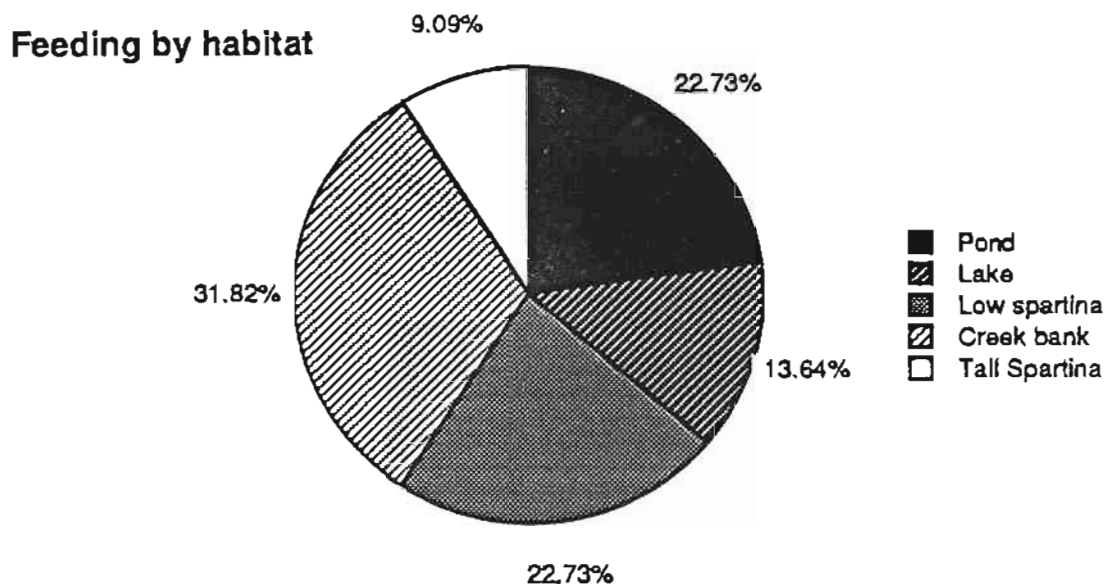


Figure 6: The distribution of feeding observations by habitat type. This is a summary of all seasons. Note the feeding on creek banks may be underestimated due to poor visibility.

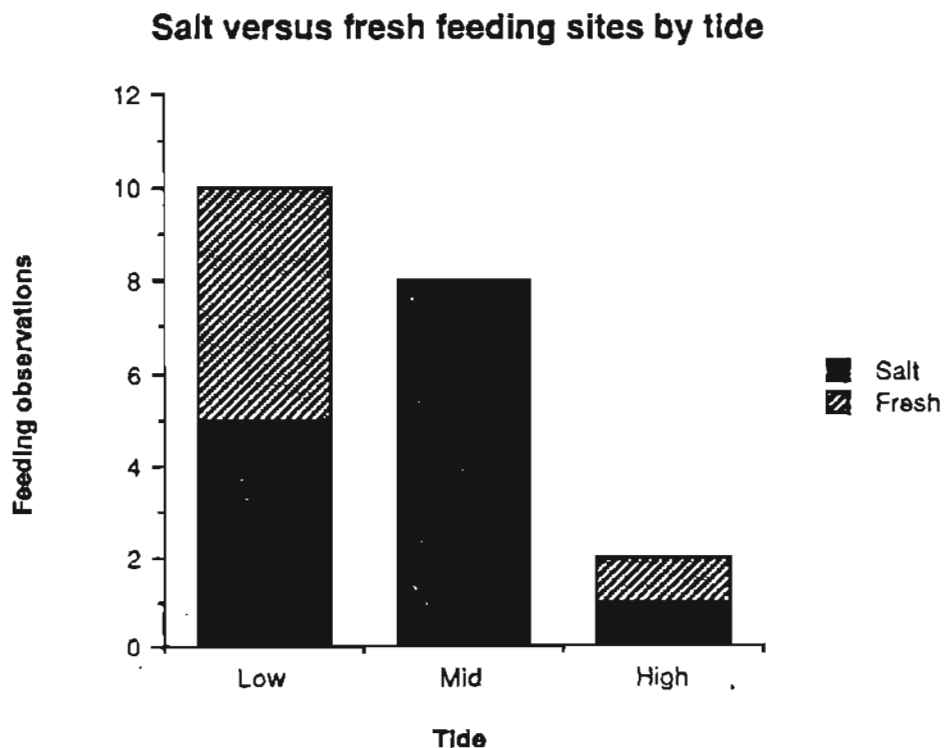


Figure 7: The distribution of feeding habitats by tide. This graph includes both observations of active feeding and observations of storks standing in or near the water.

