

**CONSOLIDATED BREEDING RECORDS FOR
COLONIAL SHOREBIRDS IN FLORIDA FROM
1973–1997**

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CONSOLIDATED BREEDING RECORDS FOR COLONIAL SHOREBIRDS IN FLORIDA FROM 1973-1997

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Abstract: This project reviews data from the Florida Committee on Rare and Endangered Plants and Animals, the Florida Natural Areas Inventory, Colonial Bird Register, reports to the Florida Field Naturalist, and Audubon Field Notes to consolidate colonial shorebird (primarily Laridae) breeding records from 1973 to 1997 into the Wildlife Observation System (WOS) of the Florida Fish and Wildlife Conservation Commission. Six hundred forty-six geographically unique colony sites were found; 238 of these were not previously recorded in WOS. Additionally, 2,569 occurrences (of a species breeding in a colony at a given time) were recorded, of which 1,679 were not already recorded in WOS. Man-made or altered sites included 271 building roofs, 41 causeways, and 100 spoil islands. Roofs were most commonly used by least terns (262 roofs) followed by black skimmers (38 roofs). These data provide a baseline for future surveys at certain colonies or regions, but do not provide a comprehensive statewide view. A total of 280 hours was spent on the 141 citations, and averaged 6 new breeding records per hour. Gaps in our knowledge of breeding shorebirds include inland nesting colonies, roof nesting in southwest Florida, and current breeding records in northeast and north-central Florida. I recommend continued recording of breeding records from the Florida Field Naturalist and from reports specific to nesting shorebirds. Future colony surveys should record when no nesting was observed and use a Global Positioning System (GPS) receiver to help eliminate ambiguity between historical and new sites.

INTRODUCTION

Gulls, terns, and other colonial shorebirds share several natural history characteristics that heighten their susceptibility to population loss, including low reproductive rates that slow recoveries, competition with humans for coastal habitat, and threats of disturbance, development, and oil spills (Duffy and Nettleship 1992). In Florida, increased development of coastal shorelines and disturbances on undeveloped shorelines may have negative impacts on the breeding population.

Thirteen species of colonial gulls, terns, and other shorebirds nest in Florida (collectively called colonial shorebirds throughout this report; scientific names are listed in Table 1). Of these species, the least tern and roseate tern are considered threatened by the Florida Fish and Wildlife Conservation Commission (Commission) and the black skimmer as a species of special concern (Wood 1997). The Florida Committee on Rare and Endangered Plants and Animals (FCREPA) account of birds (Rodgers et al. 1996) regarded the magnificent frigatebird as threatened; the sandwich tern,

royal tern, sooty tern, Caspian tern, and brown noddy as species of special concern; and the gull-billed tern as having undetermined status (Table 1).

Many authors of the FCREPA species accounts researched the current breeding status of the aforementioned colonial shorebirds. This project's objective was to consolidate those breeding records by placing them into the Wildlife Observation System (WOS) (Runde and Reynolds 1990) of the Commission. Articles in the Florida Field Naturalist (FFN) and Audubon Field Notes (AFN), and unpublished reports, were also reviewed. Electronic sources reviewed include the Florida Natural Areas Inventory (FNAI) database, the Colonial Bird Register (CBR), and the World Wide Web (WWW).

STUDY POPULATION

This project focused on consolidating breeding records of colonial shorebirds in Florida (Table 1) from 1973 to 1997. Although these species are obligate coastal species, inland breeding records were also recorded. The brown pelican (*Pelecanus occidentalis carolinensis*) was not considered, due to ongoing projects by the Commission (Nesbitt 1996).

Table 1. Colonial shorebirds that nest in coastal Florida and Florida Fish and Wildlife Conservation Commission (FWC) status (Wood 1997) and the Florida Committee on Rare and Endangered Plants and Animals (FCREPA) status (Rodgers et al. 1996). If the status column is blank, the species has not been assigned a status.

Common name	Scientific name	FWC status	FCREPA status
Magnificent frigatebird	<i>Fregata magnificens rothschildi</i>		Threatened
Laughing gull	<i>Larus atricilla</i>		
Gull-billed tern	<i>Sterna lilotica</i>		Status undetermined
Caspian tern	<i>S. caspia</i>		Species of Special Concern
Royal tern	<i>S. maxima</i>		Species of Special Concern
Sandwich tern	<i>S. sandvicensis</i>		Species of Special Concern
Roseate tern	<i>S. dougallii</i>	Threatened	Threatened
Common tern	<i>S. hirundo</i>		
Least tern	<i>S. antillarum antillarum</i>	Threatened	Threatened
Sooty tern	<i>S. fuscata</i>		Species of Special Concern
Bridled tern	<i>S. anaethetus</i>		
Brown noddy	<i>Anous stolidus</i>		Species of Special Concern
Black skimmer	<i>Rynchops niger</i>	Species of Special Concern	Species of Special Concern

METHODS

Species accounts from FCREPA (Rodgers et al. 1996) and Robertson and Woolfenden (1992) were reviewed to find breeding records of colonial shorebirds (Table 1). Recorded colonies were searched for in the WOS based upon site name and latitude and longitude to determine if they were known. If the colony was not previously recorded, its latitude and longitude were determined from the DeLorme Gazetteer (DeLorme 1997a) to the nearest 1/2 minute. For roof colonies, the building name (e.g., Tallahassee Mall) was located on a city map or the street address was found using the WWW (yellow pages or general search); subsequently DeLorme Street Atlas (DeLorme 1997b) software was used to determine the latitude and longitude (accurate to ca. 50–200 m). Colony locations derived from FFN or AFN articles were often inexact, but where sites could be matched with known colonies the better location information was included.

As much information as possible from each source was recorded in a relational database (Fig. 1) including the original citation. Since inconsistent methods were used to record data in the original citations, no distinction was made between pairs of birds and actual nests, nor was the sex recorded.

WWW pages were searched using Metacrawler (www.metacrawler.com) with the phrase "Florida Seabirds." For WWW pages the Universal Resource Locator (URL), page title, and date were recorded in the database (Appendix A). Besides general searching, online Rare Bird Alerts (RBA) were used (e.g., www.birdware.com, www.virtualbirder.com).

Breeding Bird Atlas (BBA) data only confirms breeding by species (no nest count) and only provides location to the nearest quadrangle and block (5-km precision) (Kale et al. 1992). BBA records were only saved into the WOS for species other than least tern, black skimmer, and laughing gull (41 records). FNAI (337 records) and CBR (1,198 records from 1976 to 1985) data were electronically queried to select the species for the desired period of 1973–1997, and formatted to the common format (Fig. 1).

