

BIRDS OF SWALE MARSHES ON JOHN F. KENNEDY SPACE CENTER

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Abstract.—Birds were surveyed in several isolated freshwater wetlands on John F. Kennedy Space Center to determine species composition and the importance of these wetlands to birds. The Red-winged Blackbird and Green-backed Heron were the two most abundant breeders in the swale marshes. The Common Yellowthroat was the most common winter resident but was rare in summer. These marshes are important features within landscapes dominated by uplands particularly because of their significance to amphibians and reptiles.

Few studies have been conducted on land bird composition as it relates to vegetation type in Florida (Robertson 1955, Rohwer and Woolfenden 1969, Robertson and Kushlan 1974, Hirth and Marion 1979). These studies have shown a depauperate breeding land bird fauna with a decline in the number of species southward along the peninsula. In contrast, more water birds breed in Florida than other southeastern states, although the number of species is not as diverse as in the West Indies, Cuba, or the Bahamas (Robertson and Kushlan 1974). More than half the total bird species found regularly in south Florida are wintering species or transients (Robertson and Kushlan 1974).

Several studies were undertaken to survey the seasonal assemblages of birds in different vegetation types in a central area of John F. Kennedy Space Center (KSC) to identify environmental impacts of proposed development. Vegetation types included scrub (Breininger and Schmalzer 1990) and hammocks and swamps (Breininger 1990). The objective of this paper is to characterize bird composition within swale marshes that were interspersed among scrub and sometimes adjacent to forest on the central part of KSC. This type of marsh has elsewhere been termed "flatwoods marsh" where it occurs in slight depressions in an otherwise flat landscape (Kushlan 1990). These marshes are referred to on KSC as "swale marshes" where they frequently occur in a north-to-south direction as narrow (less than a few hundred meters across) depressions oriented parallel to ancient dunes of the scrub and slash pine flatwoods (Schmalzer and Hinkle 1985, Breininger et al. 1988).

STUDY AREA AND METHODS

Marshes, scrub, flatwoods, hammocks and swamps dominate the landscape at KSC (Sweet et al. 1979, Stout 1980). The area consists of 57 000 ha of land and lagoon and is located on the northern part of Merritt Island on the east coast of central Florida. Areas not used for the space program are managed by the U.S. Fish and Wildlife Service as Merritt Island National Wildlife Refuge and by the National Park Service as Canaveral National Seashore. Subtropical and temperate faunal and floral assemblages occur together on KSC (Provancha et al. 1986a).

Swale marshes on KSC are mapped as "mixed graminoid marsh", which also includes the impounded salt marsh adjacent to brackish water lagoons; mixed graminoid marsh comprises 7883 ha (Provancha et al. 1986b). The isolated swale marshes consist of cordgrass (*Spartina bakeri*), arrowhead (*Sagittaria lancifolia*), sawgrass (*Cladium jamaicensis*), and scattered willows (*Salix caroliniana*) (Hall et al. 1985). The marshes are often flooded during fall and winter and often dry during late spring. A few small areas of open water (3-8 m across) occurred within the marshes. Waters were acidic (pH <5.6) with high total organic carbon, nutrients which were low and mostly organically bound, and low dissolved oxygen levels (below 3.0 ppm during early morning) (Hall et al. 1985). No fish were found in the marshes surveyed, although fish can occur in these marsh types elsewhere on KSC, especially in ditches. The benthic community was dominated by oligochaetes and dipterans (Hall et al. 1985).

The variable circular plot (VCP) method (Reynolds et al. 1980) was selected to survey birds because of its advantages in patchy habitats and large geographic areas. The survey was conducted from June 1983 through May 1984; each station was sampled 22 times, approximately every 17 days. Surveys involved sampling routes comprised of eight stations, in different cover types (Breininger and Schmalzer 1990, Breininger 1990) arranged in a roughly elliptical pattern approximately 200 m apart. Seven stations were located in four marshes. Counts were made for seven minutes at each station; pause time was not used after arriving at a station since birds detected upon arrival were not always detected again (Anderson and Ohmart 1981). All birds seen or heard were recorded except for those flying over the area without landing, such as tree swallows (*Tachycineta bicolor*). Distances were usually estimated, although a rangefinder was used periodically to keep the investigator calibrated. Surveys were conducted between one-half hour before sunrise to three hours after sunrise. No surveys were conducted during rain or windy conditions. The effective detection distance (x) was determined for each species by estimating the inflection point of a graph of the number of birds per area of band using concentric 10 m bands, according to the criteria of Reynolds et al. (1980).

