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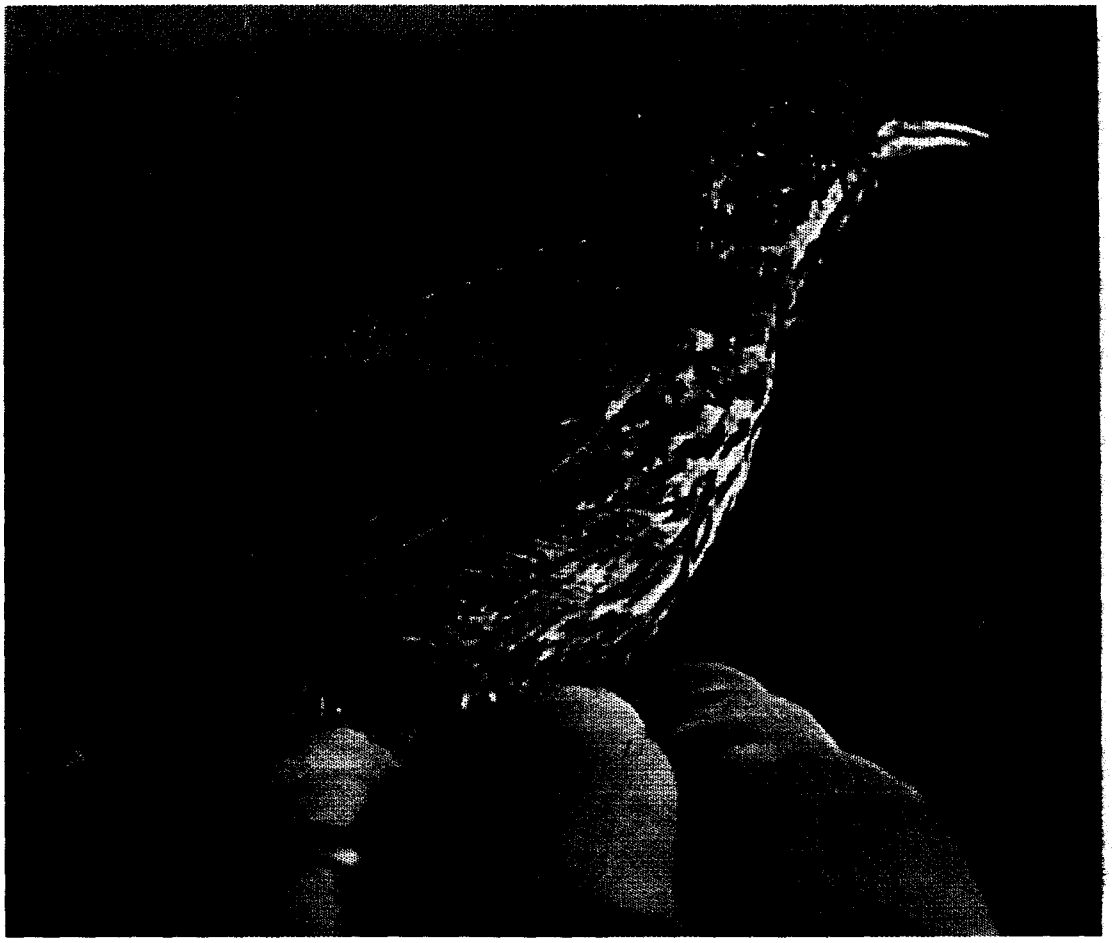
Cape Sable Seaside Sparrow

Annual Report 1994



ANNUAL REPORT

1994

Long Term Assessment of the Effects of a Modified Water Delivery Schedule for the C-111 Basin on the Cape Sable Seaside Sparrow

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ABSTRACT

The 1994 Cape Sable Seaside Sparrow breeding season constituted the second year of this five year study. We collected field data from 3 April to 30 May 1994. Data collected included: 1) marking of territories of singing males; 2) establishment of three new permanent study sites; 3) color banding of 20 birds; 4) observations on two active nests; 5) partial completion of the annual extensive survey; and 6) initial analyses of the effects of fire on sparrow distribution and numbers. We present the results of our field activities as well as detailed descriptions of our techniques and proposed adjustments to our 1995 field season.

ACKNOWLEDGMENTS

This project is funded by the National Park Service with assistance provided by the U. S. Fish and Wildlife Service with supplemental funding from the Pew Scholars Program. We gratefully acknowledge the staff of Everglades National Park for their permission to conduct our field research and for their help in providing us with everything from housing and vehicles to staples and paper clips. We are especially indebted to Marty Fleming of the National Biological Survey and Sonny Bass of the National Park Service for administration and data collection, respectively. We also owe Gordon Anderson (NBS) a special thanks for allowing us use of the GPS equipment (and for correcting our mistakes afterward). A special thanks also goes to Bob Doren, Troy Mullins, and Jan Pasik for providing the fire data that made our analysis possible, and for their keen interest in our project.

INTRODUCTION

Proposed changes to the artificial water delivery schedule for Everglades National Park may effect the quantity and distribution of Cape Sable Sparrow habitat. This sparrow, a federally listed endangered species, inhabits fresh to slightly brackish interior marshes, with highest densities found in *Muhlenbergia* prairie. Areas with more or less continuous hydroperiod, usually dominated by sawgrass (*Cladium jamaicensis*), are either avoided or support only low sparrow densities. In our first report (Curnutt and Pimm. 1993. *Status and Ecology of the Cape Sable Seaside Sparrow*, Report to the NPS), we recognized six sub-populations of sparrows that are more or less isolated from each other by physiographic barriers (*i.e.*, unsuitable habitat) (fig. 1). Two of these, areas A and B, contained over 80% of sparrows recorded in 1992 and 1993—we considered these to be "core" population areas, with the remaining four areas considered "peripheral".

The general relationship of hydrologic conditions and associated dominant vegetation and sparrow density, first discussed by Harold Werner, serves as the basis for understanding how the sparrow will respond to altered hydrologic conditions. However, more precise knowledge of the sparrow's life history and distribution are needed to develop an accurate predictive model. The primary goal of this project is to develop such a model and apply it to simulated hydrologic scenarios, thereby allowing for informed management decisions.

The objectives of this project are to: 1) obtain estimates of Cape Sable Sparrow numbers and distribution throughout its range each breeding season; 2) collect data on habitat variables known to be important in Cape Sable Sparrow distribution and correlate them with results of sparrow distribution; and 3) collect base-line demographic data (breeding density, nesting success, survival, movement) on sub-populations.

One of our key objectives of the second year of this project was to continue collecting data on the distribution and numbers of sparrows to determine

the direct effects of Hurricane Andrew on the population. We also planned to begin collecting demographic data by initiating a banding project.

To accomplish the objectives of the second year, we intended to collect data at the height of the 1994 breeding season (April through June) and compare it to comparable data collected in 1993. The extensive survey of all potential habitat (to be conducted by NPS staff) was to be repeated exactly as in 1993. The intensive field component was to include setting up five permanent sites (ca. 50 ha each) in addition to the five established in 1993. These sites were to be monitored repeatedly to determine sparrow breeding territories. Providing all applicable permits were procured, sparrows were to be captured and banded with USFWS and color bands. We also intended to describe habitat at each study site and locate and monitor nests to determine reproductive effort (number of eggs per clutch and number of clutches) and reproductive success (survival of nestlings and number fledged). Analysis was to include determination of changes in distribution and abundance of sparrows.

DATA

Study Sites

In 1993, we established five permanent study sites distributed throughout the sparrow's range. At those sites, and at additional sites to be established each year, we mark birds and territories, make measurements of important habitat variables, and observe sparrow territorial and feeding behavior. We established three new permanent study sites in 1994 for a total of eight sites established so far (fig. 2). In the following list of sites, new study sites are preceded by an asterisk (*):

Taylor Slough: This site is 1100 m by 600 m (66 ha) and roughly overlays the site that Harold Werner established in 1974. It runs along the east side of Taylor Slough and is bisected by the Main Park Road. The vegetation is a mix of sawgrass and *Muhlenbergia* and consists of large areas of "pinnacle rock" (exposed limestone) with infrequent

patches of well developed soil. Being at the edge of the slough (and downstream from a floodgate) this site can become inundated early in the wet season by rain or by the opening of the floodgate. In both 1993 and 1994 this site was covered with surface water before the end of our field season (May 30).

Aerojet: This site is 600 m by 600 m (36 ha) and is located half way between the two sets of buildings on the former Aerojet Corporation property (now jointly managed by the South Florida Water Management District and the Florida Game and Freshwater Fish Commission). The area is predominantly long-hydroperiod and dominated by sawgrass, there are, however, small dryer patches dominated by *Muhlenbergia*. This site is located in one such patch, which accounts for its small size.

Sweetbay: This site is 600 m by 800 m (48 ha) and is located ca 400 m southeast of Sweetbay Pond, south of the remnants of Old Ingraham Highway. The site is dominated by sparse to moderate *Muhlenbergia*, but ridges left from past agricultural activity provide habitat for a wide range of other herbaceous species. This site usually remains dry throughout the field season.

East Slough: Actually located on the west side of Shark Slough, this site gets its name from a small nearby slough that drains west into the Gulf of Mexico. This site is 800 m by 800 m (64 ha) and is about 40% sawgrass and 60% mixed prairie. There are substantial patches of *Muhlenbergia*. This site was completely inundated throughout the 1993 field season but remained dry through most of the 1994 season.

Old Ingraham Highway-North (OIHN): This site is 600 m by 800 m (48 ha) and is located less than 100 m north of the west end of the Old Ingraham highway. The site is mixed-prairie habitat dominated by *Muhlenbergia* and remains dry throughout the field season. In 1993 and 1994, grass cover was moderate with patches of higher stem density.

*Old Ingraham Highway-South (OIHS): This site is 600 m by 800 m (48 ha) and is located south of the end of Old Ingraham Highway. The northeast corner of this site is *ca.* 500 m south of the Old Ingraham Highway-North (OIHN) site established in 1993. It is a mixed-prairie habitat dominated by *Muhlenbergia*. Like OIHN there was

no surface water on this site throughout the field season. However, the grass cover at this site is, on the whole, much more dense.

*Dogleg: This site, located between the Main Park Road and the remnants of the Old Ingraham Highway, is approximately 20 ha. The juxtaposition of roads and pinelands to the north account for this sites small area and unusual shape. The vegetation is dominated by *Muhlenbergia* but cover is sparse in many areas due to thin soil and apparently recent fire activity.