RESULTS

One thousand one colony sites were found, of which 646 were geographically unique (>500 m apart and distinct geographically) and 238 were not previously recorded in WOS. Additionally, 2,569 breeding records (a species in a colony at a given point in time) were recorded, of which 1,679 were not already in WOS. Although there have been many surveys of nesting

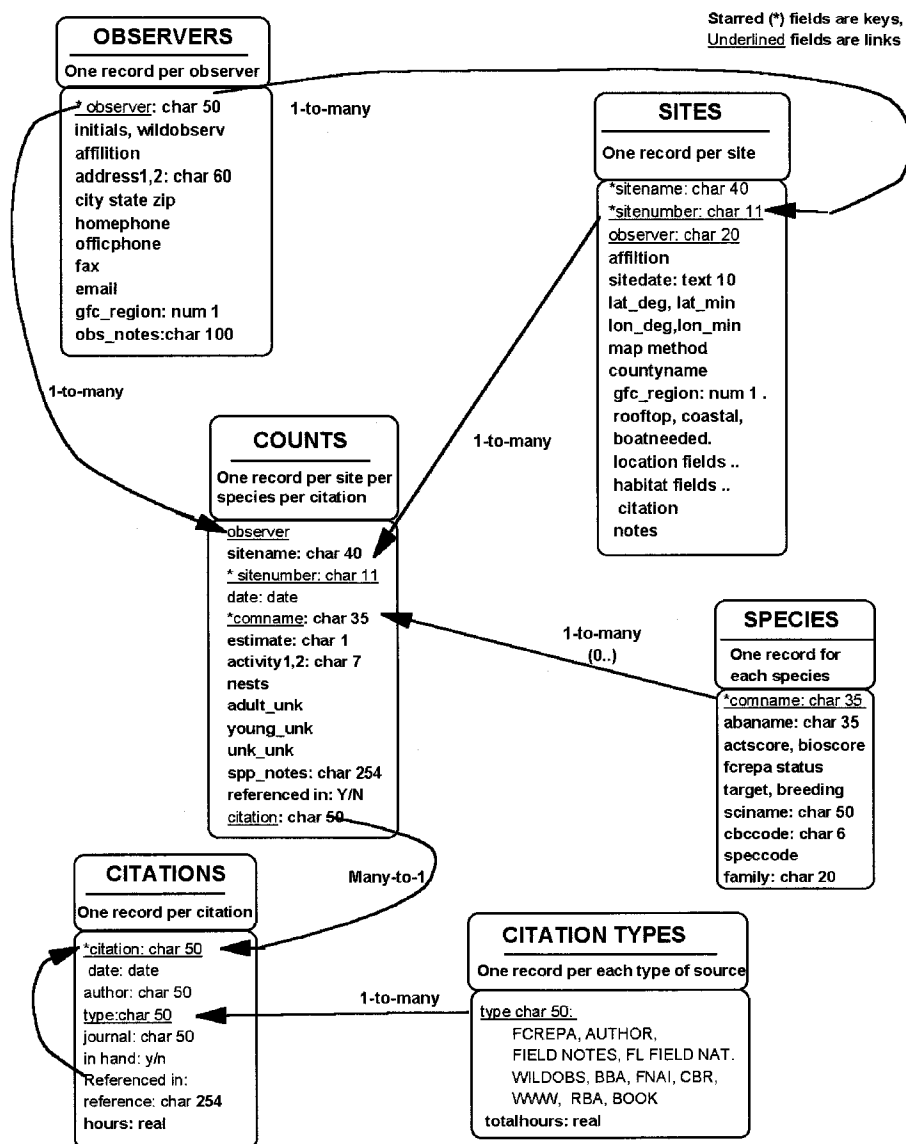


Fig. 1. Overview of colonial nesting shorebird database.

shorebirds in different regions of Florida, there have been few statewide surveys. The Florida Keys have been surveyed for nesting least terns and roseate terns (Kushlan and White 1985, Hovis and Robson 1989, Zambrano et al. 1996) and the northern Gulf coast has been surveyed for nesting black skimmers and least terns (Gore 1991, Hovis and Gore 1996). Downing (1973) surveyed nesting least terns and black skimmers throughout coastal Florida, but only sites accessible by vehicle. Fisk (1975) compiled roof-nesting records throughout the state. Several regional atlases of colonial waterbird species (e.g., Portnoy et al. 1981, Clapp et al. 1983, Spindel and Patton 1988) have included coastal Florida. Laughing gulls were surveyed in south Florida (Kushlan and White 1977, Frohling and Kushlan 1986) and Tampa Bay (Patton and Hanners 1984). Paul and Schnapf of National Audubon Society, have regularly surveyed all shorebird colonies in the Tampa Bay area (e.g., Paul and Schnapf 1996). Schreiber and Schreiber (1978) surveyed terns on spoil islands in Tampa Bay, Citrus County, and the Indian River. In general, the most recent breeding records were found in the FCREPA account.

Looking at the number of reported ground and roof colonies from 1973 to 1997 by county (Fig. 2), it can be seen that:

- a) Many ground and roof colonies have been found in the western Panhandle (Bay, Okaloosa, and Escambia counties).
- b) Many roof colonies occur in southeastern Florida, particularly in the Florida Keys (31 colonies in Monroe County).
- c) A huge number (118) of historical ground colonies have been reported in Monroe County. This is partly due to widespread nesting of laughing gulls on mangrove islands (Kushlan and White 1977, Frohling and Kushlan 1986).
- d) Few roof colonies have been reported for southwestern Florida.
- e) Few colonies have been reported for the Big Bend area.

Because previous surveys were conducted in different years and at different geographic scales, this compilation should not be used to provide species' distributions. That task is best left for a survey in which all colonies and species throughout the state are surveyed in the same year with the same method (Hovis and Gore 1998). This compilation is, however, useful for determining the range in number of nesting pairs and locations of historically important colonies. For each species, I listed the 12 colonies with the highest nest counts for a species during 1973–1997 (Table 2, Fig. 3). Many important colonies occur in the Tampa Bay area (Fig. 4) (Paul and Below 1991). For some species such as the sooty tern (Robertson and Robertson 1996), brown noddy (Robertson 1996), and magnificent frigatebird (Robertson and Wilmers 1996), the Dry Tortugas was the only breeding area in Florida (Fig. 5).

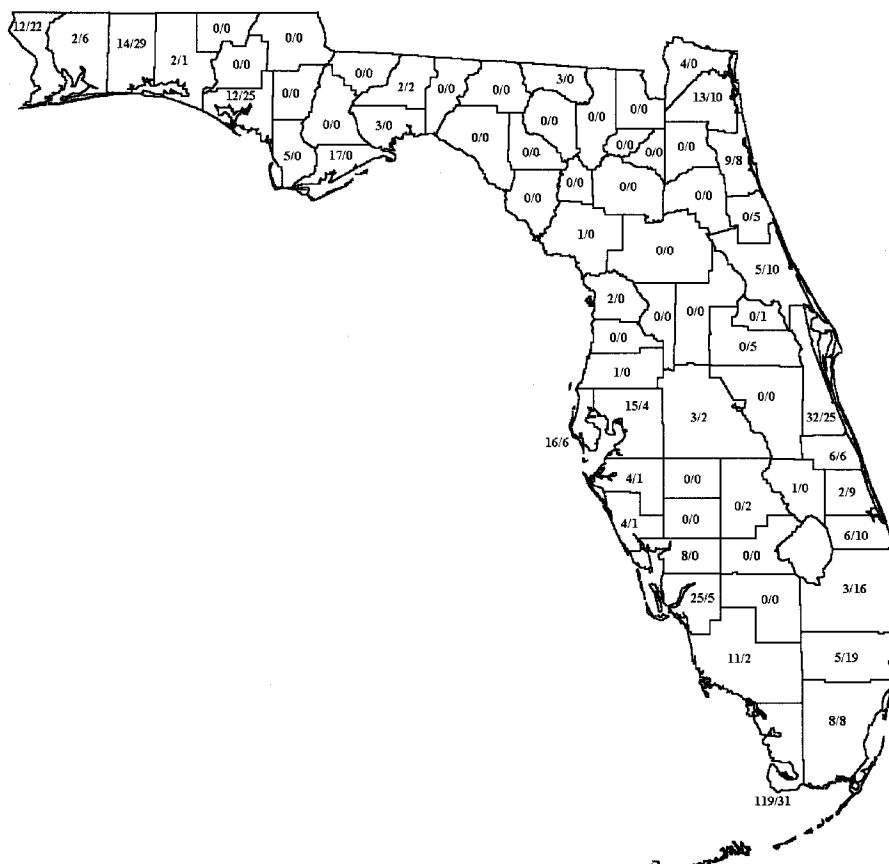


Fig. 2. Number of unique ground/roof colonial shorebirds breeding sites per Florida county for the period between 1973 and 1997. Total ground sites = 375, total roof sites = 271.

