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OCCURRENCE OF BIRDS IN BEACH HABITAT IN EAST-CENTRAL FLORIDA

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Abstract.—Few studies quantify the use of open beach habitat by birds in Florida, and none address beaches that are protected from human disturbance. Between November 1995 and October 1996, I documented the numbers of waterbirds using beach habitat along 16.5 km of Atlantic coast beach in east-central Florida that receives very low human use. A total of 16,841 observations of waterbirds were made during 19 surveys. A diverse group of waterbirds used the beach, including 35 species (six families in three orders). The four most common species observed were Royal Tern (*Sterna maxima*), Sanderling (*Calidris alba*), Laughing Gull (*Larus atricilla*), and Brown Pelican (*Pelecanus occidentalis*). Results indicate that east-central Florida beaches and nearshore waters are important foraging and roosting habitat for wintering, migratory, and resident shorebirds, gulls, terns, Brown Pelicans, and Double-crested Cormorants (*Phalacrocorax auritus*). Results also indicate that Florida beaches protected from human disturbance are important conservation areas for species that are dependent on beach habitat during all or part of their life cycles.

Coastal areas of Florida constitute important wintering habitat for several species of shorebirds and waterbirds that breed in North America (Paul and Below 1991, Robertson and Woolfenden 1992, Sprandel et al. 1997). High quality wintering habitats are essential for birds to maximize overwintering survival, and for some species, to meet pre-breeding nutritional requirements (Maron and Myers 1985). Large numbers of individuals of several species also depend on coastal Florida habitats as stopover sites on their way to wintering areas in the West Indies or South America. Stopover sites are important components of shorebird migration strategies (Myers et al. 1987, Skagen and Knopf 1994).

The continued availability and quality of coastal habitats has been recognized as a conservation priority for Florida (Cox et al. 1994, De

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Freese 1991). Unfortunately, nearly half of all natural coastal habitat in Florida has been lost to development or altered by humans since the arrival of Europeans (Johnson and Barbour 1990). Based on remote sensing data, Kautz et al. (1993) estimated the loss of coastal strand vegetation from pre-settlement amounts of nearly 98%. The loss of Florida's natural beach habitat is greatest on the southern Atlantic coast where many counties (e.g., Palm Beach, Broward, Dade) have almost no natural beach vegetation remaining (Johnson and Barbour 1990). Johnson and Barbour (1990) list the Cape Canaveral-Merritt Island coastline as being among the best-preserved beaches in Florida. Loss of habitat increases the risks faced by migratory populations (Myers 1983, Myers et al. 1987). Shorebirds are vulnerable to coastal habitat loss and degradation, and for this reason they are considered an avian group of conservation concern in Florida (Millsap et al. 1990, Breininger et al. 1998). In some cases, habitat might be available, but its value to migrants could be diminished by other factors. For example, human disturbance could effectively reduce time spent foraging and increase energy expenditures (e.g. alertness, flight response) which would exacerbate the difficulties birds face during long-distance migrations (Burger 1981, Burger and Gochfeld 1991, Pfister et al. 1992). It follows that conservation efforts should make the preservation of undisturbed waterbird habitat a priority.

Few studies have examined the use of beach habitat by birds along the east coast of Florida. Loftin (1960) reported on a summer shorebird survey of Florida that included eight sites on the East Coast, including two near Cape Canaveral, Florida. Longstreet (1934) conducted a five-year shorebird survey along a 5 mile (8 km) stretch of beach near Daytona Beach, Florida. Sprandel et al. (1997) surveyed coastal Florida for wintering birds in 1993 and 1994, and identified important wintering sites for shorebirds in Florida. Previous surveys were designed to document species occurrence and included habitats other than open beach. Here I report seasonal bird use of open beach habitat on Cape Canaveral, in east-central Florida. The area provided a unique opportunity to determine the seasonal use of beach habitat and numbers of wintering and migratory waterbirds in a low-disturbance area. Data from this study will serve as a baseline for comparative studies to assess waterbird use of beach habitats exposed to various levels of human disturbance.

