

**1988 Surveys for Wood Storks
and Least Terns,
Cumberland Island National Seashore**

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Purpose and Content of the Report Series

In order to make data and results from research and monitoring projects more easily and quickly available to interested scientists and National Park Service staff, the Cooperative Park Studies Unit at the Institute of Ecology, University of Georgia, has initiated a numbered *Technical Report* series. This series produces limited printings of scientific project reports, data matrices, bibliographies, species check lists, review papers and summaries of resources management activities which concern U.S. National Park Service areas and park-related problems. The reports are from various sources, not all federally funded. These reports are not intended to determine park policy, but rather to distribute information to interested scientists and managers.

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Abstract

A total of 33 two hour survey flights in two series were undertaken to locate wood storks (*Mycetria americana*) in the Cumberland Sound region. The first series of 18 flights located from 17 to 291 per flight, with an average of 94 storks per flight. Numbers of storks observed increased as the surveyor and pilot grew more experienced at finding storks. A 13 completed flights (from a second series of 15 flights, two of which were aborted) located from 109 to 411 storks, with an average of 303 storks seen per flight. Storks were seen foraging in both fresh and salt water habitats. Of the fresh water habitats, ponds were the most frequently utilized by storks. Of the salt water habitats, storks were seen foraging on upper marsh flats, in secondary tidal creeks, and occasionally on tidal rivers. Roosting areas adjoined both fresh and salt water, although there were more sightings of storks resting near salt marshes.

Survey on foot located three areas of least tern (*Sterna albifrons*) nesting and activity, a site in front of the primary dune about one-half mile south of the Sea Camp boardwalk, a site behind the primary dune line about 50 m south of the Lake Retta outflow, and a site behind the primary dune line 25 m south of the Lake Whitney outflow. Small flocks of terns also foraged near these areas. The flock near Lake Whitney outflow approached 30 birds.

Part I

Aerial Wood Stork Survey

of the

Cumberland Sound

Methods

During the summer of 1988, a preliminary effort was made to survey wood storks (*Mycteria americana*) from the air for an area including the south end of St. Simons Island, Jekyll Island and the perimeter of the Cumberland Sound, Georgia. During July, August, and September 1988, 18 surveys of approximately two hours duration attempted to find major concentrations of wood storks and preferred feeding areas in both fresh and salt water habitats on the Georgia Sea Islands, including Jekyll Island and Cumberland Island, and on the western shore of the Cumberland Sound. These surveys were flown between July 12 and Sept. 13, and are hereafter called the first series (Table 1). One of these surveys also made a preliminary investigation of the Sea Islands north of St. Simons on Sept. 23.

From Sept. 20, 1988 to Sept. 30, 1988 a series of 15 flights on a standardized route were initiated. These are referred to as the second series. Two of these were aborted prematurely, resulting in 13 flights of about two hours duration. These flights were distributed through the morning and afternoon to cover both high and low tides (Table 1). Each flight team consisted of a pilot and a spotter familiar with the Cumberland Sound region. For the second series a standardized data sheet was employed recording for each group of wood storks seen, the date, observer, time of the observation, altitude of the aircraft, cloud cover, time to the next high tide, whether the tide was incoming or out-going, the map sector, the number of storks, a description of the location, and a habitat description. Salt water habitats included open water, mud flat or bank, sand flat or bank, oyster bar, tall *Spartina alterniflora*, low *Spartina*, other marsh vegetation, shrubs near shore, trees

near shore, and in flight over salt marsh. Fresh water habitats included open water, mud or sand bank, floating mat, tall grass, low grass, shrubs, trees, and in flight over land. Estuaries were further divided by size: sound shore, major river, major creek, 2nd order creek, and upper marsh. Fresh water habitats were further classified as ditches, sloughs, ponds and lakes. (Habitat classifications were refined between the first and second series so the second series offers slightly more detail.) If storks were in flight, the direction, estimated altitude and presence of circling behavior were noted. The observer attempted to determine the storks' general activities if on the ground. These included resting, feeding and other behaviors, of which preening was the most frequently recorded. The observer also noted if the storks were disturbed, but since the flights were generally from 500 to 600 feet, the plane rarely noticeably disturbed wood storks in trees or on the ground. In addition to aerial survey, an effort was made to inspect potential roosting sites on Cumberland Island on foot during the months of April, July, August and September.

