SOUTH FLORIDA RESEARCH CENTER

Report M-660
Cape Sable Sparrow Management Plan

Everglades National Park, South Florida Research Center, P.O. Box 279, Homestead, Florida 33030

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TABLE OF CONTENTS

LIST OF FIGURES

PART I - INTRODUCTION

The Cape Sable Sparrow (Ammospiza maritima mirabilis), a subspecies of the Seaside Sparrow, restricted to 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 well known as the last bird species described from the United States (Howell, 1919; Stimson, 1968). It was widely believed to have been exterminated by a hurricane in September, 1935, but discoveries, apparent losses, and subsequent rediscoveries of the bird in various areas repeatedly brought it to public attention and aroused 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, defined 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 similarities in the 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 this race of the Seaside Sparrow resulted in its being classified as endangered under the original Federal listing of endangered species in 1967. Most Cape Sable Sparrow habitat lies within areas managed by the National Park Service. It is not completely distinctive in plumage, and, as demonstrated in the next section, recent studies suggest that its behavior is similar to that of other races. It is unique among Seaside Sparrows, in its ecological setting because it is a bird of inland marshes and flooded prairies in a subtropical seasonally dry environment.

DISTRIBUTION AND HISTORY

The Seaside Sparrow (Ammospiza 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. The species is in need of taxonomic revision (Kale and Post, pers. comm.). Ongoing studies have suggested that the birds formerly recognized as A. m. pelonota on the Florida east coast are not distinguishable from the more northern A. m. macgillivraii and have been extirpated in the southern part of their range (Kale, pers. comm.). A. m. juncicola of the Florida Gulf coast may not be a valid race, and birds once called A. m. howelli of the Florida panhandle are referable to A. m. fisheri (Post, pers. comm.). On the mid-Florida east coast, the Dusky Seaside Sparrow (A. m. nigrescens) formerly occurred along the St. Johns River and on Merritt Island (Baker et al., 1979). Along the Florida west coast A. m. peninsulae ranges south to Tampa. 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 on Howell (1932) and Kale (in press).

The recent history of the Dusky Seaside Sparrow is pertinent to development of a conservation strategy for the Cape Sable Sparrow. The Dusky Seaside Sparrow has been studied by Sharp (1969a, 1970), Trost (1968), and Baker (1973), and a recovery plan has been approved (Baker et al., 1979). It appears that this race is biologically extinct in the wild (Delaney et al., 1981). Sykes (1980) reviewed its status and management options on Merritt Island. He concluded that impounding and flooding of the high salt marsh on which the sparrow depended was the primary cause for its drastic decline there. Invasion of hardwoods on remaining higher marsh also was important. On the St. Johns River, Sykes (pers. comm.) believes that the demise of the Dusky Seaside Sparrow was due to habitat changes caused by drainage and frequent man-caused fires during the dry season. Williams (pers. comm.) suggests that the specific reasons for the decline are not completely understood, and it was the lack of such information that resulted in the loss of these birds.

For ease in discussing ornithological history and in planning conservation efforts for the Cape Sable Sparrow, it is convenient to divide its known range into the following 4 areas: Cape Sable; southern Big Cypress Swamp; Ochopee; and Taylor Slough (Fig. 3). Sparrows were discovered in these 4 areas in 1918, 1928, 1942, and 1972, respectively. Such a subdivision in no way implies reproductive isolation, nor is this the only division possible. Although the status of sparrows in each of these areas before their respective discoveries cannot be known, they easily could have been overlooked in interior habitats, where Seaside Sparrows would not be expected to occur, and where access is difficult, particularly at the best time of day for encountering the birds. The Northern Seaside Sparrow (A. m. maritima) is the only other race known to occur in southern Florida. It is a rare winter resident found primarily in coastal areas.

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). Werner (1975) heard males singing in Taylor Slough every month, with persistent singing from February into July, which can be considered the breeding season. Thus, it would appear that the males remain on or near their breeding territories year-round. Werner (1975, in press) 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, the "type A" territory pattern typical of monogamous passerine birds. In Taylor Slough, 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 0.38 to 6.8 ha (Werner and Woolfenden, in press) and appeared to be inversely correlated with population density, which in turn was strongly related to length of time since the last fire (Werner, 1976). 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 with similar territorial spacing (Woolfenden, 1956; Norris, 1968; Sharp, 1969b; 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 up to 30 pairs/ha. Greenlaw (pers. comm.) has suggested, based on censuses of large areas, that territory distribution may be rather uniform with local, sometimes annually shifting, concentrations of birds in areas of suitable vegetation. This may also occur to lesser extent with Cape Sable Sparrows, but there is no suggestion of the existence of a tightly clumped territorial system.

Seaside Sparrows 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 sparrows on the Cape Sable prairie as 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 muhly (*Muhlenbergia filipes*) 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 thereby provided the only available cover for nests when 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 (in press), on the other hand, has found territories in low density in scattered areas of persistent grass. Thus, the supposed coloniality of Seaside Sparrows is best considered a matter of nest site selection

(Post, 1974:569), accompanied by such adjustments of territorial behavior as local situations require (Greenlaw, in press). 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 muhly 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 (pers. comm.) suggested that Seaside sparrow nesting habitat can be characterized as being a marsh with moderately dense, clumped, persistent, and live grasses 0.5 m or more high, having sufficient open space among the stems to permit movement and small scale patchiness that creates localized openings in the grass cover. Sparrows nest in the persistent and tall grass, singing from its stems, and they feed among the grass stems and in the open areas.

Movement

In all marking studies of Seaside Sparrows, the males have proved to be restricted in their movements. 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) uncovered a movement in excess of 1 km.

While nest site tenacity might be anticipated in the sedentary Cape Sable and Dusky subspecies, it seems to be equally developed in the migratory subspecies. 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 tends to return to the same area. If something happens to make a territory unsuitable for nesting and adjacent habitat is occupied, it is possible that a male Cape Sable Sparrow may be removed from the breeding population, but this possibility needs to be determined.

Post and Greenlaw (in press) found that female Seaside Sparrows on Long Island showed as strong a site tenacity as did males, judged by similar return rates for both sexes. Movement and mortality of adult female Cape Sable Sparrows are unknown.

Observers 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). Werner (1976) noted ". . . the post-breeding emigrations of the fledglings provide the principal mechanism of population mobility." Sharp (pers. comm.) has suggested that such movements as exist are particularly important to population maintenance in habitat subject to periodic perturbations.

Trost (1968) found that 2 male and 1 female Dusky Seaside Sparrow nested about 300 m from their natal nest sites of the previous year, whereas Greenlaw (unpubl.) observed that a Northern Seaside Sparrow dispersed 8 km. It seems probable that juveniles tend to choose their adult activity area at the time they initially disperse. Current 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 occurred in this race, perhaps because of habitat degradation (Sharp, pers. comm.). It is clear that the fate of juveniles and the extent of their ability to colonize distant areas need to be determined. It is especially important to know whether surplus birds return to natal areas or move into other suitable habitat and how fires affect their ability to colonize an area. 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 their first nesting attempts elsewhere. Such shifts of location may occur in the Cape Sable Sparrow, as Taylor (in press) found increased densities in remaining habitat after nearby areas burned. The extent of movement of adult birds and their colonizing ability is an important factor in this management. If movement of adult Cape Sable Sparrows is restricted, it becomes unlikely that drastic habitat alteration would be compensated by population shifts, except to nearby habitat. Movement patterns of adults outside the nesting season should be determined, perhaps by radio-telemetry. What happens to adults when their territory is altered, especially by fire, needs to be understood.

Breeding

The Cape Sable Sparrow's breeding season typically 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 essentially 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 becomes flooded (Werner, 1978). In the absence of deep flooding, nesting activity apparently does not diminish through mid-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 remate 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 build cupped nests, some of which have a canopy formed by pulling over stems above the cup (Greenlaw, pers. comm.).

Werner (1975) found that Cape Sable Sparrows fail to nest in marshes when shrub invasion begins. Other Seaside Sparrows, which occur in tidal situations, are said to nest at heights as great as 4 m in marshelder (Iva sp.), saltbush (Baccharis sp.), and black mangrove (Avicennia germanans), which 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 tidal wrack have been reported (Austin, 1968b). In Cape Sable Sparrow habitat, Werner (pers. comm.) has suggested that brush invasion may increase its use by Red-winged Black Birds (Agelaius phoeniceus), which may adversely affect the sparrows. Precisely how bushes impact sparrows requires study.