METHODS

The study site consisted of 16.5 km of beach on an Atlantic coast barrier island complex in east central Florida (Fig. 1). The study site was surrounded by protected federal lands, including the Canaveral National Seashore, the Merritt Island National Wildlife Refuge (which includes the Kennedy Space Center), and the Cape Canaveral Air Station.

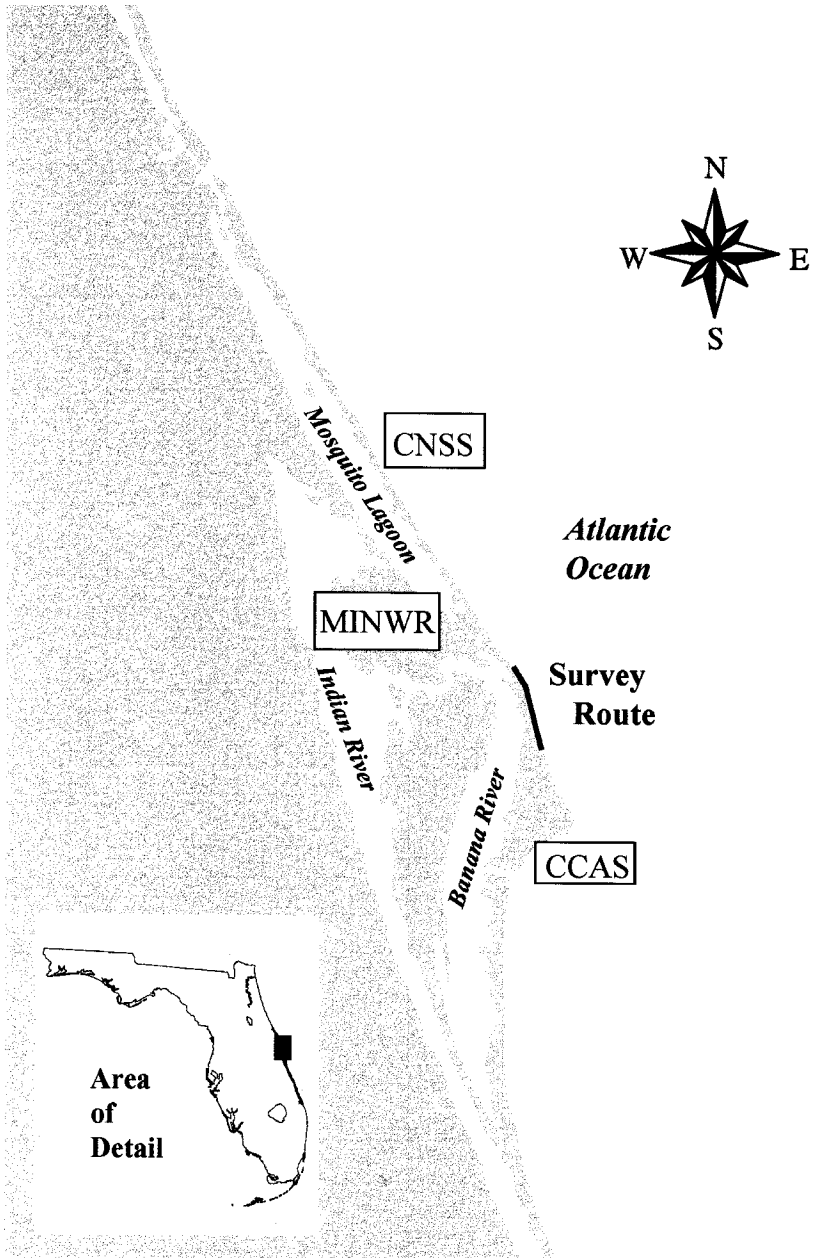


Figure 1. Map of study site beach in east-central Florida showing location of 16.5 km survey route. Also shown are the locations of the Merritt Island National Wildlife Refuge (MINWR), Cape Canaveral Air Station (CCAS), and the Canaveral National Seashore (CNSS).

