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Cape Sable Sparrow Recovery Plan

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THIS PLAN IS A DRAFT DOCUMENT INTENDED FOR REVIEW AND SUBSEQUENT REVISION BASED ON THE COMMENTS OF COLLEAGUES AND AGENCIES. WE INVITE COMMENTS BEFORE JULY 1, 1981.

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INTRODUCTION

The Cape Sable Sparrow (Ammospiza maritima mirabilis), a subspecies of the Seaside Sparrow localized in extreme southern Florida, has elicited considerable interest and concern since its discovery in the early 1900's. Before being relegated to subspecific status, it was considered to be the last bird species described from the United States (Howell 1919, Stimson 1968), and it was widely believed to have been exterminated by a hurricane in September, 1935. Discoveries, apparent losses, and rediscoveries of the bird in various areas repeatedly brought public attention and concern for its conservation.

The sparrow was discovered by A. H. Howell in 1918 on the coastal prairie of Cape Sable, at the southwest tip of the Florida peninsula (Howell 1919). He described his specimens as Thryospiza mirabilis, recognizable by plumage characteristics and size. Griscom (1944) and Beecher (1955) considered it to be an extremely light-colored Seaside Sparrow (Ammospiza maritima). Stimson (1956, 1968) commented on the similarities in behavior of Cape Sable Sparrows and Dusky Seaside Sparrows (then A. nigrescens). In recent years, taxonomic reviews tended to merge both these forms with the polytypic A. maritima, a view formally adopted by the American Ornithologists' Union in 1973 (Eisenmann et al. 1973).

The limited distribution, and apparently catastrophic history, of the Cape Sable Sparrow resulted in its being classified as endangered under the original Federal listing of endangered species in 1967. Because most Cape Sable Sparrow habitat lies within areas managed by the National Park Service, personnel of the Service



Figure 1. Range of the Seaside Sparrow (from Robins et al. 1966, H. W. Kale II, pers. comm.).

were assigned by the U.S. Fish and Wildlife Service to develop a recovery, conservation, and management plan for this subspecies. The lead in drafting the plan was assumed by an interdisciplinary team with expertise in animal ecology, plant ecology, fire ecology, wildlife biology and hydrology from the South Florida Research Center. The first draft plan was modified in response to generous reviews of a number of people, G. E. Davis, R. F. Doren, J. S. Greenlaw, G. Y. Hendrix, R. H. Hofstetter, H. W. Kale II, P. Koepp, I. Mortensen, I. C. Olmsted, O. T. Owre, W. Post, C. Schell, C. H. Trost, H. W. Werner, and G. E. Woolfenden. The present draft will also be reviewed by knowledgeable workers, conservationists and agency personnel. A final draft will then be submitted to the U.S. Fish and Wildlife Service for internal and cooperating agency review. The final plan is intended to guide the actions of Government agencies in conservation of the Cape Sable Sparrow.

PART I - DISTRIBUTION, HISTORY, BIOLOGY, AND STATUS

Distribution and History

The Seaside Sparrow (*Ammodramus* *maritima* (Wilson)) is widespread along the Atlantic and Gulf coasts of North America from Massachusetts to Texas (Fig. 1). Within this range it is restricted primarily to a narrow band of coastal salt marsh habitat. Nine subspecies were recognized by the AOU (1957), 6 of which Howell (1932) recorded as nesting in Florida (Fig. 2). The species is in need of taxonomic revision (H. W. Kale II, W. Post pers. comm.). Ongoing studies have suggested that *A. m. pelonata* of the Florida east coast is not distinguishable from the more northern *A. m. macgillivraii* (H.W. Kale, II pers. comm.). *A. m. junicola* of the

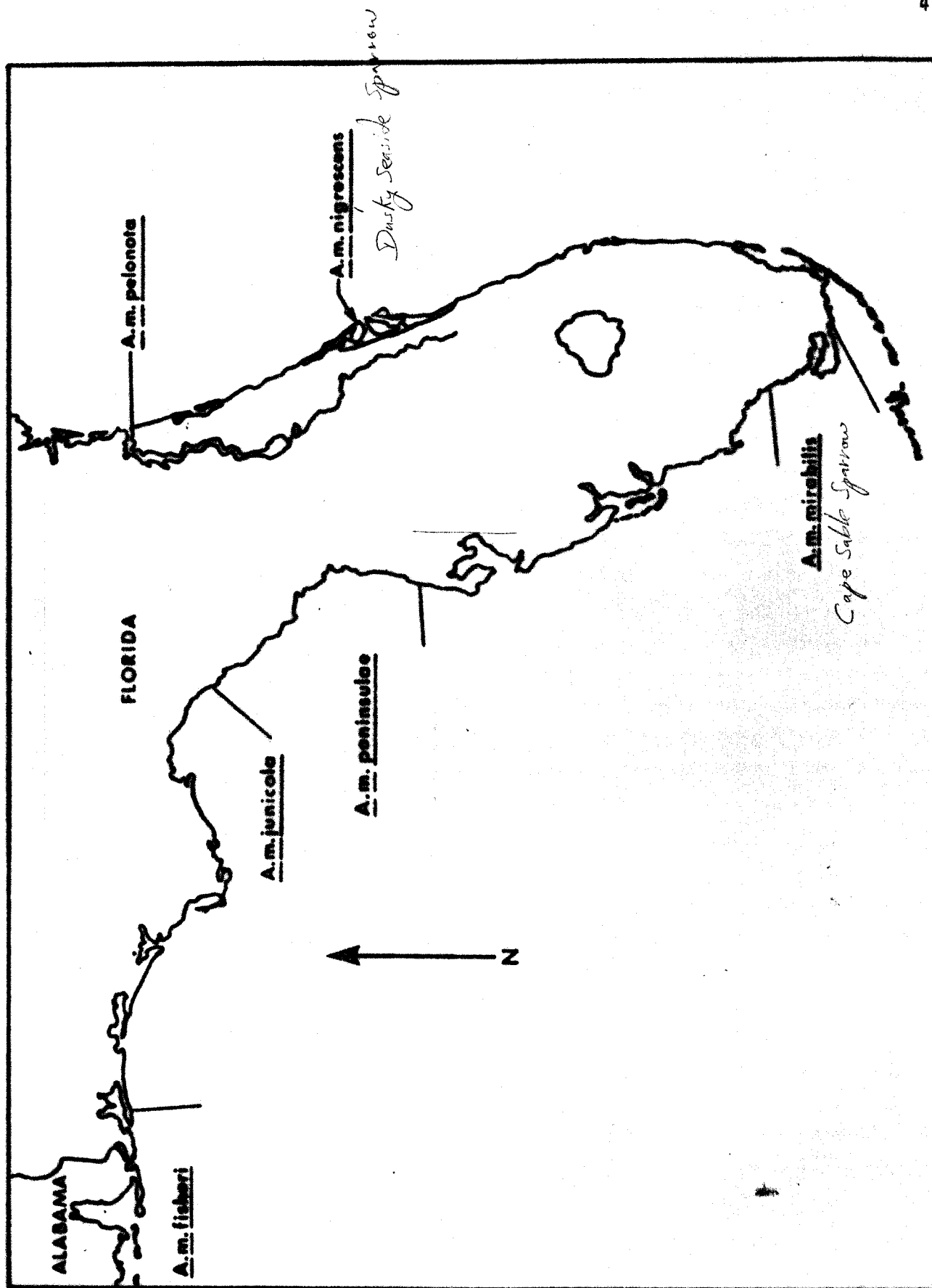


Figure 2. Range of Seaside Sparrow subspecies in Florida (from Howell 1932 and more recent information).

Florida Gulf coast may not be a valid race and A. m. howelli of the Florida panhandle is referable to A. m. fisheri (Post pers. comm.). On the mid-Florida east coast, the Dusky Seaside Sparrow (A. m. nigrescens), which recently has been reduced to only a few individuals (Baker et al. 1979), occurs along the St. Johns River and formerly on Merritt Island. Along the Florida west coast A. m. peninsulae ranges south to old Tampa Bay. The Cape Sable Sparrow, occurring only in extreme southern Florida, is disjunct from breeding populations of other Seaside Sparrows. Figure 2 shows the current distribution of Seaside Sparrows in Florida, based especially on Howell (1932) and on the unpublished studies of Post and Kale (pers. comm.).

The recent history of the Dusky Seaside Sparrow is pertinent to development of a the conservation strategy for the Cape Sable Sparrow. The Dusky Seaside Sparrow has been studied by Sharp (1960, 1970), Trost (1968), and Baker (1973, 1980), and a recovery plan has been approved (Baker et al. 1979). Sykes reviewed (1980) its current status and management options on Merritt Island. Impounding and flooding of the high salt marsh on which the sparrow depended was the primary cause for its drastic decline. Invasion of hardwoods on remaining higher marsh and effects of the levee system also were important.

