A population and banding study on the Belding's Savannah Sparrow at Ballona Wetland, 1989-1990.

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ABSTRACT

A population and banding study on the Belding's Savannah Sparrow (*Passerculus sandwichensis beldingi*) was conducted at Ballona wetland from June 1989 through July 1990. There were 9 breeding pairs in 1989, 11-12 in 1990. These figures represent a considerable decline from the 29 pairs counted in 1987. Probable reasons for the decline are discussed.

Territory shapes and sizes changed markedly from 1989-1990 and varied in size from 856 m to .

Thirty-two sparrows were trapped and individually color banded after the 1989 breeding season. Some were apparently winter visitors, as only 10 were seen on territories in 1990.

Foraging patterns were observed on 4 study plots during the winter to determine differential use of micro-habitats.

INTRODUCTION

The state endangered Belding's Savannah Sparrow *Passercccculus sandwichensis beldingi* is holding on in the last few coastal salt-marshes in southern California in alarmingly low numbers. The latest California census in 1986 (Zembal & Kramer 1986) produced a total of 2,274 pairs. The importance of saving the remaining salt-marsh areas in California and Mexico has become a matter of life or extinction for the Belding's Savannah Sparrow (BSS) and other salt-marsh dependent species.

At the degraded Ballona Wetland in Playa Del Rey, Los Angeles, California, a planned salt-marsh habitat restoration project has been underway for many years, and the local BSS population has been a major consideration in this plan. In order to better understand the utilization of Ballona Wetland by the BSS, a study was conducted for 13 months from June, 1989 - July, 1990 to determine the number of breeding pairs, the size of each territory, preferred feeding areas, and to document the breeding and feeding changes within the yearly cycle.

STUDY AREA

Ballona Wetland is criss-crossed with streets, powerlines, and the concrete Ballona Creek channel. The study area was located in area B (Fig. 1) between Ballona Creek and Culver Blvd. where minimal tidal flushing still occurs. Pickleweed (*Salicornia virginica*) surrounds the tidal channels, eventually giving way to open dirt/salt flats. Throughout the Salicornia there are scattered shrubs and upland weeds. Only the vegetation near the tidal streams receive any tidal flushing; the salt flats and outer Salicornia receive none. A detailed vegetational analysis of area B has been done by Pacific Estuarine Research Laboratory (1989).

METHODS

Census

A census of the breeding population was conducted by KC throughout Ballona Wetland in *Salicornia*-dominant areas by counting the number of singing males. The survey was done on 10 separate days in June and July of 1989, and on 7 separate days in March-May in 1990. All censusing began within a half hour after sunrise and ended by 9 or 10 AM.

Each territory (T) was located by sitting and observing one singing male at a time. A territory was defined as the area within a circle of perches where the same BSS male sang. A few extra feet beyond these perches were included as part of the territory as described by Massey (1979). Territorial boundary lines were double-checked by observing how far the male would chase other BSS intruders; when the resident male reached his territory boundary, the chase was usually discontinued. Occasionally, two neighboring males would sing 3-5 m apart from each other with the territorial boundary line in between the two birds. Steel "bamboo" garden stakes were then used to outline the territories.

BSS nest sites were not searched for fear of leading predators to them; e.g. Red Foxes (*Vulpes fulva*) were regularly seen in the breeding area.

Banding

Banding was begun on 27 July 1989, after there were no further indications of nesting activity. BSS were all caught with mist-nets; net placement and the procedure for herding birds into the nets was refined by trial and error. On the first attempt, with the nets set up at dawn and two people in the field, we caught only 3 sparrows. Three more sessions (including an unsuccessful one at night) during which we revised the technique, resulted in a method that worked well. In the early morning on 2 October we placed 5 mist nets across the breeding area, with one stretched across a tidal channel. With 6 people to herd the birds, we walked quietly towards the nets. Sparrows would start up from the pickleweed and fly short distances ahead of us. When we were close to the nets we clapped and called and rushed toward the nets. The birds were by then too close to the net to avoid it. We trapped 13 sparrows at this session, as many as on the 4 previous attempts.

After trapping 26 BSS, we deferred further banding until the breeding season, when a selective banding technique was then employed to capture individual territorial males. A single mist-net and a tape recorder, placed directly under the net and playing a BSS song (endless loop cassette), were set up on the edge of an observed territory. The male on territory would fly into the net in an attempt to chase the "intruder". This technique netted 3 territorial males.