The beach is a high-energy beach characterized by stretches of high primary dune with steep beach slopes, interspersed with areas that are broad and flat (for details see Schmalzer and Hinkle 1990).

Associated with the barrier island system are extensive brackish wetlands including 4,352 ha of saltmarsh and mangroves, and 3,680 ha of impounded salt marsh (Provancha et al. 1986). To the west is a large estuarine system composed of the Indian and Banana rivers and the Mosquito Lagoon. The southern portion of this barrier island complex has been largely developed with little of the original mangrove and saltmarsh habitat remaining intact (Larson 1995). Nearly all salt marsh habitat of the northern portion has been impounded for mosquito control (Schmalzer 1995). The climate of the region is subtropical. Mean annual rainfall on Merritt Island is 131 cm. Lowest temperatures occur in January (11.8°C mean monthly minimum) and highest temperatures are in August (32.6°C mean monthly maximum) (Mailander 1990).

Public access to this beach is limited and the number of people using this area of beach is very low (I estimate <0.2 km/day) and is mostly limited to areas near a few access points. Most visits are brief (<1 h) and occur during daylight hours. During Kennedy Space Center and Cape Canaveral Air Station launch operations, even this low level of activity is curtailed for many days at a time. Thus, this beach is among the least disturbed on Florida's Atlantic coast.

All birds occurring within a zone extending from the base of the primary dune to approximately 100 m over the ocean were counted along 16.5 km of undisturbed beach. Birds were either foraging in the surf-zone, resting on the beach up to the dune vegetation, on the water's surface, or flying within this zone. I rode a four-wheeled all-terrain vehicle at approximately 10 km/h and counted all birds within the transect as I approached them. When a large group of birds was encountered, I stopped and counted from a distance of approximately 100 m. Birds were identified to species except: Western Sandpiper (*Calidris mauri*), Semipalmated Sandpiper (*C. pusilla*), and Least Sandpiper (*C. minutilla*) which were recorded as *Calidris* spp.; and Short-billed Dowitcher (*Limnodromus griseus*) and Long-billed Dowitcher (*L. scolopaceus*) which were recorded as *Limnodromus* spp.

Nineteen surveys were conducted between 2 November 1995 and 21 October 1996. Surveys were conducted biweekly when possible, but because of flight operations that limited beach access intervals between many counts were longer (mean between-count interval was 19.7 days). Surveys were initiated approximately 30 min prior to low tide and were completed within 2 h. Most surveys were conducted in the morning (between 1 and 5 h after sunrise) and all surveys were completed before mid-afternoon (by 8 h after sunrise). The route was always surveyed from south to north beginning at the abandoned Launch Complex 34 on the Cape Canaveral Air Station (lat. 28°31'16", long. 80°33'26"). Surveys were not conducted in rain or during high winds (>40 km/h).

RESULTS

Fourteen species of shorebirds used the beach for feeding and roosting (Table 1). Ten sandpipers (Scolopacidae) were observed with a combined mean density over all surveys of 15.4 individuals/km. Sanderlings comprised 79% of all sandpipers, and were seen on all surveys except one in July. Sanderling numbers were highest during fall migration (July through September). Ruddy Turnstones (*Arenaria interpres*) were the second most common shorebird observed, and occurred throughout the year; their numbers were highest during spring and fall migrations (April through May, August through Sep-

Table 1. Mean number of waterbirds observed during 19 surveys of 16.5 km beach from 2 November 1995 through 21 October 1996.