For ease in discussing the ornithological history and in planning conservation efforts of the Cape Sable Sparrow, it is convenient to divide its known range into the following four areas: ¹ Cape Sable; ² Ochopee; ³ ~~southwestern~~ ^{central} Big Cypress Swamp; and, ⁴ Taylor Slough and the East Everglades (Fig. 3). Sparrows were discovered in these four areas in 1918, 1928, 1942, and 1970, respectively. Such a heuristic subdivision in no way implies reproductive isolation, nor is this the only division

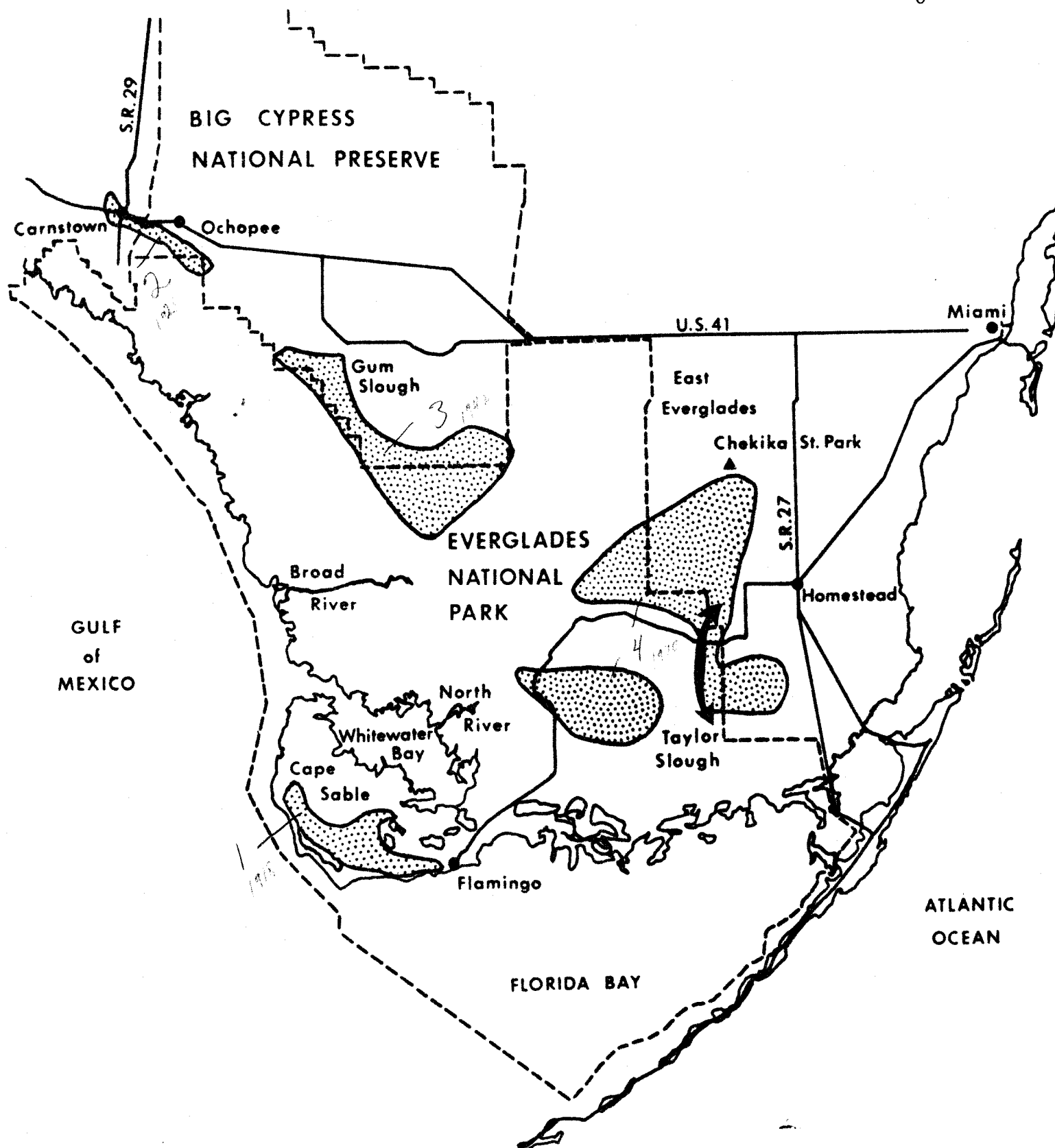


Figure 3. Maximum documented historic range of the Cape Sable Sparrow. Historic range is stippled.

possible. Although the status of sparrows in these areas before their discovery cannot be known, they easily could have been overlooked in interior habitat where such Seaside Sparrows would not be expected to occur.

On Cape Sable, the sparrow was known to range along the southern coast from Flamingo to Northwest Cape inland as far as the Fox Lakes (Stimson 1956, Werner 1971). Howell (1919) found that the species was "moderately numerous." Although the birds may not have been abundant, they were rather widely distributed in the Spartina prairies inland from the beach front. The population survived the hurricane of 1929 (Howell 1932), but it was widely thought to have been extirpated by the hurricane of September 1935 (Nicholson 1938, Stimson 1956, 1968), despite an observation to the contrary (Semple 1936). Werner (1971) rediscovered this subpopulation in 1970.

In the southeastern Big Cypress Swamp, sparrows were discovered in the marshes northwest of the true Everglades (Nicholson 1928). They were separated from the occupied area on Cape Sable by Whitewater Bay and mainland mangrove forests. Nicholson found the birds near Lostmans Pines, but an error in reporting the location of this colony, later corrected by Stimson (1954, 1956), prevented immediate confirmation of his discovery. Our knowledge of the distribution of these birds during the 1950's resulted from the work of Stimson and his colleagues (Stimson 1956 and references therein). He found the sparrow to be widely distributed from the western edge of the southern Everglades to Broad River and Gum Slough.

Near Ochopee sparrows were first found by Anderson (1942). Stimson (1956) found that birds occurred north of the Huston River through Ochopee and Carnestown, and probably north of U.S. Highway 41, west of State Road 29. Stimson (1956) reported that there was a hiatus in distribution between Gum Slough and the Huston River.

East of the true Everglades in Taylor Slough, sparrows were found in 1970 (Ogden 1972). These birds occupy the area west of Homestead, north to Chekika State Park in the area called the East Everglades, and southwest to the headwaters of the North River (Werner 1975). The population is patchily distributed over an area of about 10,000 hectares. The sparrow apparently existed in this area before its official discovery, as a previously overlooked observation occurred in 1957 (Werner 1975), and it seems likely that some Cape Sable sparrows have occurred in at least part of this area through historic times.

Biology

Spatial relations

Cape Sable Sparrows exhibit some territorial activity throughout the year. Birds on the Cape Sable prairie were "in full song" in January, 1932 (Grimes in Stimson 1968), and Werner (1975) heard males singing in Taylor Slough every month, with persistent singing from February into July. It would appear that the males remain on or near their breeding territories year around. Werner (1975) for the Cape Sable Sparrow and Post and Greenlaw (1975) for northern Seaside Sparrows have described and analyzed the vocal and visual displays associated with territorial activity.

The territorial arrangement of Cape Sable Sparrows consists of a mosaic of nest site based defended areas, "type A" territories, the pattern typical in monogamous passerine birds. In Taylor Slough, the activity ranges of adjacent pairs overlap considerably (Werner 1975), suggesting that the defended territory is a nest-centered area smaller than the breeding season home range. Territory size varied from 0.28 to 6.8 ha (Werner 1978) and appeared to be inversely related to population density which, in turn, was strongly correlated with length of the fire-free interval (Werner 1976:35). Peak densities of 20 pairs/40 ha measured by Werner (1976) in Taylor Slough seem to fall near the middle of the range of densities reported for other Seaside Sparrow subspecies having similar territorial spacing (Woolfenden 1956, Norris 1968, Post 1974).

Territorial behavior in Seaside Sparrows is adjustable. Post (1974) described two territory patterns within a Long Island population. Birds that nested in ditched marsh maintained large, exclusive type A territories. In unaltered marsh, where nest sites were thought to be limiting, birds nested in "grouped territories" at densities as great as 30 pairs/ha. Greenlaw (pers. comm.) suggests on the basis of censuses of large areas, that distribution may be rather uniform with local, sometimes annually shifting, condensations of birds in areas of suitable vegetation. This may also occur in a moderate way in Cape Sable Sparrows, but there is no suggestion of a tightly clumped territorial system.

Seaside Sparrow characteristically have an uneven distribution of breeding populations in areas of seemingly uniform habitat. Tomkins (1941:47) referred to the "semi-colonial nesting habit" of Seaside Sparrows in Georgia and northern Florida. Howell (in Stimson 1968) spoke of Cape Sable Sparrows on the Cape Sable prairie as

X occurring "in small more or less isolated colonies." Werner (1975) referred to "four small colonies" in the Ochopee marsh in 1970 and noted that "distribution and densities were very patchy" in the Muhlenbergia prairies of Taylor Slough. Post (1974) showed that patchy breeding distribution of Seaside Sparrows in a marsh on Long Island resulted from groupings in spots where marsh vegetation of the year before had not been flattened by winter storms and provided the only available cover for nests at the time nesting began. Within weeks new growth had obscured the variation, and the marsh appeared to be a featureless expanse. In all cases that have been described adequately nest site scarcity was, or may have been, the driving force leading to territorial arrangements that departed from the usual passerine pattern. Greenlaw (pers. comm.), on the other hand, has found territories in low density in scattered areas of persistent grass. Thus, the supposed coloniality of Seaside Sparrows is probably a matter of strict nest site selection (Post 1974:569), accompanied by such adjustments of territorial behavior as local situations require. In the Cape Sable Sparrow, the more than 10-fold variation in breeding density that Werner (1975) found seems most likely to be related to the fire mosaic within Muhlenbergia communities and to the effects of fire extent and fire-free time interval on the availability of cover.

Overall, there is considerable similarity in the generalized habitat use pattern of Cape Sable Sparrows and those of other populations. Greenlaw suggested (pers. comm.) that the general characteristics of sparrow nesting habitat are moderately dense, clumped, [↓]persistent, live grasses of 0.5 m or more high with sufficient open space among the stems to permit movement and small scale patchiness among grass clumps and open area.

Movement

In all marking studies of Seaside Sparrows, the males have proved to be localized. Werner (1975:131) found that many males used the same area for 2 years and some held essentially the same territory for 3 consecutive years. Trost's (1968) data for the Dusky Seaside Sparrow showed much the same degree of site tenacity, although Sykes (1980) found movement of greater than 1 km, perhaps on a regular basis. While nesting site tenacity might be anticipated in sedentary subspecies, such as the Cape Sable and Dusky, it seems to be equally developed in the migratory subspecies, as Post (1974:570) found that the consecutively used nest sites of 9 male northern seaside sparrows were separated by an average of only 13.6 m. On Long Island, tenacity does not necessarily mean that the exact territory site is reused (Greenlaw pers. comm.), but Post (pers. comm.) found that once a male Seaside Sparrow is established as a breeder, it seems to tend to return to the same area. It is probable that, if something happens to make the place unsuitable for nesting and adjacent habitat is occupied, the male may be removed from the breeding population.

Greenlaw (unpubl.) has found female Seaside Sparrows on Long Island show as strong a site tenacity as do males and has found a return rate similar to males. Trost (1968:853) stated that he had no later records of the few female Dusky Seaside Sparrows he banded. Movement and mortality of adult female Cape Sable Sparrows are unknown.