All Seaside Sparrows nest in habitats subjected to occasional flooding and coastal Seaside Sparrow populations are under pressure to place their nests above the usual flooding level. 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 is unusual in occurring in non-tidal situations and in accomplishing much of its nesting in dry marsh, before the rainy season begins. Mean nest elevation for Cape Sable Sparrows in Taylor Slough, 18 cm (Werner, 1975), is almost the same as for a population of Northern Seaside Sparrows that nests in a tidally inundated marsh (Post, 1974:569). This height allows Cape Sable Sparrows to continue nesting for some time after summer flooding of the prairie begins. Seaside Sparrows responded to moderate increases of water level by placing their nests higher (Trost, 1968). Werner (pers. comm.) doubts that sparrows will nest once flooding begins, thus losses are insignificant in the Taylor Slough population (Werner, 1975).

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 1 clutch of 5 eggs, 9 of 4, 8 of 3, and 1 of 2, giving a mean clutch size of 3.53. The median clutch size for Seaside Sparrows in west Florida is 3 (n = 150, Post, pers. comm.), and 4 on Long Island (Greenlaw, pers. comm.). 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 on other subspecies of Seaside Sparrows has tended to converge on an incubation period of 12 or 13 days (Sprunt, 1968; Trost, 1968). Post and Greenlaw (pers. comm.) have found that incubation commonly begins with the penultimate egg in other populations of Seaside Sparrows.

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 activity centers near natal sites.

It is usual for Cape Sable Sparrows to nest 2 or 3 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; Sharp, pers. comm.) and probably other populations as well (Norris, 1968; Post, pers. comm.). From South Carolina to the northern range limit, the species is normally single-brooded (Woolfenden, 1956, 1968; Sprunt, 1968). Birds in a Long

Island population commonly made second or third attempts after earlier nests had failed and on very rare occasions (2 instances mentioned) nested again after succeeding in a first effort (Post, 1974).

SUBPOPULATION AREAS

Cape Sable area

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 cordgrass 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 (Semple, 1936). Werner (1971) rediscovered this subpopulation in 1970.

When first discovered on Cape Sable, sparrows occupied seasonally flooded cabbage palm (Sabal palmetto) prairie, dominated by short, sparse cordgrass, saltgrass (Distichlis spicata), 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 the area once occupied by extensive cordgrass prairie is now dominated by mangroves, bare mud flats, and stands of halophytic forbs (saltwort (Batis sp.) sea purslane, sea oxeye (Borrichia sp.)). This change was caused by the hurricane of 1935, and there is no evidence that the cordgrass prairie is being reestablished. As a result, a marked decrease of potential sparrow habitat has taken place on Cape Sable.

Cape Sable Sparrows recently occupied the only 3 extensive patches of cordgrass marsh that remain on Cape Sable near the Fox Lakes (Fig. 4); sites dominated by Spartina bakeri growing in clumps. Werner (1975) found that the site occupied by sparrows was broken into discontinuous patches of marsh by creeks, ponds, and areas of shorter vegetation, including spikerush (Eleocharis cellulosa), sea purslane, and saltgrass. Fire is a factor in the persistence of cordgrass habitat on the Cape. Three prescribed fires and 2 lightning-caused fires occurred there between 1972 and 1979. The prescribed fires were set in winter and affected 125 ha. In 1975, a lightning-caused fire burned 90 ha. All areas burned from 1972 to 1975 were burned again in August 1979 by fire ignited by a lightning strike. This fire burned 560 ha including most of the cordgrass prairie west and north of Middle Fox Lake. The fire left a mosaic of cordgrass prairie on the south, west, and north of Little Fox Lake and killed mangroves invading the cordgrass marsh at the eastern cordgrass-mangrove ecotone.

Cape Sable Sparrows in this area were in 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, 1 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, or 1981 (Kushlan and Bass, in press).

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 are a natural phenomenon. Continued monitoring of the area formerly occupied by sparrows is needed to determine recovery potential of this population segment, which apparently has, for many years, been a small portion of the total Cape Sable Sparrow population.

Ochopee area

Sparrows were first found near Ochopee by Anderson (1942). Stimson (1956) located birds 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. 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 cordgrass and sawgrass (Cladium jamaicensis) marsh and patches of spikerush, blackrust, saltgrass, sea purslane, and cattail (Typha sp.). Cordgrass 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, 1975). Within this area, Cape Sable Sparrows have been observed in cordgrass marsh dissected by spikerush, dense cordgrass, cordgrass mixed with sawgrass, and sparse cattail mixed with cordgrass (Werner, 1975).

The vegetation in the coastal marshes near Ochopee appears to be changing. From 1970 to 1975, it appeared to Werner (1975) that blackrush and spikerush were replacing cordgrass and saltgrass. 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. With the exception of the Turner River drainage (Rosendahl and Sikkema, 1981), the hydrology of the Ochopee marshes has not been studied in detail, but it appears to have been altered by canals. Effects on the Ochopee well fields and a history of increasing conductivity measurements show seasonal saltwater intrusion as far inland as salinity barriers near the Tamiami Trail (Rosendahl and Sikkema, 1981). 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) used fire statistics from the Florida Division of Forestry to prepare a composite fire history map for the Big Cypress National Preserve. It 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 ha in the Ochopee-Turner River area.

Few birds have occurred south of Ochopee 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 have been present in cordgrass-sawgrass marsh near Barnes Strand (Fig. 5), where singing males were found during surveys in 1978 and 1979 (Kushlan and Bass, in press). The decline and possible loss of this population segment appears to be the result of man-caused fire and salinity changes. Additional information on the reasons for the population decline is needed, but it appears that unless habitat conditions are restored, there is little reason to expect improvement.

Southern Big Cypress area

Sparrows were discovered in the southern Big Cypress Swamp 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.

Presently, in the Big Cypress, sparrows occur in the area north and west of Shark Slough, between the coastal belt of cordgrass marsh and sawgrass marshes of the Everglades (Fig. 5). The area is dominated by freshwater marshes of sawgrass and muhly with scattered cypress strands, hammocks, and bayheads. 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. He later (1959) thought that the population had been 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 ha, and 3 prescribed fires, 2 of which were for the purpose of studying habitat recovery rates in cordgrass marsh. Ten smaller lightning fires are also known to have occurred in the area.

It appears that, unlike in the Ochopee area, the frequency and extent of recent fires in this area were not sufficient to markedly impact sparrow habitat. In 1980, and 1981, 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) (Kushlan and Bass, in press). They estimate the population to be about 2,900 birds. Sparrows, therefore, continue to inhabit their historic range in the Big Cypress.

Taylor Slough area

Sparrows were found south and east of the true Everglades in Taylor Slough in 1972 (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 (Fig. 6) (Werner, 1975). The population is patchily distributed over an area of about 10,000 ha. 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.

Taylor Slough, the East Everglades, and nearby areas support a substantial population segment of Cape Sable Sparrows. 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 0.3-0.6 m, 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 the Everglades (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 this estimate based on the density of birds in his study site most typical of Taylor Slough populations, to give a figure of between 1,900 and 2,800 sparrows.

The birds now occupy an area bordered by the relatively deeper water marsh of the Everglades 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). Preliminary surveys conducted during 1978-1980 indicated that the population is widespread throughout the area. Sparrows were found at 11 of 12 sites surveyed in 1978, in 11 of 20 sites surveyed in 1979, and in 31 of 50 sites surveyed in 1980 (Kushlan and Bass, in press). In the intensive survey of 1981, sparrows were found in 155 of 396 sites surveyed (Bass and Kushlan, in prep.). 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 has not changed since the early 1970's.

Although Cape Sable Sparrows are well dispersed throughout the Taylor Slough area, they especially inhabit seasonal marshes dominated by muhly. They also occur in mixed sawgrass prairie and more elevated rocky areas dominated by the grass Schizachyrium rhizomatum. The vegetation of this area has been described 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.

Because of the importance of muhly prairie as sparrow habitat, it is important to consider its characteristics in some detail. A typical muhly prairie is overwhelmingly dominated by muhly, which generally accounts for 90-95% of the biomass and 70-95% of the total plant cover (Olmsted et al., 1980). Most of the 70 species of vascular plants found in muhly prairies are herbaceous. The muhly 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 sawgrass marsh at lower elevations and Schizachyrium prairie on higher ground. Olmsted et al. (1980) found that the inundation time of muhly in Taylor Slough prairies has decreased with the construction of levees in 1969. Muhly is fire-adapted, recovering immediately after a fire when soil moisture is adequate. Werner (1975) and Olmsted et al. (1980) found that muhly 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 live material by 3 to 5 times (Werner, 1975; Olmsted et al., 1980). Old culms become decumbent and occupy the space between plants. Werner (1975) concluded that in his study site this makes the habitat unsuitable for nesting by Cape Sable Sparrows, and such habitats were sparsely used if unburned for 5 years.