Results

The first series of flights located from 17 to 291 storks. The average per flight was 94 storks and seven flights located 100 or more storks. The completed surveys from the second series counted from 109 to 411 storks (Table 1). The average number of storks seen per flight was 303. Eight of the flights located 300 or more storks. The number of storks seen increased steadily as the first series of flights progressed, and observers became more experienced at locating storks. The second series also regularly included the south end of St. Simons Island, whereas the first series did not. The survey figures from the first series are thus low estimates of the number of storks in the Cumberland Sound area during the flights (Table 1). The lack of a pre-determined route for the first series may also have influenced the number of fresh versus salt water sightings from flight to flight.

Table 1: Dates, times, and total storks seen on 1988 survey flights for wood storks

<i>Date</i>	<i>Start</i>	<i>Final</i>	<i>Total Groups</i>	<i>Total Storks *</i>	<i>Nearest high tide</i>	<i>Flight Code</i>
<i>First series</i>						
7-12	13:00	15:20	1	1 (6)	16:15	1
7-13	13:05	14:15	3	6	8:36	2
8-9	8:45	10:00	3	67	7:50	3
8-9	13:00	14:15	2	27	20:13	4
8-10	9:00	11:10	7	83 (4)	8:35	5
8-10	14:00	15:15	2	6	20:00	6
8-23	14:05	15:30	5	36	18:20	7
8-23	18:30	19:55	6	120	18:20	8
8-24	14:40	15:55	10	69	19:30	9
8-31	11:30	12:40	13	159	12:55	10
9-1	15:35	16:10	5	96	13:50	11
9-2	9:20	11:00	12	84	14:45	12
9-2	14:50	16:20	7	183 (1)	14:45	13
9-12	9:00	10:15	9	113(12)	10:30	14
9-12	13:55	15:35	8	107	10:30	15
9-13	8:40	10:15	14	291	11:00	16
9-13	14:05	15:30	8	120	11:00	17
9-23**	13:30	15:40	4	68	13:00	18
[* numbers in () are storks in flight, **9-23 was the flight including islands to the north]						
<i>Second series</i>						
9-20	12:10	12:40	3	17	15:50	A (aborted)
9-20	16:00	18:10	12	146	15:50	B
9-22	11:37	13:45	15	109	5:22	C
9-22	15:55	18:30	16	404	18:08	D
9-24	9:15	11:30	31	386	7:24	E
9-24	12:45	14:50	26	238	7:24	F
9-25	13:05	15:20	26	232	20:41	G
9-26	9:15	12:10	25	357	9:03	H
9-26	13:40	16:05	23	379	21:27	I
9-28	10:30	13:00	25	411	10:36	J
9-28	15:25	17:55	28	213	22:59	K
9-29	10:30	12:45	17	324	11:27	L
9-29	14:30	17:50	16	331	11:27	M
9-30	15:30	17:55	21	408	12:20	N
9-30	18:35	19:30	6	91	12:20	O (aborted)

For all groups of storks seen in the first series 10 % were flying, 18 % were feeding or on the ground in salt water habitats and 14 % were feeding or on the ground in fresh water habitats. Twice as many storks were noted resting in trees near salt water habitats than near fresh water habitats. For all groups of storks seen in the second series, 9 % were flying, 29 % were in trees near fresh water bodies, 53 % were in trees near salt water, 4 % were in fresh water ponds, creeks or sloughs, and 4 % were in salt marshes or tidal creeks or rivers. The first series thus was relatively consistent with the second series in terms of the numbers of birds in or near fresh versus salt water habitats, but had a much higher percentage of foraging sightings. This could be due to a seasonal difference in foraging intensity but is more likely due to differences in survey methods. Storks foraging in open salt marshes and ponds may be easier for an inexperienced observer to see.