Dispersal of juveniles appears to provide most of the mobility in Seaside Sparrow breeding populations. Juveniles tend to move on the order of hundreds of meters to

several kilometers after they are self-sufficient. Trost (1968) found that 2 males and one female Dusky Seaside Sparrow nested the following year about 300 m from their natal nest sites. Greenlaw (unpubl.) found a northern sparrow disperse 8 kilometers. It seems probable that juveniles tend to choose their adult activity area at the time they initially disperse. Habitat distribution and adult population density seem likely to be major factors determining the distance and direction of dispersal by juveniles. Sykes (1980) found Dusky Seaside Sparrows 8 to 32 km from known nesting areas outside the breeding season, suggesting some dispersal occurs in this race.

Woolfenden (1956:61) noted an influx of new adult northern Seaside Sparrows onto his New Jersey study area in late June and thought they were probably individuals that had failed in a first nesting attempt elsewhere. Although such within-season shifts of location may occur in other populations, Werner (1975) includes no comparable records for the Cape Sable Sparrow. Overall, available information strongly suggests that movements in the Cape Sable Sparrow are restricted. This conclusion is important for two reasons. It is unlikely that the staggered discovery of various subpopulations was due to recent establishment in the areas of discovery. It is also unlikely that drastic habitat alteration would be compensated by population shifts, except to habitat immediately nearby.

Breeding

The Cape Sable Sparrow's breeding season extends over nearly half the year. The limits of known egg dates are March 29 and July 7 (Stimson 1968, Werner 1975), but Werner saw young birds out of the nest in Taylor Slough as early as April 2 and

young still in the nest as late as July 26. These dates indicate that nesting may begin as early as late February and may persist into early August. The amount of summer nesting, which means the number of third broods attempted, may depend mainly on the characteristics of individual rainy seasons, as nesting activity tended to decrease abruptly when the marsh flooded (Werner 1978). In the absence of deep flooding, nesting activity apparently does not diminish in summer (Werner 1975:132).

In the northern populations of Seaside Sparrows, the pair-bond is often maintained throughout the breeding season (Woolfenden 1968, Post 1974). In the Cape Sable Sparrow, first-brood pairs sometimes did not mate for later broods even though both remained in the area (Werner 1975). Such mate switching within one breeding population apparently occurs in all races studied but in no predictable way (Post pers. comm.).

There seems to be nothing likely to be limiting in nest construction requirements of Seaside Sparrows. Nests for all populations, including the Cape Sable Sparrow, seem to be built of readily available local materials, lined with finer grades of the same material. That Cape Sable Sparrows build a new nest for each successive brood in a season (Werner 1975) suggests that nesting material is easily at hand. All populations appear to build both domed and cupped nests.

Cape Sable Sparrows apparently stop nesting in marshes when shrub invasion begins (Werner 1973). Other Seaside Sparrows, however, are said to nest at heights as great as 4 m in shrubs such as ^{marsh}Iva, ^{groundsel}Baccharis, and ^{black mangrove}Avicennia that commonly colonize slight elevations in marshes (Tomkins, 1941, Woolfenden 1956, Austin

1968b). This may particularly occur in areas of extreme tides (Post pers. comm.). Nests imbedded in ridges of tide wrack have also been reported (Austin 1968b).

All Seaside Sparrows nest in habitats subject to occasional flooding, and coastal Seaside Sparrow populations are subjected to pressure to place their nests above the level of usual flooding. In salt marsh vegetation, flooding of nests by storm tides can be a major cause of nest loss (Post 1974; Greenlaw pers. comm.). The Cape Sable Sparrow and perhaps the Dusky Seaside Sparrow along the St. Johns River are unique in that much of their nesting is accomplished in dry marsh, before the rainy season begins. Mean nest elevation for Cape Sable Sparrows in Taylor Slough, 18 cm (Werner 1975:147), is almost the same as for a population of northern Seaside Sparrows that nests in a tidally inundated marsh on Long Island (Post 1974:569). This height allows them to continue nesting for some time after summer flooding of the prairie begins. Losses to flooding are insignificant in the Taylor Slough population (Werner 1975). Cape Sable Sparrows might respond to moderate increases of water level by placing their nests higher, as Trost (1968) noted for Dusky Seaside Sparrows after salt marshes were impounded.

Cape Sable Sparrows usually lay a clutch of 3 or 4 eggs (Werner 1978). Data for 19 nests presumed to have held complete clutches - 3 from Cape Sable (Stimson 1968) and 16 from Taylor Slough (Werner 1975) - show one clutch of 5 eggs, 9 of 4, 8 of 3, and one of 2, giving a mean clutch size of 3.53. The medium clutch size for Scott's Seaside Sparrow is 3 ($n = 150$, Post unpubl. data). From his work in Taylor Slough, Werner (1975, 1978) determined that the incubation period of the Cape Sable Sparrow was more than 11 days. Opinion and observation for other subspecies of Seaside Sparrows has tended to converge on an incubation period of 12 or 13 days

(Sprunt 1968, Trost 1968). As in most passerines, incubation usually does not begin with the first egg. Post and Greenlaw (pers. comm.) have found that incubation commonly begins with the penultimate egg in other populations of Seaside Sparrows.

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Young Cape Sable Sparrows spend 9 to 11 days in the nest (Werner 1978), and, when they leave it, they are active as pedestrians, although unable to fly and are attended by parents on the natal territory for 10 to 20 additional days, a timing of events similar in other subspecies (Trost 1968, Woolfenden 1956, 1968). Werner (1975) noted that on abandonment fledglings tended for a short time to form groups with specific activity centers near natal sites. Observations of several subspecies agree in reporting that independent young soon disperse to distances of several hundred meters to several kilometers, determined in large part by the distribution of suitable habitat (Tomkins 1941, Woolfenden 1956, Trost 1968). As Werner (1976:41) noted, "... the post-breeding emigrations of the fledglings provide the principal mechanism of population mobility."

It is usual for Cape Sable Sparrows to nest two or three times per season irrespective of the fate of earlier attempts (Werner 1975, 1978), as is also true of other Seaside Sparrows on the southern Atlantic coast (Tomkins 1941, Trost 1968, Austin 1968a) and probably other populations as well (Norris 1968, Post unpubl.). From South Carolina to the northern range limit (Woolfenden 1956, 1968, Sprunt 1968), the species is normally single-brooded. Birds in a Long Island population (Post 1974) commonly made second or third attempts after earlier nests had failed and on very rare occasions (two instances mentioned) nested again after succeeding in a first effort.

Subpopulation Areas

Cape Sable

On Cape Sable, when first discovered, the sparrow occupied seasonally flooded cabbage palm (Sabal palmetto) prairie, dominated by short, sparse Spartina bakeri, ^{saltgrass} Distichlis sp. and ^{Sea purslane} Sesuvium sp. (Holt and Sutton 1926, Semple 1936, Nicholson 1928, Stimson 1954, Werner 1978). Comparison of early descriptions and photographs (Holt and Sutton 1926) with current conditions shows that this area, once occupied by extensive Spartina prairie, is now dominated by mangroves, bare mud flats, and stands of halophytic forbs (e.g., Batis sp., Sesuvium sp., Borrchia sp.). This change was caused by the hurricane of 1935, and there is no evidence that the Spartina prairie is being reestablished. This change resulted in a marked decrease of potential sparrow habitat on Cape Sable.

Cape Sable Sparrows recently occupied the only three extensive patches of Spartina marsh that remain on Cape Sable near the Fox Lakes (Fig. 4), sites dominated by Spartina bakeri growing in clumps 2 m high. Werner (1975) found that the site occupied by sparrows was broken into discontinuous marsh patches by creeks, ponds, and areas of short vegetation (^{- spike rush} Elocharis cellulosa, Sesuvium sp., and Distichlis sp.). Fire is a factor in the persistence of Spartina habitat on the Cape. Three prescribed fires and two lightning fires occurred there between 1972 and 1979. The prescribed fires were set in winter and affected 125 hectares. In 1975, a lightning-caused fire burned 90 hectares. All areas burned from 1972 to 1975 were burned again in August 1979 by fire ignited by a lightning strike. This fire burned 560 hectares including most of the Spartina prairie west and north of Middle

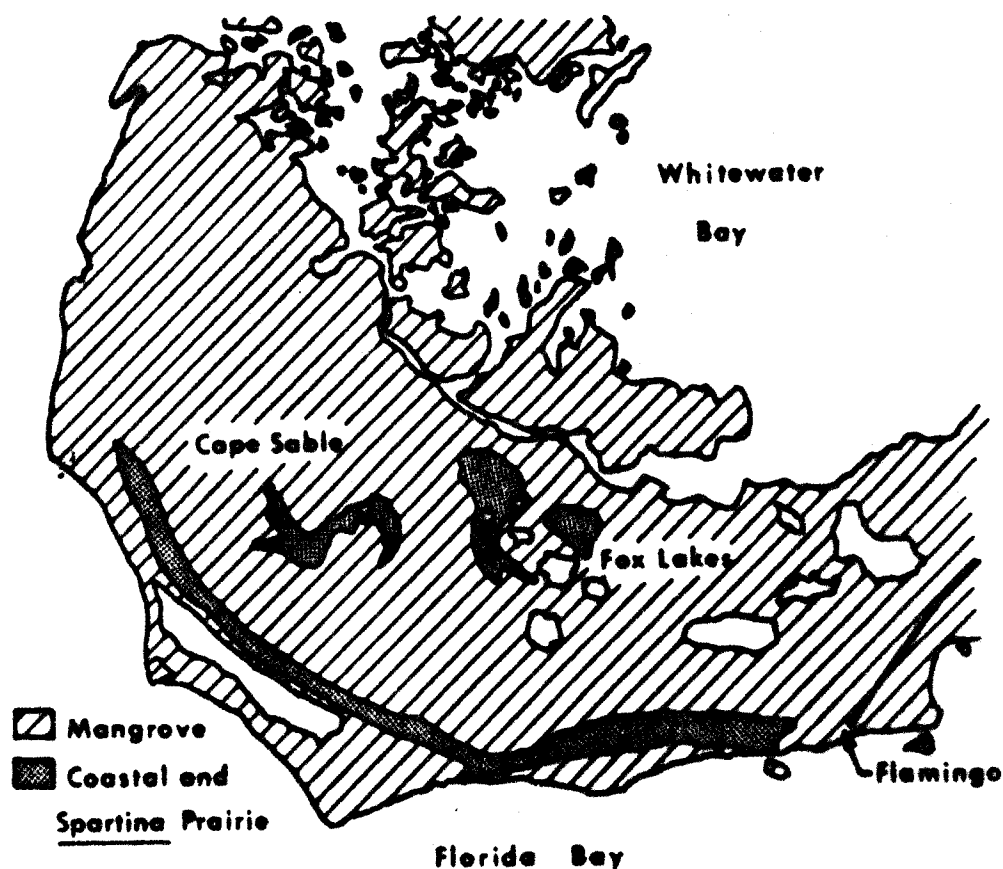


Figure 4. Vegetation and distribution of Cape Sable Sparrows on Cape Sable (1978-80). Base map from Werner (1975). Closed circle indicates site where Cape Sable Sparrows were found. Open circles indicate sites that were surveyed where no Cape Sable Sparrows were found.