*Finger Glade: Is 800 m by 600 m (48 ha). It is located in a large finger glade west of the Hole-in-the-Donut and north of the (unpaved) Long Pine Key Road. The vegetation is dominated by *Muhlenbergia* and *Spartina*. Cover is very dense throughout the site indicating a lack of fire in recent years. Remnant of furrows in the site indicate that much of it had been farmed sometime in the past.

All three new sites are located within the core sub-population east of Shark Slough. While one objective of this study is to collect and compare data from each sub-population, logistical difficulties limited our access to those areas we could reach by car (see **Discussion**).

Marking Of Territories

We marked the territories of singing male Cape Sable Sparrows using the same method we used in 1993. On observing a singing bird we marked its perch with colored flagging tape. By advancing on the bird and marking each subsequent perch, we could establish the perimeter of its territory. In most cases the accuracy of the territory estimates were born out by subsequent observations of territorial disputes between neighboring birds. Occasionally adjustments were made to territories based on observed movements of suspected resident birds. Ideally territories would be estimated by observing marked birds. However, we received proper authorization to capture and mark sparrows late in the field season (9 May) and so, we conducted most territory marking prior to marking.

We spent the final days of the field season recording marked territories with a Trimble Pathfinder Basic Plus® geographical positioning system.

(GPS). The system was used in WPT (Waypoint) mode with RVR set to *No Interval.* We traced each territory by continuously recording our position while walking its perimeter. One position of each territory was recorded twice to aid later identification of data sets in each RVR file. Unfortunately the GPS system was cleared of its RVR files accidentally, leaving only uncorrected waypoints. However, we were able to recover and adjust the waypoints with the help of Gordon Anderson of the National Biological Survey.

Figure 3 shows the territories we marked during the 1993 and 1994 field seasons. In 1993 we marked 18 territories in three sites and in 1994 we marked 25 territories in four sites. Three of our eight sites had no sparrows in either year. In the absence of identifiable individual birds the territories we marked are of limited use for analyses. However, a rough approximation of the minimum extent of territories and the variation that exists in territory size among and between study sites is presented in table 1. The largest territory we marked was a sprawling 38 ha at the OIHS site. The smallest territories were less than three ha (one each at Sweetbay and East slough).

For comparison, we show our Taylor Slough study site and the site that Harold Werner established in 1974 (fig. 3a). By observing marked birds, Werner detected 15 territories of singing male sparrows in his study site—nine of which lay within the boundaries of our site. Since we haven't detected any sparrows at or near our site during the two field seasons of this project we cannot make direct comparisons between our territory size estimates and Werner's. Be that as it may, Werner reported average territory sizes in Taylor Slough of about 2 ha while our average territory size, calculated over all sites, is 2.43 ha. The similarity of these territory estimates is reassuring, and, beginning in 1995, we will be able to observe individually marked birds to make more accurate measures of territory size. We can then discover whether this discrepancy is actual or an artifact of our method.

Table 1. Mean area and standard errors (SE) of Cape Sable Seaside Sparrow territories marked on study sites during the 1993 and 1994 field seasons. Only those sites and years in which sparrows were present are listed. Territory marking methods are described in the text.

Study Site	Year	N	Mean Area	S.E.
Dogleg	1994	3	4.46	2.80
East Slough	1993	3	1.2	0.20
OIHN	1993	7	1.87	0.36
	1994	6	1.33	0.06
OIHS	1994	9	3.02	0.05
Sweetbay	1993	8	1.96	0.35
	1994	7	3.17	0.66
Taylor Slough	1993	0		
	1994	0		
Finger Glade	1994	0		
Aerojet	1993	0		
	1994	0		

Capture And Marking Sparrows

We received authorization to capture and band Cape Sable Sparrows on 9 May, 1994 and we began capturing birds the next day. Our technique involved setting two 40 ft mist nets (each attended by 2 people), targeting 2 separate birds. The bander (Pimm) would range between the nets and process birds as soon as they were captured. Nets were set opportunistically (i.e., on seeing or hearing a bird) or in or near a marked territory and baited with our own recordings of singing Cape Sable Sparrows.

We recorded sparrow songs, warning 'ticks' and calls using a directional microphone connected to a Panasonic® RQ-a170 cassette tape recorder with internal speaker. We then attempted to edit and amplify the song using a Sony Walkman® (cassette to cassette). We found that recording

was best done on calm days not further than 20 meters from a singing male. Each tape we made consisted of songs from various singing males to increase the chance that the targeted bird will be exposed to the song of a "stranger".

We placed nets just inside the edge of a territory with the playback device directly underneath the center of the net, speaker facing toward the center of the territory. Normally birds would approach within 20 m of the net and perch high on a grass stalk. Within a few minutes the bird would approach the net either by flying directly at it, or by hopping along the ground. Once effective recordings and net positioning were identified (as described above) three of every four net sets were successful in trapping a sparrow.

We captured and marked 20 Cape Sable Sparrows in eight mornings (table 2). Two of the sparrows were nestlings banded at 10 days after hatching (see *Nest Observations*) the rest appeared to be adults (worn plumage). We captured birds at four of the five sites where birds were observed. The East Slough site had at least 2 singing males on 29 April but we didn't observe any when we returned with our capture equipment on 13 May. There was no injury or mortality of captured birds nor were any species other than Cape Sable Sparrows captured.

While we were very successful at capturing sparrows we feel that the ratio of captures to net hours could increase significantly if we had higher quality recordings. The quality of our recordings was limited by the type of equipment we used. We feel that excessive background noise, variable volume and the limited range of frequencies that we were able to record frequently led to wariness or disinterest of target birds. Better recording and playback equipment and computer software to digitize and manipulate recordings will improve or capture rate (see **Budget**).

Nest Observations

We found 2 active nests in 2 separate study sites during the 1994 field season. The first was discovered on 7 April at the OIHN study site. It was built in a 0.5 m tall clump of *Muhlenbergia* growing at the edge of a *ca* 0.75 m diameter solution hole that was dominated by sawgrass (*Cladium jamaicense*). Nest measurements were: outside diameter 11 cm; inside diameter 7 cm; depth of inside cup 5 cm. The bottom of the nest was 10 cm above the surrounding prairie (> 10 cm above the bottom of the solution hole). The nest had three eggs and one sparrow was flushed from it at the time it was discovered. The nest was revisited on 10 April when there were three chicks which apparently hatched that day. On 14 April the nest was found empty and the characteristic "hood" of grass that was built over the nest was disturbed—possibly indicating predation of the young. We searched this area frequently after the nest failure and found no evidence of further nesting activity.

The second nest was discovered with three eggs in it on 23 April at the Sweetbay study site. It was revisited on 27 April and still had three eggs and on 30 April when 2 chicks and one egg were found. We returned to the nest on 10 May when the chicks were 10 days old to band them. We successfully captured 2 of the chicks by hand and attached bands, the third chick escaped into the grass. To avoid drawing predators to the nest we did not take time to measure it. It was similar in size and shape to the nest described above and was built in a *ca.* 0.8 m tall *Muhlenberia* clump.

Annual Extensive Survey

<u>1994 Survey</u>

The extensive Cape Sable Sparrow survey, in which all potential habitat is sampled at 1 km intervals, was first conducted in 1981. The survey was repeated in 1992 and, as part of this five year study, in 1993. It is to be conducted each year for the duration of this study with the purpose of discovering large scale temporal and spatial dynamics of the entire population. Unfortunately, mechanical and logistical problems prevented the 1994 survey from being completely successful. The survey was started on 18 April and was ended on 31 May. Of the 689 total sites, 225 were

sampled. Most of the sites (131) within the core population area east of Shark Slough were sampled as well as about a quarter (94) of the sites within the core west of Shark Slough (table 3).

Table 3. The estimated number of Cape Sable Sparrows in each area for each season. Sparrow numbers are estimated by multiplying the actual number of birds observed by the Bass and Kushlan correction factor (≈ 16).

Area	1981	1992	1993	% of sites surveyed in 1994	1994	No. birds in 1993 at sites surveyed in 1994
A	2,688	2,608	427	23%	77	77
B	2,352	3,136	2,434	74%	2,123	2,375
C	432	48	0	0%	No Data	—
D	400	112	95	0%	No Data	—
E	672	592	316	12%	108	170
F	112	0	0	0%	No Data	—
Total	6,656	6,496	3,272	33%	2,308	2,622

The only area that was sampled sufficiently in 1994—Area B, the core population east of Shark Slough—held numbers of sparrows consistent with earlier results. Area A, the core population west of Shark Slough was not sampled enough (23% of sites) or early enough in the season to draw any strong inferences. This was the area that exhibited the largest decline in sparrow numbers from 1992 to 1993. We regret that this important aspect of the project was not fulfilled and we are taking steps to insure successful completion of the entire survey in 1995.

Comparing Survey Results

With each additional year of data collection we are better able to investigate large-scale population dynamics of the Cape Sable Sparrow.

Figures 4 through 7 show the abundance of sparrows across their entire range for 1981 and 1992 through 1994, respectively. The most striking feature of this series of maps is the near disappearance of sparrows from west of Shark Slough and the loss of isolated groups of birds east of the slough (figs. 8 and 9). Even disregarding the 1994 data (fig. 7) as incomplete, comparing 1981 to 1993 (figs. 4 and 6, respectively) shows a constriction of the distribution of sparrows to basically one small area (Area B).

significant difference in when surveys were done?

In 1993, we estimated the entire population of sparrows to be 3,347 individuals, a decline of nearly 50% from 1992. Nearly all of this decline occurred on the west side of Shark Slough and we attributed it to either the direct effects of Hurricane Andrew (mortality) or extensive surface water in that area (low detection of birds that were present). Coverage of the west side of Shark Slough during the 1994 survey was insufficient to conclusively determine which mechanism was at work in 1993. However, we can compare the 94 (23%) sites that were sampled in 1994 with the same sites in 1992 and 1993. In 1992 we detected 41 sparrows spread over the slightly more than 20,000 ha that the 94 sites encompass. In 1993 we detected five sparrows confined to four sites across 2,000 ha and in 1994, again five sparrows, these at 2 sites one km apart. While not conclusive, the maintenance of a nearly 90% drop in the number of sparrows in this subset of sampling sites for 2 years after Hurricane Andrew suggests that there may be factors other than direct mortality operating to keep the population on the west side of the slough from recovering. Seaside sparrows exhibit a very high reproductive potential, a neccessary demographic trait for species that live in highly variable environments. The fact that the Cape Sable Sparrow population hasn't rebounded after the hurricane suggests that a lack of breeding habitat—especially as defined by fire history and surface water conditions—may be a limiting factor.

how many sites?