Group size

Aside from the observations in the roosting and rookery areas, a majority of the observations of wood storks on Cumberland Island were of one or two birds. Fourteen of 21 observations of birds feeding or stationary on the ground were of three birds or less. There were four observations of single birds and four observations of six to nine birds feeding in the ponds or Lake Whitney. There were nine observations of one or two birds, two observations of three or four birds, and one observation each of eight and 18 birds feeding in the salt marshes. Thirty-five of 40 observations of birds flying were of three birds or less. The "wood stork" watch produced similar results. The largest group observed was in trees at the edge of Lake Whitney and was recorded as "greater than 10 birds". The next largest group was of eight birds on the flats very near the roost at South End Ponds. Twenty-three of the 32 sightings by "wood stork watch" were of three birds or less.

Discussion

The repeated use of the roost and rookery sites indicates wood storks were resident on Cumberland Island throughout 1987. Wood storks are utilizing a very wide variety of locations on Cumberland, including forested sites near water for roosting (both at the South End and Lake Whitney), fresh water ponds, lakes, and salt marshes for feeding. Wood storks may be seen on Cumberland at any time of day or year, and during 1987, birds remained on the island through the winter.

In terms of foraging locations, these data indicate the small ponds on the South End of the island are frequently used. Foraging in Lake Whitney was less than expected, possibly due to high water levels in the spring, followed by very low water levels during the summer. The importance of the tidal creeks may be underestimated by the survey methods used in this study, since visibility into these areas is very limited when surveying on the ground. These data indicate the larger estuaries, with exposed mud banks, are potentially quite important to wood storks. Wood storks forage in small groups in this habitat and may be dispersing feeding activities over a wide area of marsh. Wood storks use Beach Creek estuary and marsh for feeding, and the site may receive more use than some other similar areas because of its proximity to the South End Ponds.

Wood stork movements on Cumberland are strongly related to time of day and the tidal cycle. More wood stork foraging was observed in the early morning and wood storks tended to be away from the roost at this time. Selection of foraging sites appeared to be partially determined by tides, with freshwater sites favored at low and high tides, while salt marsh was favored at mid- to

low tide. The use of South End Ponds very close to low tide may be due to the lack of water and fish in the estuaries at that time. There was more wood stork use of the marshes on the incoming tide, which may be a result of a concentration of prey species at this tidal stage. Fish would be swimming up the creeks at this time, and perhaps are easier to catch. This study did not collect enough observations, however, to determine if these data represent a general pattern.

Allen (1986) reported four observations of large flocks - 50, 36, 26 and 18 birds. These observations and Marlene Finley's observation of 200 birds on Cumberland on Oct.31, 1986, seem to be atypical of the general Cumberland pattern of individual birds, pairs and small flocks, except at the rookery. The birds seen in the Cumberland area may be coming from more than one roost or rookery. A majority of the birds using Cumberland on most days are probably roosting in the local area (ie. South End Ponds). Additional birds from other roosts or rookeries, such as the large rookery at Dover Bluff, may utilize Cumberland or Kings Bay as well (and may account for the larger flocks at Kings Bay). These data suggest there is a small population resident in the Cumberland Island area, which mixes to an unknown extent with birds from elsewhere in Georgia and north Florida.

Wood storks in south Florida do not normally forage in estuarine areas. This may have been due to the availability of superior fresh water feeding sites prior to the present difficulties with water management. South Florida has less tidal amplitude than south Georgia, however, and fish populations may not be as concentrated in Florida Bay as they are in areas such as Beach Creek (see Powell 1987 for a discussion of wading birds in Florida Bay). Use of estuaries may influence optimal flock size for wood storks. Since there are a large number of tidal creeks to choose from as the tide comes in, the birds may not congregate, but may select "best" locations on the banks for reaching fish. Wood storks feeding on low *Spartina* flats may tend to form larger flocks. The use of estuaries may result in other behavioral changes, such as a change in food capture strategies. This study did not collect enough estuarine foraging sightings to document the frequency of different hunting methods.