Muhly 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 muhly in his definitive early survey of south Florida plant communities, but not as a dominant of an extensive community. However, muhly in the vegetative state is quite similar to several other species, notably black-top sedge (Schoenus nigricans) and beak rush (Rhynchospora tracyi) and it is likely that muhly was overlooked in earlier times because of its similarity to black rush (Olmsted et al., 1980; Robertson pers. obs.)

In Taylor Slough and the East Everglades, invasion of native and exotic trees into prairies inhabited by Cape Sable Sparrows is a particular threat (Werner, 1975). The exotic Australian pine (Casuarina spp.) is currently the most abundant of the 3 most critical exotic trees in the East Everglades, and in some locations potential Cape Sable Sparrow habitat has been lost because of Australian pine 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). Australian pine is to some extent held in check by fires, although abundant resprouting frequently occurs from root systems of young fire-killed trees. The exotic Brazilian pepper (Schinus terebinthifolius) tolerates a wide range of site conditions (Ewel, 1979) and is invading prairies throughout the East Everglades, possibly in response to lowered water tables. Brazilian pepper does not appear to be a threat to the Cape Sable Sparrow where hydroperiods are long enough to also prevent invasion by native hardwoods. The exotic melaleuca (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 of 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 and maintenance of natural hydroperiods.

According to Werner (1975), man-caused fires in the East Everglades-Taylor Slough area have 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 8 years. Possible effects of repeated burning on Cape Sable Sparrow habitat should be considered in the fire management plan of Everglades National Park and other agencies responsible for fire management in the East Everglades.

Despite being inundated each year, former muhly prairie sites in the East Everglades 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, farming for even a single season, in conjunction with rockplowing, obliterates the natural prairie vegetation. Muhly and other native prairie species will not recolonize such sites, although Brazilian pepper and other exotics may be able to do so. Rockplowing 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 discharging 4,570 hectare-meters of water to Taylor Slough on a pre-determined monthly schedule (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 km downstream from the pumping station. Monitoring the effects of pumping is essential, and 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 muhly 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 muhly prairies are extended beyond 4-5 months, the vegetation will change slowly toward increasing dominance of sawgrass. 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.

The most important threat to the Cape Sable Sparrow occurs in the East Everglades, the only part of its range not under National Park Service management. Recently a series of detailed studies have been conducted on environmental and economic 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 the Dade County Planning Department (1980). This plan divided the East Everglades into 3

Table 1. Mean monthly discharge for Taylor Slough

Month	1960-1968 (cms)[1]	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

1 cms = cubic meters per second

management zones. Much of the currently designated critical habitat (Fig. 7) was classified as "transitional seasonal wetlands" in which farming is to be allowed. Farming there includes rockplowing, which requires dredge and fill permits issued by the U.S. Army Corps of Engineers.

The area included in the presently designated critical habitat of (Fig. 7) the Cape Sable Sparrow does not reflect current occupancy or needs of the sparrow. Because of alterations, probably irreversible, parts of the critical habitat are no longer occupied by sparrows (Bass and Kushlan, in prep.). Thus the extent of current essential habitat requires review. We consider essential habitat to be the area presently occupied by sparrows and adjacent habitat which has not been adversely altered by drainage, hardwood invasion, or substrate alteration. Based on the results of a recent survey in the East Everglades (Bass and Kushlan, in prep.), Figure 8 shows in detail the area considered to be the essential habitat of the Cape Sable Sparrow in Taylor Slough and the East Everglades. 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

Present knowledge of the distribution of the Cape Sable Sparrow is derived from a complete census conducted in 1982 (Fig. 9) (Kushlan and Bass, in press; Bass and Kushlan, in prep.). During this census, sparrows were located at 278 of 864 sites surveyed. The sparrow remains widely distributed over a large area of southern Florida and continues to occupy much of its historically known range (Fig. 3, and 9). At present, sparrows appear to be rare or absent from the Cape Sable and Ochopee areas. The preponderance of the Cape Sable Sparrow population occurs in the Big Cypress Swamp and in and near Taylor Slough, and includes a minimum of 6,640 birds (Kushlan and Bass, in press). Most sites are protected in Everglades National Park and the Big Cypress National Preserve. Some are in the East Everglades. All breeding sites in the East Everglades area were within the designated critical habitat for the species (Fig. 7, Appendix 1, U.S. Fish and Wildlife Service 1977). Specific locations of birds in this area are shown in Bass and Kushlan (in prep.). Figure 10 shows the essential habitat of the Cape Sable Sparrow as it exists in 1981.

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 from the Smyrna Beach area of northeastern Florida has been attributed to occupation of its salt marsh habitat by balck mangrove (Austin, 1968a), and it is possible that part of the reason for the decline of the Dusky Seaside Sparrow near the St. Johns River may have been habitat changes from invading salt bush (Baccharis), extensive fires, and alteration of hydrologic conditions (Kale, Sharp, Sykes, and Post, pers. comm.). Reduction of the Cape Sable Sparrow population on 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 marshes were impounded for mosquito control (Baker et al., 1979; Sykes, 1980; Trost and Kale, pers. comm.). In as far as sparrows require prairie, uninterrupted by trees, Werner (1975) believed the greatest threat to Cape Sable Sparrows is in the East Everglades and Taylor Slough because of the invasion of trees. Most invaders are exotics, perhaps encouraged in part by lowering water tables.

Unlike most other Seaside Sparrow populations, the Cape Sable Sparrow is adapted to life in vegetation that burns periodically. Werner (1976:35) found in his densely vegetated Taylor Slough study site that population density peaked 3 years after a fire, decreased in the fourth year, and declined to 0 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 to sustain a population. Sharp (pers. comm.) has suggested that Dusky Seaside Sparrow colonies of fewer than 10 pairs were not self-sustaining. Werner felt that the loss of sparrows in the Ochopee area was due to the population falling below minimum size. In Werner's Taylor Slough plot, litter became dense 5 years after a fire. Olmsted et al. (1980) found that on less densely vegetated muhly-dominated sites on shallow soils accumulation of dead material was slower. Such sites would be capable of supporting sparrows for longer periods between fires than more densely vegetated stands (Taylor, in press). Such sparse habitats may be important during periods when fire does not occur over large areas of dense prairie.

Sufficient information exists to provide prescriptions for management of fire. Burning should occur in the wet season between August and November. No burning should take place during nesting in the dry season between February and mid July. Fires should be ignited by spot ignition or as a backing fire and controlled to result in a mosaic of patches of burned and unburned vegetation not more than 200 ha each. Line fires, large area fires, fires out of season, or too frequent should be controlled. Dense muhly prairies of Taylor Slough should be burned on a 5 year rotation. The time between fires for sparser prairies should be longer, on the order of 8-10 years (Taylor, in press). At no time should large contiguous areas be allowed to burn in the same year. Mosaics of burned and unburned vegetation must be protected to supply suitable habitat adjacent to previously occupied sites. No more than 8-10% of the habitat should be burned in 1 year. Furthermore, maintenance of a historic water regime is also critical and fire should not be used merely as a substitute for lowered water tables.

Food and feeding

Cape Sable Sparrows appear to be mainly insectivorous during nesting (Stimson, 1968; Werner, 1975). The birds are primarily gleaners, and feed on the ground 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 small moths (Woolfenden, 1956; Sprunt, 1968). 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 by 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 species likely to be strong competitors for food. Only Red-winged blackbirds might compete with Cape Sable Sparrows.

Mortality

In Seaside Sparrows, the loss of eggs and young to predators is generally low, although great variations occur between years (Post, pers. comm.). An unknown predator emptied 1 of the 16 nests that Werner (1975) studied in Taylor Slough. Post (1974) recorded only 5 nests lost to predation (9% 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, pers. comm.). Such small losses are especially notable because they included samples of nests that were visited frequently, which probably increased the predation rate over that occurring naturally. A dissenting opinion was that of Nicholson (in Austin 1968a) who believed that predators destroyed at least 25% 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. Sharp (pers. comm.) proposed that rodents and snakes may play a more significant role in artificially dried marsh. 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 morta lity 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 1 record of a Cape Sable Sparrow in a Short-tailed Hawk (Buteo brachyurus) nest (Ogden, 1972). 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%. In a comparable set of data for a population subject to nest loss from flooding, Post (1974) found overall nesting success of about 50% (235 of 477), and nest success can vary dramatically in different areas in Long Island (Greenlaw, pers. comm.). The known survival rate of marked adult male Cape Sable Sparrows from 1974 to 1975 was 88%, and survival over the 1975 nesting season was 93% (Werner, 1975). Thus the approximate annual rate of survival of adult males was about 90%, 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% of adult males in a Long Island population of Seaside Sparrows (Post, 1974), and the difference perhaps indicates losses during 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% 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 50-75%, this population has the ability to maintain itself or expand.

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 its extensive occupancy of inland marshes. As such, it is worthy of conservation efforts.