Spatial Population Dynamics

Local population extinctions and colonization are common for any species that exists in even a moderately variable environment. When, as with the Cape Sable Sparrow, habitat varies both temporally and spatially because of

fire, hydrology and plant community dynamics, the ability to disperse and colonize must be paramount to survival. Using the extensive survey data, we can calculate what proportion of the population each year is able to colonize unoccupied areas.

Excluding the subset of sample sites west of Shark Slough because of poor coverage, we calculated the number of extensive survey sites that were occupied each year in 1992, 1993 and 1994. We then determined how many sites were vacated and how many became occupied (colonized) from one year to the next. Obviously, for 1992 we have only the number of occupied sites. As would be expected for a declining population, the number of birds and the number of occupied survey sites declined each year (table 4). But more important is the extent of colonization that occurs even while the population declined. In 1993, previously empty sites were colonized at a level equivalent to 14% of the number of 1992 occupied sites, in 1994 colonization reached 16% of the 1993 occupied sites. However, the rate at which sites were vacated was higher, 29% and 22%, respectively. These analyses are inconclusive, we will need a larger number of surveys to detect a trend or to develop a predictive model of how the sparrow is able to disperse across space and through time. Development of a predictive model will also require further data and analyses on the spatial relationship between colonization sites and previously occupied sites and on the dispersal ability of individual birds.

Table 4. Sample site occupancy, colonization, and extinction for Cape Sable Sparrows east of Shark Slough, 1992 through 1994.

	1992	1993	1994
Number of sparrows	230	174	143
Number of sites occupied (t)	108	77	58
Number of sites vacated (V)		31	19
Number of sites colonized (C)		17	16
Extinction rate [V/(t-1)]		0.29	0.24
Colonization rate [C/(t-1)]		0.15	0.21

Fire

Fire is an essential element in maintaining Cape Sable Sparrow habitat. Periodic fires inhibit invasion of hardwood species into the marsh and prevent build-up of dead plant material, either of which makes an area uninhabitable for sparrows. In Taylor Slough, Harold Werner determined the population of sparrows for two successive years in three areas that burned one, three and five years previous to 1974. In areas that burned up to three years previously, he found sparrow numbers increasing annually. In the area that had burned five and six years previous (to 1974 and 1975, respectively) he noticed a decline in sparrows. From this, Werner concluded that:

> "...Cape Sable Sparrows could begin to use a Muhlenbergia prairie approximately one year or more after a fire, and that density could escalate at least through the third year. After the fourth year the density could be expected to decline sharply."

We obtained data on locations and dates of fires that occurred in and around Everglades National Park from 1986 through 1993 from Park Service staff. To investigate the effect of fire on the distribution and abundance of sparrows we generated a fire history map (fig. 8) of the years since the latest fire and overlaid data from the 1992 and 1993 sparrow surveys. The highest densities of sparrows in both years occurred at sites that were burned in the 35,000 ha "Ingraham Fire" of 1989 (fig. 9). For the sparrows recorded in 1992 these sites had burned three years previous, for those recorded in 1994, four years. Relatively high densities of sparrows were also recorded in the 1992 survey for sites that had burned five years before.

These results roughly fit Werner's assertion stated above. But the unusual magnitude of the fire of 1989, nearly encompassing the entire range of the sparrow, may confound the relationship between density and time since fire. The fire burned the most stable and densely populated area of sparrow habitat (Area B) where we found most of the birds we detected in 1993 and 1994. The question becomes: is the high density of sparrows at

sites burned five years ago a result of fire dynamics or a spurious coincidence of the fire in an area intrinsically full of birds? One way of answering this question is to calculate changes in the density of sparrows between years with respect to years since fire separately for each side of Shark Slough. Figure 10 shows how densities changed on the east and west sides of Shark Slough. On the west side of the slough the continuous decline in number of sparrows detected each year is reflected in the drop in density for all fire-year classes but one—four years. On the east side of the slough densities increased the most at four years as well, if we exclude the "greater than eight year" class which is constitutes very few data.

These initial analyses of the effect of fire on Cape Sable Sparrow distribution and abundance tend to support Werner's findings, except that we found peak numbers of sparrows at four years after a fire versus Werner's 3 years. We can investigate directly the fire and sparrow history of Taylor Slough by integrating Werner's data with our own. Figure 10 shows an incomplete fire history of the Taylor Slough area and the number of sparrows detected there at various surveys. The overall number of sparrows in the area has decreased with each survey, however, for specific areas effectd by fires Werner noticed the sparrow dynamic described above. The absence of sparrows from the entire site from 1992 through 1994—one to three years since fire—shows that fire is not a deciding factor in sparrow distribution. Other factors, such as hydrology and plant community dynamics could account for the recent absence of sparrows in the area. However, another occurence, witnessed by Werner in 1974, is the removal of sparrows from restricted or isolated patches of habitat by fire and the subsequent absence of sparrows probably due to a low probability of colonization. We have seen the loss of "satalite" populations of sparrows around the Taylor Slough area over the last three years. It may be that Taylor Slough is not inhabited by sparrows for the simple reason that no sparrows have found it.

Data from the 1995 survey will be instrumental in tracking the effect of the "Ingraham" fire. At that time, the effected area will have burned six years previous to the survey, and subsequent fires may produce a spatial mosaic of fire history that would allow a finer resolution of sparrow-fire

interactions. As we stated above, this is a preliminary analysis of how sparrows react to fire. We are currently analyzing the effect of fire frequency on sparrow dynamics and how fire history effects sparrows in different habitats.

DISCUSSION

The highlights of the second field season were the initiation of a banding program and the discovery of 2 nests. We experienced a high level of success in capturing and banding most of the singing males we saw. Next breeding season these birds will begin providing critical data on longevity, territory size and demographics. Finding the well-hidden nests of this species is a rare event, and the opportunity to band nestlings is especially infrequent. The dispersal of young, however, probably plays an important role in the spatial dynamics of this species. The two nestlings we banded may provide critical insight into this dynamic.

Possibly the most important realization that we had during the 1994 field season was the heavy dependence of this project on reliable access to a helicopter. The two least successful elements of this season—the incomplete extensive survey and the failure to establish study sites outside of the eastern core area—resulted from a lack of reliable air transportation.

Being already limited by time of day and weather constraints, the original design of the survey allows for sampling of the nearly 700 sites well within the 2 month window of the peak breeding season. This year, however, the survey was not initiated until 18 April—17 days later than proposed. Even after the helicopter was available there were recurrent problems with the navigation system. When it became obvious that the survey would not be completed in time we suggested that the remaining effort should be spent in the core population area west of Shark Slough—the area that showed the most drastic decline in numbers from 1992 to 1993. Our suggestion was not implemented. Unfortunately, the survey data collected during the 1994 season are not sufficient to meet the primary

objective of the survey. They can tell us nothing of large-scale population dynamics. We can, however, use the few data available to make some site-by-site analyses.

Adjustments For The 1995 Field Season

Based on 2 years of field work we are making the following adjustments for the 1995 season:

- Obtain control of the extensive survey. To date all aspects of the survey have been controlled by NPS. With the creation of the NBS (to which this contract will be transferred) we feel that the entirety of the project should fall under the control of one government agency—NBS. Marty Fleming, the GTR on this project, has agreed to retain a contracted helicopter and pilot for exclusive use by our project. A volunteer, Thomas Brooks, who sampled 165 of the total 225 sites sampled in the 1994 season, will conduct the entire survey in 1995.

- Establish study sites in remote areas. Currently, half of our study sites are within the core population area east of Shark Slough (Area B). With reliable air transportation we will set the majority of the new sites for 1995 in the area west of Shark Slough (Area A).

- Initiate the survey and the banding effort earlier. With control of the helicopter and all banding permits in hand we can begin all aspects of the project on 1 April. This should allow completion of the extensive survey and increase capture success of the more active early-season singing males.

- Collect habitat data. With marked male birds we can now know with certainty the extent of territories. This will allow us to collect habitat data (vegetation type, height and density, surface water, etc.) and compare samples from within territories to those outside territories, between territories, and between study sites.

- Find more active nests. We intend to increase our efforts to find active nests. Finding nests is essential to collecting data on demographics and to banding nestlings. Discovering the dispersal pattern of nestlings throughout the landscape is necessary to understanding large-scale population dynamics.

- Increase the use of volunteers. We were fortunate to secure four well-qualified volunteers to assist us during the 1994 season. Those volunteers will return in 1995 and we will attempt to recruit more. At least two of the above proposals—collecting habitat data and finding more nests—are labor intensive. Increasing the number of observers in the field is the best way to collect those data.

Unfunded Adjustments For The 1995 Field Season

- Collect food habit data. An intrinsic part of understanding Cape Sable Sparrow biology is to describe and quantify food habits. These sparrows are mostly insectivorous, especially during the breeding and pre-breeding seasons. Observing feeding bouts of a large number of sparrows throughout the year will provide data on type of food (to lowest taxonomic level), frequency of feeding (for adults, fledglings and nestlings), and search effort. These data will lead to the development of accurate energetics models and subsequently, to individual-based models.
- Collect insect density data. This is obviously related to the above suggestion. Describing and quantifying insect abundance across a wide range of prairie habitats may lead to important insights into sparrow distribution, breeding activity, breeding success and fledgling survival and dispersal. methods should include a variety of survey techniques including sweep nets and harvesting of vegetation for intensive searches.