Management implications

The wood stork, a nationally endangered species, should be considered potentially resident on Cumberland Island throughout the year. Both the roosting sites at South End Ponds and the rookery at Serendipity Pond should be protected from human disturbance. Possible concerns include direct human disruption of breeding birds, frequent visits by bird watchers, and damage to the vegetation around the ponds. James Kushlan (personal communication) suggests that no one

be allowed to visit a colony during nesting season, except for management purposes.

Park interpreters should not advertise the wood stork roost or rookery to visitors. During this survey, there was occasional human use of the sites. Boat use of Beach Creek should be stabilized as much as possible, and no management actions should be taken which increase boat traffic in early morning or late afternoon. Since the South End Ponds are of research interest, scientists working in the area should try to plan sampling trips for time periods when the wood storks are less likely to be present.

Of high importance is the protection of the larger estuaries. Wood storks can probably forage effectively in several of the tidal creeks on Cumberland. Any reduction in fish populations in these habitats, however, could have an adverse impact on wood storks. Wood stork use of Beach Creek should be monitored, since Department of Defense dredging activities may change the hydrology of the estuary. Dredging initiated erosion or hydrological change could also cause a change in water levels at the South End Ponds, which might in turn inhibit wood stork foraging. The nesting failure during 1987 is thought, however, to be a consequence of the drought and not in any way directly related to dredging activities.

An attempt should be made to obtain more data on foraging in estuaries and on possible use of main land foraging sites by birds roosting on Cumberland Island. Further, it is possible other small roosting sites and rookeries have not been located in the south Georgia - north Florida region. A search needs to be conducted around the Cumberland Sound to determine if other small colonies of wood storks are present.

The management staff of Cumberland Island National Seashore needs to develop management strategies for wood stork foraging, roosting and potential nesting areas within the boundaries of the National Seashore and need to develop a section on wood storks for the park resources management plan. Any new developments on tidal creeks (ie. docks, housing) should consider potential adverse impacts on wood stork foraging.

Acknowledgements

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for their efforts at recording information for "wood stork watch". Barb Zoodsma and Jim Kushlan commented on the final manuscript.

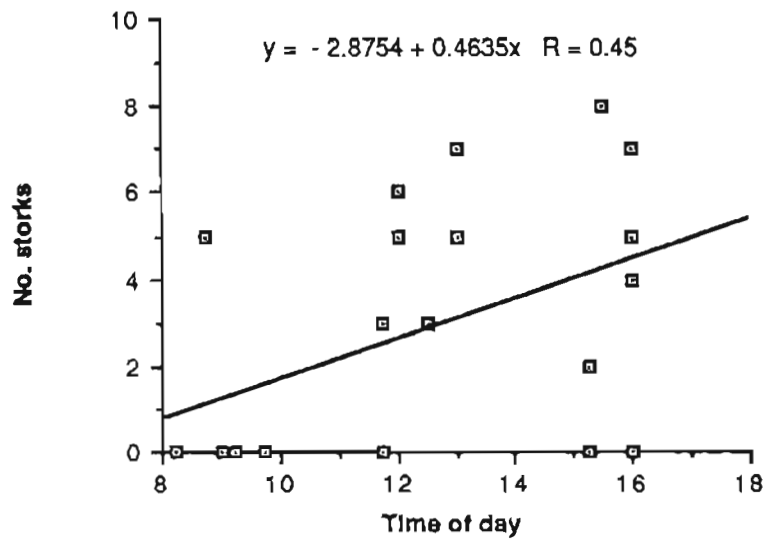
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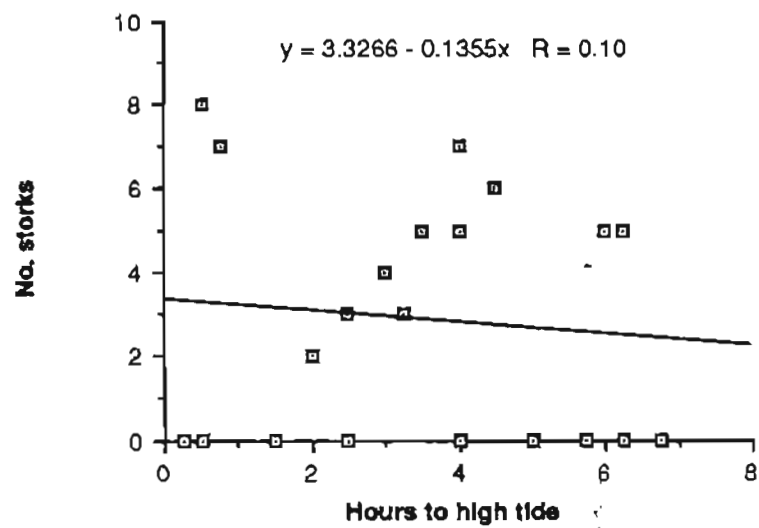
Appendix I.
Graphs and regressions of wood stork use
of the roosting area at
South End Ponds
versus time of day and time to next high tide