The sparrow was probably never abundant but was, apparently, and remains, 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 reappeared after having been lost from surveys. Birds near Ochopee are few, probably 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 the East Everglades, by habitat alteration and by the 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. As evidenced particularly in 1981, extensive fires over land that is then deeply flooded can severely inhibit recovery of vegetation. A primary positive effect of fire is to render the character of the marsh suitable for nesting after vegetation recovery. A second positive effect may be to reduce invasion of grassland habitat by bushes and trees, which are not tolerated by sparrows. This invasion is probably permitted by shortened hydroperiods, except for melaleuca, a species resistant to and benefited by fires and capable of surviving in standing water. Maintenance of water levels is also important to sparrows because periods of inundation are required to perpetuate the marshes on which they depend. High water level at the wrong time of year, a possibility because of the manipulative capabilities of the water management system can reduce the duration of the nesting season. Loss of vegetation to development or alteration of soil characteristics by rockplowing destroys sparrow habitat. Such impacts are possible outside Everglades National Park in 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. A natural fire regime resulting in a burn mosaic is compatible with protecting sparrow habitat. Definite prescriptions for dense marsh habitats are available as are more tentative guidelines for sparse prairies. 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 plant species like melaleuca, initial emphasis should be placed upon stopping encroachment at the front of invasion. Native prairie vegetation cannot become reestablished on land converted to farmland, with or without rockplowing; thus, no such alteration of soil should occur on land occupied by sparrows. Hydroperiods should be maintained that perpetuate current marsh habitat types, especially in the Big Cypress Swamp and in Taylor Slough. This also applies to the Ochopee population.

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 throughout all or a significant portion of its historic maximum range. Its status is that of a race likely to become in danger of extinction if the current range contracts markedly. Thus, it is possible that the listing status of this race as endangered should be re-examined in light of current information. It remains an isolated population facing several identifiable potential threats. The rapid decline of the Dusky Seaside Sparrow lends further cause for concern for this subspecies. Vigilance and some management action are desirable to maintain the current status of the Cape Sable Sparrow.

PART II - RECOVERY

OBJECTIVES

The objectives of this plan are to determine and maintain the present distribution and abundance of the Cape Sable Sparrow, and to prevent it from becoming in danger of extinction.

RECOVERY OUTLINE

1. Determine present distribution and abundance through field surveys.

    11. Conduct distribution survey.
    12. Develop methods of determining abundance and productivity and estimate population abundance.

2. Maintain present distribution and abundance, where possible.

    21. Maintain Ochopee population

        211. Determine cause of decline of population.
        212. Institute management required to maintain a population.

    22. Maintain southern Big Cypress population

        221. Determine effects of fire and water management programs.
        222. Institute programs that do not negatively affect sparrows.
        223. Evaluate establishment of essential habitats.

    23. Maintain Taylor Slough population.

        231. Maintain population in park.

            2311. Determine effects of pump station in Taylor Slough and institute any required revisions to provide more natural water conditions.
            2312. Perfect fire schedule in sparse prairies.
            2313. Determine fire effects and institute any required changes in fire management program.

        232. Evaluate and institute management in East Everglades.

            2321. Re-evaluate extent of essential habitat.
            2322. Evaluate management options, including zoning, fire, purchase and hydrology, and institute measures to protect essential habitat.

    24. Monitor habitat on Cape Sable for recolonization.

3. Conduct biological studies.

    31. Determine causes of patchy distribution.
    32. Better define habitat requirements.
    33. Determine individual patterns of habitat use.
    34. Evaluate genetic isolation and taxonomy.
    35. Determine movements and colonizing ability.

RECOVERY RECOMMENDATIONS

Because the race is not immediately in danger of extinction, the objective of the plan is to determine and then maintain the present distribution and the present abundance of the birds. In this way, managers can avoid having the sparrow become in danger of extinction.

A complete survey of the distribution of the Cape Sable Sparrow is needed to document current status. This work will be completed in 1982 (Bass and Kushlan, in prep.), and the results have been included in this report.

Determining the abundance of the bird is also needed. A minimum estimate of the number of singing males can be obtained using a helicopter survey. Thereafter, a more exact estimate should be developed. A promising technique is to determine population density in various habitats with respect to time since last fire. A population estimate might then be derived by monitoring fire history of each habitat. Alternatively, a more intensive breeding bird census program could be instituted. It is also important to determine productivity of young each year. Mist net sampling during the summer might be a useful technique.

The Ochopee population, occurring within Everglades National Park, is marginal and represents a minor proportion of available habitat. Because changes in the habitat seem to be man-caused, management actions may reverse habitat degradation and return it to more natural conditions. To do this, it is first necessary to determine specifically, the causes of population decline with respect to fires, human access, and hydrology. It is then necessary to institute actions required.

The sparrow population of the southern Big Cypress Swamp includes about half of the known birds. Critical factors affecting sparrow habitat in this area are fire and water conditions. Both of these factors are aspects of management programs in Everglades National Park and the Big Cypress National Preserve. The effects of ongoing and proposed programs on sparrows need to be evaluated and non-damaging programs instituted if necessary. Establishing essential habitat in this area should be evaluated.

The Taylor Slough population also accounts for half of the known population. Sparrows are widespread in Taylor Slough, within Everglades National Park. The major factors affecting birds in the park are fire and water conditions. To maintain populations in the park, the effects of water management and fire management programs should be evaluated. The effects of operation of the pump station and adjacent canals should be evaluated and changed if necessary. The effects of the fire program should also be evaluated, specifically the effects of large area burns, including boundary burning. To the greatest extent possible, fire prescription in sparse prairies needs to be perfected. Overall, restoration of a natural fire regime resulting in a mosaic of burned and unburned patches will best protect sparrow habitat.

Cape Sable Sparrows are in their greatest jeopardy in the East Everglades, the only area not under Federal land management. The distribution of birds in this area has contracted because of habitat changes caused by invasion of trees, rockplowing, and lowered water tables. Because of these irreversible changes, the extent of essential habitat needs to be re-evaluated, as suggested in this plan. Within this essential habitat, management options including the use of fire and removal of exotics must be evaluated and instituted if this population segment is to survive. Evaluation of the need to zone or purchase essential habitat is required, as is assignment of agency responsibilities.

As far as surveys can detect, the sparrow no longer occurs on Cape Sable. Events leading to its reduction in numbers were natural, and restorative management action is not possible or called for. Suitable habitat should be monitored for recolonization by natural means.

To properly manage habitat and to account for the effects of management action and natural events, it is necessary to conduct studies to obtain basic biological information on the Cape Sable Sparrow. Overall, the goals of such studies are to understand limiting factors and the extent that habitat characteristics limit expansion of the population. Needed research includes the following:

a. Determine the underlying biological causes of patchy distribution of nesting birds, with emphasis on relative effects of social and ecological factors, especially vegetation characteristics of occupied versus unoccupied habitat.

b. Better define habitat requirements by determining habitat correlates of abundance, adult survival, nest placement, predation, and reproductive success. It is important to determine roles of water regime and hydroperiod, physical structure of the grass community, the specific effect of brush and tree invasion, and other, probably subtle, habitat features required by the sparrows.

c. Determine individual patterns of habitat use, time budgets, movements, foraging tactics, nesting, foraging activity areas, and year-to-year changes in territory use.

d. Evaluate the nature of genetic isolation and revise taxonomy of Seaside Sparrow populations to determine the need and priority for protecting this race.

e. Determine movement patterns of adults outside the nesting season and the dispersal and mortality of fledglings to provide information on the mechanisms of colonization.

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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, T58S 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.

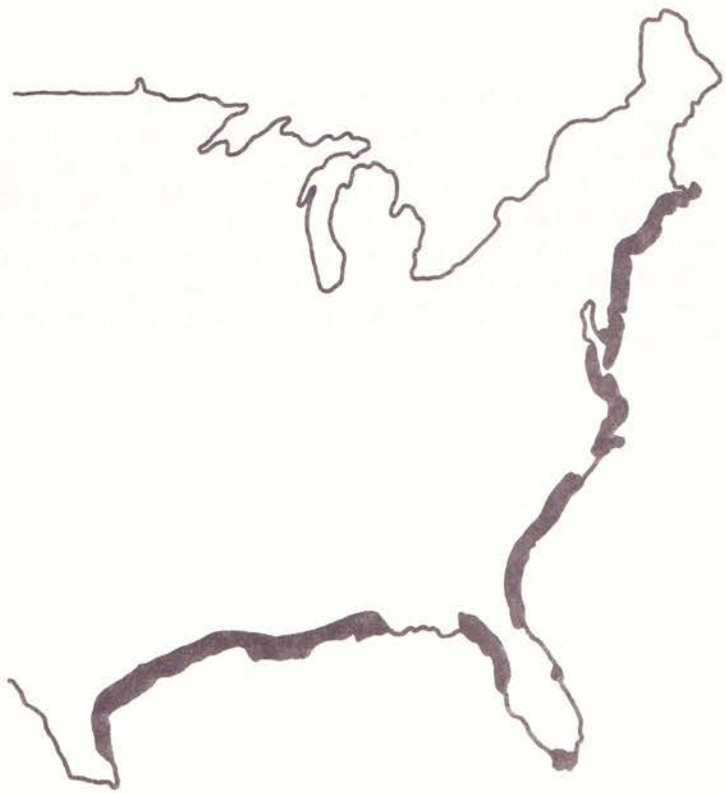

Figure 1. Range of the Seaside Sparrow (from Robbins et al., 1966; and Kale, pers. comm.).