In the first series there were slightly more sightings of storks on the ground or in the water in the salt marshes, while in the second series sightings of storks foraging or resting on the ground or in the water were evenly divided between fresh and salt water sites (Table 2). In the first series there was little relationship between tide and when storks were seen foraging or resting in fresh versus salt water. In the second series there was a strong relationship between tides and the type of site storks selected for foraging. Within two hours of high tide, seven sightings of storks on the ground were in fresh ponds, and only one was in the upper reaches of a salt marsh. During mid-tide, from two to four hours from the high tide, three sightings were in fresh ponds, and three were in upper salt marsh. From four hours from the high tide to the low tide, four groups were seen in upper salt marsh, four were seen on "second order" tidal creeks in salt marsh, one was seen on a major salt water river, two were seen at fresh water ponds or lakes, and one group, at 4:31 from the high tide, was seen at a dredge spoil pond of unknown salinity (probably brackish, with minimal diurnal change in water level). Although the overall trend appears to be more storks foraging and resting in the water in fresh ponds at high tide, the summed data of the two series did

Table 2: Sightings of storks on the ground or in the water

<i>Time to high tide</i>	<i>Fresh or salt</i>	<i>Habitat</i>	<i>Microhabitat</i>	<i>No. birds</i>	<i>Time</i>	<i>Behavior</i>	<i>Series</i>
First series							
<u>High</u>							
:30	S	Upper marsh	Short spartina	11	12:25	Feed	1
:35	S	2nd creek	Open water	6	12:20	Feed	1
:30	F	Pond	Tall grass	3	10:00	Rest	1
:39	F	Pond	Short grass	29	12:16	Feed	1
:45	F	Pond	Short grass	6	12:00	Feed	1
:55	F?	Dredge pond	Water/trees	10	19:15	Rest	1
:55	S	Upper marsh	Short spartina	15	12:10	Rest/feed	1
:55	S	Upper marsh	Tall spartina	17	12:10	Rest/feed	1
:55	S	Mudflat	Short spartina	4	15:40	Rest/feed	1
1:00	S	Marsh	Short spartina	20	8:50	Feed	1
1:05	S	Marsh	Tall spartina	12	9:25	Feed/rest	1
1:10	F	Pond	Short grass	12	9:50	Feed/rest	1
1:16	F	Pond	Short grass	16	19:36	Feed/rest	1
<u>Mid</u>							
2:06	F	Pond	Open water	28	15:56	Feed/rest	1
2:06	F	Mud flat	Short grass	4	15:56	Feed/rest	1
2:10	S	Mud flat	Short spartina	32	10:45	Feed/rest	1
3:40	S	Upper marsh	Short spartina	1	14:40	Feed	1
3:43	S	2nd creek	Tall spartina	10	14:42	Feed	1
3:45	F	Pond	Short grass	3	14:40	Feed	1
3:50	S	Mud flat	Short spartina	8	14:50	Feed/rest	1
3:59	S	Marsh	Tall spartina	2	13:25	Feed	1
<u>Low</u>							
4:00	S	Salt pond	Short spartina	49	15:00	Feed/rest	1
4:00	S	2nd creek	Tall spartina	8	14:30	Feed/rest	1
4:03	S	Marsh	Short spartina	1	10:42	Feed	1
4:10	F	Pond	Water/trees	11	15:20	Rest/feed	1
4:05	F	Pond	Water/trees	10	15:25	Rest/feed	1
4:25	S	2nd creek	Tall spartina	6	15:05	Feed	1
4:35	S	Mud flat	Short spartina	12	14:55	Feed	1
4:35	F	Pond	Short grass	6	10:10	Feed	1
4:40	S	2nd creek	Open water	2	15:10	Rest/feed	1
4:55	F	Pond	Open water	2	15:05	Feed	1
5:00	F	Pond	Open water	2	15:30	Rest/feed/preen	1
5:03	F	Pond	Shrubs?	7	15:10	Feed	1
5:05	S	Mud flat	Short spartina	3	9:40	Rest	1
5:10	S	Mud flat	Short spartina	9	14:20	Feed	1
5:30	S	Upper marsh	Tall spartina	4	14:37	Feed	1