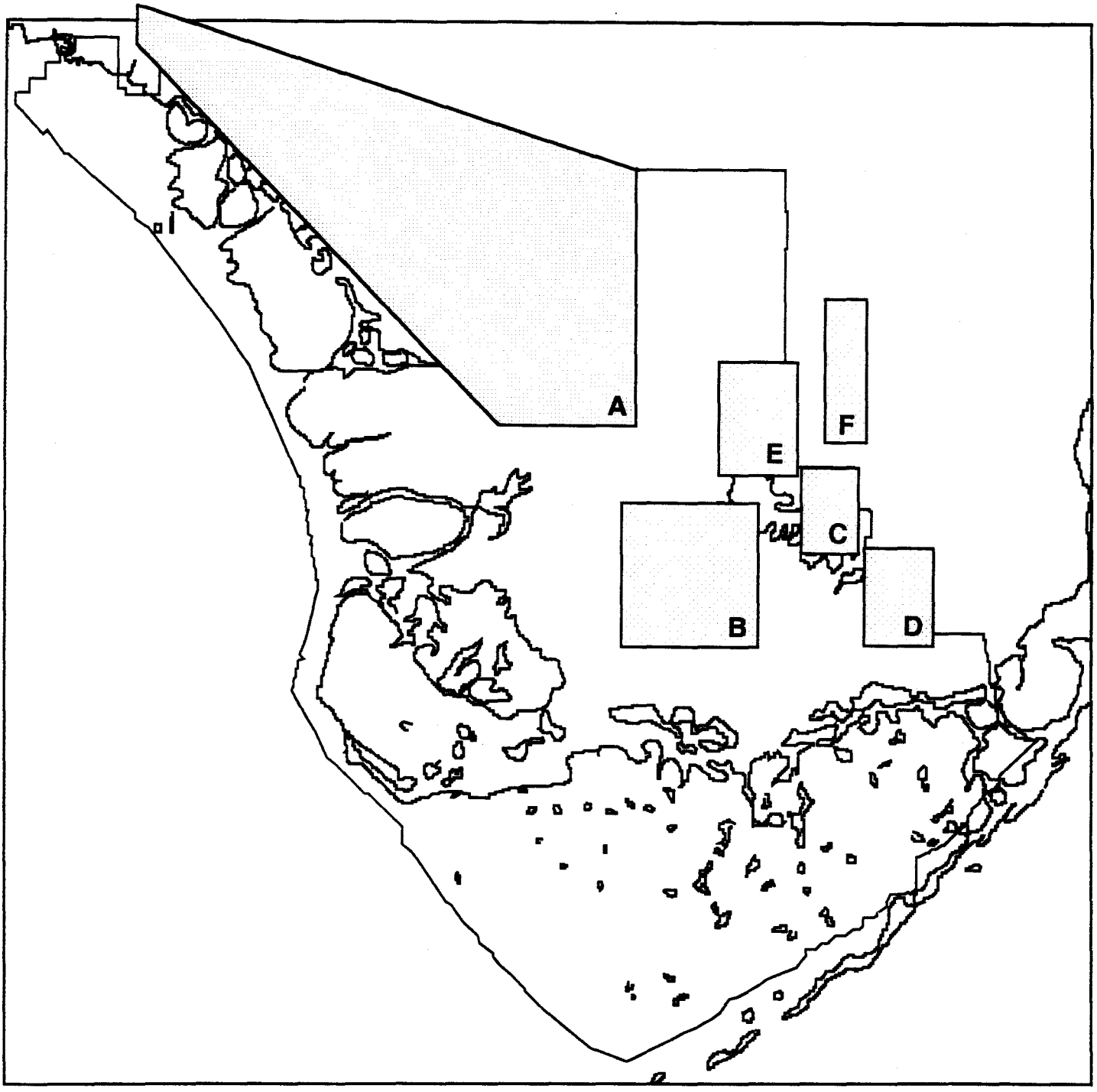


Figure 1. Cape Sable seaside sparrow study sites representing sub-populations referred to in the text.

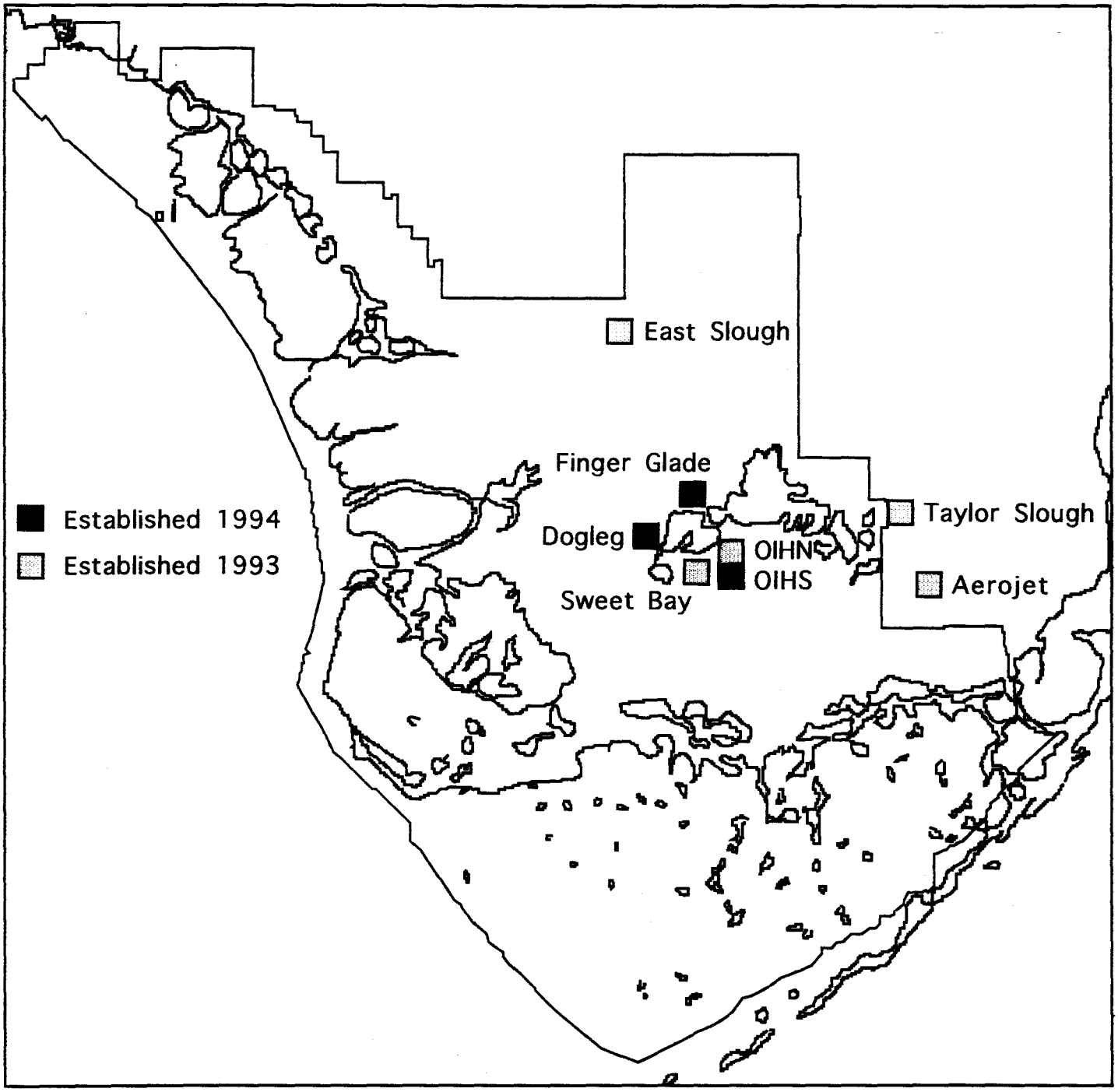


Figure 2. Cape Sable seaside sparrow sites established in 1993 and 1994.

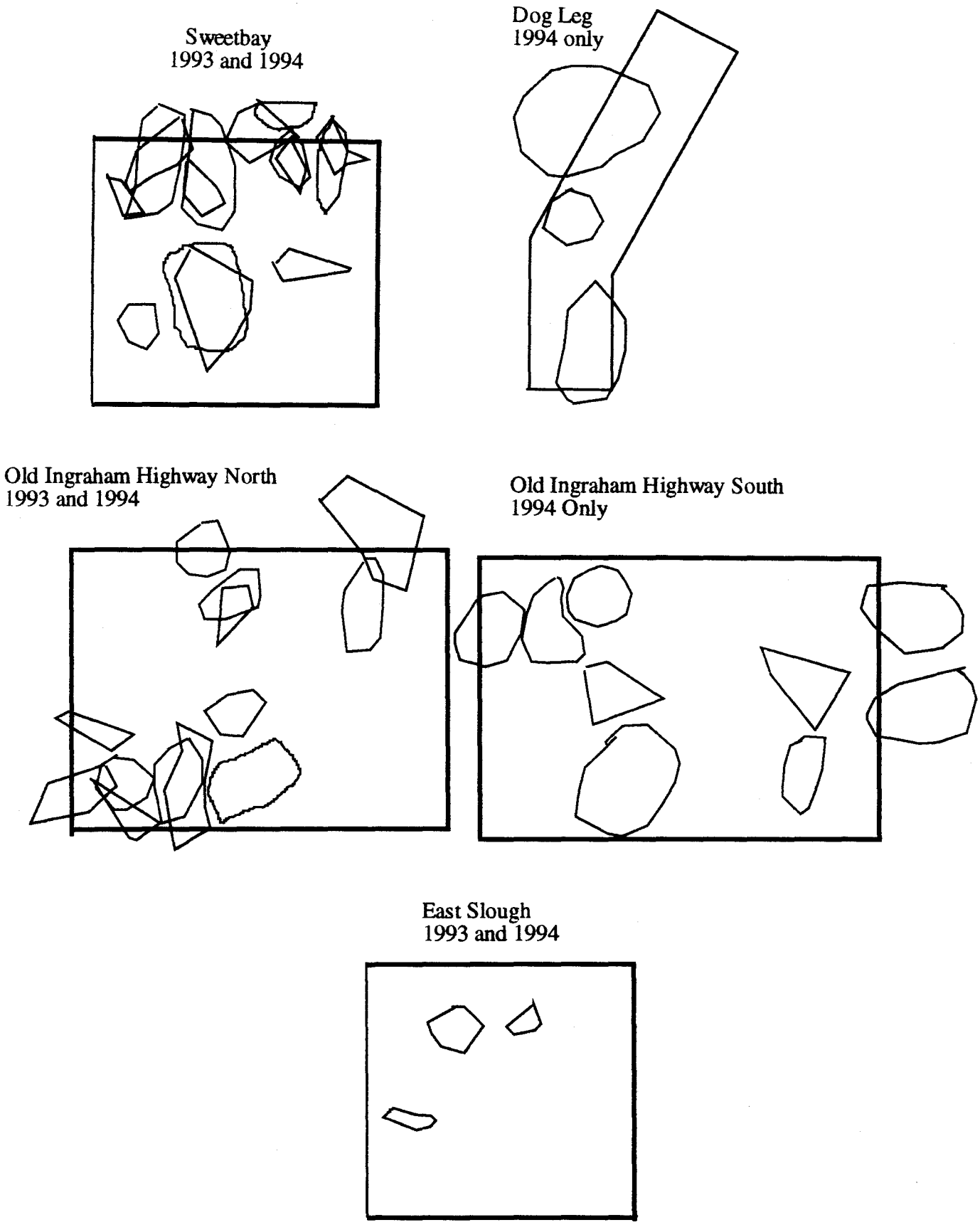
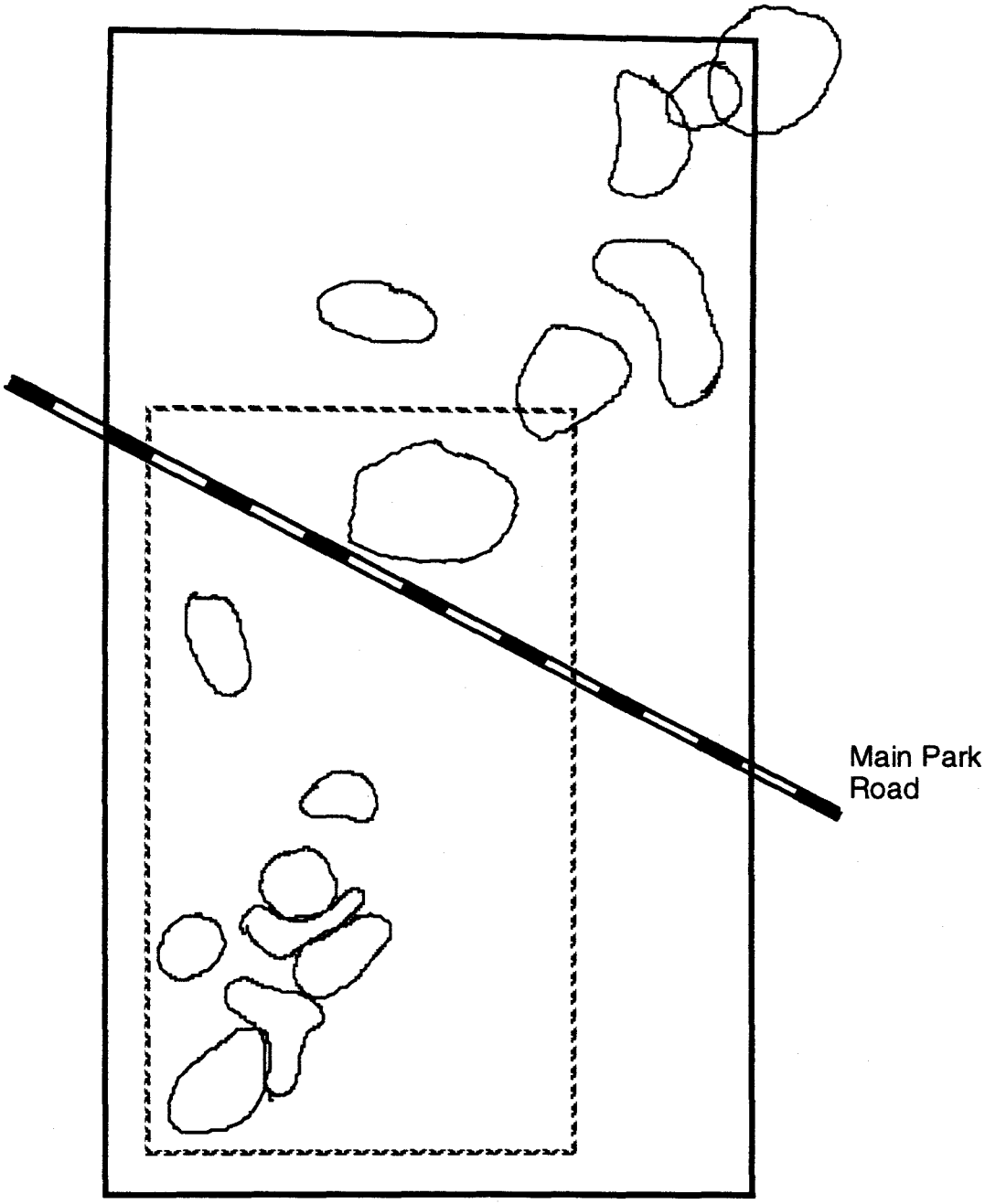