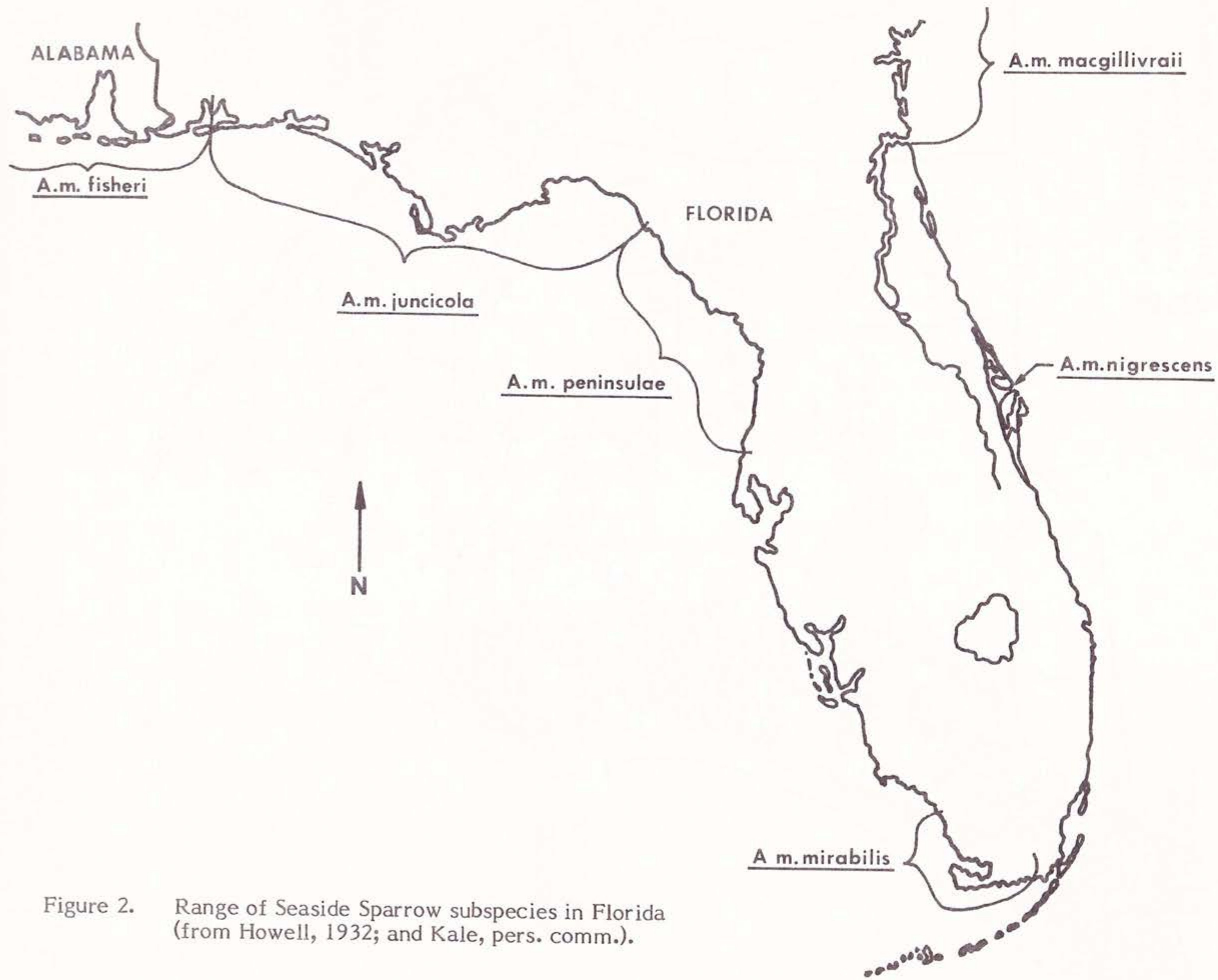

Figure 2. Range of Seaside Sparrow subspecies in Florida (from Howell, 1932; and Kale, pers. comm.).

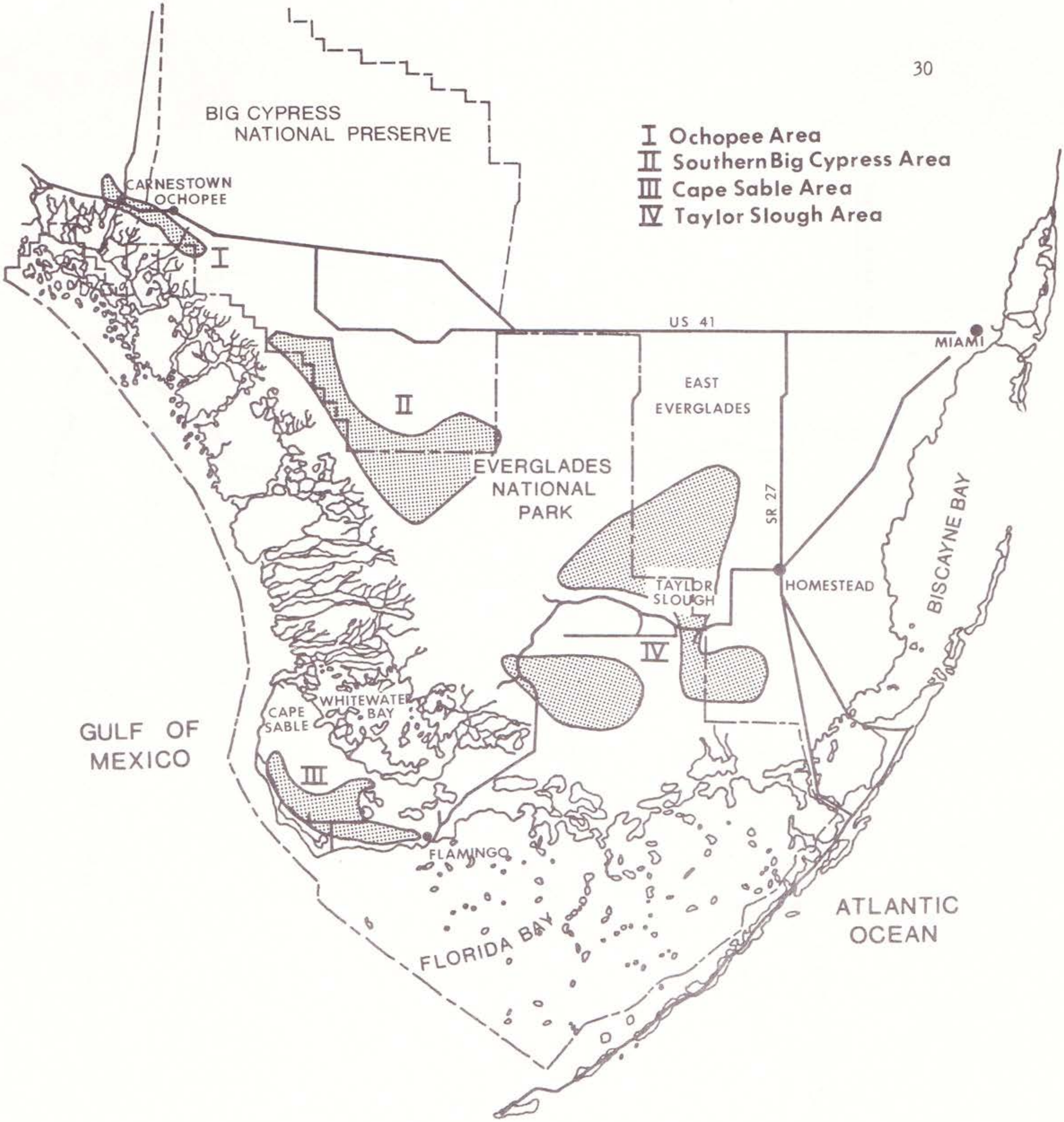

Figure 3. Maximum documented historic range of the Cape Sable Sparrow.