Table 2 (continued) : Sightings of storks on the ground or in the water

<i>Time to high tide</i>	<i>Fresh or salt</i>	<i>Habitat</i>	<i>Microhabitat</i>	<i>No. birds</i>	<i>Time</i>	<i>Behavior</i>	<i>Series</i>
Second series							
<u>High</u>							
:20	F	Pond	Open water	1	16:10	Rest	2
:43	S	Upper marsh	Short spartina	23	10:44	Rest/feed/preen	2
1:02	F	Pond	Short grass	12	17:06	Rest/feed	2
1:15	F	Pond	Short grass	2	11:51	Feed	2
1:26	F	Pond	Short grass	1	16:42	Rest/feed	2
1:47	F	Pond	Water/trees	50+	17:37	Rest/feed	2
1:49	F	Pond	Open water	8	12:25	Feed	2
1:59	F	Pond	Short grass	3	9:23	Rest	2
<u>Mid</u>							
2:35	S	Upper marsh	Short spartina	25	9:59	Rest	2
2:46	S	Upper marsh	Short spartina	6	10:10	Rest?	2
2:57	S	Upper marsh	Short spartina	30	10:21	Rest	2
3:44	F	Pond	Water/trees	37	16:04	Feed/rest/preen	2
3:54	F	Pond, farm	Tall grass	5	16:14	Feed	2
<u>Low</u>							
4:31	F?	Dredge pond	Mud bank	40	16:51	Feed	2
5:26	S	2nd creek	Tall spartina	11	14:28	Feed	2
5:27	F	Lake	Tall grass	8	17:47	Rest?	2
5:34	S	2nd creek	Mud bank	8	17:25	Feed	2
5:42	F	Pond	Short grass	2	19:02	Feed	2
5:42	S	Upper marsh	Short spartina	2	13:02	Feed	2
5:44	S	2nd creek	Open water	14	14:57	Feed	2
5:45	S	Upper marsh	Tall spartina	9	12:23	Feed	2
5:59	S	Upper marsh	Mud bank	9	18:45	Feed	2
6:04	S	2nd creek	Tall spartina	7	13:28	Feed	2
6:13	S	Upper marsh	Short spartina	15	13:37	Feed	2

Note: This table does not include sightings where the storks are in trees with a few storks in the water, and the storks are resting. It does include sightings where all resting storks are on the ground or some of the storks not in trees are feeding.

not provide a significant difference ($X^2 = 4.67$, $p=.6$).

The tidal trend did not apply to storks resting in trees. Storks were as likely to be resting near fresh ponds at the low tide as at the high ($X^2 = .13$, $p=.975$ using the second series to compare stork use of trees at high and low tides for salt and fresh water habitats). There was also no evidence storks moved from roosts in the upper estuaries to roosts along larger tidal creeks or rivers in response to the tide ($X^2 = 7.62$, $p=.50$, second series). Roosting groups do not therefore appear to be selecting roost sites in conjunction with food availability at specific times of day. More birds were noted to be flying between locations at low tide. Although there was only slightly more time spent surveying at low than at high tides during the second series, 82% of the observations of groups of birds on the wing were at low tide, while 11% were at high tide.