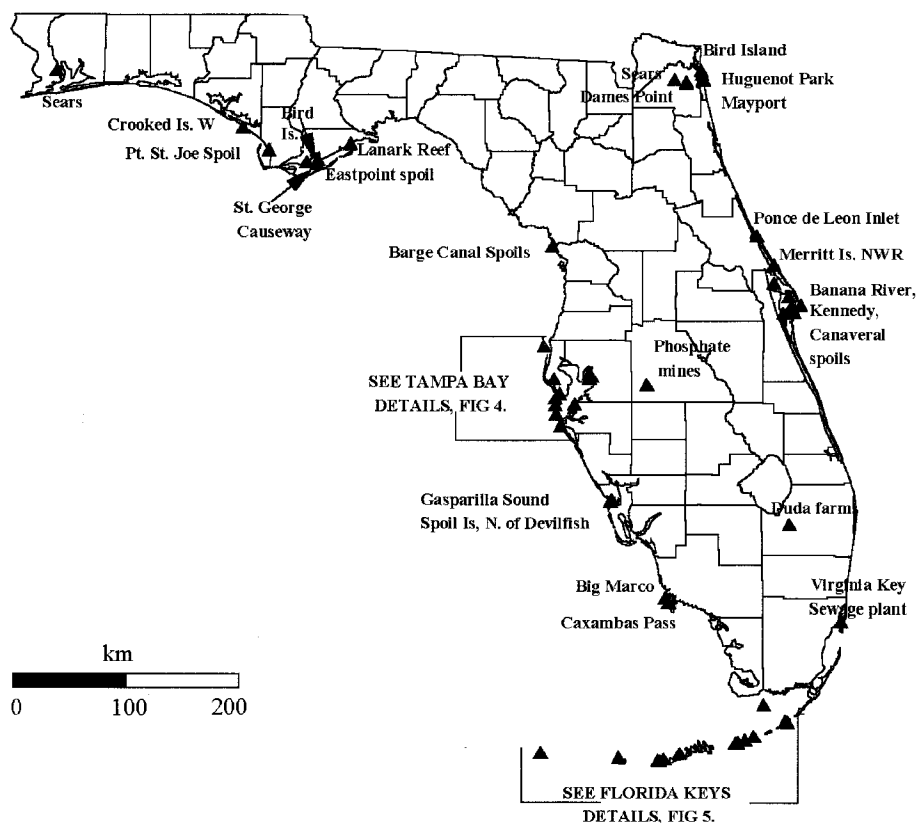


Fig. 3. Location of important colonial shorebird breeding sites in Florida based on compilation of colonies between 1973 and 1997. Only sites among the 12 colonies with the highest nest count for a species are shown.

Table 2. The highest nest count of colonial shorebird species at the top 12 colonies in Florida for the species, based on compilation of breeding records in Florida between 1973 and 1997.

Nests	Date	Colony name	Site number	County	Latitude	Longitude	Citation
Black skimmer							
933	1976/07/10	Bird Island, subcolony 1976	DUVA004004i	Duval	30°30'	81°27'	CBR ^a
531	1994/06/15	Three Rooker Bar	PINE004011a	Pinellas	28°6.8'	82°50.6'	Pranty 1995
400	1983	Hillsborough Bay Island 3D	HILL004009a	Hillsborough	27°50'	82°26.5'	Paul and Woolfenden 1985
300	1975	Merritt Island NWR	BREV004026a	Brevard	28°39.5'	80°46.5'	Ogden 1975
278	1993/06/26	Huguenot Memorial Park	DUVA004007d	Duval	30°24.8'	81°24.4'	WOS ^b
265	1983	Passage Key	MANA004001a	Manatee	27°33.5'	82°44.5'	Paul and Woolfenden 1985
246	1980	Banana River Spoil Islands	BREV004031a	Brevard	28°32.5'	80°38.5'	Breining et al. 1994
208	1990/06/01	St. George Island Causeway	FRAN004006a	Franklin	29°42'	84°53.2'	WOS
200	1993	Shell Key	PINE004008a	Pinellas	27°40.1'	82°44.7'	Blair 1998
200	1984	Caxambas Pass	COLL004003a	Collier	25°54'	81°43'	Paul 1984
200	1995/03/21	Marco Island CWA	COLL004002k	Collier	25°56.5'	81°45'	Zambrano et al. 1996
200	1997	Bird Island, Apalachicola	FRAN004027a	Franklin	29°42.7'	84°58.5'	Laufenberg 1997
Bridled tern							
3	1991/05/30	Pelican Shoals	MONR004069b	Monroe	24°30.1'	81°37.8'	Robson 1998
Brown noddy							
2,500	1993/04/21	Bush Key, Dry Tortugas	MONR004079a	Monroe	24°37.7'	82°52.1'	FNAI ^c
Caspian tern							
93	1996	Hillsborough Bay Island 3D	HILL004009a	Hillsborough	27°50'	82°26.5'	Paul and Schnapf 1996
84	1995/05/16	Alafia Bank	HILL004007b	Hillsborough	27°51'	82°25'	Pranty 1996
39	1997	Bird Island, Apalachicola	FRAN004027a	Franklin	29°42.7'	84°58.5'	Pranty 1998
31	1975	Merritt Island NWR	BREV004026a	Brevard	28°39.5'	80°46.5'	Ogden 1974
31	1979	Kennedy Space Center, spoil is.	BREV004041a	Brevard	28°27'	80°37'	Breining et al. 1994
30	1978	Eastpoint Spoil Areas	FRAN004009d	Franklin	29°44.3'	84°52.4'	Ogden 1979
16	1974/06/04	Hillsborough Bay Is. Pelican Point	HILL004014a	Hillsborough	27°52.5'	82°26'	Dunstan et al. 1975
1	1978	Gasparilla Sound	CHAR004004a	Charlotte	26°48'	82°14'	Clapp et al. 1983
1	1962/06/13	Bayway, Spoil Island I-49b	PINE004023a	Pinellas	27°42.5'	82°42'	Woolfenden and Meyerriecks 1963
1	1973	St. Petersburg, Bayway	PINE004016a	Pinellas	27°36.5'	82°44.5'	Dunstan et al. 1975
1	1974/07/20	Spoil island N. of Devilfish Key	CHAR004006a	Charlotte	26°47'	82°14.5'	Dunstan et al. 1975

Table 2. Continued.