Fox Lake. The fire left a mosaic of Spartina prairie on the south, west, and north of Little Fox Lake and killed mangroves invading the Spartina marsh at the eastern Spartina-mangrove ecotone.

Cape Sable Sparrows in this area consisted of small and localized groups. When this population segment was rediscovered in 1970, Werner (1971) found 4 singing males and netted 5 juveniles in a 2-day effort. In much more limited surveys, one male was found in 1975 (Werner 1975), and 2 were heard in 1978. No birds were located in surveys conducted immediately following the lightning-caused fire of 1979 or in 1980.

Vegetation changes on Cape Sable appear to be caused primarily by the natural processes of hurricanes and fire, and as a result the low population levels of sparrows there is a natural phenomenon. Continued monitoring of the area of sparrow occupancy is needed to determine recovery potential of this population segment.

Ochopee

Near Ochopee, sparrows occupied the ecotone between the Big Cypress Swamp and west coast mangroves near the boundary between Everglades National Park and the Big Cypress National Preserve (Fig. 5). The marsh vegetation there consists of Spartina bakeri and Cladium stands and strips and patches of Eleocharis sp., Juncus roemerianus, Distichlis sp., Sesuvium sp., and Typha sp. Spartina bakeri is low (1 m), and scattered, in contrast to the taller clumped plants on Cape Sable. These prairies are flooded most of the year, with a short dry season in the spring (Werner

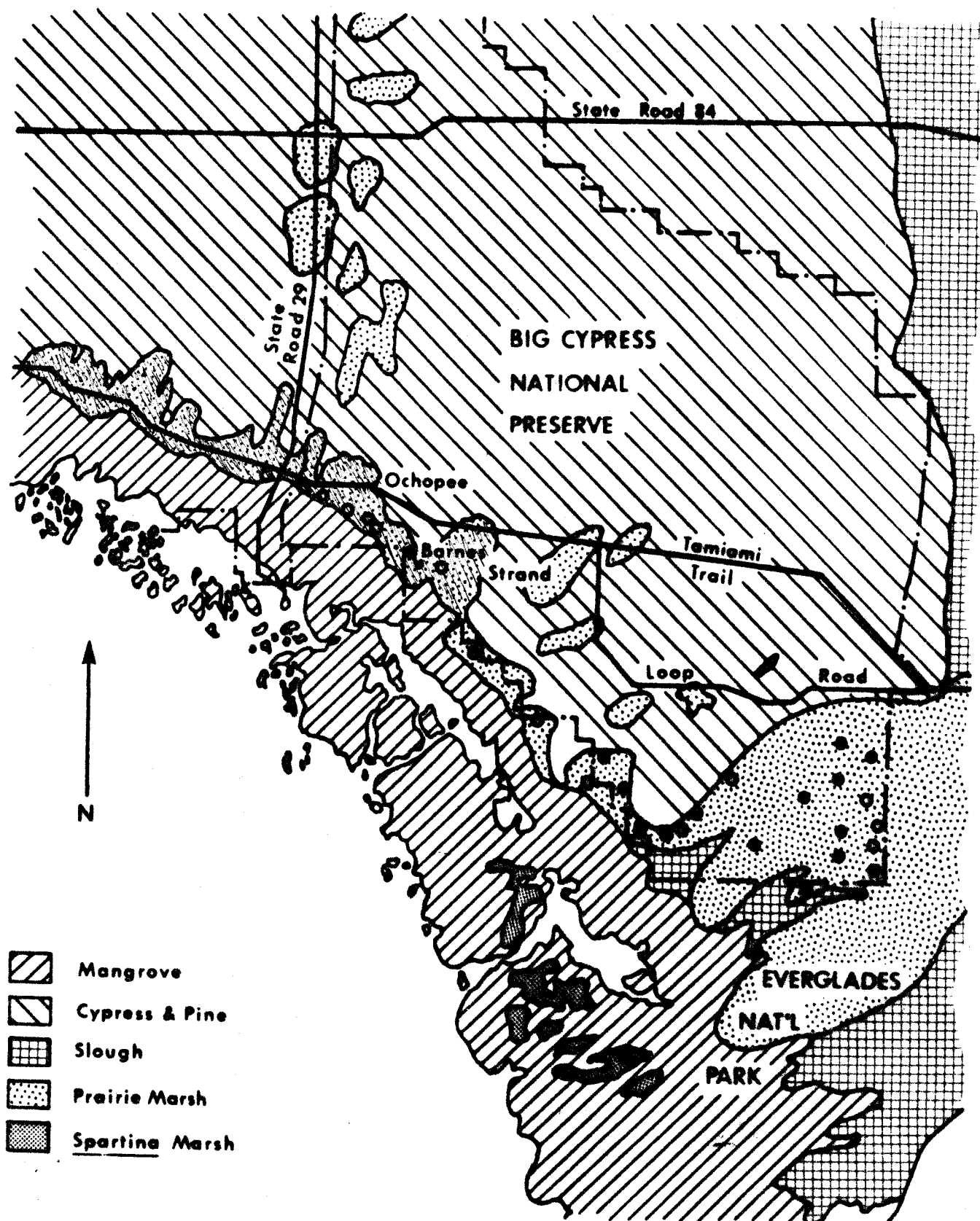


Figure 5. Vegetation and distribution (1978-80) of Ochopee and Big Cypress subpopulations of the Cape Sable Sparrow. (Base map from Werner 1975). Closed circles indicate where Cape Sable Sparrows were found. Open circles indicate sites that were surveyed where no Cape Sable Sparrows were found.

Cordgrass
salt marsh grass
20

1975). Within this area Cape Sable Sparrows have been observed in Spartina marsh dissected by Eleocharis, dense matted Spartina, Spartina mixed with Cladium, and sparse Typha mixed with matted Spartina (Werner 1975). ^{SAUGRASS}

The vegetation in the coastal marshes near Ochopee appears to be changing. From 1970 to 1975, it appeared to Werner (1975) that Juncus sp. and Eleocharis sp. were replacing Spartina sp. and Distichlis sp. Mangroves also have shown a long-term encroachment inland, although this invasion was checked by freezes in 1977. Some of these changes were probably associated with altered hydrologic conditions in the area. Although with the exception of the Turner River drainage (Rosendahl and Sikkema, in prep.), the hydrology of the Ochopee marshes has not been studied in detail, it appears to have been altered by canals. Effects on the Ochopee well fields and conductivity measurements show seasonal saltwater intrusion as far inland as salinity barriers near the Tamiami Trail (Rosendahl and Sikkema in prep.). Hydroperiods may have changed, probably shortened, as a result of the drainage effects of canals connecting upland marshes to tidewater.

Little information exists on fire frequency in the Ochopee area prior to 1979. Duever (1979), using fire statistics from Florida Division of Forestry to prepare a composite fire history map for the Big Cypress National Preserve, showed an extremely high incidence of fires in the Ochopee area for 1972-76, over 30 times that occurring further south in similar habitat. The difference was probably associated with a high incidence of human use and man-caused fires. During 1979, fires burned 2,600 hectares in the Ochopee-Turner River area.

The birds occurring south of Ochopee have remained few in recent years. Werner (1975) found sparrows at 6 scattered sites in this area from 1970-1975, and noted a decline in both the number of sites and number of individuals seen. Sparrows are known to remain in Spartina sp. and Cladium sp. marsh near Barnes Strand (Fig. 5), where singing males were found during surveys in 1978 and 1979. The low population level in this area appears to be an unnatural result of the impact of man-caused fire and salinity changes on sparrow habitat.

Big Cypress

In the Big Cypress, sparrows occur in the area north and west of Shark Slough, between the coastal belt of Spartina marsh and sawgrass marshes of the Everglades (Fig. 5). The area is dominated by freshwater marshes composed of sawgrass (Cladium sp.) and Muhlenbergia sp. with scattered cypress strands, hammocks, and bay heads. The area between cypress swamp and mangroves has vegetation patches similar to those found in the Ochopee marshes.

In the 1950's, Stimson (1956) found sparrows scattered throughout this area. However, he (1969) thought that the population was extirpated by widespread fires of the early 1960's. Records from 1972 through 1979 show at least 17 fires occurred in the general area, including 4 incendiary fires, one of 11,400 hectares, and three prescribed fires, 2 of which were for the purpose of studying recovery rates in Spartina marsh. Ten smaller lightning fires are also known to have occurred in the area.

It appears that, unlike in the Ochopee area, the recent fire frequency and extent in this area was not sufficient to markedly impact sparrow habitat. In 1980, surveys indicated that the sparrows were well dispersed over the area from 1 km south of the Loop Road into the headwaters marshes of coastal rivers (Fig. 5). Sparrows were found in 11 of 21 survey sites, with 1 to 6 males heard per site. Sparrows, therefore, continue to inhabit their historic range in the Big Cypress.

Taylor Slough-East Everglades

Taylor Slough, the East Everglades, and nearby areas support the largest population segment of Cape Sable Sparrows (Fig. 6). Taylor Slough, the second major natural drainageway within Everglades National Park is characterized by small hydraulic gradients of 1-3 cm per km, shallow water depths of .3-.6 meters, and a width of several kilometers. Its headwaters, lying outside the boundaries of Everglades National Park in the East Everglades, are generally considered to be bordered on the north by Grossman's Rock Ridge, on the west by Shark Slough and on the east by developed areas (Fig. 6).