In the first series there was no significant difference in distribution of group size between fresh and salt water areas. The largest group reported foraging on the ground was 49 birds at a salt pond. The largest group reported resting in trees was 53 birds at the edge of a salt marsh. As suggested in Bratton (1988) most of the groups were small. At fresh water locations, 57% of the groups in the first series were 10 birds or less, and at salt water locations, 49% were 10 birds or less. During the second series, proportionately more large groups were sighted in fresh water areas ($X^2 = 17.15$, $p=.01$, comparing fresh ponds and lakes to salt marsh, by size class of groups). Although there were not enough sightings to test the difference statistically, only groups of less than 20 were seen near fresh water creeks, while only groups of more than 20 were seen roosting near fresh water sloughs. (Table 3) The second series also noted some groups of about 100 birds at both fresh water ponds and upper marsh sites (in trees), and there were several sightings of groups larger than 50 in fresh water locations. Flying groups of storks were much smaller than groups on the ground - 54% of the observations in the first series and 61% of the observations in the second series were of single birds.

Table 3. Wood stork sightings by habitat and group size (Second series)

<i>Habitat</i>	<i>In Trees</i>	<i>Number of storks in a group</i>				
		<i>1-5</i>	<i>6-10</i>	<i>11-20</i>	<i>21-30</i>	<i>>30</i>
Fresh ponds	Yes	18	14	14	16	9
Fresh ponds	No	5	2	1	1	4
Fresh creeks	Yes	2	2	1	-	-
Fresh sloughs	Yes	-	-	5	1	5

Salt marsh	Yes	58	45	26	14	15
Salt marsh	No	2	5	3	3	-

Flying birds	-	26	1	1		

Aerial and foot survey located four stork roosting areas on Cumberland Island. One at the south end of Willow Pond, one where the slough immediately south of Plum Orchard enters the Sound, one on the shore of the tidal flat immediately west of Stafford House, and one at South End Ponds. Island residents reported use of the roost south of Plum Orchard throughout the year. The South End Ponds roost did not appear to be used as regularly as it was during 1987. Investigation on foot in spring and early summer of 1988 found no storks at the site in early evening. The rookery active at Heron Pond in 1987 (Bratton 1988) was not used for nesting in 1988 and did not serve as a major roosting area.

The flight to the north of St. Simons on Sept. 23 did locate storks including one flying near Moses Hammock on Sapelo Island, 10 resting at English Cut on St. Catherines Island and 17

resting at South End Field on Ossabaw Island. There was a group of 40 storks at Harrington Pond on St. Simons Island. Harrington Pond was surveyed during the second series and wood storks were regularly sighted there. Investigation on the ground found a mixed species rookery at Harrington Pond. Wood storks were also frequently noted at Musgrove Plantation Lake on St. Simons Island.

Discussion

These data suggest a large number of wood storks are using the Cumberland Sound area in late summer. Since high counts for the September survey were 404, 408 and 411, one suspects 400- 500 birds is a minimum summer population estimate for the Cumberland Sound region. The single flight to the north found birds at Sapelo, St. Catherines and Ossabaw Islands, and wood stork foraging is seen regularly at sites such as Sapelo Island (Dick Wiegert, personal communication). The late summer coastal stork population north of the Florida border may thus be 600-1000 storks. These figures should be confirmed by aerial survey of a wider area, including the other Georgia and South Carolina Sea Islands and freshwater wetlands further inland in both states.

Although the first few survey flights were probably ineffective at finding storks due to the inexperience of the survey crew, there is some possibility there were more storks in the area later in the season. Sightings of immature storks are frequent in the Cumberland Island area during late summer, and it is also possible larger groups may be more common at this time of year. Since the first survey series was "developmental," however, no firm conclusions can be drawn by comparing the two sets of data.