(All regressions computed by Cricket Graph on a MacIntosh micro-computer)

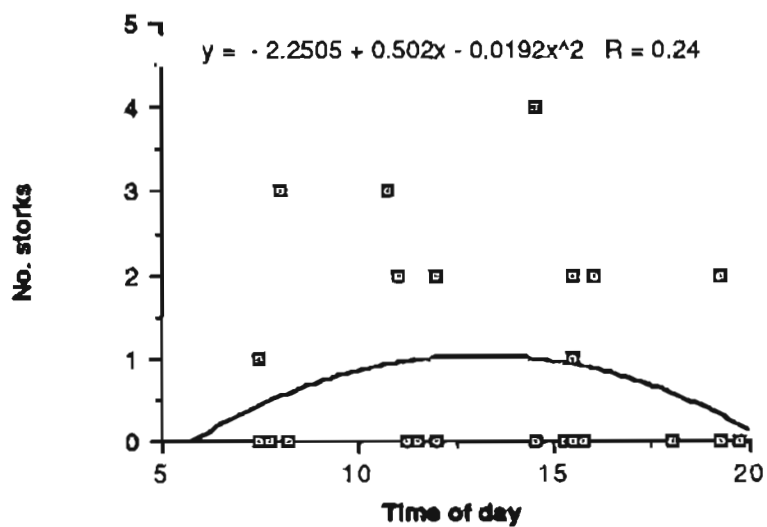
Number of roosting woodstorks -winter



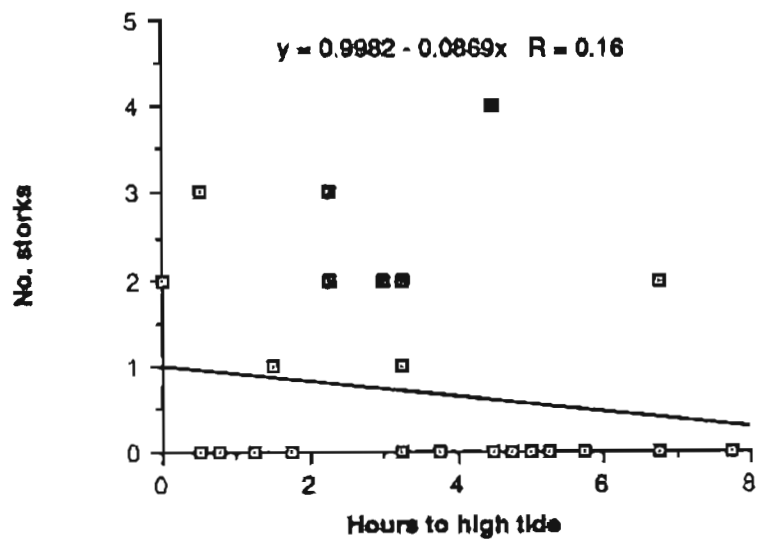
Roosting by tide - winter



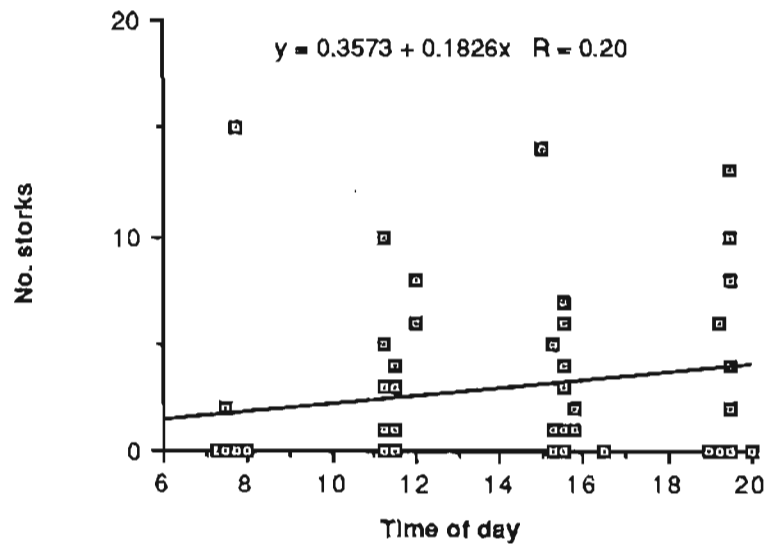