Figure 3. Cape Sable Sparrow study dites where sparrows were recorded in 1993 and 1994.



Our Taylor Slough study site

Werner's Taylor Slough study site

Cape Sable Sparrow territories detected
by Werner during the 1975 breeding season.

Figure 3a. Cape sable Sparrow study sites at Taylor Slough. Werner's site was established in 1974, our site was established in 1993 and was designed to encompass an area populated by sparrows during Werner's study.

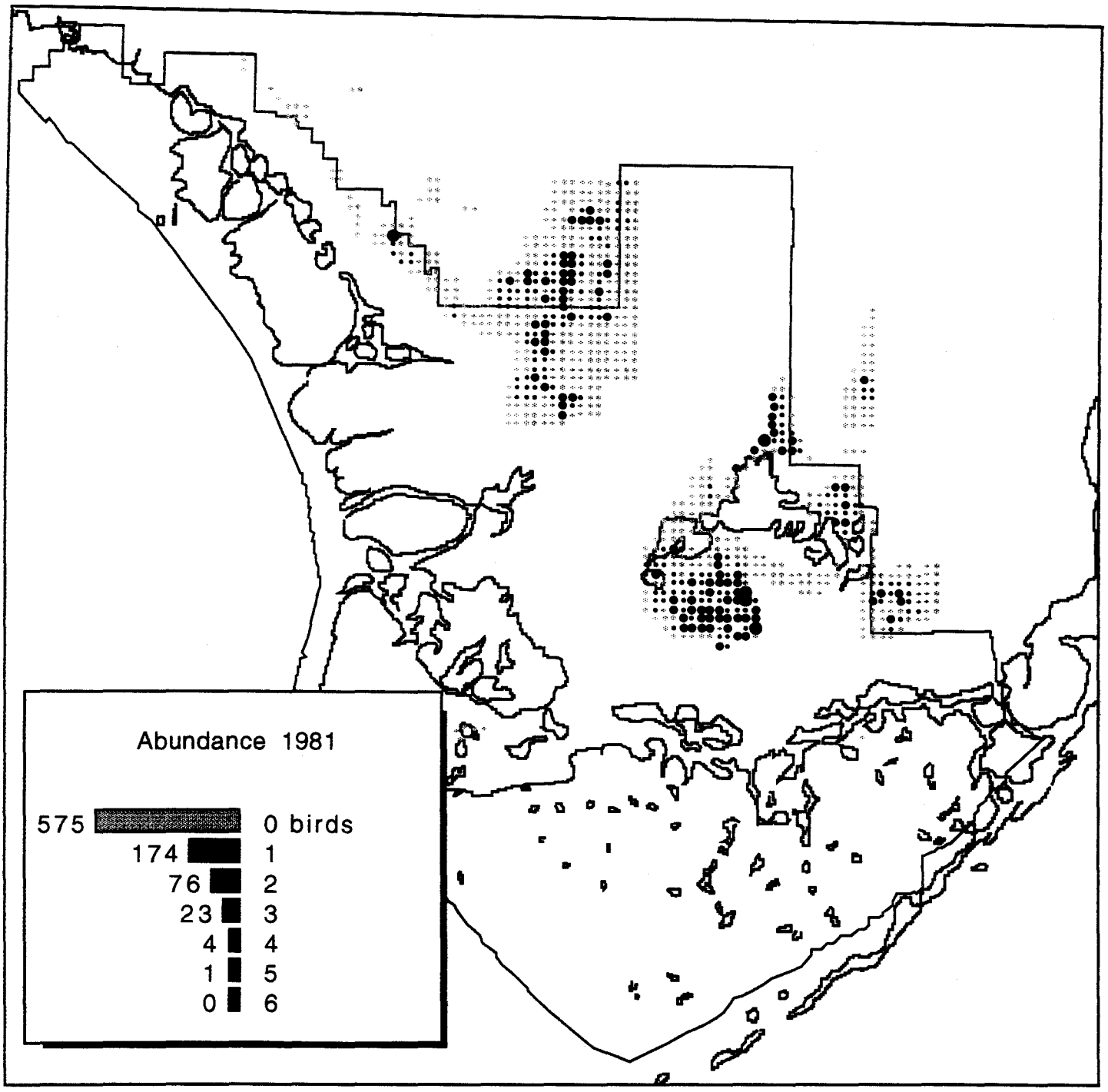


Figure 4. Abundance map of Cape Sable seaside sparrows sampled during 1981 extensive survey.

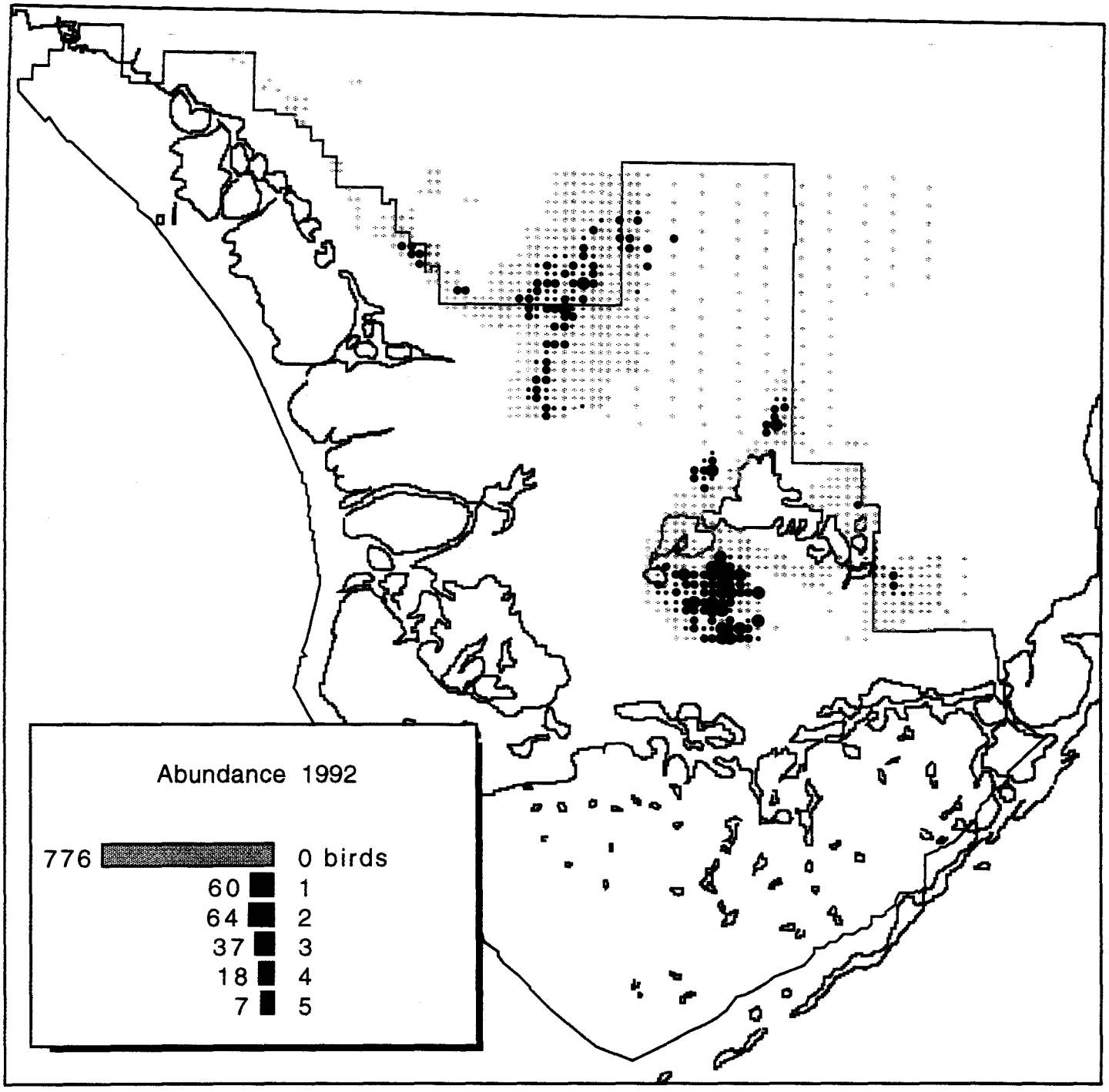


Figure 5. Abundance map of Cape Sable seaside sparrows sampled during 1992 extensive survey.