These data further confirm the potential correlation between stork foraging sites and the tidal cycle suggested in Bratton (1988). The second series found storks on the ground or in the water in salt marsh areas at low to mid-tides, and in fresh water areas at high tides. The second series suggests storks use upper salt marsh and short spartina areas during high tides and move into tall

spartina and larger tidal creek areas at the low tides. These data also suggest roosting storks do not select roosts in response to tides and may be found in trees near salt marshes or creeks at any point in the cycle. The relatively low percentage of the sightings thought to be foraging storks suggests the survey flights may have been initiated too late in the day. Early morning flights present problems with cloud cover, and occasionally with thunder storms, but should be evaluated for an increase in the number of foraging observations. Pilot availability influenced flight times during this survey and we suggest future surveys book early morning flights in advance.

Some habitats initially defined for the survey were not used by storks during the survey flights. These included oyster bars, salt marsh vegetation other than *Spartina alterniflora*, shrubs near salt marshes, floating mats in fresh marshes, and ditches. Storks were seen in both tall and short *Spartina*, and in tall and short fresh water marsh grasses. Recording the size of creeks on which storks forage is potentially useful. Storks appear to be using a wide range of salt marsh habitats, from the upper reaches (often short *Spartina*) of the salt marshes, to the secondary tidal creeks, to tidal rivers.

The data from this survey agree with the observations of Bratton (1988) that most of the groups of birds seen foraging in marsh sites are small, but the data from this survey suggest larger average group sizes. The largest group seen foraging in the Cumberland marshes in Bratton (1988) was 18 birds, whereas the largest group on the ground in salt water habitat in the first series was 49 birds and in the second was 30 birds. One group of over fifty birds was seen roosting and foraging in a fresh water pond in the second series. However, over half the groups seen on the ground or in the water in the aerial survey were less than ten birds. Most large groups, thirty birds or more, were observed roosting in trees. The differences between the two surveys may be "platform of observation" differences. Bratton (1988) was based on ground survey data and this report is based on aerial survey data - the latter may provide better estimates of numbers of birds, particularly in tidal creeks. Many of the sightings of foraging storks in Bratton (1988) came from the South End

Ponds and Beach Creek areas, where a small wood stork roost with less than 20 birds was active. This small colony may have accounted for many of the Cumberland sightings, thus group size would be generally small. Other roosts around the Cumberland Sound appear to be larger than the one at South End Ponds and thus may produce larger foraging and resting flocks.

The foraging observations collected by this survey suggest slightly greater use of salt water habitats for foraging. More groups were sighted resting in trees near salt marshes, but groups resting near fresh water tended to be larger. Since fresh water ponds actually occupy a much smaller percentage of the area surveyed than do salt marshes, the preservation of open bodies of fresh water may be very important to the wood stork population in Georgia. Further investigation should determine stork preferences in terms of vegetation cover in and near ponds, pond depth and other features critical to stork roosting and foraging.

From a management perspective, the responsible agencies need to locate the fresh water ponds frequented by storks and provide protection from future human disturbance, particularly development activities that might change water levels. The Willow Pond area on Cumberland needs further investigation, as do Harrington Pond and Musgrove Plantation Lake on St. Simons. Large roosts and frequently used roosting areas on tidal creeks also need to be verified. Sites used frequently from year to year should be buffered from development on the inland side. The U.S. National Park Service should continue to locate roosting areas on Cumberland Island and should, through enforcement and resources management activities, provide the wood storks basic protection from human harassment. Any new trails or facilities development on Cumberland should avoid known stork roosting areas.

The geographic data from these surveys have been summarized on a Geographic Information System developed by John Pickering at the University of Georgia and will be available in a separate report.