Number of roosting woodstorks -spring



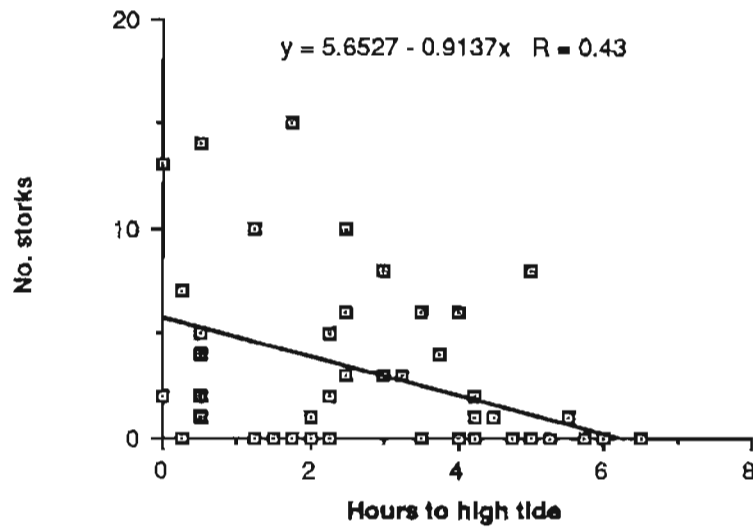
Roosting by tide - spring



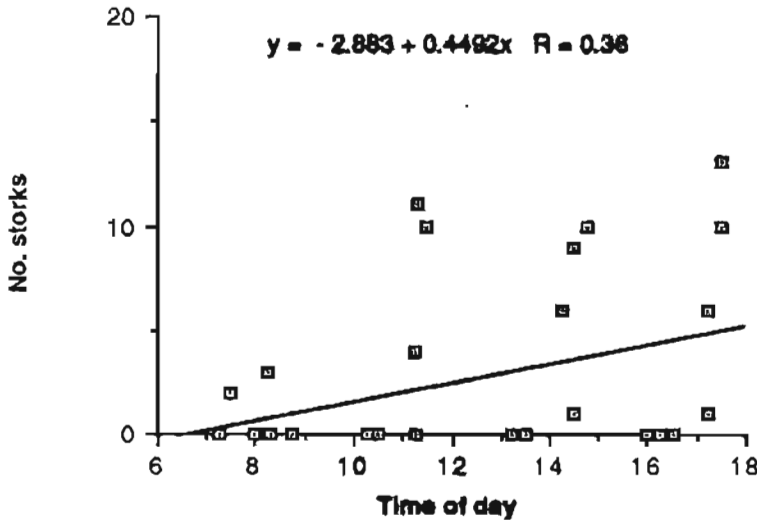
Number of roosting woodstorks - summer



Roosting by tide - summer



Number of roosting woodstorks - fall



Roosting by tide - fall