Species	Number Observed				
	November-January (n = 5) ^a	February-March (n = 5)	April-July (n = 4)	August-October (n = 5)	
Pelecaniformes					
Brown Pelican (<i>Pelecanus occidentalis</i>)	6.3 (7.9; 0.4-19.3) ^b	5.0 (1.9; 2.4-7.6)	0.5 (0.4; 0.1-1.0)	4.5 (3.3; 0.7-8.8)	
Double-crested Cormorant (<i>Phalacrocorax auritus</i>)	0.2 (0.6; 0-2.0)	2.4 (1.1; 0.8-3.7)	0	0.02 (0.05; 0-0.1)	
Ciconiiformes					
Great Blue Heron (<i>Ardea herodias</i>)	0.3 (0.3; 0-0.7)	0.04 (0.03; 0-0.06)	0	0.2 (0.2; 0-0.6)	
Great Egret (<i>Ardea alba</i>)	0.01 (0.03; 0-0.06)	0	0	0	
Snowy Egret (<i>Egretta thula</i>)	0.02 (0.05; 0-0.1)	0.02 (0.05; 0-0.1)	0.3 (0.2; 0.2-0.6)	0.4 (0.3; 0-0.9)	
Reddish Egret (<i>Egretta rufescens</i>)	0.01 (0.03; 0-0.06)	0	0	0	
Yellow-crowned Night Heron (<i>Nyctanassa violacea</i>)	0	0	0.02 (0.03; 0-0.06)	0	
White Ibis (<i>Eudocimus albus</i>)	0	0	1.3 (2.0; 0-4.2)	0.1 (0.3; 0-0.7)	
Charadriiformes					
Black-bellied Plover (<i>Pluvialis squatarola</i>)	0.5 (0.7; 0.4-1.8)	1.0 (1.7; 0-4.0)	1.3 (1.1; 0-2.4)	0.7 (0.5; 0.1-1.3)	
Wilson's Plover (<i>Charadrius wilsonia</i>)	0.04 (0.03; 0-0.06)	0.1 (0.2; 0-0.4)	0.3 (0.2; 0.06-0.6)	0.1 (0.2; 0-0.4)	
Semipalmated Plover (<i>C. semipalmatus</i>)	0.8 (1.6; 0-4.7)	3.1 (5.8; 0-13.3)	0.05 (0.06; 0-0.1)	0.4 (0.5; 0.1-1.2)	
Piping Plover (<i>C. melodus</i>)	0	0	0	0.02 (0.05; 0-0.1)	
Killdeer (<i>C. vociferus</i>)	0.2 (0.3; 0-0.7)	0	0	0	
Willet (<i>Catoptrophorus semipalmatus</i>)	0.07 (0.2; 0-0.6)	0.8 (1.1; 0-2.5)	1.3 (1.4; 0.4-3.5)	1.1 (1.2; 0.1-3.2)	
Spotted Sandpiper (<i>Actitis macularia</i>)	0	0.01 (0.03; 0-0.06)	0	0	
Ruddy Turnstone (<i>Arenaria interpres</i>)	0.2 (0.3; 0.2-0.7)	0.5 (0.6; 0-1.5)	1.6 (1.2; 0.4-2.7)	1.9 (2.1; 0.3-4.4)	

^aThe number of surveys conducted during that season.

^bMean number of individuals/km for all surveys during the season, and standard deviation and range for season in parentheses.

Table 1. (Continued) Mean number of waterbirds observed during 19 surveys of 16.5 km beach from 2 November 1995 through 21 October 1996.