Nests	Date	Colony name	Site number	County	Latitude	Longitude	Citation
Common tern							
141	1977/05/30	Bird Island	DUVA004004h	Duval	30°30'	81°26'	CBR
	1986-89	Courtenay Quad - block 6	BREV004QCO6	Brevard	28°23.75'	80°41.25'	BBA ^d
Gull-billed tern							
325	1974/06/16	Bird Island off Little Talbot Is.-N.	DUVA004004g	Duval	30°29.5'	81°25.5'	Loftin et al. 1975
300	1977	Banana River Spoil Islands	BREV004031a	Brevard	28°32.5'	80°38.5'	Schreiber and Schreiber 1978
285	1975	Merritt Island NWR	BREV004026a	Brevard	28°39.5'	80°46.5'	Ogden 1975
67	1979/06/16	Mayport	DUVA004007j	Duval	30°24.5'	81°24.5'	Ogden 1979
20	1995	Huguenot Memorial Park	DUVA004007c	Duval	30°24.8'	81°24.4'	Smith and Alvear 1997
15	1976/07/05	Cape Canaveral J	BREV004050j	Brevard	28°28'	80°32'	CBR
12	1982/07/17	Duda Farms - SE of Belle Glade	PALM004005a	Palm Beach	26°35'	80°38'	Paul 1982
10	1989	Dames Point Bridge, island	DUVA004019a	Duval	30°23'	81°33.5'	Smith and Alvear 1997
8	1984	Hillsborough Bay Island 3D	HILL004009a	Hillsborough	27°50'	82°26.5'	Paul 1984
5	1989	Dames Point - small island near	DUVA004020a	Duval	30°23.5'	81°33.5'	Smith and Alvear 1997
5	1979	Eastpoint Spoil Areas	FRAN004009d	Franklin	29°44.3'	84°52.4'	Ogden 1979
4	1981	Hillsborough Bay Island 2D	HILL004008a	Hillsborough	27°52.5'	82°26'	Smith and Alvear 1997
4	1990	Hillsborough Co. phosphate mine	HILL004012a	Hillsborough	28°00'	82°15'	Cooper 1990
4	1990	Phosphate mines, Polk County	POLK004002c	Polk	27°47'	81°55'	Paul 1991
4	1995	Bird Island, Apalachicola	FRAN004027a	Franklin	29°42.7'	84°58.5'	Pranty 1998
4	1993	Crooked Island West	BAY 004030a	Bay	30°0.3'	85°32.9'	Smith and Alvear 1997
4	1987/06/15	Port Canaveral spoil bank	BREV004035a	Brevard	28°24.5'	80°35.5'	Paul 1987
Laughing gull							
31,000	1981	Bayway, Spoil Island I-49b	PINE004023a	Pinellas	27°42.5'	82°42'	Patton and Hanners 1984
20,000	1984/06	Hillsborough Bay Island 2D	HILL004008a	Hillsborough	27°52.5'	82°26'	Paul 1984
10,000	1996	Shell Key	PINE004008a	Pinellas	27°40'	82°44.5'	Blair 1998
10,000	1987	Hillsborough Bay Island 3D	HILL004009a	Hillsborough	27°50'	82°26.5'	Paul 1987
7,300	1981	Alafia Bank	HILL004007b	Hillsborough	27°51'	82°25'	Patton and Hanners 1984
6,300	1982	Passage Key	MANA004001a	Manatee	27°32'	82°44'	Patton and Hanners 1984
6,000	1981	Hillsborough Bay, Fantasy Island	HILL004016a	Hillsborough	27°50'	82°26'	Patton and Hanners 1984
5,000	1981	Tampa Bay, Spoil Island I-66	MANA004003a	Manatee	27°38'	82°34.2'	Patton and Hanners 1984
4,000	1997	St. George Island Causeway	FRAN004006g	Franklin	29°42'	84°53'	J. A. Gore pers. commun.
4,000	1993	Three Rooker Bar	PINE004011a	Pinellas	28°06.8'	82°50.5'	Pranty 1994
3,800	1982	Hillsborough Bay, North Spoil	HILL004015a	Hillsborough	27°52.5'	82°26'	Patton and Hanners 1984

Table 2. Continued.

Nests	Date	Colony name	Site number	County	Latitude	Longitude	Citation
Least tern							
1,300	1995/05/12	Big Marco Pass CWA	COLL004002k	Collier	25°55'	81°45'	Zambrano et al. 1996
704	1990	St. George Island Causeway	FRAN004006g	Franklin	29°42'	84°53.2'	Paul 1991
600	1987	Caxambas Pass	COLL004003a	Collier	25°54'	81°43'	FNAI
525	1993/05/27	Sears University Mall	ESCA004010b	Escambia	30°30.2'	87°13.3'	WOS
500	1996	Florida Power, Weedin Island	PINE004018a	Pinellas	27°50'	82°45'	Paul and Schnapf 1996
500	1976/04/29	Virginia Key Sewage plant	DADE004005e	Dade	25°42'	80°17'	CBR
500	1975/06/03	Key Haven near Key West	MONR004084a	Monroe	24°34'	81°45.5'	Fisk et al. 1988
400	1974/05	Cluett Key	MONR004086a	Monroe	25°01.9'	80°51.8'	Fisk et al. 1988
385	1977	Sears roof, Jacksonville	DUVA004022a	Duval	30°25'	81°38.54'	Ogden 1977
350	1976	Longboat Key, Apartment	MANA004005a	Manatee	27°26'	82°41.5'	Fisk 1978
300	1973/05/16	Ponce de Leon Inlet	VOLU004001h	Volusia	29°04.4'	80°55.5'	Downing 1973
300	1987/06/15	Spoil Island, Apalachicola	FRAN004028a	Franklin	29°41.4'	84°52.7'	FNAI
Magnificent frigatebird							
250	1976	Marquesas Keys	MONR004077a	Monroe	24°34.5'	82°09'	Robertson and Wilmers 1996
75	1993/04/21	Long Key, Dry Tortugas	MONR004078a	Monroe	24°37.5'	82°52'	FNAI
7	1988/05/31	Bush Key, Dry Tortugas	MONR004079a	Monroe	24°37.7'	82°52.1'	Langridge 1988
Roseate tern							
300	1995/07	Pelican Shoal CWA	MONR004069d	Monroe	24°30.1'	81°37.8'	FNAI
263	1976/06/26	Tank Island, Key West	MONR004070a	Monroe	24°33.5'	81°49'	Kushlan and White 1985
96	1981/6/21	Lower Matecumbe Key	MONR004082a	Monroe	24°53'	80°39'	Paul 1981
65	1976/06/26	Grassy Key, generic	MONR004134a	Monroe	24°46'	80°57'	Kushlan and White 1985
60	1989/05/26	Marathon condominium rooftop	MONR004080a	Monroe	24°42.5'	81°06.8'	Paul 1989
50	1970	Dry Tortugas	MONR004079a	Monroe	24°37.6'	82°52.1'	Smith 1996
42	1976/06/15	Indian Key fill, Upper Matecumbe	MONR004036b	Monroe	24°53.5'	80°40'	Kushlan and White 1985
35	1975/06/21	Key Haven near Key West	MONR004084a	Monroe	24°34'	81°45.5'	Fisk et al. 1988
30	1991	Casa Cayo condo	MONR004039b	Monroe	24°42.5'	81°06.8'	Smith 1996
30	1985	Truman Annex-Key West NAS	MONR004066b	Monroe	24°33'	81°48.5'	Kale 1985
30	1997	Marathon FWC - DEP Bldg	MONR004108a	Monroe	24°42.7'	81°5.8'	H. Smith pers. commun.
25	1976/06/14	Key West harbor	MONR004083a	Monroe	24°33'	81°48'	Ogden 1976
7	1990/07/09	Vaca Rock	MONR004072a	Monroe	24°44'	81°01.6'	Smith 1996