Part II

Survey of Least Terns

Nesting on

Cumberland Island National Seashore

Methods

A census of least tern (*Sterna albifrons*) nesting areas was conducted between July 5th and July 15th, 1988, on Cumberland Island. Approximately 16 miles of beach area suitable for nesting was surveyed by walking the beach along a route on the ocean side of the primary dune about 10 m above the high tide line. The area included the Atlantic beach from Long Point to 500 m south of the Jetty. The walking technique yielded defensive mobbing reactions from nesting terns, but did not draw reactions from resting flocks of terns. Upon encountering mobbing, the surveyor would move away from the nesting habitat to a spot below the high tide line, allow the birds to resettle, and then mark the location.

Results

Three areas of small nests concentrations with seven nests total were located. Although least terns were observed in pairs and larger groups all along the beach, they appeared to congregate at the outflows of Lake Whitney and Lake Retta and also in an area roughly one-half mile south of the boardwalk access to the beach at Sea Camp. Four nests within 100 m of each other were found in the area south of Sea Camp. All scrapes in the Sea Camp area were within 10 m of the high tide line (8, 5, 9.5, and 1.5 m). No scrapes in this area were in secondary dunes. Two scrapes were

located within the 50 m area south of Lake Retta outflow. These scrapes tended to be farther from the high tide line, behind the primary dune and in the interdune area before the secondary dune. These scrapes were 14 m and 17 m from the high tide line. A last nest was located 25 m south of the Lake Whitney outflow. This nest was also 14 m from the high tide line.

On five different observation runs via truck more than 30 least terns were observed within 100 m of the Whitney outflow. Most terns were at rest on packed, wet sand. Others were feeding in ocean surf, and displaying such behaviors as hovering, swooping and plunging into the water. This group should probably be considered a "true colony". A smaller flock of 15 terns was seen on two occasions in the Retta outflow area. These birds were also observed feeding.

All nests were discovered on July 5 or July 9. Of the seven original nests three had two eggs and four had one. When nests were rechecked July 15, only two of six nests relocated were still active (the Whitney nest was not rechecked).

Discussion

Least terns have nested in the area around from Sea Camp to just south of the Dungeness cross-over for more than ten years (Susan Bratton, conversations with park staff and field observations). The nesting area has moved from year to year, and has, in the past, been very close to the high visitor use area near the sand road at Dungeness. Least terns have previously been recorded as nesting on Long Point, but scattered nests or colonies between Long Point and Stafford cross-over have not been previously recorded. The discovery of nests behind the primary dune suggests that intensive survey may locate further nest sites.

This survey was run near the end of the tern nesting season (due to dependence on student labor). The survey should be conducted twice each summer, one in early in June and once late in June or early in July. Nests were most easily detected during mid-afternoon between 14:00 and 18:00 hours when parents were there to protect them from the sun. Nesting birds were more likely

to be absent when it was cloudy, making nests harder to find. It is thus better to survey the beach in full sunlight, avoiding the early morning and evening hours, and cloudy days. Extreme care must be taken, however, not to frighten the birds off the nests, or have them leave eggs or young birds exposed to the sun. If search is made under low light, care must be taken not to step on or disrupt eggs or young.

The eggs which disappeared prior to July 15 may have been removed by high tides or by predation (the remaining nests were relatively distant from the high tide line - 9.5 m for the remaining Sea Camp nest, and 17.3 m for the remaining nest at Retta outflow). There were two thunderstorms the week of July 10 and tides were relatively high.

Any change in beach profiles which results in erosion of the primary dune line may be detrimental to least terns. Not just nesting but nest success should be monitored to determine if populations are stable. Least terns are presently considered threatened for the entire Atlantic coast, so it is highly desirable to maintain productive colonies on Cumberland Island. The greatest threats to the terns are direct disturbance by humans, trampling by feral horses and loss of nest areas due to shoreline erosion. As long as dredging is underway in the St. Marys Entrance, colonies as far north as Whitney should be monitored and nest location compared to changes in shoreline profiles.

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References

Bratton, S.P. 1988. Wood stork roosting and foraging on Cumberland Island National Seashore. *Institute of Ecology, CPSU Technical Rep. No. 51*. 24 pp.