Species	Number Observed			
	November-January (n = 5) ^a	February-March (n = 5)	April-July (n = 4)	August-October (n = 5)
Red Knot (<i>Calidris canutus</i>)	1.0 (1.8; 0-5.1)	0.7 (1.5; 0-3.4)	0.4 (0.8; 0-1.6)	0.1 (0.1; 0-0.3)
Sanderling (<i>C. alba</i>)	6.1 (1.2; 4.2-7.3)	5.2 (2.1; 3.5-8.8)	9.1 (13.7; 0-29.2)	19.0 (8.5; 10.1-31.2)
White-rumped Sandpiper (<i>C. fuscicollis</i>)	0	0	0	0.02 (0.05; 0-0.1)
<i>Calidris</i> spp.	0	0.06 (0.09; 0-0.2)	0.09 (0.1; 0-0.3)	0.07 (0.1; 0-0.2)
Dunlin (<i>C. alpina</i>)	0.4 (0.8; 0-1.8)	0.8 (1.8; 0-4.1)	0	0.05 (0.1; 0-0.2)
<i>Limnodromus</i> spp.	0	0.01 (0.03; 0.06)	0	0
Laughing Gull (<i>Larus articala</i>)	11.3 (14.7; 0.1-36.6)	8.0 (11.5; 0-27.7)	0.5 (0.5; 0.06-1.1)	1.1 (1.2; 0-2.9)
Bonaparte's Gull (<i>L. philadelphia</i>)	0.01 (0.03; 0-0.06)	0	0	0
Ring-billed Gull (<i>L. delawarensis</i>)	4.0 (3.5; 0-8.2)	3.7 (4.5; 0-10.9)	0	0.06 (0.1; 0-0.3)
Herring Gull (<i>L. argentatus</i>)	2.7 (5.6; 0-12.7)	8.0 (10.0; 0-24.4)	0	0.2 (0.4; 0-0.9)
Great Black-backed Gull (<i>L. marinus</i>)	0.04 (0.03; 0-0.06)	0.05 (0.05; 0-0.1)	0	0.01 (0.03; 0-0.06)
Caspian Tern (<i>Sterna caspia</i>)	0.1 (0.3; 0-0.8)	0.04 (0.08; 0-0.2)	0	0.5 (1.0; 0-2.2)
Royal Tern (<i>S. maxima</i>)	12.8 (22.2; 0-68.0)	25.6 (20.9; 4.4-50.9)	3.9 (5.7; 0.2-12.4)	3.4 (4.9; 0-10.5)
Sandwich Tern (<i>S. sandvicensis</i>)	1.4 (1.4; 0-3.2)	0.7 (0.9; 0-2.1)	0.03 (0.06; 0-0.1)	0.8 (1.7; 0-3.8)
Common Tern (<i>S. hirundo</i>)	0	0	0.02 (0.03; 0-0.06)	0.3 (0.7; 0-1.5)
Forster's Tern (<i>S. forsteri</i>)	3.3 (7.3; 0-16.3)	0.4 (0.6; 0-1.3)	0	0.07 (0.2; 0-0.4)
Least Tern (<i>S. antillarum</i>)	0	0	2.9 (3.8; 0-8.0)	1.3 (2.9; 0-6.5)
Black Tern (<i>Chlidonias niger</i>)	0	0	0.1 (0.3)(0-0.6)	0.2 (0.4)(0-0.8)
Black Skimmer (<i>Rynchops niger</i>)	0	0	0.08 (0.2)(0-0.3)	0

^aThe number of surveys conducted during that season.

^bMean number of individuals/km for all surveys during the season, and standard deviation and range for season in parentheses.

tember, respectively). Red Knots (*Calidris canutus*), and Willets (*Catoptrophorus semipalmatus*) also were numerous during surveys. Five species of plovers (Charadriidae) used the beach with a combined mean density over all surveys of 2.6 individuals/km. Semipalmated Plovers (*Charadrius semipalmatus*) comprised 55% of all plovers observed and occurred on 13 surveys. Their numbers peaked in early February; lesser numbers occurred throughout the rest of the year. Although less numerous, Black-bellied Plovers (*Pluvialis squatarola*) were observed on all but two surveys. They were usually foraging near the surf-zone.