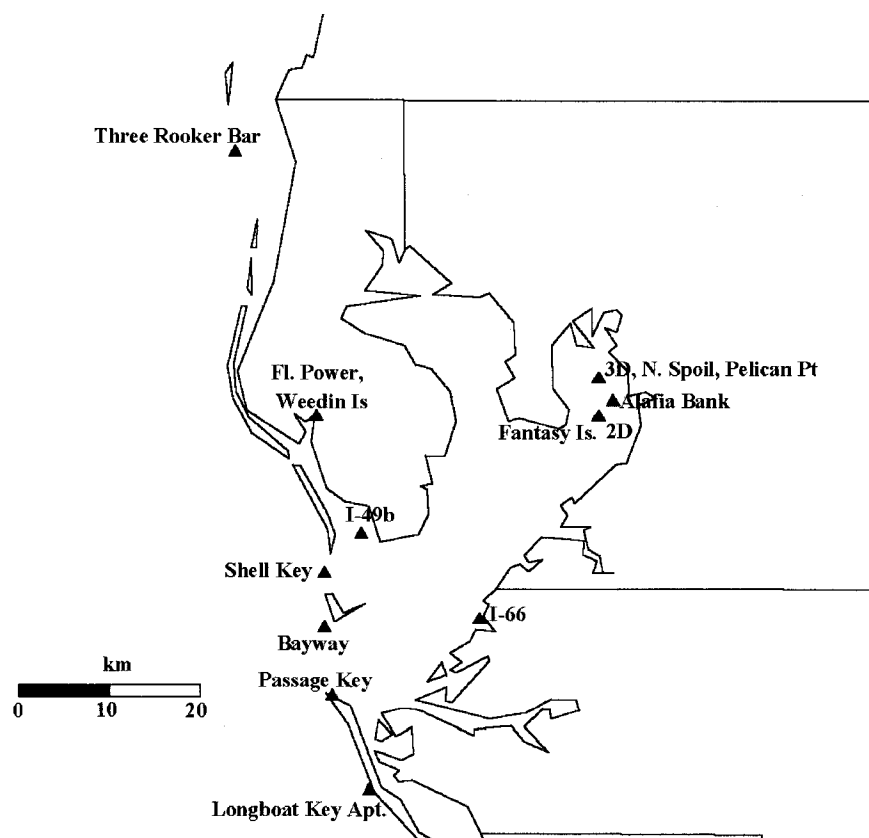


Fig. 4. Location of important colonial shorebird breeding sites in Tampa Bay, Florida, based on compilation of colonies between 1973 and 1997. Only sites among the 12 colonies with the highest nest count for a species are shown.

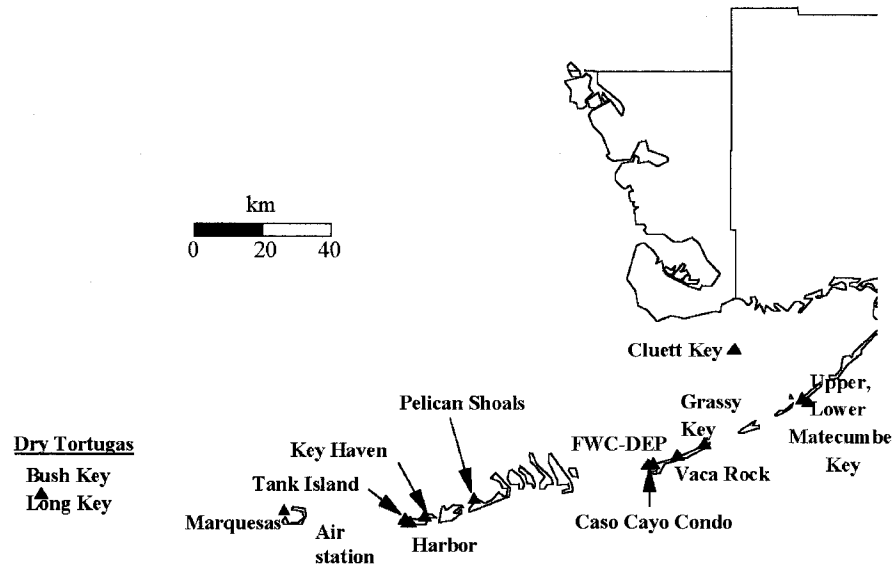


Fig. 5. Location of important colonial shorebird breeding sites in Florida Keys, Florida, based on compilation of colonies between 1973 and 1997. Only sites among the 12 colonies with the highest nest count for a species are shown.

Changes have taken place in the occurrence of shorebirds breeding in Florida (Table 3). Species such as the bridled tern, Caspian tern, and magnificent frigatebird all began breeding in the state in the 1960s. The Caspian tern has increased in the 1990s with highest counts in Hillsborough Bay and movement into Bird Island near Apalachicola in the Panhandle. Conversely, the common tern and gull-billed tern have apparently declined, particularly in northeast Florida (Table 2). Other changes include decreased nesting at Bird Island in Duval County, the colonization of the spoil islands (2D and 3D) in Hillsborough Bay, and the expansion of roof nesting by black skimmers and least terns.

Although most colonies were historically on natural mainland beaches or barrier islands, human development has influenced the distribution of colony sites. Of the 646 historical colonies, 271 were on roofs (Fig. 2). Since 1973, least tern and black skimmer colonies have been reported regularly on roofs, and least terns and black skimmers have commonly fledged young on roofs (Greene and Kale 1976, Fisk 1978, Hovis and Robson 1989, Gore 1991, Gore and Kinnison 1991, Coburn 1995, Zambrano et al. 1996, Bolte and Cobb 1998, Bolte 1999). In addition, roseate terns, gull-billed terns, royal terns, and perhaps laughing gulls occasionally have attempted to nest on roofs in Florida (Table 4).

Of 375 unique ground colonies, 41 were on causeways and 100 were on spoil islands. These colonies may have less human disturbance and predation from the eastern spotted skunk (*Spilogale putorius*) or raccoon (*Procyon lotor*).

Black skimmers, least terns, and gull-billed terns have occasionally nested at inland sites as far as 110 km from the coast (Table 5). These inland habitats have included farms, phosphate mines, building roofs, shell spits, and airports.

Most of the ground colonies were managed by various entities, including national parks or seashores (44 sites), national wildlife refuges (10), state parks or state recreation areas (26), locally owned public land (36), and Department of Defense or NASA (44). The Commission would do well to leverage off work done by these agencies to manage their respective colonies (O'Meara and Gore 1988). Shorebird colonies on 11 Critical Wildlife Areas are managed in part by the Commission in cooperation with the property owner (Schaefer 1996). Most roof colonies were on private land, and their management can only be accomplished with the help of building owners (Coburn et al. 1997).

Table 3. Chronology of first breeding records, major colonies and surveys, and events affecting colonial shorebirds in Florida, concentrating on the period between 1973 and 1997.