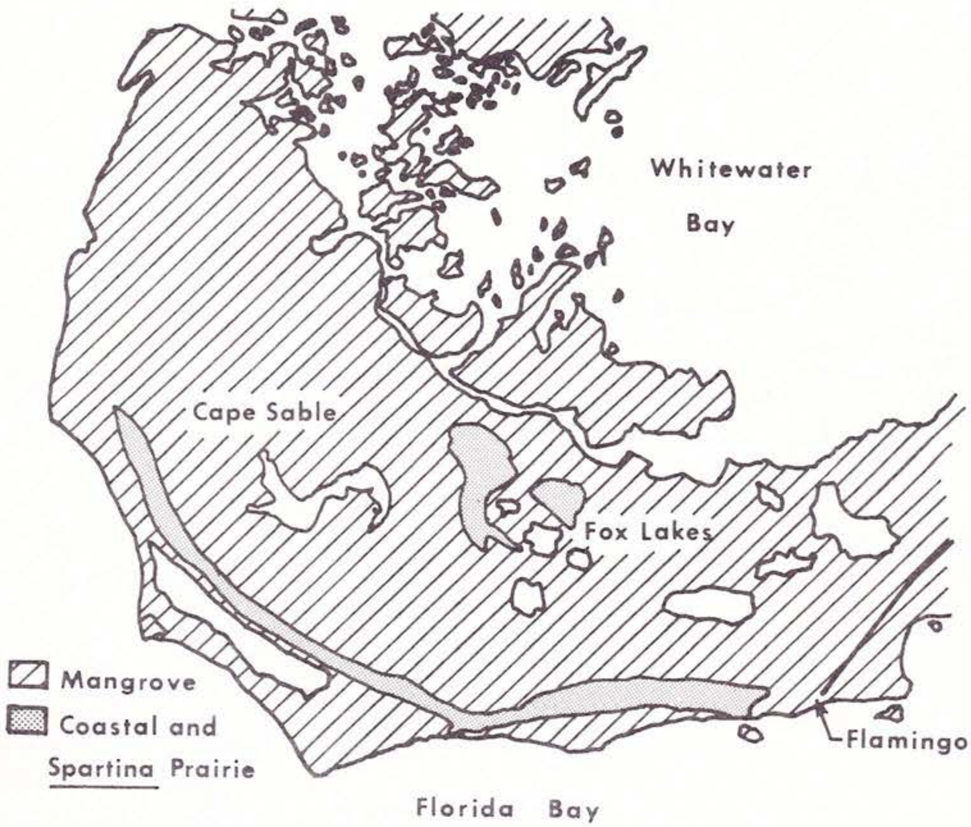

Figure 4. Vegetation of Cape Sable.