Five species of gulls and eight species of terns were observed during the study (Table 1). Larids were usually roosting in large groups on the beach; occasionally small groups of gulls were foraging in the surf zone, in association with shorebirds. Laughing Gulls comprised 52% of all gulls and were seen on 16 surveys. Laughing gulls were not seen during March or April. Royal Terns were observed during 15 surveys, and comprised 84% of all terns observed. Royal Terns were seen during every month except September.

A total of 1328 Brown Pelicans was observed; many of these observations may have been the same individuals seen on multiple surveys. The average number of Brown Pelicans observed was around 70 individuals per survey. Brown Pelicans were observed on all surveys, but were much less numerous May through August. Most Brown Pelicans were observed in large groups, with most individuals roosting on the lower beach and some individuals foraging in the surf. A total of 240 Double-crested Cormorants was observed; many of these observations may have been the same individuals seen on multiple surveys. The average number of Double-crested Cormorants observed was around 13 individuals per survey. Double-crested Cormorants were most common February through March; they were not observed during summer (Table 1). Double-crested Cormorants were observed foraging in the surf, and roosting, often in close proximity to Brown Pelicans. Six species of long-legged wading birds were observed (Table 1); wading birds were observed foraging near the surf. Only two falcons were seen during the study: a Peregrine Falcon (*Falco peregrinus*) flying over the open beach in October, and a Merlin (*F. columbarius*) in January.

DISCUSSION

Shorebird numbers on the beach were highest during fall migration, and lowest in summer. The Sanderling was the most numerous species of shorebird recorded during surveys. A large component of Sanderling populations may travel along the Atlantic coast of North

America during migration (Myers et al. 1990); many of these birds migrate through or overwinter in Florida (Sprandel et al. 1997). Sprandel et al. (1997) ranked the northeast coast as third among six regions of Florida coastline for Sanderling abundance in winter. The importance of preserving beach habitat for this species is heightened because Sanderlings have exhibited significant declines at migratory stopover sites along the Atlantic Flyway in recent years (Howe et al. 1989).

Ruddy Turnstones were common year-round with strong migratory peaks evident. Both Semipalmated Plovers and Black-bellied Plovers were abundant in winter, with peaks observed during fall and spring. Sprandel et al. (1997) identified the northeast coast as second among six regions of Florida coastline in abundance of wintering Ruddy Turnstones and Black-bellied Plovers. It was fourth in importance for Semipalmated Plovers. Among sixty sites chosen as the best wintering habitat for shorebirds in Florida, the Merritt Island National Wildlife Refuge (MINWR) stood out as crucial wintering habitat for these plovers in Florida (Sprandel et al. 1997).

Red Knots were observed in small flocks during spring migration and in winter; these birds may be members of a separate population of Red Knots that winters in Florida rather than along the Atlantic coast in South America (Harrington et al. 1988). However, the majority of Red Knots observed during winter in Florida occur on the Gulf Coast (Sprandel et al. 1997). Dunlin (*Calidris alpina*) were recorded on only four surveys in fall (October and November) and winter (January and February). Dunlin are perhaps the most common wintering shorebirds found in Florida (Sprandel et al. 1997, Stevenson and Anderson 1994) and are very common in the impounded salt marshes and along the Mosquito Lagoon shoreline of the adjacent MINWR in winter (pers. obs.). The current study may not have detected use of beach habitat by roosting Dunlin because surveys were conducted around low tide and therefore may have occurred during peak foraging activities of these birds (Warnock et al. 1995). This also may have been true of other species that are abundant at the refuge during winter including: Semipalmated Plover, Black-bellied Plover, Killdeer (*Charadrius vociferus*), *Calidris* spp., Willet, *Limnodromus* spp., and Ruddy Turnstone (Breininger and Smith 1990).