Year	Species	Event	Citation
1835	Sooty tern	Audubon sees Bush Key colony	Audubon 1835 in Robertson 1964
1957	Least tern	First documented roof nesting	Goodnight 1957
1961	Bridled tern	First U.S. breeding	Robertson et al. 1961
1962	Caspian tern	First statewide breeding	Woolfenden and Meyerricks 1963
1962	Roseate tern	More breeding in Keys	W. Robertson pers. commun. in Smith 1996
1969	Magnificent frigatebird	Marquesas, first breeding in state	Clapp et al. 1983
1973	Least tern, skimmer	Statewide survey	Downing 1973
1973	Least tern	Documented roof nesting	Fisk 1975
1974	Laughing gull	First breeding in NE Florida	Loftin and Sallas 1974
1974	Caspian tern	Begin nesting in Hillsborough Bay	Dunstan et al. 1975
1974	Royal tern	Breeds on west coast	Schreiber and Schreiber 1975
1974	Gull-billed tern	325-pair high at Bird Island, Duval	Smith and Alvear 1997
1975	Sandwich tern	Breeds on Atlantic coast	Loftin and Sutton 1975
1975	Black skimmer	Document roof nesting	Greene and Kale 1976
1975	Royal tern	3,000 pairs, Bird Island, Duval	Southall, Wildlife Observation System electronic database
1976	Laughing gull	Survey in southern Florida	Kushlan and White 1977
1976	Black skimmer	933 high count, Bird Island, Duval	Loftin, Colonial Bird Register
1976	Sandwich tern	1,530 pairs, Bird Island, Duval	Loftin, Colonial Bird Register
1977	Common tern	141 pairs, Bird Island, Duval	Loftin, Colonial Bird Register
1978	Caspian tern	First Panhandle breeding	Stevenson 1979
1978	Various	Hillsborough Bay Island 2D built	Paul and Woolfenden 1985
1979	Caspian tern	Abandoned Merritt Island	Salata 1979 in Paul 1996
1981	Various	Atlas of Atlantic coast colonies	Portnoy et al. 1981
1981	Laughing gull	31,000 pairs, Bayway spoil, Pinellas	Patton and Hanners 1984
1982	Laughing gull	Survey of southern Florida	Frohring and Kushlan 1986
1982	Various	Hillsborough Bay Island 3D built	Paul and Woolfenden 1985
1983	Laughing gull	Bayway Spoil, Pinellas last used	Paul and Woolfenden 1985
1983	Laughing gull	Toytown landfill closes, Tampa	Patton 1988
1983	Various	Summary of breeding records	Clapp et al. 1983
1985	Roseate tern, least tern	Survey of Keys	Kushlan and White 1985
1986	Black skimmer	First rooftop nesting in Panhandle	Gore 1987
1986	Black skimmer	Inland nesting	Langridge and Hunter 1986
1986	Royal tern	First roof nesting	Toland and Gilbert 1987
1987	Bridled tern	First statewide breeding	Hoffman et al. 1993
1988	Magnificent frigatebird	First confirmed Tortugas nesting	Langridge 1988
1988	Least tern	Survey done in Florida Keys	Hovis and Robson 1989
1988	Various	Atlas of colonies 1976–82 printed	Spendelow and Patton 1988
1991	Skimmer, least tern	Survey done in Panhandle	Gore 1991
1991	Royal tern	Founding of Passage Key colony	Paul and Below 1991
1993	Least tern	Survey in NE and Panhandle	Hovis and Gore 1996
1995	Gull-billed tern	First roof breeding	Coburn 1996
1995	Roseate tern	300 pairs, Pelican Shoal as in 1981	Paul and Schnapf 1995
1995	Least tern	1,300 pairs at Big Marco	Zambrano et al. 1996
1996	Caspian tern	93 at Hillsborough Island 3D	Paul 1997
1996	Gull-billed tern	First roof fledging	Sprandel et al. 1998
1996	Least tern, skimmer	South Florida survey	Zambrano et al. 1996
1997	Royal tern	3,000 pairs, Passage Key	Paul 1997
1997	Sandwich tern	426 pairs, Passage Key	Paul 1997
1997	Various	Statewide survey planned	Hovis and Gore 1998

Table 4. Roof nesting observations for colonial shorebird species other than least tern and black skimmer in Florida, between 1973 and 1997.

Nests	Young	Date	Site	Site number	County	Latitude	Longitude	Citation
Gull-billed tern								
1		1995/06/27	Walmart, Parker	BAY 004009f	Bay	30° 08.46'	85°35.55'	Coburn 1996
1	1	1996/07/01	Sears, Panama City	BAY 004032a	Bay	30°11.13'	85°38.89'	Sprandel et al. 1998
Laughing gull								
	1	1990/06/01	Gayfers, Panama City	BAY 004008a	Bay	30°11.3'	85°38.8'	WOS ^a
Roseate tern								
60		1989/05/26	Marathon Condominium Rooftop	MONR004080a	Monroe	24°42.5'	81°06.8'	Paul 1989
	3	1990/07/09	Casa Cayo Condo near Fanny Keys	MONR004039b	Monroe	24°42.5'	81°06.8'	WOS
30		1991	Casa Cayo Condo near Fanny Keys	MONR004039b	Monroe	24°42.5'	81°06.8'	Smith 1996
		1991/05/31	Casa Cayo Condo near Fanny Keys	MONR004039b	Monroe	24°42.5'	81°06.8'	Robson 1998
		1987/06/17	Hawk's Cay Resort, Duck Key	MONR004037a	Monroe	24°46.3'	80°54.8'	WOS
		1973/07/09	Key West harbor	MONR004083a	Monroe	24°33'	81°48'	Ogden 1973
1		1974	Key West harbor	MONR004083a	Monroe	24°33'	81°48'	Ogden 1974
25		1976/06/14	Key West harbor	MONR004083a	Monroe	24°33'	81°48'	Ogden 1976
1		1996/05/22	Marathon FWC - DEP Building	MONR004108a	Monroe	24°42.728'	81°05.816'	Robson 1998
1		1996/06/12	Marathon FWC - DEP Building	MONR004108a	Monroe	24°42.728'	81°05.816'	H. Smith pers. commun.
30		1997	Marathon FWC - DEP Building	MONR004108a	Monroe	24°42.728'	81°05.816'	H. Smith pers. commun.
		1981	Truman Annex-Key West NAS	MONR004066b	Monroe	24°32.7'	81°48.6'	Paul 1981
	31	1982	Truman Annex-Key West NAS	MONR004066b	Monroe	24°32.7'	81°48.6'	Paul 1982
	25	1984/07/19	Truman Annex-Key West NAS	MONR004066b	Monroe	24°32.7'	81°48.6'	Paul 1984
30		1985	Truman Annex-Key West NAS	MONR004066b	Monroe	24°32.7'	81°48.6'	Kale 1985
		1987/06/22	Truman Annex-Key West NAS	MONR004066b	Monroe	24°32.7'	81°48.6'	WOS
5		1992	Truman Annex-Key West NAS	MONR004066b	Monroe	24°32.7'	81°48.6'	Smith 1996
		1993/05/23	Truman Annex-Key West NAS	MONR004066b	Monroe	24°32.7'	81°48.6'	FNAI ^b
Royal tern								
2		1986/07/14	Vero Beach Paine Webber rooftop	INDI004011b	Indian River	27°38'	80°26'	Toland and Gilbert 1987

^aWildlife Observation System database.^bFlorida Natural Areas Inventory database.

Table 5. Colonial shorebird nesting sites in Florida that were >5 km from the coast, during the period from 1973 to 1997.