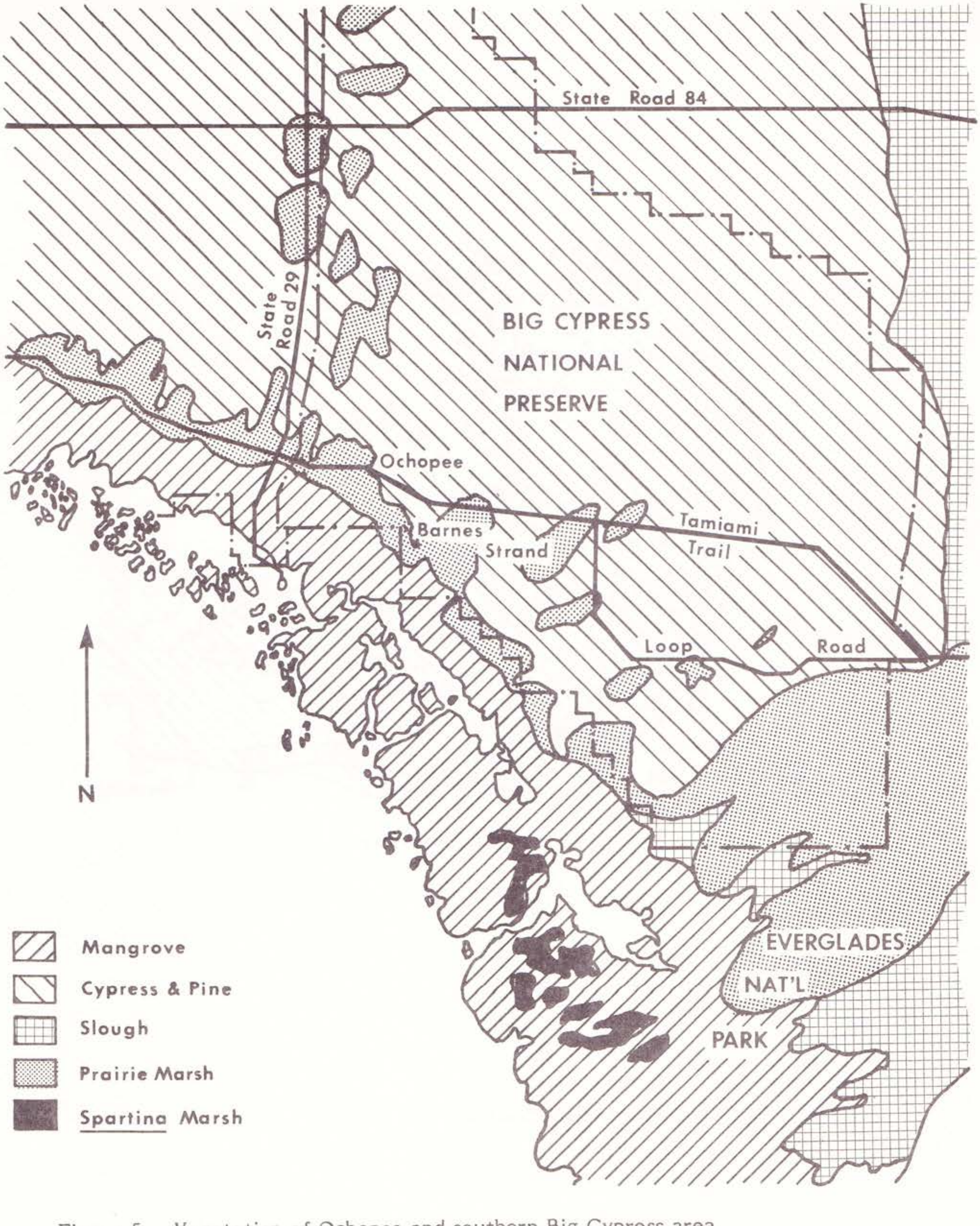

Figure 5. Vegetation of Ochopee and southern Big Cypress area

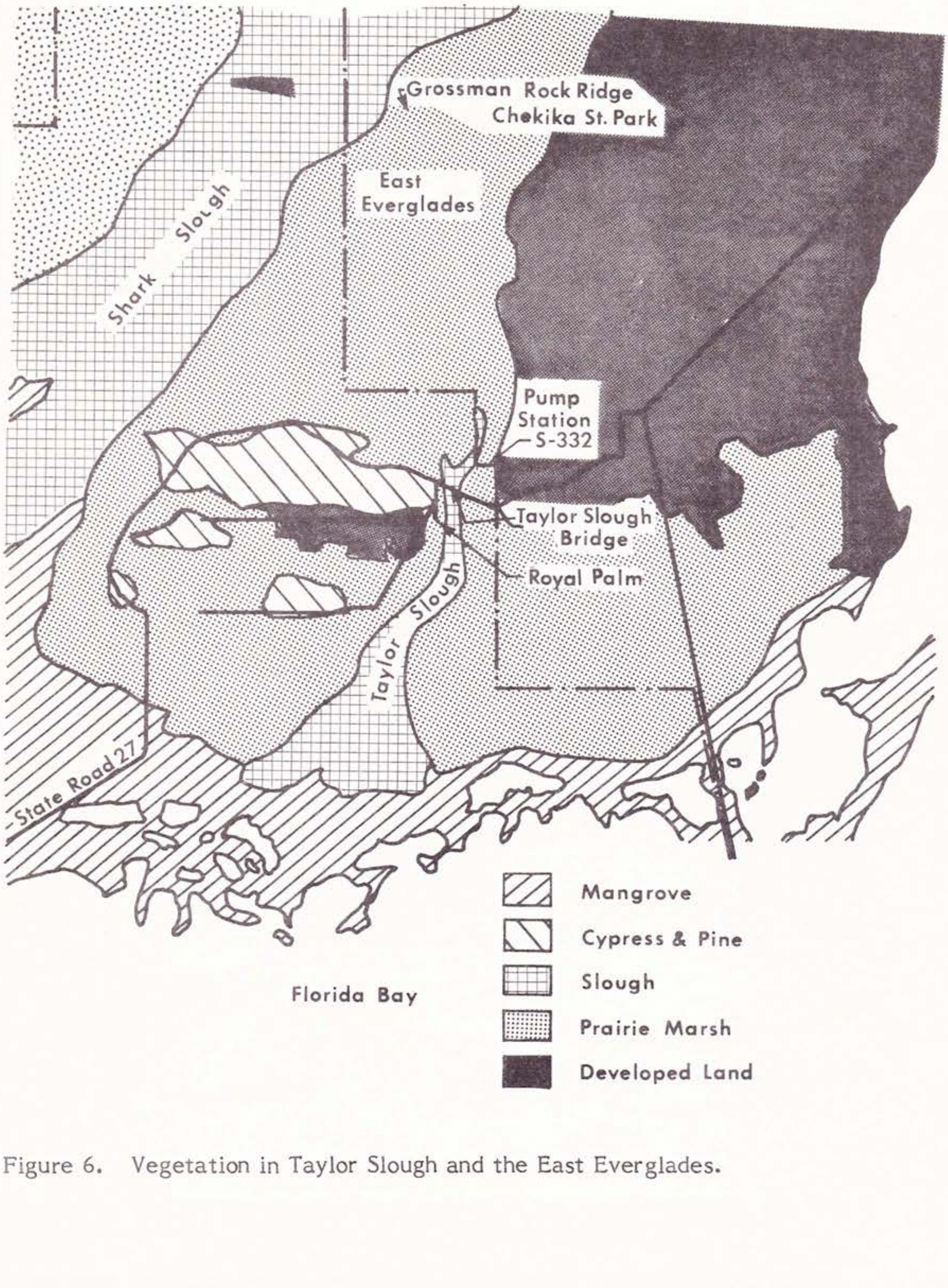

Figure 6. Vegetation in Taylor Slough and the East Everglades.

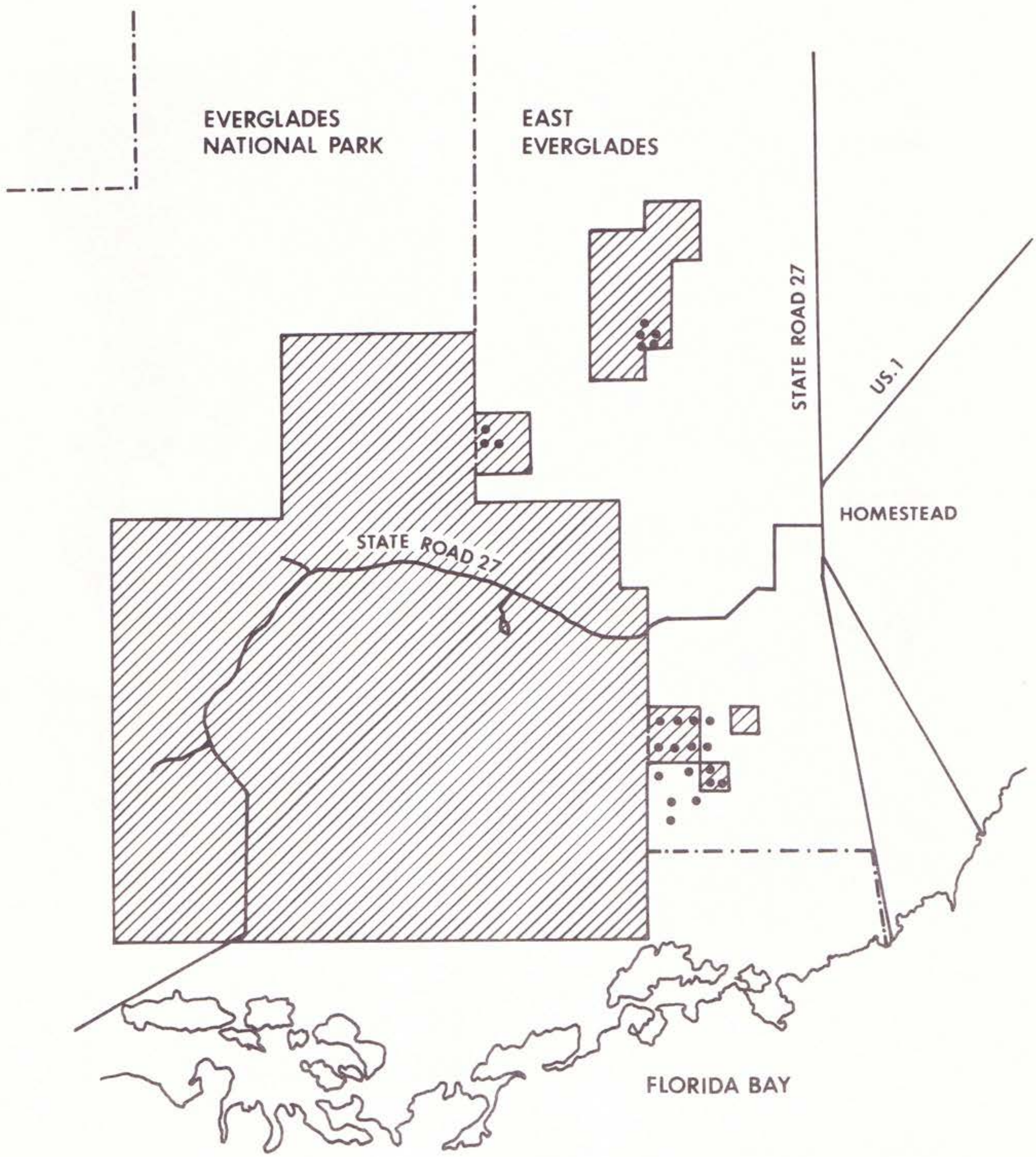

Figure 7. Designated critical habitat of the Cape Sable Sparrow showing locations of birds censused in 1981

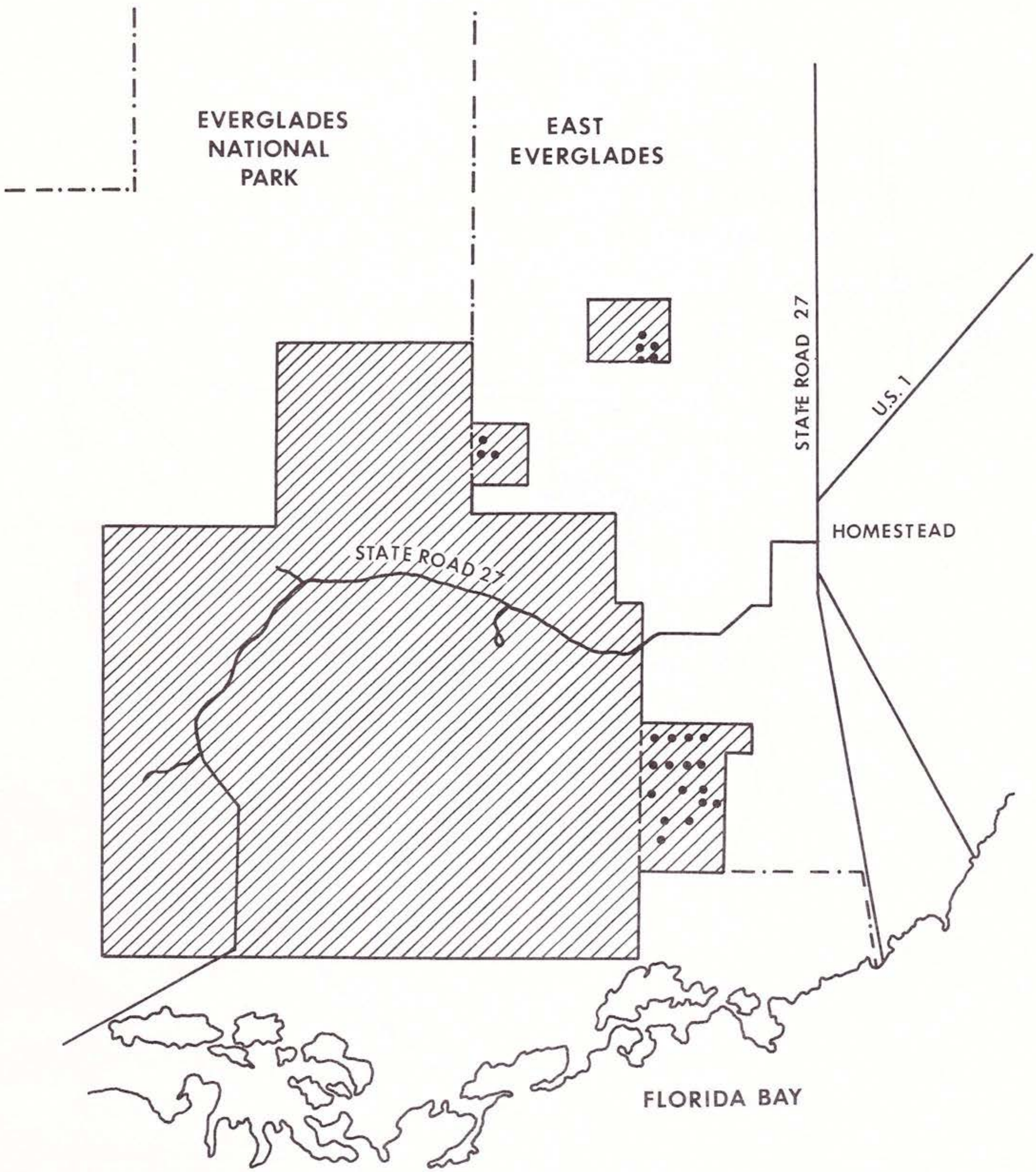

Figure 8. Proposed essential habitat of the Cape Sable Sparrow in Taylor Slough and the East Everglades, showing locations of birds censused in 1981.