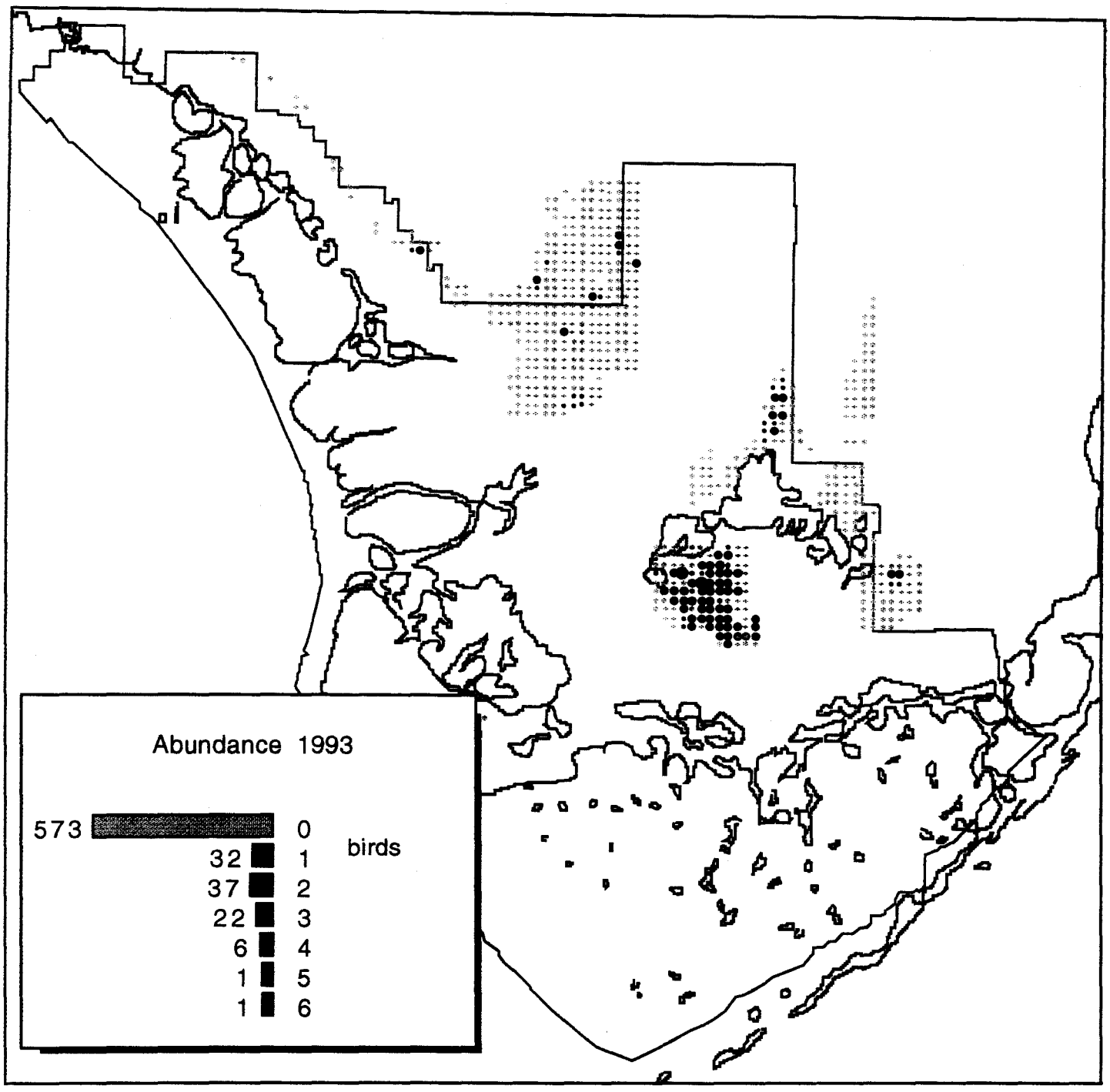


Figure 6. Abundance map of Cape Sable seaside sparrows sampled during the 1993 extensive survey.

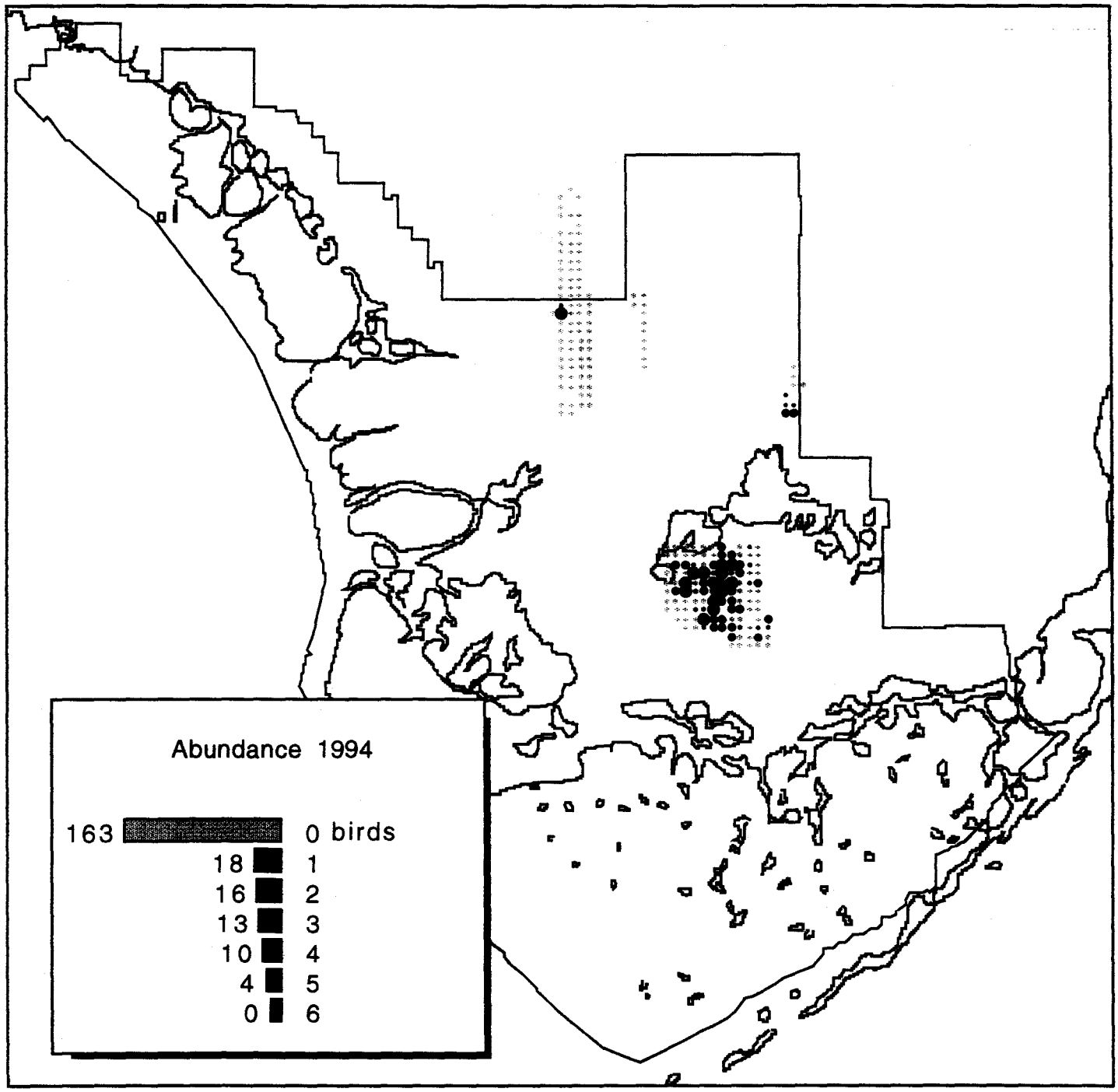


Figure 7. Abundance map of Cape Sable seaside sparrows sampled during the 1994 extensive survey.