Werner (1976) estimated that 1,900 to 2,800 sparrows occur in the Taylor Slough-East Everglades area. He arrived at this estimate as follows. He estimated the area used by Cape Sable Sparrows to be about 8,800 to 12,800 ha, and that 95% of the population occurred there. He then extrapolated population densities within measured plots in Taylor Slough to estimate between 900 and 13,900 singing males or between 1,800 and 27,800 individuals. He refined his estimate based on the density of birds in his study site most typical of Taylor Slough populations, to give an estimate of the entire population of between 1,900 and 2,800 sparrows.

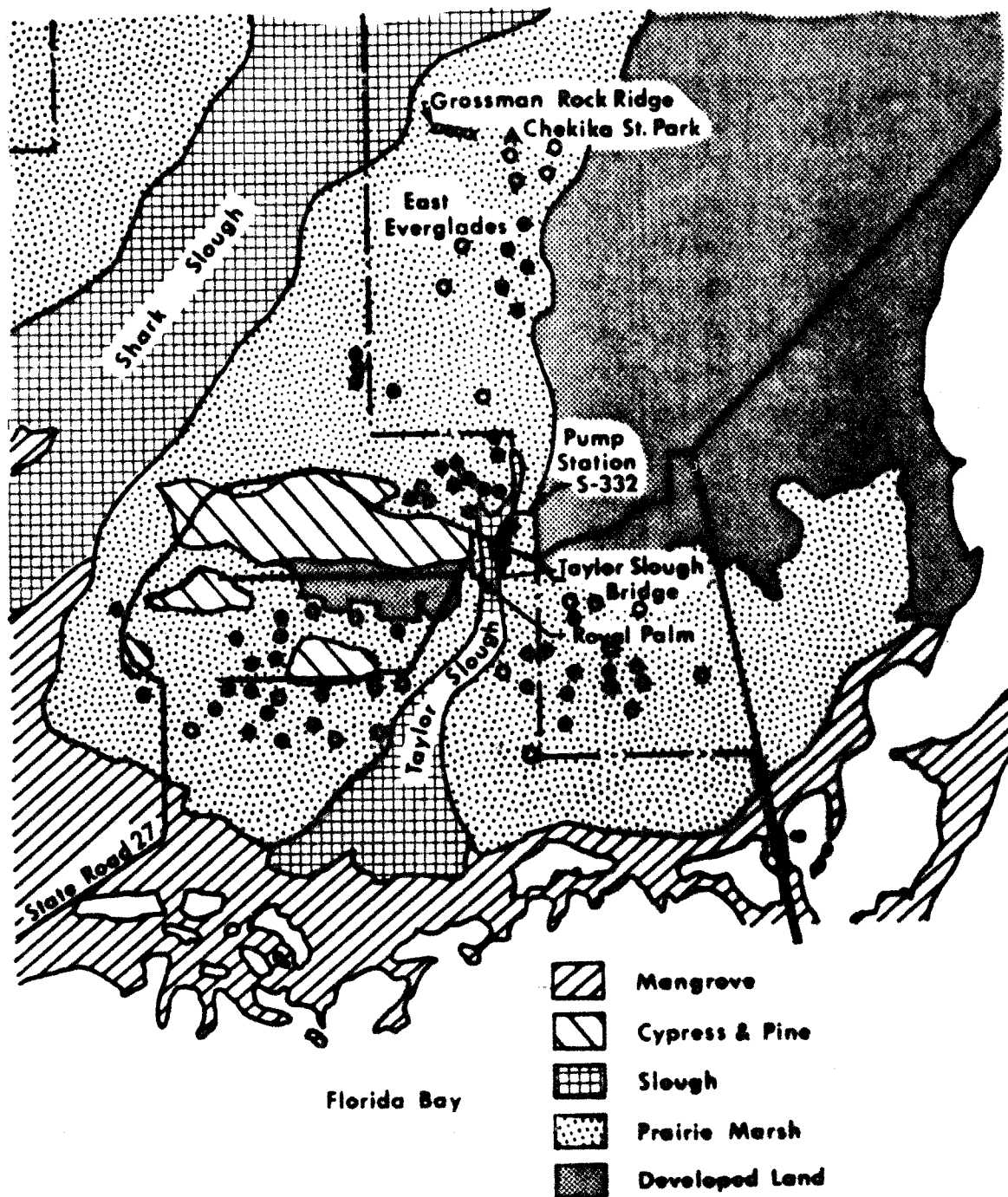


Figure 6. Vegetation and distribution (1978-80) of Cape Sable Sparrows in Taylor Slough and the East Everglades. Base map from Werner (1975). Closed circles indicate where Cape Sable Sparrows were found, Open circles indicate sites that were surveyed where no Cape Sable Sparrows were found.

Rounded to include the remaining population, he estimated the total to be 2,000 to 3,000 sparrows. This did not account for more recently rediscovered Big Cypress distribution.

The birds now occupy an area bordered by the relatively deeper water marsh of Shark Slough on the west to Chekika State Park on the north through the East Everglades, to developed lands on the east and to the mangroves on the south (Fig. 6). Surveys during 1978-1980 indicate that the population is widespread throughout the area. In 1978 sparrows were found at 11 of 12 sites surveyed. In 1979 sparrows were found in 11 of the 20 sites surveyed. In the most intensive survey of 1980, sparrows were found in 31 of 50 sites surveyed. The number of sparrows found at any one site ranged from 1 to 6 singing males. These surveys indicate that the overall distribution of sparrows in Taylor Slough - East Everglades has not changed since the early 1970's. Nor does it appear that densities are obviously different within resolution of the survey technique.

Although Cape Sable Sparrows are well dispersed throughout the Taylor Slough-East Everglades area, they especially inhabit seasonal marshes dominated by the grass Muhlenbergia sp. They also occur in mixed Cladium (sawgrass)-Muhlenbergia prairie and more elevated rocky areas dominated by the grass Schizachyrium rhizomatum. The vegetation of this area has recently been analyzed in considerable detail by Hilsenbeck et al. (1979 and Olmsted et al. (1980), who established a baseline against which to compare any future vegetation shifts associated with hydrologic changes. A typical Muhlenbergia prairie is overwhelmingly dominated by Muhlenbergia filipes, which generally accounts for 90-95% of the biomass and 70-95% of the total plant cover (Olmsted et al., 1979). Most of the 70 species of

vascular plants found in Muhlenbergia prairies are herbaceous. The Muhlenbergia prairie is the driest of the graminoid communities of Taylor Slough, with a typical hydroperiod of 2-4 months. It occurs on thin marl soil and blends into Cladium marsh at lower elevations and Schizachyrium prairie on higher ground. Olmsted et al. (1980) found that the inundation time of Muhlenbergia in Taylor Slough prairies has decreased with the construction of levees in 1969.

Muhlenbergia is fire adapted, recovering immediately after a fire when soil moisture is adequate. Werner (1975) and Olmsted et al. (1980) found that Muhlenbergia stands accumulate dead material rapidly beginning the first year following destruction of dead materials by fire. In stands several years old, the weight of dead material exceeds the live by 3 to 5 times (Werner 1975; Olmsted et al. 1980). Old culms become decumbent and occupy the space between plants. Werner (1975) found in his study site that this makes the habitat unsuitable for nesting by Cape Sable Sparrows, and such habitats were not used if unburned for 5 years.

Muhlenbergia prairie is an extensive plant community covering large areas along both sides of the Everglades. There has been some question as to whether this was the case in the recent past (Olmsted et al. 1980). Davis (1943) mentioned Muhlenbergia, but not as a dominant of an extensive community in his definitive early survey of south Florida plant communities. However, Muhlenbergia filipes in the vegetative state is quite similar to several other species, notably Schoenus nigricans (black rush) and Rhynchospora tracyi (beak rush), and it is likely that Muhlenbergia was overlooked in earlier times because of its similarity to Schoenus (Olmsted et al. 1980, Robertson pers. obs.).

The Cape Sable Sparrow requires uninterrupted expanses of prairie (Werner 1975). Invasion of native and exotic trees into prairies inhabited by Cape Sable Sparrows is a potential threat in Taylor Slough and the East Everglades. The exotic Australian pine (Casuarina spp.), is currently the most abundant of the three most critical exotic trees in the East Everglades, and in some locations it appears that potential Cape Sable Sparrow habitat has been lost because of Casuarina invasion. Major concentrations occur on higher ground within the prairie (Loope and Urban 1980) or on sites where bayheads or tropical hardwood vegetation has been removed by fire (Hilsenbeck et al. 1979). Casuarina is to some extent held in check by fires, although abundant resprouting frequently occurs from root systems of young fire-killed trees. The exotic Schinus terebinthifolius tolerates a wide range of site conditions (Ewel 1979) and occurs as scattered individuals throughout most of the East Everglades where it is invading prairies in sites where water tables have been lowered. Schinus does not appear to be a threat to the Cape Sable Sparrow where hydroperiods are long enough to prevent invasion by native hardwoods. The exotic Melaleuca quinquenervia within the past 5-10 years has invaded the area northeast of sparrow habitat in the East Everglades. The potential threat of Melaleuca to natural plant communities of Everglades National Park is discussed by Myers (1975) and Woodall (1978). The scattered Melaleuca in the East Everglades, large areas which have already been modified by canals, must be controlled if Cape Sable Sparrow habitat is to be preserved there. Herbicides are effective in control of Melaleuca (Woodall 1979). Hardwood invasion of Cape Sable Sparrow prairies, except for fire-adapted trees such as Melaleuca, can be checked by fire.

The relation of sparrow habitat to fire is complex. According to Werner (1975), man-caused fires in the East Everglades-Taylor Slough area have in the past been

destructive to Cape Sable Sparrows because of their timing and because of the large areas they affected. Without fire, however, habitat becomes unsuitable for sparrows because of litter accumulation and hardwood invasion. Incendiary fires occurring in the dry season can alter habitat and thereby affect nesting effort the following breeding season. To prevent fast traveling dry-season fires from moving into or out of Everglades National Park, the National Park Service has had a policy of attempting to burn annually along the park boundary since 1971. Fifteen fires have been attempted along this boundary over the past eight years. Possible effects of repeated burning on Cape Sable Sparrow habitat should be considered during annual reviews of the fire management plan of Everglades National Park.