Nests	Date	Site	Site number	County	Latitude	Longitude	Distance ^a	Citation
Black skimmer								
15	1985/07/27	Duda Farms - SE of Belle Glade	PALM004005a	Palm Beach	26°35'	80°38'	59	Langridge and Hunter 1986
8	1986	Duda Farms - SE of Belle Glade	PALM004005a	Palm Beach	26°35'	80°38'	59	Paul 1986
Gull-billed tern								
	1979/07/28	Occidental Chemical, 1	HAMI004003a	Hamilton	30°26'	82°45'	110	CBR ^b
4	1990/03-05	Hillsborough Co. phosphate mine	HILL004012a	Hillsborough	28°00'	82°15'	19	Cooper 1990
	1986-89	Keysville Quad-block 2	HILL004QKE2	Hillsborough	27°48.75'	82°01.875'	25	BBA ^c
1	1977	Belle Glade Farm	PALM004006a	Palm Beach	26°31'	80°40'	62	Sykes and Hunter 1978
	1978/07/16	Duda Farms-SE of Belle Glade	PALM004005a	Palm Beach	26°35'	80°38'	59	Ogden 1978
12	1982/07/17	Duda Farms-SE of Belle Glade	PALM004005a	Palm Beach	26°35'	80°38'	59	Paul 1982
6	1986/06/15	Duda Farms-SE of Belle Glade	PALM004005a	Palm Beach	26°35'	80°38'	59	Paul 1986
	1986-89	Bradley Junction Quad-block 2	POLK004QBR2	Polk	27°48.75'	81°54.375'	47	BBA
	1987	Clear Springs Phosphate Mine	POLK004004a	Polk	28°02'	81°39'	72	Paul 1987
	1986-89	Homeland Quad-block 4	POLK004QHO4	Polk	27°51.25'	81°48.75'	80	BBA
3	1990/03-05	Phosphate mines in Polk County	POLK004002c	Polk	27°47'	81°55'	59	Cooper 1990
Least tern								
15	1979/06/15	Occidental Chemical, 1	HAMI004003a	Hamilton	30°26'	82°45'	110	CBR
3	1979/06/09	Occidental Chemical, 2	HAMI004003b	Hamilton	30°26'	82°45'	110	CBR
25	1979/06/09	Occidental Chemical, 3	HAMI004003c	Hamilton	30°26'	82°45'	110	CBR
	1985	Occidental Chem Co.	HAMI004001a	Hamilton	30°27'	82°46'	110	WOS ^d
	1983	White Springs mine	HAMI004002a	Hamilton	30°20.5'	82°41.5'	107	Paul 1983
15	1975/05	3 miles SW of Lake Placid	HIGH004001a	Highlands	27°15'	81°25'	65	Fisk et al. 1988
	1981/07/23	Lake Placid, generic	HIGH004001b	Highlands	27°15'	81°25'	65	Paul 1981
50	1987/05/13	3.5 mi W of Lutz	HILL004011a	Hillsborough	28°08'	82°16'	27	WOS
6	1982/07/02	Lake Jackson	LEON004004a	Leon	30°32.5'	84°19.5'	50	Paul 1982
20	1987	Northwood Mall-Tallahassee	LEON004002a	Leon	30°28'	84°17.3'	40	WOS
	1990/06/03	Northwood Mall-Tallahassee	LEON004002a	Leon	30°28'	84°17.3'	40	WOS
	1975	Tallahassee airport	LEON004005a	Leon	30°23'	84°19'	32	Ogden 1975
20	1988	Tallahassee Publix-Capital Cir. & Mahan	LEON004001a	Leon	30°27.5'	84°13.5'	35	WOS
34	1989	Tallahassee Publix-Capital Cir. & Mahan	LEON004001b	Leon	30°27.5'	84°13.5'	35	WOS

Table 5. Continued.

Nests	Date	Site	Site number	County	Latitude	Longitude	Distance ^a	Citation
Least tern (continued)								
43	1990/06/03	Tallahassee Publix-Capital Cir. & Mahan	LEON004001a	Leon	30°27.5'	84°13.5'	35	WOS
8	1974/06/10	Lake Okeechobee shell pit	OKEE004001b	Okeechobee	27°13'	80°50'	57	Fisk et al. 1988
8	1975/06/10	Lake Okeechobee	OKEE004001a	Okeechobee	27°10'	80°50'	57	Ogden 1975
100	1981	Orlando roofs, generic	ORAN004006a	Orange	28°32.5'	81°23.1'	62	Paul 1981
75	1989	Orlando roof, generic	ORAN004006a	Orange	28°32.5'	81°23.1'	62	Paul 1989
	Unknown	Pepsi Cola Bldg.-Orlando Business Park	ORAN004005a	Orange	28°26.5'	81°24.5'	65	WOS
	1992	Publix buildings	ORAN004004a	Orange	28°34'	81°12.5'	45	WOS
	Unknown	Union Park roof colony	ORAN004001a	Orange	28°34'	81°16.5'	54	WOS
	Unknown	Winn Dixie buildings	ORAN004003a	Orange	28°34'	81°14.5'	43	WOS
200	1990	Citrus World, Lake Wales	POLK004003a	Polk	27°54'	81°35'	78	Paul 1991
	1983/07/10	Clear Springs Phosphate Mine	POLK004004a	Polk	28°02'	81°39'	72	Paul 1983
16	1985/05/28	Clear Springs Phosphate Mine	POLK004004a	Polk	28°02'	81°39'	72	Paul 1985
	1988/07/02	Clear Springs Phosphate Mine	POLK004004a	Polk	28°02'	81°39'	72	Paul 1988
10	1987/05/15	Lakeland power plant	POLK004005a	Polk	27°59'	81°58'	44	Paul 1987
	1991	NW Crooked Lake Peninsula	POLK004001a	Polk	27°49.5'	81°34.5'	80	WOS
	1990/06/14	Phosphate mines in Polk County	POLK004002c	Polk	27°47'	81°55'	59	Cooper 1991
	Unknown	Phosphate mines, broad area	POLK004002a	Polk	27°47'	81°55'	59	WOS
1	1991	Phosphate mines in Polk County	POLK004002c	Polk	27°47'	81°55'	59	Cooper 1992
	Unknown	Days Inn just north of Hwy 436	SEMI004001a	Seminole	28°40'	81°23.5'	57	WOS
45	1987	Sanford Power Plant	VOLU004003a	Volusia	28°51.5'	81°20.5'	47	WOS

^aApproximate distance to the nearest coast (km).
^bColonial Bird Register database records from 1976–1985.
^cBreeding Bird Atlas database.
^dWildlife Observation System database.

The date range for breeding records was widest for black skimmer (3/21–9/11), and the median reported date for most breeding species was in the middle of June (Table 6). There appears to be no distinct latitudinal difference in the time of nesting between north Florida (north of 28° longitude) and south Florida (south of 28° longitude) for nesting least terns (north Florida range = 04/15–08/05 [median of 05/30], south Florida range = 04/06–09/03 [median of 06/08]) or for black skimmers (north Florida range = 04/23–08/27 [median of 06/13], south Florida 03/21–09/11 [median of 07/03]). This data set may not be good for looking at nesting timing.

Data “Mining”

Mining existing sources of electronic data yielded 564 unique breeding records from CBR, 890 from WOS, and 69 from FNAI. Seasonal reports from FFN and AFN provided regular reports of new and larger colonies, most notably colonies in Tampa Bay. Journal articles were found by reviewing the FFN index starting with 1973 and by searching the National Information Services Corporation's Wildlife Worldwide database (www.nisc.com). Unpublished reports provided 231 breeding records, but these reports were difficult to find systematically.

Table 6. Nesting season of colonial shorebird species in coastal Florida.^a

Species	Kale ^b	Stevenson ^c	Historical ^d
Magnificent frigatebird	Feb–Apr	2 Feb–7 Aug	04/21–07/06 (05/20, 10)
Laughing gull	May–Aug	25 April–28 June	4/14–08/29 (06/07, 114)
Gull-billed tern	May–Jul	3 May–17 June	05/04–08/03 (06/16, 83)
Caspian tern	Apr–Aug	23 May–20 Jul	05/01–08/02 (06/07, 29)
Royal tern	Apr–Aug	16 May–31 Jul	05/01–08/29 (06/13, 102)
Sandwich tern	May–Aug	10 Apr–31 Jul	04/21–08/29 (06/16, 45)
Roseate tern	May–Aug	26 May–9 Jul	05/19–07/19 (06/17, 42)
Common tern ^e		3 Jun–24 Jul	05/30 (05/30, 1)
Least tern	Apr–Aug	25 Apr–6 Aug	04/06–09/03 (06/02, 839)
Bridled tern ^f		30 May–15 Jul	05/28–07/15 (06/12, 11)
Sooty tern ^g	Mar–Aug	Feb–Mar	In 1960s started in May, recently mid-Feb ^h
Brown noddy ^g	Mar–Aug	early Mar	04/21 (04/21, 1)
Black skimmer	May–Sep	11 May–3 Aug	03/21–09/11 (06/19, 309)

^aFrom Robertson and Woolfenden (1992) and Stevenson and Anderson (1994).