Several species of shorebirds used beach habitat during the summer months. Willets were abundant on the beach March through September; during this time Willets nest on adjacent dunes and wetlands near the study site. Wilson's Plovers (*Charadrius wilsonia*) occurred at low density throughout the study, with the highest numbers in March through August when they nest on the beaches of the study site (M. Epstein, MINWR pers. comm.). Although they do not breed in Florida, Black-bellied Plovers were observed throughout the year, and were

still common in June and July. This same pattern was observed for Sanderlings and Ruddy Turnstones. Loftin (1960) documented that in several species of boreal-breeding shorebirds, some individuals are found in Florida during the breeding season. These birds are mostly in basic plumage, but a few individuals in alternate plumage have been recorded in mid-June through early July (Loftin 1960, Stevenson and Anderson 1994).

Of the five species of gulls observed during the study, only Laughing Gulls were observed in Spring and Summer. Laughing Gulls nest on spoil islands in the Banana River west of the study site (Paul and Below 1991, pers. obs.). Among the terns, Royal Terns, Sandwich Terns (*Sterna sandvicensis*), and Least Terns (*S. antillarum*) were all observed during the breeding season. Royal Terns and Least Terns nest on nearby spoil islands of the Indian River Lagoon system (Paul and Below 1991, Breininger et al. 1994, pers. obs.). Least Terns also nest on the beach approximately 6 km south of the study site, and on rooftops within 5 km of the study site (pers. obs.). Sandwich Terns are not known to breed near the study site (Stevenson and Anderson 1994). Although the majority of the Caspian Terns (*Sterna caspia*) observed were seen in winter, three were seen in April, before the start of nesting season. Caspian Terns occasionally nest on spoil islands of MINWR (Breininger et al. 1994).

Although statistical comparisons were not possible, some similarities are striking between shorebird data from this study and those of Longstreet (1934), which were collected near Daytona Beach, Florida. Both studies recorded the same species of shorebirds during year-round surveying efforts with the exception of Killdeer, which I observed but Longstreet (1934) did not. Seasonal numbers peaked in July-August for Sanderling and Willet, and between November and February for Black-bellied Plover. During months of peak abundance, Longstreet (1934) reported densities (individuals / km of beach) of 26.5 (Sanderling), 2.98 (Willet), and 1.14 (Black-bellied Plover); this study reported densities of 31.2 (Sanderling), 3.45 (Willet), and 4.0 (Black-bellied Plover). Because Sanderlings have exhibited population declines (Howe et al. 1989), and because beaches near Daytona Beach are under strong encroachment pressure, protected beaches near Canaveral gain particular importance for shorebird conservation.

Dissimilarities between studies were sharpest for Red Knots. I observed densities of 1.64 individuals / km in May whereas Longstreet (1934) reported 21.75. Unfortunately, it is impossible to assess the full implications of these differences. If it is assumed that the beach surveyed by Longstreet (1934) was not yet altered by human encroachment or disturbance, contrasts between studies suggest that Red Knots do not use Canaveral extensively during migration. However, it is also

possible that these species could use either beach, (e.g. Daytona Beach or Canaveral) but this study occurred during a year of low use. Alternatively, Longstreet (1934) might have sampled during high tide when Red Knots were resting on the beach. Assessing such possibilities underscore the value not only of surveys conducted over wide geographical areas (see Sprandel et al. 1997), but also of surveys within portions of Florida (e.g. Northeast) to formulate conservation strategies.

During this study, open beach was used extensively for feeding and roosting by migratory and wintering shorebirds. The beach also was heavily used by gulls and terns as winter roosting sites, and for resting sites when foraging in nearshore waters. Similarly, open beach was used for roosting and for resting during foraging by large numbers of Brown Pelicans and Double-crested Cormorants, especially in winter. These avian groups, some of which contain endangered species or species of special concern, are easily disturbed by human activities (Erwin 1980, Burger 1981, Burger and Gochfeld 1991, Pfister et al. 1992, Rodgers and Smith 1997). These data suggest that undisturbed beaches like the one in this study may be important refugia for many species of waterbirds in central Florida, where most beaches receive heavy use by humans.

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