Despite being inundated each year, former Muhlenbergia prairie sites are used for farming. Meador (1977) found that farming converts seasonally inundated prairie with non-mycorrhizal soils to sites potentially able to support mycorrhizal woody species through soil aeration, addition of nutrients, and increase in soil volume. Therefore, rockplowing, especially in conjunction with farming for even a single season, obliterates the natural prairie vegetation. Muhlenbergia and other native prairie species will not recolonize such sites, although Schinus and other exotics may be able to do so. Rockplowing farming eliminates any site as habitat for the Cape Sable Sparrow.

Water levels in sparrow habitat in the northern regions of Taylor Slough are influenced by rainfall and water levels within northeast Shark Slough. Hydrologic conditions in the area have been especially affected by canals in the area (Rose et al. 1981). They showed that decreases in hydroperiod and shifts in seasonal flow patterns have occurred. Development in the East Everglades will further affect

hydrologic conditions in Cape Sable Sparrow habitat in Taylor Slough to the extent that surface water conditions there are altered. Downstream habitat in Everglades National Park could also be similarly affected. To enhance water levels within Everglades National Park a pumping station at the park boundary in Taylor Slough (Fig. 6) will become operational in 1982. This station will be capable of delivering 4,570 hectare-meters of water to Taylor Slough on a pre-determined monthly (Table 1). Pumping surface waters to Taylor Slough is expected to increase hydroperiods in the extreme northern area of the slough in the park. Hydroperiods are expected to increase markedly only within the area lying directly south of the pump station to Royal Palm (Anhinga Trail) (Rose et al. 1981). The effect of pumping will diminish south of Royal Palm and little noticeable effect is foreseen 6 kilometers downstream from the pumping station. Monitoring of the effects of pumping must continue and with revisions in the schedule should be proposed if required.

The shift in hydroperiod immediately downstream of the pumping station in upper Taylor Slough will probably affect Cape Sable Sparrow habitat in that area. Olmsted et al. (1980) found that the mean hydroperiod for Muhlenbergia prairie communities in upper Taylor Slough is between 2 and 4 months, whereas adjacent sawgrass marshes experienced hydroperiods of 4-8 months. It is likely that wherever hydroperiods of existing Muhlenbergia prairies are extended beyond 4-5 months, the vegetation will change slowly toward increasing dominance of Cladium. It appears that such a change would affect less than 5% of the range of the Cape Sable Sparrow in Taylor Slough and less than 1% of the presently known total range.

Table 1. Mean monthly discharge for Taylor Slough

Month	1960-1968 (cms)	1969-1978 (cms)	Pumping (cms)	Schedule (hectare-meters)
Jan	0	0	1.11	91.3
Feb	0	0	0.62	45.7
Mar	0	0	0.28	22.8
Apr	0	0	0.29	22.8
May	0	0	0.56	45.7
Jun	0.51	0.27	10.69	822.1
Jul	1.95	1.41	12.57	913.4
Aug	0.67	1.10	5.66	365.4
Sep	3.56	3.30	12.60	730.7
Oct	5.86	1.41	13.13	959.1
Nov	1.91	0.26	6.02	456.7
Dec	0.07	0	1.12	91.3

The most important threat to portions of the Cape Sable Sparrow population occurs in the East Everglades, the only part of its range not under Federal management. Recently a series of detailed studies have been conducted on environmental economic and conditions in the area. These studies, including surveys of vegetation (Hilsenbeck et al. 1979) and wildlife (South Florida Research Center 1979), supported a detailed planning effort for zoning of the area by Dade County Planning Department (1980). This plan, now subject to approval by local county government, divided the East Everglades into 3 management areas. Much of the currently designated critical habitat (Fig. 8) was classified as "transitional seasonal wetlands" in which farming is to be allowed. Farming there includes rockplowing, which requires dredge and fill permits to be issued by the U.S. Army Corps of Engineers. Such permits should not be issued in essential habitat. However, in that sparrows have not recently been located in parts of critical habitat in the east Everglades, the extent of essential habitat requires review. Essential habitat are those areas presently occupied by sparrows and adjacent habitat which has not been adversely altered by drainage, hardwood invasion, or substrate alteration. Such essential habitat must be protected from development and should be managed to protect sparrows. Possible management options include zoning or purchase and management by appropriate state or Federal agencies.

Overall distribution

The known present distribution of the Cape Sable Sparrow is summarized in Figure 7. The map shows the location of singing males found from 1978 through 1980. During this period, sparrows were located at 70 of 120 sites surveyed. The sparrow remains widely distributed over a large area of southern Florida and

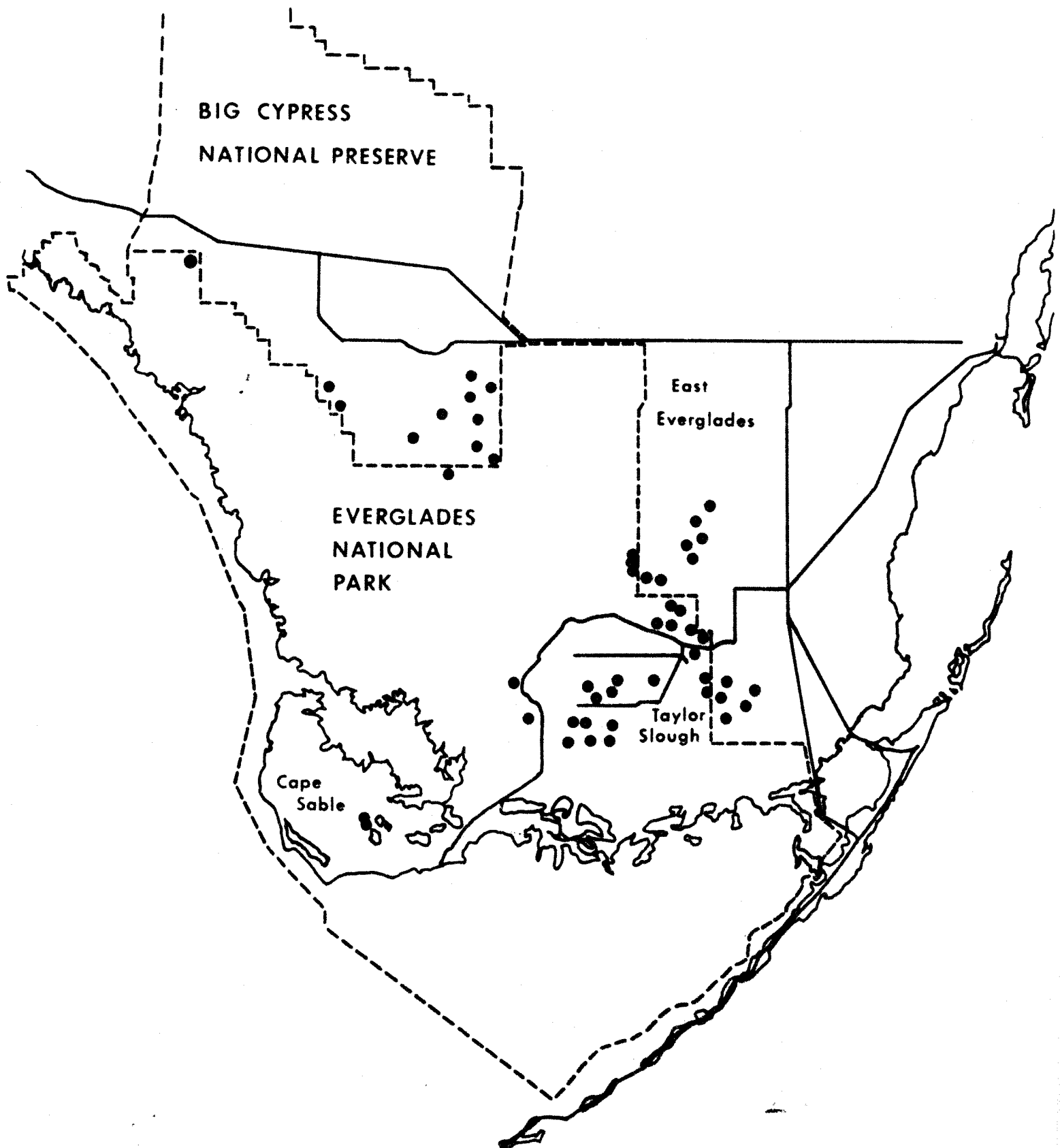


Figure 7. Present range of the Cape Sable Sparrow. Dots indicate locations where sparrows were found, 1977-1980.

continues to occupy nearly all of its historically known range (Fig. 3, 9). The preponderance of the Cape Sable Sparrow population occurs in the Big Cypress Swamp and in and near Taylor Slough. Most sites are in Everglades National Park and the Big Cypress National Preserve or in the East Everglades. All breeding sites in the Taylor Slough-East Everglades area were within the designated critical habitat for the species (Fig. 8 and Appendix 1, U.S. Fish and Wildlife Service 1977).

Potential Limiting Factors

Habitat and fire

Vegetation change and fire have been identified as major adverse influences on the Cape Sable Sparrow. The virtual extirpation of the Seaside Sparrow in north-eastern Florida has been attributed to occupation of its salt marsh habitat by black mangrove (Avicennia) (Austin 1968a), and the decline of the Dusky Seaside Sparrow near the St. Johns River resulted in part from dense salt bush (Baccharis) colonization (H. W. Kale II and W. Post pers. comm.). Disappearance of the Cape Sable Sparrow from much of Cape Sable was probably caused by natural vegetation change resulting from higher soil salinity following the hurricane of 1935 (Werner 1976, 1978). Disappearance of the Dusky Seaside Sparrow from Merritt Island was associated with the loss of Spartina when tidal marshes were impounded for mosquito control (Baker et al. 1979; Trost and Kale pers. comm.). The sparrows apparently require large expanses of prairie, uninterrupted by trees, and Werner (1975) believed the greatest threat to Cape Sable Sparrows is in the East Everglades and Taylor Slough because of the invasion of trees, especially exotics, Casuarina sp., Schinus terebinthifolius and Melaleuca quinquenervia.