Estimates of birds/ha were calculated by summing the number of detections within x , dividing by the number of visits (154) and Πx^2 , and multiplying by 10 000. The number of detections were calculated by multiplying the number of singing males by two, unless the total count of all sightings was greater, in which case the total number of sightings was used (DeSante 1981). Estimates of density were calculated for all species where the number of detections was > 40 (Burnham et al. 1981). Estimates were calculated for the following seasons: spring (Mar, Apr, May), summer (Jun, Jul, Aug), fall (Sep, Oct, Nov), and winter (Dec, Jan, Feb). The mean number of birds/visit was calculated for every species by summing the total number of detections and dividing by the number of visits.

RESULTS AND DISCUSSION

Red-winged Blackbirds, Green-backed Herons, and Boat-tailed Grackles were common residents that nested within these marshes (Table 1). Only one Carolina Wren nest and one Common Moorhen nest

Table 1. Mean birds/visit within isolated wetlands on John F. Kennedy Space Center, 1983-1984.

Common name	Scientific name	Mean birds/visit
Red-winged Blackbird ⁿ	<i>Agelaius phoeniceus</i>	0.67
Green-backed Heron ⁿ	<i>Butorides striatus</i>	0.41
Common Yellowthroat	<i>Geothlypis trichas</i>	0.36
American Robin ^w	<i>Turdus migratorius</i>	0.13
White Ibis	<i>Eudocimus albus</i>	0.11
Common Grackle	<i>Quiscalus quiscula</i>	0.11
Carolina Wren ⁿ	<i>Thryothorus ludovicianus</i>	0.10
Common Moorhen ⁿ	<i>Gallinula chloropus</i>	0.07
Boat-tailed Grackle ⁿ	<i>Quiscalus major</i>	0.06
Yellow-rumped Warbler ^w	<i>Dendroica coronata</i>	0.06
Florida Scrub Jay	<i>Aphelocoma coerulescens coerulescens</i>	0.06
Blue Jay	<i>Cyanocitta cristata</i>	0.03
Northern Cardinal	<i>Cardinalis cardinalis</i>	0.03
White-eyed Vireo	<i>Vireo griseus</i>	0.03
King Rail ⁿ	<i>Rallus elegans</i>	0.02
Rufous-sided Towhee	<i>Pipilo erythrophthalmus</i>	0.02
Red-shouldered Hawk	<i>Buteo lineatus</i>	0.02
Pied-billed Grebe	<i>Podilymbus podiceps</i>	0.01
Pileated Woodpecker	<i>Dryocopus pileatus</i>	0.01
Great Blue Heron	<i>Ardea herodias</i>	<0.01
Great Egret	<i>Casmerodius albus</i>	<0.01
Snowy Egret	<i>Egretta thula</i>	<0.01
Tricolored Heron	<i>Egretta tricolor</i>	<0.01
Sharp-shinned Hawk ^w	<i>Accipiter striatus</i>	<0.01
Northern Harrier ^w	<i>Circus cyaneus</i>	<0.01
Common Snipe ^w	<i>Gallinago gallinago</i>	<0.01
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	<0.01
Northern Flicker	<i>Colaptes auratus</i>	<0.01
Gray Catbird ^w	<i>Dumetella carolinensis</i>	<0.01
Swamp Sparrow ^w	<i>Melospiza georgiana</i>	<0.01

ⁿspecies observed nesting

^wspecies that winter but do not nest on KSC

were found; adult birds from both nests were frequently seen during the survey. Two pairs of King Rails also nested but were rarely seen. Other wading birds (Ciconiiformes) nested elsewhere on KSC but only rarely used these marshes for feeding. Florida Scrub Jays nested in adjacent oak/palmetto scrub habitats (Breininger and Schmalzer 1990). Their territory boundaries frequently extended across swale marshes and the edges occasionally have been used for hunting prey and caching acorns (Breininger and Smith unpublished data). Most other species seen in these marshes nested in adjacent habitats (Breininger and Schmalzer 1990, Breininger 1990). Only a few wintering species were common; these included the Common Yellowthroat, American Robin, and Yellow-rumped Warbler. The Common Snipe was encountered often along the

Table 2. Seasonal densities of birds (birds/ha) within isolated seasonal freshwater wetlands on John F. Kennedy Space Center, 1983-1984.