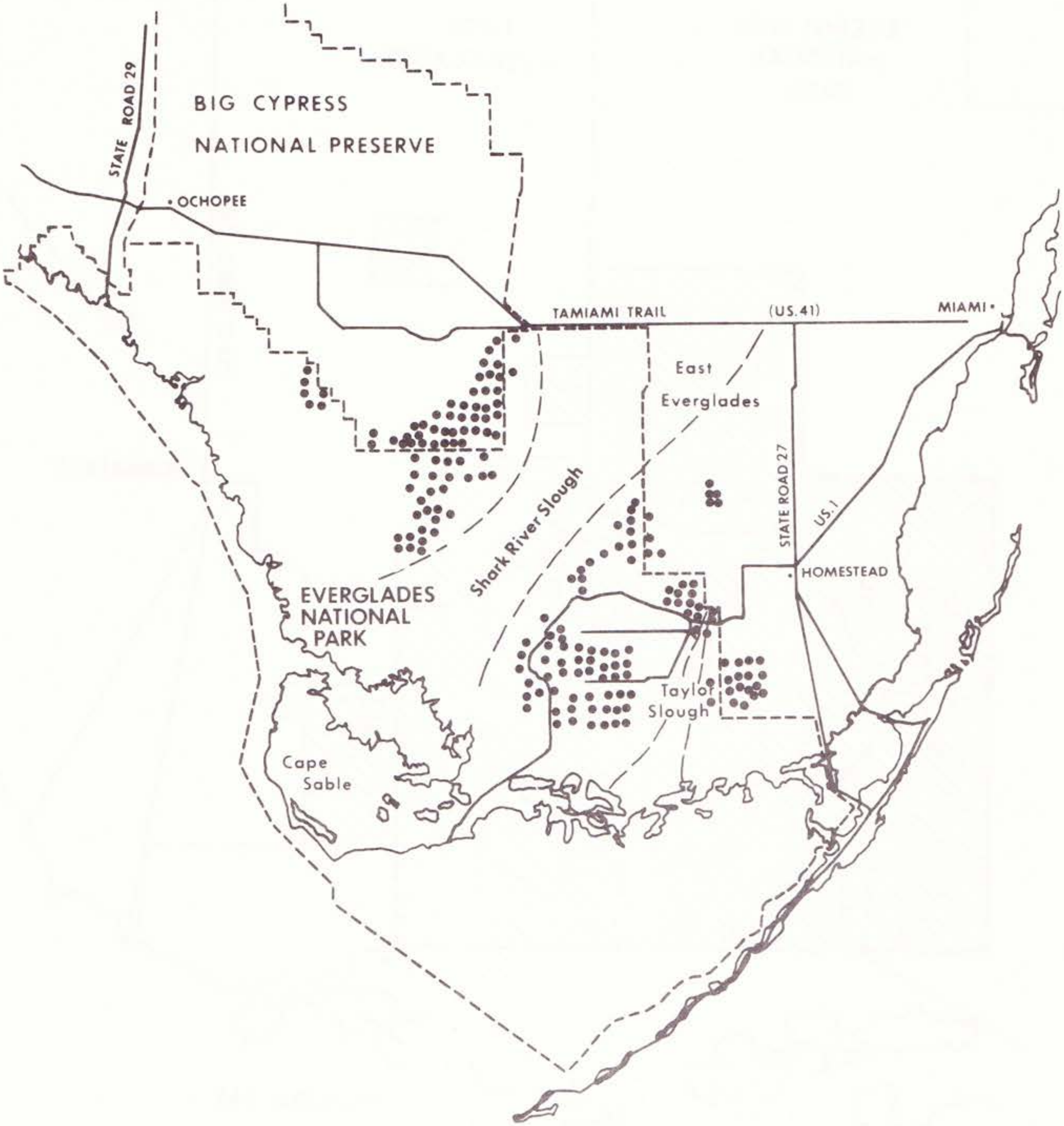

Figure 9. Distribution of the Cape Sable Seaside Sparrow. Solid dots indicate where birds were surveyed in 1981.

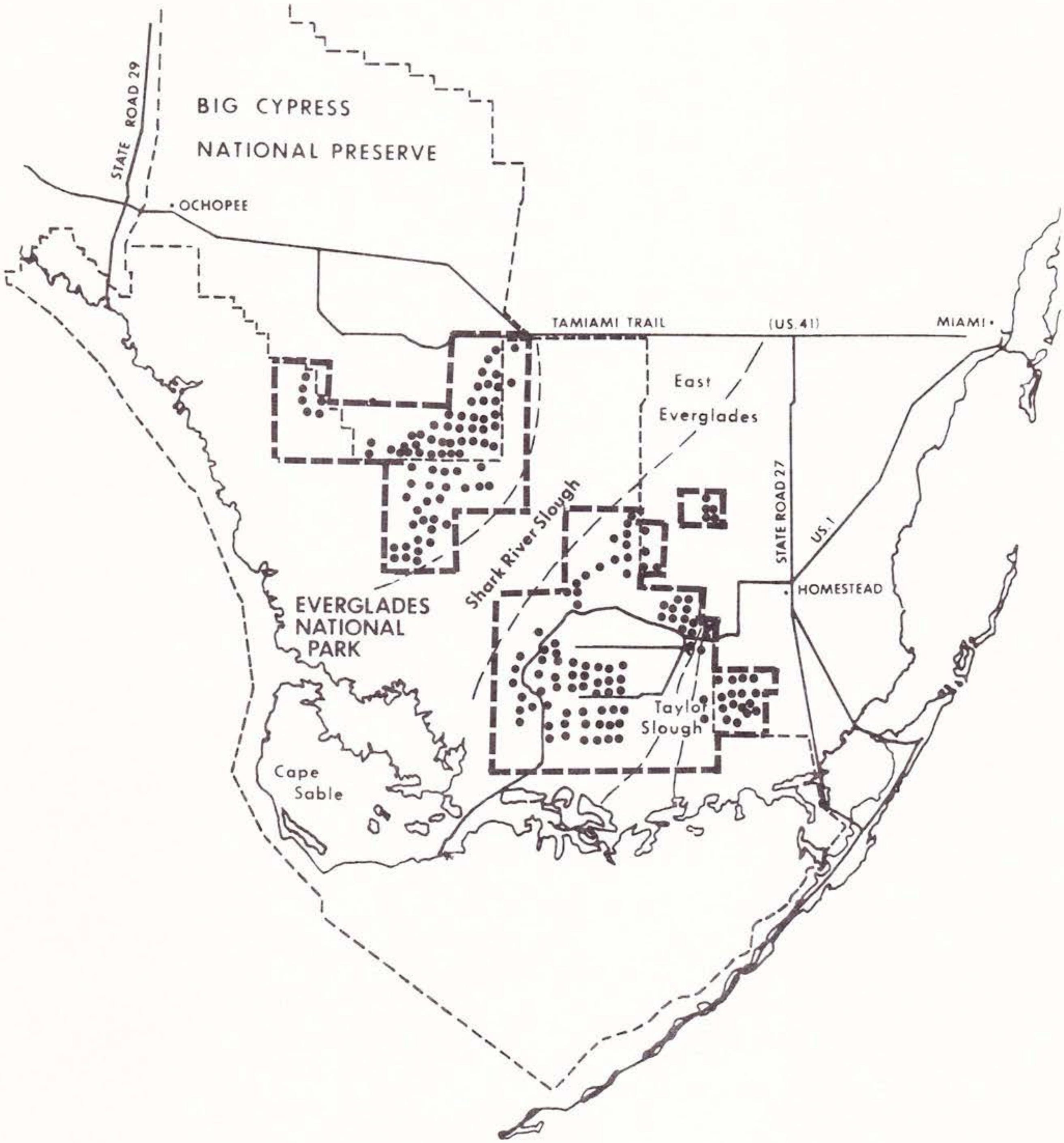

Figure 10. Essential habitat of the Cape Sable Sparrow as of 1981.