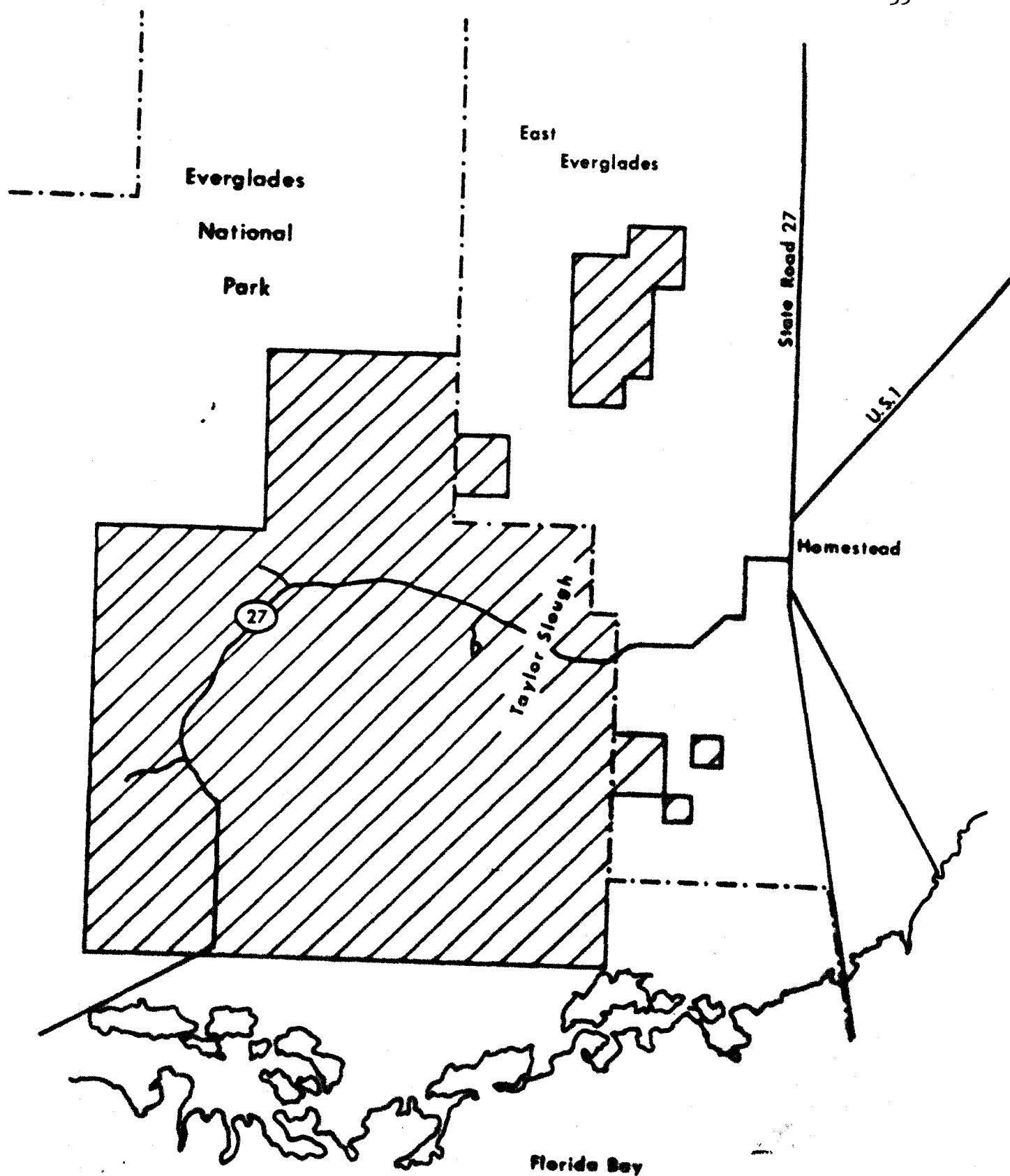


Figure 8. Designated critical habitat of the Cape Sable Sparrow.

Unlike other Seaside Sparrow populations, the Cape Sable Sparrow appears to be adapted to life in vegetation that is of a short-interval fire type. Werner (1976:35) found in his densely vegetated Taylor Slough study site that, population density peaked 3 years after fire, decreased in the fourth year, and declined to zero after 6 years. He reported that the population loss was correlated with a decrease in the ratio of living to dead plant matter. Fires late in the dry season during nesting and post nesting threaten nests, adults, and newly fledged young. Werner (1975) felt that if such an area burned as soon as the habitat biomass was sufficient to carry a fire, it would never achieve a vigorous population of nesting Cape Sable Sparrows. Under a frequent fire regime, small isolated sparrow groups might be reduced below the size necessary for persistence. Werner felt this had happened to colonies in the Ochopee area. In Werner's Taylor Slough plot, litter became dense 5 years after a fire. Olmsted et al. (1980) found that, on less densely vegetated Muhlenbergia-dominated sites on shallow soils, accumulation of dead materials was slower. Such sites may be capable of supporting sparrows for longer periods between fires than more densely vegetated stands. Such sparse habitats may be important during periods when fire does not occur in large areas of prairie.

Based on Werner's study, sufficient information exists to provide an optimal prescription for management of fire in dense Muhlenbergia prairies of Taylor Slough. Such prairies should be burned on 5 year rotation; burning should be concentrated in August-November, and no burning should take place during nesting, between February and mid-July. Fires should be ignited and controlled to result in a mosaic of patches of burned and unburned vegetation not more than 200 to 300 hectares each. Other man-caused fires should not be permitted and should be controlled if not following prescription. While such an optimal schedule may not be

achievable in practice or may conflict with other management requirements, it represents a clearly defined prescription for management of this species in one habitat. The time between fires for sparser prairies should be longer, but the role of fire in this and other sparrow habitat needs to be determined. Fire frequency may not be critically important in some areas, as sparrows currently persist under various fire regimes.

Food and feeding

Like most fringillids, Cape Sable Sparrows appear to be mainly insectivorous during nesting (Stimson 1968, Werner 1975). The birds are primarily gleaners, harvesting such items as lepidopteran larvae and spiders from vegetation and odonate nymphs, amphipods, beetles, small worms, and tiny snails from moist ground beneath the marsh vegetation or bare mud along the edges of tide channels. They also feed readily on more active insects, such as flies, orthopterans, and, particularly (Woolfenden 1956, Sprunt 1968) small moths. The species may feed more extensively on vegetable matter such as seeds at periods of the annual cycle other than nesting. Werner (1975:125-130) presented a comprehensive catalog of organisms that are potentially food for Cape Sable Sparrows. His work and that on other subspecies, particularly Post (1974), suggest that food supply is unlikely to be limiting for Seaside Sparrows. As pointed out by Trost (1968) for the Dusky Seaside Sparrow, the avian community of the marshes inhabited by Seaside Sparrows includes few or no species likely to be strong competitors for food.

Mortality

In Seaside Sparrows, the loss of eggs and young to predators is generally low; although great variations occur among years (Post pers. comm.). An unknown predator emptied one of the 16 nests that Werner (1975) studied in Taylor Slough. Loss of nestling Cape Sable Sparrows as a result of the invasion of nests by ants has been reported (Werner 1975). Post (1974) recorded only 5 nests lost to predation (9 percent of known nest losses) in a 3-year study of Seaside Sparrows on Long Island, but this rate may be higher in some years (Greenlaw unpubl.). Such small losses are especially notable because they included samples of nests that were visited frequently, which probably would increase predation rate over that occurring naturally. A dissenting opinion seems to be that of Nicholson (in Austin 1968a) who believed that predators destroyed at least 25 percent of the nests of Smyrna Seaside Sparrows. Post (pers. comm.) has also reported high losses of Scotts Seaside Sparrow nests to rice rats (Oryzomys palustris). Various accounts mention about 40 vertebrate species as potentially preying upon Seaside Sparrow eggs and young, but definite records are few. Most of the potential predators found in Cape Sable Sparrow habitat have such low populations that the losses they cause are undoubtedly minor. Overall nest mortality appears to be low for the Cape Sable Sparrow.

The causes of mortality of adult Seaside Sparrows appear to be almost unknown. Werner (1978) suggested that feral dogs and cats may have contributed to the decline of Cape Sable Sparrows near Ochopee. There is one record of a Cape Sable Sparrow in a Short-tailed Hawk nest (Werner 1976). Although the known instances of adult mortality thus seem to be either local or incidental, it is likely that most

adults ultimately are victims of predation. Loss of adult Cape Sable Sparrows seems to be low both within a season and between seasons (2 of 16 marked males from 1974 to 1975, 2 of 28 during the 1975 season), and Werner (1976) suspected that attrition is greatest when flooding reduces cover in the marsh.

Population dynamics

Cape Sable Sparrows, as studied in Taylor Slough, appear to be markedly successful. Werner (1975) reported that 34 young fledged from 55 eggs laid in 1974 and 1975, a nesting success rate of approximately 62 percent. In a comparable set of data for a population subject to nest loss from flooding, Post (1974) found overall nesting success of about 50 percent (236 of 477). The known survival rate of marked adult male Cape Sable Sparrows from 1974 to 1975 was 88 percent, and survival over the 1975 nesting season was 93 percent (Werner 1975). Thus the approximate annual rate of survival of adult males was 82 percent, higher than expected for temperate passerines and more similar to tropical passerines. The high survival of Cape Sable Sparrows contrasts with a year-to-year survival of 55 percent of adult males in a Long Island population of Seaside Sparrows (Post 1974), and the difference perhaps indicates losses due to migration. If we assume a population of 100 adult male Cape Sable Sparrows, each of which is assumed conservatively to be associated with two 4-egg nesting attempts per year and if we also assume a balanced sex ratio among juveniles, then the population of males could maintain its numbers if 93 percent of the juvenile males did not survive their first year to breed. Because it is likely that first-year mortality is actually in the range of 50 to 75 percent, this population has the ability to maintain itself or expand.

PART II - CONCLUSIONS, OBJECTIVES, AND RECOMMENDATIONS

Conclusions

The Cape Sable Sparrow is an isolated race of the widespread Seaside Sparrow localized in, and presumably peculiarly adapted to, the seasonally inundated coastal and inland marshes of southern Florida. Among Seaside Sparrows, it is distinctive in plumage characteristics and its extensive occupancy of inland marshes. As such, it is worthy of conservation efforts.