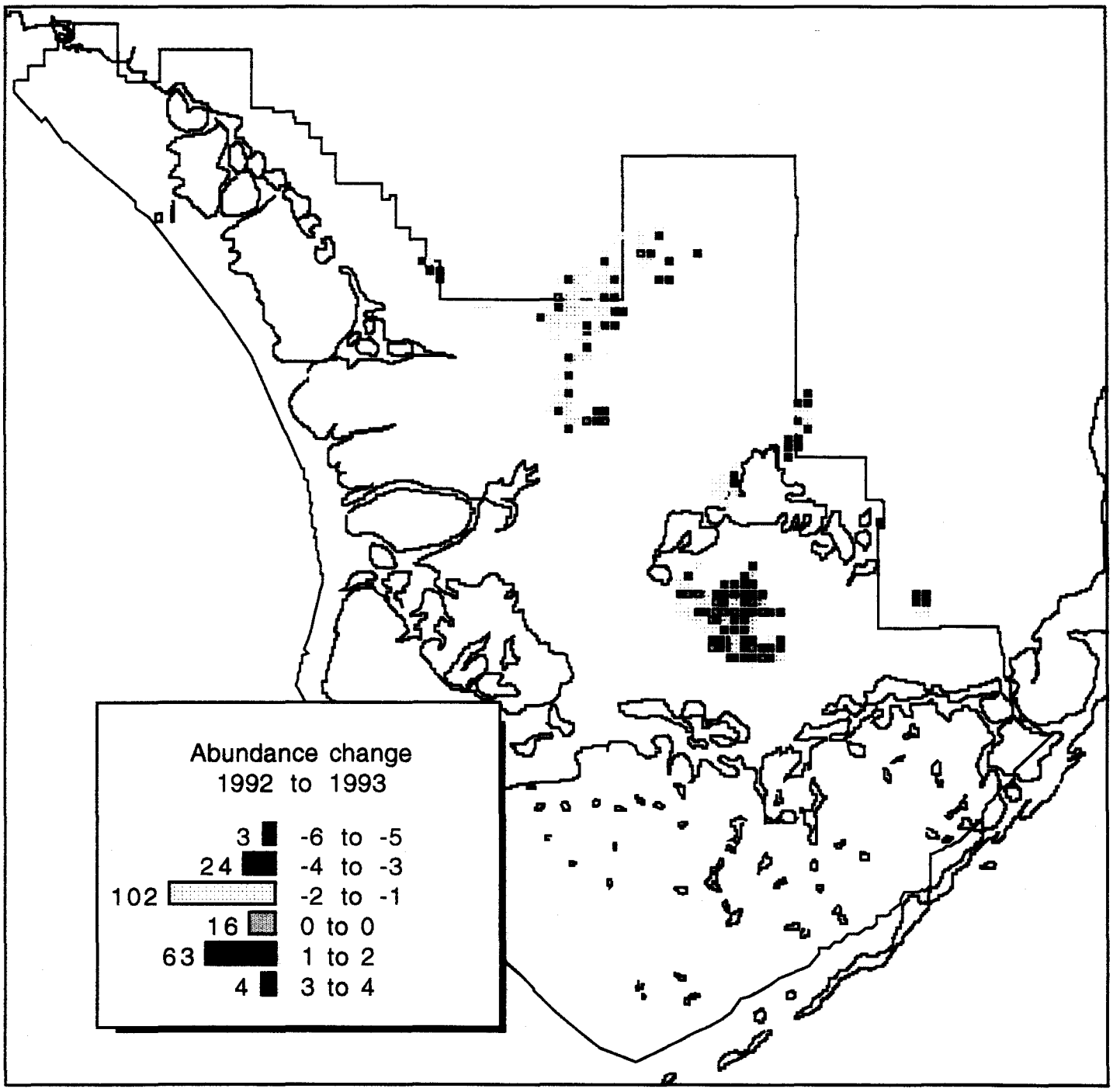


Figure 8. Changes in abundance of Cape Sable seaside sparrows between 1992 and 1993.

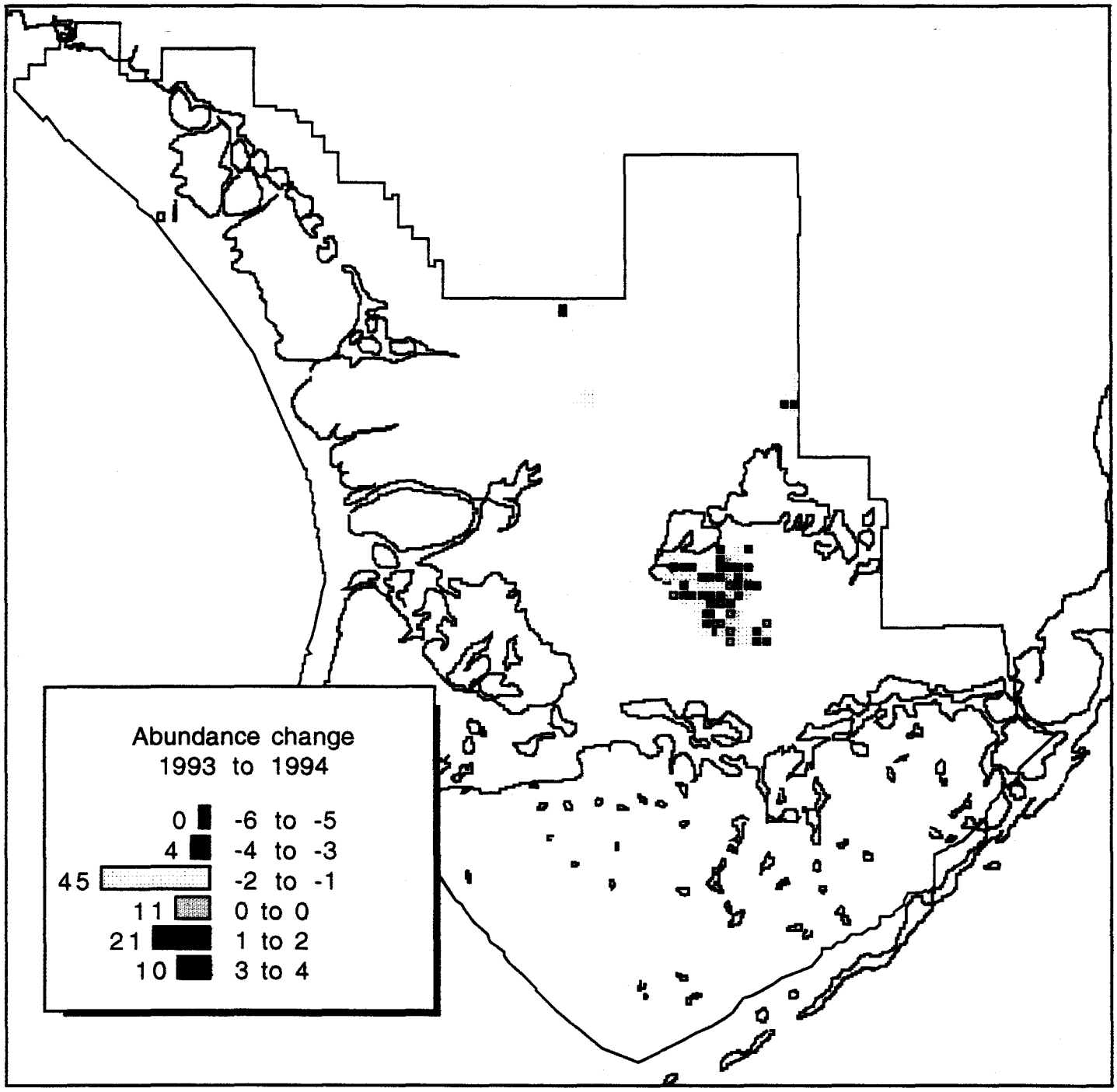


Figure 9. Changes in abundance of Cape Sable seaside sparrows between 1993 and 1994.

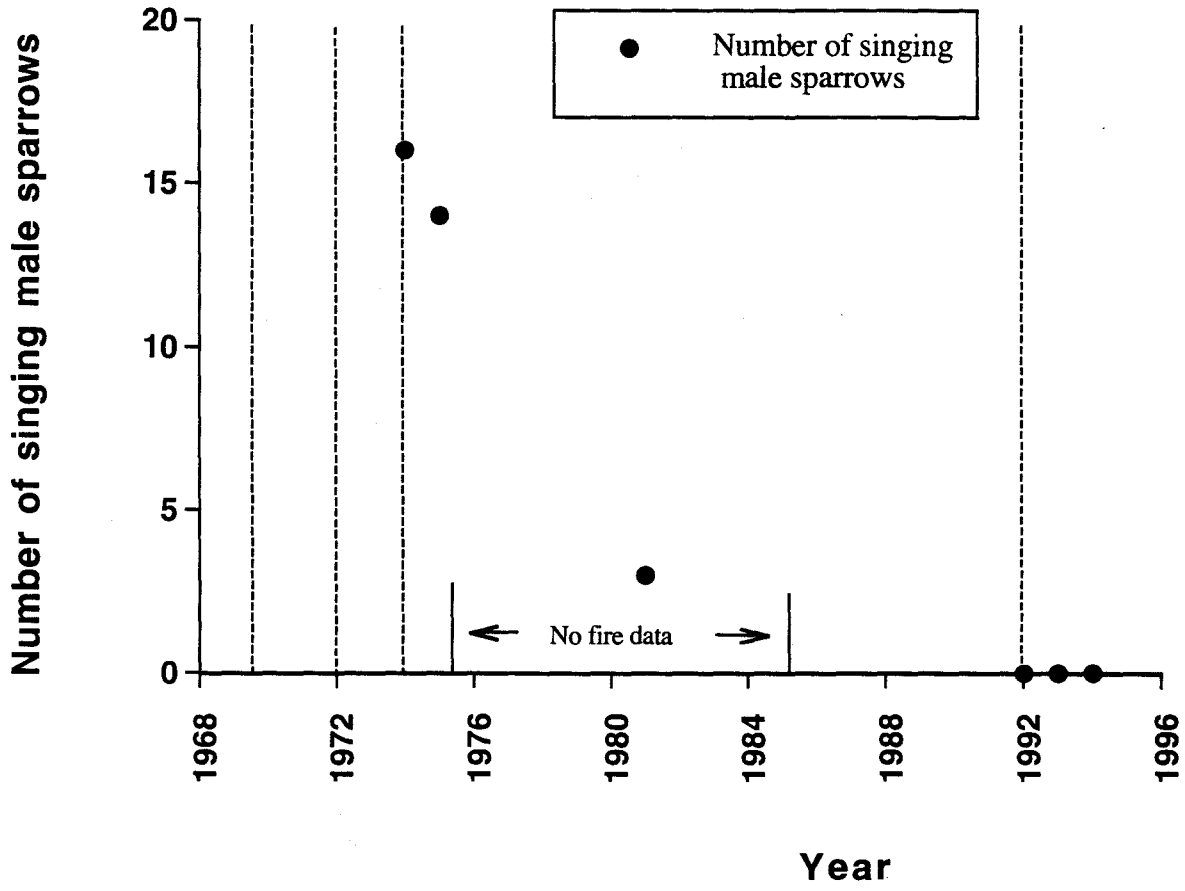


Figure 10. The number of singing male Cape Sable Sparrows detected within Werner's Taylor Slough study site and the occurence of fires (dashed lines) within the same area.