^bFrom Kale and Maehr (1990).

^cFrom Stevenson and Anderson 1994.

^dFrom this compilation of records. This is the range-of-observed date and (median, number of record) from records 1973–97.

^eRare; 2 nesting locations in the Panhandle.

^fRare; 1 nesting location in the Keys.

^gDry Tortugas only.

^hFrom Robertson and Robertson 1998.

Searching the WWW was time consuming and ineffective at finding specific shorebird breeding records. Using meta-search engines, such as www.metasearch.com, with phrases such as "Florida" and "seabirds," or "black skimmer" found many Web pages concerning Florida's environment, but little specific information about colonies or nest numbers. Although 350 Web pages of federal, state, and private conservation organizations were referenced, the information contained in them was primarily about the organization or general occurrence of the species in the area (e.g., a bird checklist), and only 7 breeding records were found. The successful "hits" were Florida Audubon Society, Kennedy Space Center, and rare bird alert transcript pages. Although currently few pages are relevant, the WWW growth is exponential (10X/year, Berners-Lee 1996), so future searches may find more rare bird alerts and governmental "grey" literature.

Although the author spent 280 hours on this project, only 174 hours could be directly tied to one of the 141 specific citations (Table 7). This disparity included library and search time to find new references, time to print reports, time to proof the data, and preparation time of this report. The 280 hours needed to find 238 new colonies and 1,679 new breeding records, produced an average of 0.85 colony/hour and 6 breeding records/hour. The CBR was most efficient with 94 breeding records/hour. Contrasted with field work, 48 hours were spent for the 22 colonies and 27 counts surveyed in the Florida Panhandle by this author in 1998, for an efficiency of 0.55 colony/hour and 0.67 breeding record/hour.

Table 7. Sources of colonial breeding shorebird breeding records for the period between 1973 and 1997.

Source	Hours	Citations	Breeding records
Florida Committee on Rare and Endangered Plants and Animals	14	10	33
Florida Field Naturalist	29	33	226
Audubon Field Notes	26	27	266
World Wide Web pages	2	6	7
Colonial Bird Registry	6	1	564
Unpublished report	20	19	249
Wildlife Observation System	22	2	890
Personal communication	5	5	98
Breeding Bird Atlas	6	1	41
Florida Naturalist	7	6	28
Florida Natural Areas Inventory	18	1	69
Other books, journals, newspapers, talks	19	30	98
Totals	174	141	2,569

Problems with data mining historical data included inconsistent recording of pairs versus nests, use of vernacular or temporal geographic names that made finding the exact location difficult, missing or imprecise latitude and longitude, and failure to publish when nesting did not occur at historical colonies. Future sources should clearly record what is actually observed in the field, rather than making inferences about the number of pairs based on the number of adults.

Information Gaps

Gaps in our general knowledge of shorebirds can be observed from this review of breeding records. Along the northeast coast either a great decline has occurred in the number of breeding shorebirds or colonies have been inadequately surveyed since the mid to late 1970s. Likewise, few breeding records were published in the last 10 years from the Indian River Lagoon, particularly the Banana River Spoil Islands. Roof surveys in northwest, northeast, and southeast Florida have been successful at finding both nesting least tern and black skimmer colonies; however, no similar survey has been conducted in southwest Florida.

MANAGEMENT IMPLICATIONS

Ongoing Data Mining

The use of existing data provides an efficient means of acquiring wildlife observations that may be useful for planning statewide surveys, determining critical wildlife areas, or looking at changes in populations at the scale of a colony. The FFN provides current information on new colonies and ongoing information, particularly about important colonies in Tampa Bay. This source is more comprehensive than similar records in AFN. Data from contracted research projects and shorebird survey projects should be provided to the Commission in an electronic format and added to WOS. These reports, though usually restricted geographically, often provide detailed information about a species or colony. Information from staff at military installations, national parks and seashores, national wildlife refuges, and state parks and recreation areas would facilitate the monitoring of these colonies.

Increase Data Availability

Incorporating these records into WOS makes the data available within the Commission and, through cooperative agreements, to the FNAI. There is, however, perhaps a greater community of researchers and agencies that might

be served by these records. Providing data to the federal government's central colonial waterbird database (Steinkamp et al. 1998) would aid researchers of a particular species working at a continent-wide scale. Placing the data in an accessible form on the WWW might facilitate sharing of information with other agencies within Florida (e.g., Minno and Minno 1998, www.flmnh.ufl.edu/wadingbirds/). Finally, publishing results of systematic surveys in technical journals facilitates sharing of information.

Future Surveys

Future surveys should concentrate on areas with information gaps, such as the northeast coast, Indian River Lagoon, and southwest Florida roofs. A statewide survey should be done with consistent methodology for the entire state. Such a survey should be sure to report absence of breeding at historical colonies. All future surveys should include usage of a GPS receiver with at least 100-m accuracy to facilitate determining if colonies are new.

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Appendix A. Citation format for World Wide Web (WWW) pages in Literature Cited.

The goal is to be able to take the citation and find the page again. Because pages move, change, and are lost, it is recommended that all pages be printed if they are being cited in a printed publication. The recommended format is:

Author's last name, initials.¹ Modification date.² Page title.³ Main title of complete work.⁴ Page publisher.⁵ Protocol and address.⁶ (access date)⁷

¹ If known, otherwise the sponsoring organization should be listed as the author. Use Anon only as a last resort. Using an unsigned individual's page is risky.

² Last modification date of the document. If listed in the document use that date, otherwise with Netscape this is available with Document Info under View in the Menu Bar, or with Internet Explorer with Properties under File.

³ The title on the page. If untitled, it may be obtained with Document Info or Properties.

⁴ If this is a sub-page, list the main page name also.

⁵ Publisher of the page, if known and different from the author.

⁶ Complete address to the document including protocol of access.

⁷ Date of actual access.

Examples:

Florida Fish and Wildlife Conservation Commission. 1999, Jul. 25. Anclote River Parks Wildlife Viewing. <http://www.state.fl.us/fwc/viewing/sites/site56.html> (Jul. 15, 1997)

Erwin, R. M. and B. Hoover. 1997, Jan. 24. Colonial Waterbird Inventory and Monitoring. Patuxent Wildl. Res. Center, Laurel, Md. <http://www.im.nbs.gov/cwb/cwb.html> (May 2, 1997).

Referring to specific subpages.

Geissler, P. H. 1996. Randomization and sampling issues. [<http://www.im.nbs.gov/naamp3/papers/15s.html>]. In Third Annual Meeting of the North American Amphibian Monitoring Program. <http://www.im.nbs.gov/naamp3/naamp3.html> (May 2, 1997).

Citing WWW pages in text.

The above literature cited method allows for easy citing in the text of a paper, for example:

When visiting Anclote Rivers Park (Florida Fish and Wildlife Conservation Commission 1999), it may be desired to conduct wading bird surveys (Erwin and Hoover 1997) using a random sampling scheme (Geissler 1996).

Designing web pages.

To facilitate correct citing, designers of web pages should include:

1. Author name (ideally include e-mail address).
2. Organization, if this is an "official" page.
2. Page title.
3. Revision date.