The sparrow was probably never abundant but was apparently widespread in southern Florida. For management planning, its range can be divided into 4 subpopulational areas, each with its own history and unique conservation problems. Birds on Cape Sable have been reduced by natural events to a small number, which in the past have repeatedly reappeared after having been lost from surveys. Birds near Ochopee are few, probably in part because of man-caused environmental changes in the area. In the Big Cypress Swamp and Taylor Slough-East Everglades, birds remain extensively distributed. They are potentially impacted by the effects of fire and, in East Everglades, by habitat alteration and by invasion of exotics.

Overall, a modified fire regime, invasion of exotic plants, manipulation of hydrologic systems, and development pose the most significant threats to the continued existence of the Cape Sable Sparrow. Periodic fire is required to maintain sparrow habitat, but fires that are too frequent, too extensive or inappropriately timed can lead to lowered habitat quality. A primary positive

effect of fire is to render the character of the marsh suitable for nesting after vegetation recovery. A second positive effect is to reduce invasion of grassland habitat by bushes and trees, which are not tolerated by sparrows. Invasion of exotic trees, especially Melaleuca, a species resistant to and benefited by fires, destroys sparrow habitat. Hydrologic conditions also affect sparrows. Periods of inundation are required to perpetuate the marshes on which they depend, but high water level at the wrong time of year can reduce the duration of the nesting season. Loss of vegetation to development or alteration of soil characteristics by rock plowing destroys sparrow habitat. Such impacts are possible on land east of Everglades National Park in Taylor Slough and the East Everglades.

It is possible at this time to propose management actions to control the critical threats to the Cape Sable Sparrow. Prescribed fires and natural wet season fires can enhance marsh habitat and retard the invasion of native shrubs and trees into the prairies occupied by sparrows. Fire programs that burn sparrow habitat frequently and extensively should be re-evaluated. Adequate methods to control exotic plant invaders seem to be available and should be used in sparrow habitat in Everglades National Park and the East Everglades. For species like Melaleuca, initial emphasis should be placed upon stopping encroachment at the front of invasion. Once converted to farmland, with or without rockplowing, native prairie vegetation cannot become reestablished. Thus, no such alteration of soil should occur on land occupied by sparrows. Hydroperiods should prevail that maintain the current marsh habitat types, especially in the Big Cypress Swamp and Taylor Slough-East Everglades.

The Cape Sable Sparrow is present throughout most of its traditional range, and it thus appears that the bird is not in immediate danger of extinction should its

present range be maintained. It remains an isolated population facing several identifiable potential threats to its current status. The rapid decline of the Dusky Seaside Sparrow lends further cause for concern for this subspecies. Thus, vigilance and management action are desirable to maintain the current status of the Cape Sable Sparrow.

Objectives

The objectives of this plan are to determine and maintain the present distribution and abundance of Cape Sable Sparrows.

Recommendations

Each subpopulation requires specific management activity. The first priority is to determine distribution, establish a monitoring system, and protect the habitat of Cape Sable Sparrows in Taylor Slough and the East Everglades. Protection especially involves management of the effects of fire, exotic plant invasion, and development. ^XThe second priority is to determine better the distribution of the Big Cypress population, especially its relation to fire management in this area. ^XThe third priority is to assess the causes of the low population levels near Ochopee. The fourth priority is to monitor the status of the population on Cape Sable and should that population become extirpated, analyze the rationale for reintroduction. The fifth priority is to initiate basic studies on little understood aspects of the biology of the Cape Sable Sparrow.

Specific recommendations are discussed below and outlined in the implementation schedule in the next section:

1. Establish a system for monitoring distribution of Cape Sable Sparrows. The system for monitoring distribution should consist of a complete survey by helicopter in 1981 and every 3 years ¹⁹⁸⁴ thereafter, covering all potential sparrow habitat. In addition, sparrow distribution in the East Everglades and Ochopee should be monitored (yearly) along with selected comparative unthreatened sites in Taylor Slough. Specific breeding season surveys should precede development activities especially in East Everglades and in the Big Cypress. Additional surveys should be conducted following hurricanes or extensive fires. The technique to be used is given in Appendix II.
2. Develop methodology for monitoring population abundance of sparrows. Development of such a monitoring system should attempt to make use of a possible relation between population density and time elapsed since the occurrence of fire in various habitats. Understanding this relation would permit an estimate of population size to be derived from monitoring fire history in known sparrow habitat.
3. Determine more precisely the distribution of sparrows in the Big Cypress and west coast marshes. Determine need for critical habitat designation.
4. Determine distribution and abundance in East Everglades. The status of the sparrow in all areas of existing critical habitat in the East Everglades should be carefully determined. To accomplish this an intensive survey should be

undertaken in this area. At the conclusion of the survey it should be possible to document the extent of habitat presently essential to the bird in the East Everglades.

5. Protect all essential sparrow habitat in East Everglades against exotic plant invasion, development, and hydroperiod alteration, by management, purchase, permitting, or other management actions.
6. Conduct management fires and allow natural fires in National Park Service areas. These fires should enhance maintenance of natural sparrow habitat. A reevaluation of fire management in the area is desirable. Effects of fires should be monitored closely.
7. Determine proper burning rotation for sparse prairie habitat.
8. Conduct management burns in East Everglades. These burns should follow prescriptions developed for maintenance of sparrow habitat.
- X 9. Investigate causes of habitat alteration in Ochopee area. This investigation should address, especially, the possibility of reduction of fire frequency to natural levels and reestablishment of freshwater flows.
10. Monitor sparrow populations, water conditions, and vegetation changes downstream from the pump station in Taylor Slough along established permanent plots and evaluate effects of pump station operations.

11. Monitor vegetation and population recovery of sparrows in the Fox Lakes area of Cape Sable. If no sparrows are located for 5 consecutive years, assess desirability of and extent of potential habitat to support reintroduction from wild stock.
12. Monitor fire events in Cape Sable Sparrow habitat in areas managed by the National Park Service.
13. Monitor fire events in sparrow habitat in East Everglades.
14. Conduct studies to obtain basic biological information on the Cape Sable Sparrow. Goals include but are not limited to the following:
 - a. Determine the underlying biological causes of patchy distribution of nesting birds, with emphasis on relative effects of social and ecological factors.
 - b. Determine habitat correlates of abundance, adult survival, movement, nest placement, predation, and reproductive success to better define habitat quality.
 - c. Determine individual patterns of habitat use, time budgets, movements, foraging tactics, nesting, foraging activity areas, and year-to-year changes in territory used.

- d. Determine rotation time for fire in sparrow habitats, especially in sparse Muhlenbergia, and determine the relation of juvenile habitat selection to fire history.
- e. Evaluate nature of genetic isolation and revise taxonomy of Seaside Sparrow populations.

PART III - IMPLEMENTATION

The following table outlines the implementation schedule of this plan.

Cape Sable Sparrow Recovery Plan Implementation Schedule, 1981-1984

Task No.	Job	Priority	Responsibility		Funding Source	Target Dates		Estimated Costs (\$1000)				
			Lead	Cooperators		Begin	End	FY 81	FY 82	FY 83	FY 84	FY 85
1	Establish distribution monitoring	1	NPS		NPS	Ongoing	Continuing	13	4	4	16	6
2	Develop method of monitoring abundance	1	NPS		NPS	Ongoing	83	5	5	5	5	
3	Determine distribution in Big Cypress	2	NPS	FGFWFC	NPS FGFWFC	81	81	See 1				
4	Determine distribution in East Everglades and reevaluate essential habitat there	1	NPS	FWS, FGFWFC	NPS	81	81	5	0	0	0	0
5	Evaluate management options and protect critical habitat in East Everglades	1	FGFWFC	FWS, DNR DER, Dade Co. ACE	FWS FGFWFC	82	Continuing	Unknown				
6	Conduct management fires in park service areas	2	NPS		NPS	81	Continuing	8	8	8	8	8
7	Determine fire schedule for sparse prairie	1	NPS	FGFWFC	NPS FGFWFC	Ongoing	84	5	10	10	10	0
8	Conduct management burns in East Everglades	2	FGFWFC	FDF, FWS Dade Co.	FWS	82	Continuing	0	3	4	5	6
9	Study status and habitat in Ochopee	3	NPS		NPS	82	83	0	5	4	0	0
10	Monitor pump station effects	1	NPS	ACE, SFWMD	NPS	81	Continuing	10	10	10	10	10
11	Monitor population on Cape Sable	4	NPS		NPS	Ongoing	Continuing	3	3	3	3	3

Cape Sable Sparrow Recovery Plan Implementation Schedule, 1981-1984 (continued)

Task No.	Job	Priority	Responsibility		Funding Source	Target Dates		Estimated Costs (\$1000)				
			Lead	Cooperators		Begin	End	FY 81	FY 82	FY 83	FY 84	FY 85
12	Monitor fire events in habitat in park areas	1	NPS		NPS	81	Continuing	3	3	3	3	3
13	Monitor fire events in East Everglades	1	FGFWFC	FDF, FWS Dade Co.	FWS	81	Continuing	4	4	4	4	4
14	Conduct biological studies	5	FWS	NPS, FGFWFC	FWS	82	Continuing	Undetermined				

NPS = National Park Service, FGFWFC = Florida Game and Fresh Water Fish Commission, FWS = U.S. Fish and Wildlife Service, DNR = Florida Department of Natural Resources, DER = Florida Department of Environment Regulation, Dade Co. = Metropolitan Dade County Government, ACE = Army Corps of Engineers, SFWMD = South Florida Water Management District, FDF = Florida Division of Forestry.

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APPENDIX I

Designated critical habitat for the Cape Sable Sparrow (U.S. Fish and Wildlife Service, 1977).

Florida Areas of land, water, and airspace in the Taylor Slough vicinity of Collier, Dade, and Monroe counties, with the following components (Tallahassee Meridian): Those portions of Everglades National Park within T57S R36E, T57S, R36½E, T57S R37E, T58S R35E, TR58S R36E, T58S R37E, T58½S, R35E, T58½S, R36½E, T59S, R35E, T59S, R36E, T59S R37E. Areas outside of Everglades National Park within T55S R37E Sec. 36; T55S R38E Sec. 31, 32; T56S R37E Sec. 1, 2, 11-14, 23-26; T56S R38E sec. 5-7, 18, 19; T57S R37E Sec. 5-8, T58S R38E Sec. 27, 29-32; T59S R38E Sec. 4.