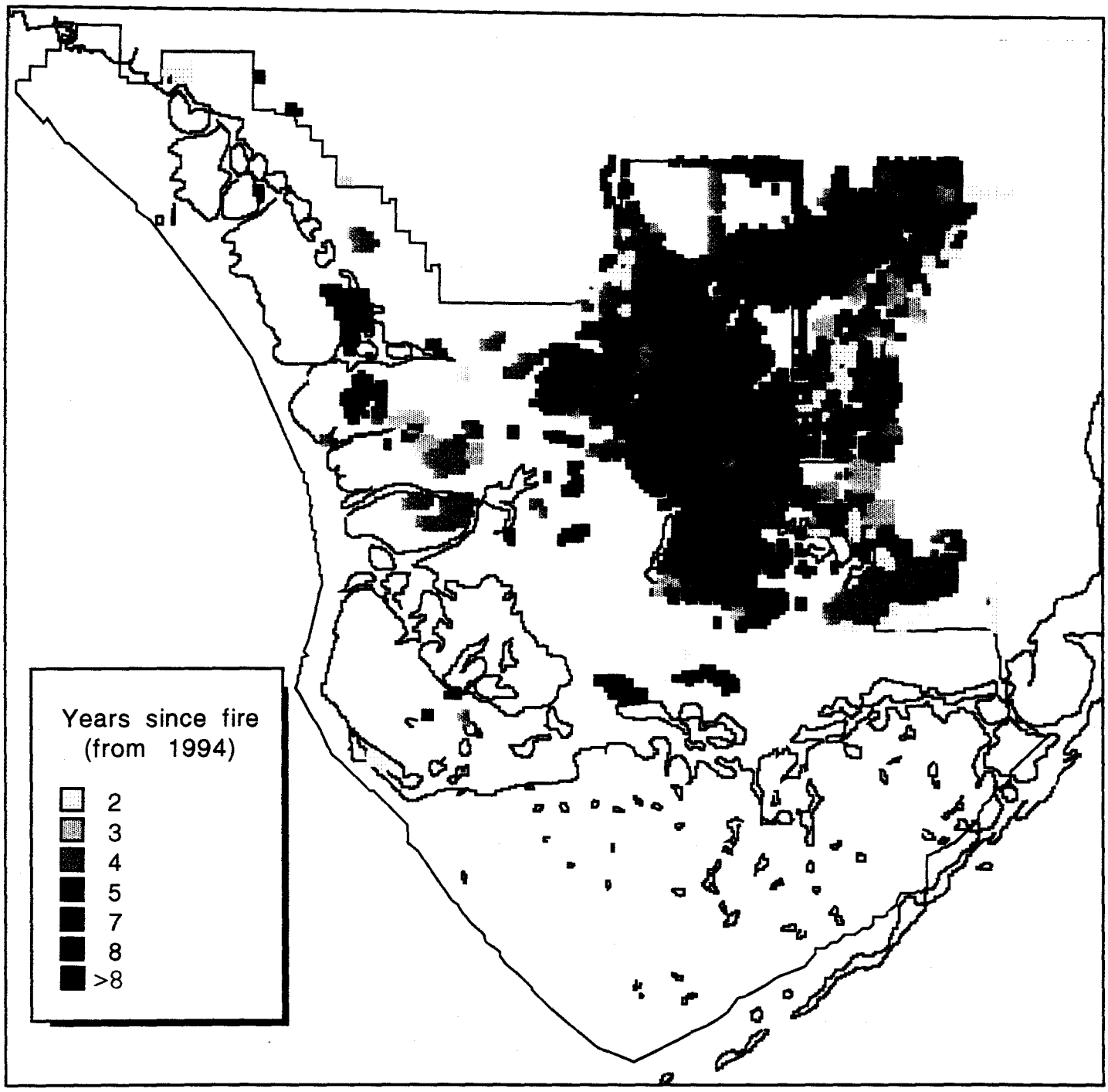


Figure 11. A fire history map of ENP. Based on fire cache data from 1994 back, at 500m resolution.

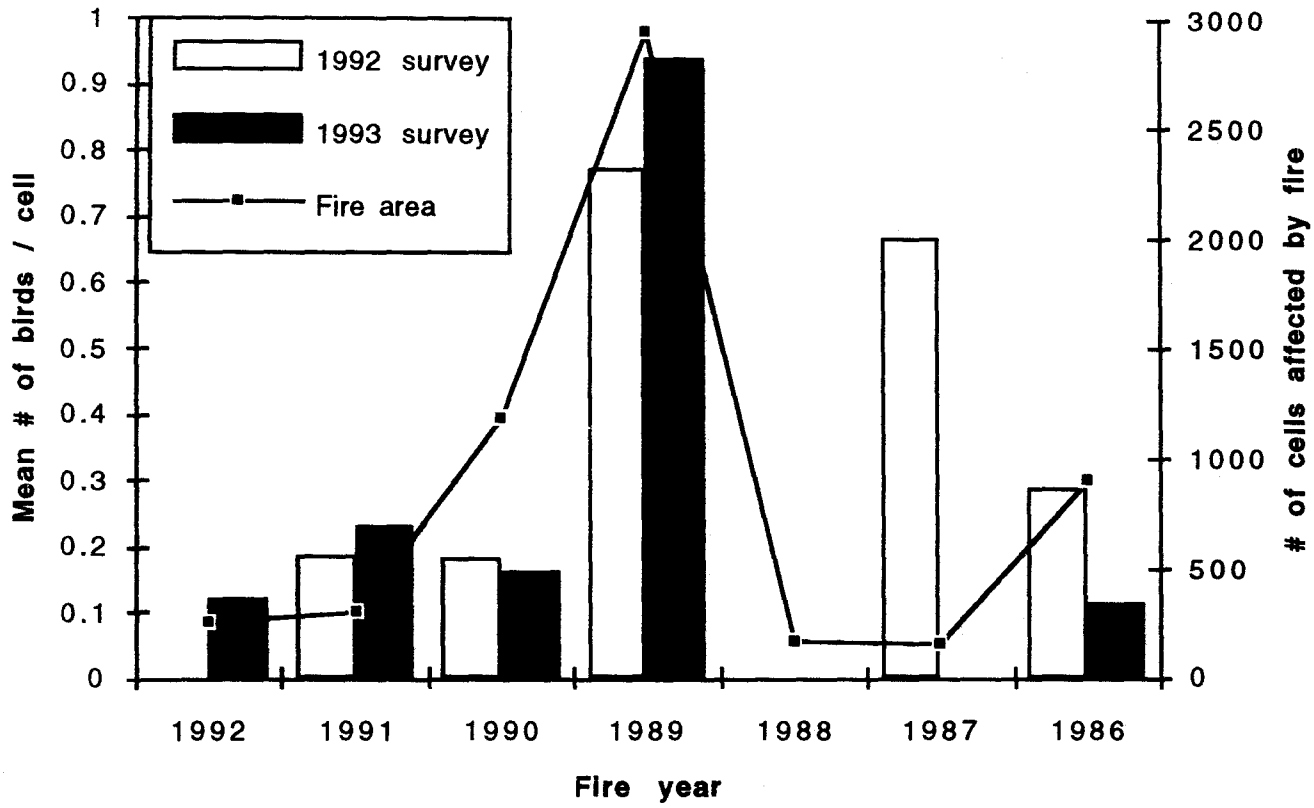


Figure 12. Average densities of Cape Sable seaside sparrows (birds/cell) recorded during the 1992 and 1993 extensive surveys classified by the last year the survey sites burned. The line indicates the number of cells that burned in each year.

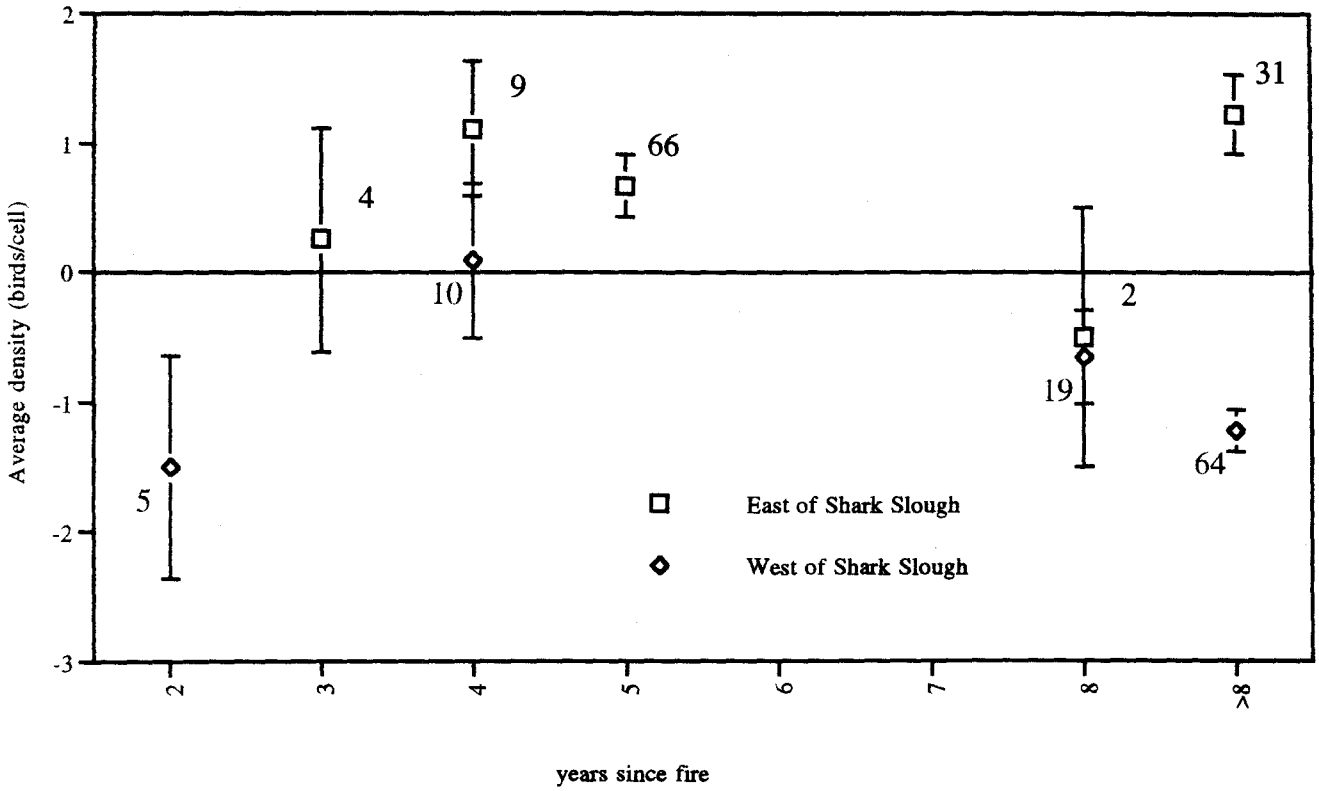


Fig 13. Change in sparrow density (birds/site) between 1992 and 1993 for east and west of Shark Slough classified by years since fire. Numbers depict sample size.