	Summer	Fall	Winter	Spring
Red-winged Blackbird	3.0	1.0	0.8	2.2
Green-backed Heron	1.3	0.9	0.0	1.0
Common Yellowthroat	0.2	0.9	2.0	1.6

edges of the marshes during winter but was only detected at a station when an individual was flushed. The Common Yellowthroat was common throughout all seasons except summer in swale marshes and in adjacent scrub and pine flatwoods (Breininger and Schmalzer 1990, Breininger and Smith in press). Nearly all individuals of this species leave the KSC barrier island complex during the nesting season. This is unusual because the Common Yellowthroat is a common permanent resident south to the limit of suitable habitat on the southern Florida mainland (Robertson 1955, Robertson and Kushlan 1974).

The Red-winged Blackbird, Green-backed Heron, and Common Yellowthroat were the only species sighted enough times to allow density estimates (Table 2). The effective detection distance was 40 m for all three species. The density estimates are approximate because the only accurate method of determining absolute densities involves total mapping procedures of color-banded birds (Verner 1985). Nearly all Green-backed Herons were sighted within sawgrass and willows but not cordgrass. Few or no Green-backed Herons resided in these marshes during winter. Although Red-winged Blackbirds frequented the cordgrass for feeding, they nested within the sawgrass and willows.

No birds using these swale marshes are restricted to this habitat type; they frequent other local wetland types (Leenhouts 1981a, b; Breininger 1990; Breininger and Smith 1990; Breininger unpublished data). Few wading birds (except for Green-backed Herons) have been sighted in a large freshwater swale marsh during four years of monthly aerial surveys. Impoundments, lagoon estuaries, and ditches have been the primary feeding sites for most wading bird species (Breininger and Smith 1990; Smith and Breininger unpublished data). Many swale marshes within scrub and slash pine flatwoods on KSC were traversed frequently (approximately 120 times per year between 1988-1990) but wading birds were seldom sighted, except for Green-backed Herons.

Environmental impacts within swale marshes can influence the surrounding landscape. The marsh vegetation is maintained by periodic fire that eliminates the dead vegetation, providing nutrients for new growth (Kushlan 1990). Recent fire can enhance habitat for many marsh birds (Vogl 1973). Native hardwoods, especially wax myrtle, willow, and red maple, and exotics such as *Melaleuca* invade swale marshes where fire

is excluded or hydrology is altered (Schmalzer and Hinkle 1985), thereby fragmenting an open scrub and slash pine landscape with wooded areas. Flammable marsh vegetation is replaced by woody plants that burn poorly so that fires may not carry into the surrounding scrub and slash pine flatwoods. This can reduce habitat quality for Florida Scrub Jays; optimal habitat allows them to scan their surroundings for long distances (Woolfenden and Fitzpatrick 1984), which is important for predator detection (McGowan and Woolfenden 1989).

The results of the study must be applied cautiously because only four marshes were surveyed during a one year period. Swale marshes on KSC were used by foraging gopher tortoises (*Gopherus polyphemus*) (Breininger et al. 1988, Giovanetto 1988) and were frequented by indigo snakes (*Drymarchon corais*) during telemetry studies (Kehl, Smith, and Breininger unpublished data). Many anurans breed almost exclusively in ephemeral, freshwater wetlands which are essential because predators, particularly fish, are not usually abundant (Moler and Franz 1987, Pechmann et al. 1989). Ephemeral, freshwater wetlands on KSC are represented by swale marshes which therefore are necessary for much of the herpetofauna of the scrub and pine flatwoods landscape.

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