Each Savannah Sparrow was banded with three color bands and a U.S. Fish and Wildlife service band: two color bands on one leg and one color band and one service band on the other leg. The colors used were:

1. Mauve (M)
2. Dark Blue (B)
3. Light Blue (b)
4. Black (K)
5. Red (R)
6. White (W)
7. Light Green (G)
8. Service band (S)

Habitat Use

In order to evaluate the use by BSS of micro-habitats in the wetland an index survey was conducted. Three 60 x 60 m plots were set up in the study area (Fig. 1). Plot 1 was placed over pickleweed/saltflat edge, Plot 2 over

pickleweed/tidal channel, and Plot 3 cover a continuous section of pickleweed (Fig. 1). A 4th plot was established on the southern bank (rip rap) of Ballona Creek. Using 10 x 50 binoculars or a 20-60x scope, each plot was surveyed for a duration of 60 seconds every 5 minutes, 3 times in a row. All plots were surveyed twice in a row on 6 different days in both the breeding and nonbreeding seasons at various times of the day.

Vegetational sampling

A 75 m line transect was laid through Plot 3 along the long axis (Fig. 1) and the amount of vegetational cover calculated along its entire length. Categories of cover included plant species, bare ground and litter. A 1 m^2 circular quadrat was placed around every 5 m mark on the line transect and percent cover determined within the circle. The vegetation in Plots 1 & 2 were not analyzed as they were not different from Plot 3; all were monotypic stands of *S. virginica*.

The territories were each outlined with stakes. Compass readings and distances were measured between each stake and plotted on a map. A computerized planimeter was then used to find the area of each territory.

RESULTS

Breeding and Wintering Chronology

The breeding season of 1989 ended by August when singing stopped and territories broke down as the BSS began to flock together in feeding groups of up to 25 birds. The non-breeding season extended from August 1989 through January 1990. The first BSS song of the 1990 breeding season was heard on 8 Feb. However, feeding flocks of up to 20 BSS were seen until the end of February. The first copulation was seen on 1 March. Establishment and fierce defense of territorial boundaries was first observed on 5 March. This timetable is similar to that reported by Massey (1987).

Territories and Breeding Population

In both the 1989 and 1990 breeding seasons, breeding territories were found in the area surrounding tidal channel Y in area B (Fig. 2 & 3). No other areas of Ballona Wetland contained any breeding BSS. In 1989, 9 pairs maintained territories, and in 1990 there were 12 pairs. The size of each territory (Table 1) varied considerably from 856 m^2 to 19,081 m^2. In 1990,
4 territories included portions of the salt flats between clumps of pickleweed with MK-SK's territory being the largest at 19,081 m^2 (12,201 m^2 saltflat and 6,880 m^2 pickleweed).

Territorial boundaries apparently remained constant throughout the breeding season with one exception. In late May of 1990 SR-RR, the male on T3, disappeared and was not seen again during the study, presumably having died. On 6/12/90, the males on T2 and T4 on either side of T3 expanded their territories into the newly vacant territory of SR-RR.

Between seasons, territory shapes and sizes changed rather markedly (Figs. 2 & 3).

Feeding Areas and Utilization of Ballona Wetland

Fig. 4 shows photographs of the feeding plots in October 1990. Plot 1 (Fig. 1), consisting of 95% *S. virginica*, contained the most BSS in both the winter and summer indexes (Table 2). Plot 2, consisting of 60% *S. virginica* and 40% tidal channel had the second highest index in both winter and summer while Plot 3, away from any tidal flushing, containing 60% *S.virginica* and 40% salt flat had the lowest indexes for both winter and summer. The Ballona Creek edge (Plot 4) remained an important feeding area throughout the year.

The vegetational transect for Plot 3 is shown in Table 3. The only plant was *S. virginica*, the other categories were 'bare ground' and 'litter'.

The general feeding pattern of the BSS at Ballona in the breeding season was very difficult to observe, as any BSS

other than a singing male was extremely hard to see. However, no exodus from the nesting area in the late morning occurred as it did at Anaheim Bay (Massey, 1979). It appeared that most of the feeding activity took place in the nesting area throughout the day. One to two BSS were observed flying from the nesting area or Ballona Creek to another part of the wetland (mostly to the western pickleweed fields of area B) only 5 times during the breeding seasons of 1989 and 1990. Almost all activities in the breeding season (courting, nesting, feeding, preening) took place within the general breeding area shown on Fig. 2. Within this area, feeding was more easily observed in the open areas along tidal channel/pickleweed edges, pickleweed/salt-flat edges, and along the rocks of Ballona Creek. Feeding was also observed rarely within the pickleweed, but it is apparent from the index numbers of Plot 3 (95% pickleweed) that the BSS spent most of its time there.

The onset of fall and winter brought about drastic changes in feeding and social patterns. The BSS began flocking in August and fed together in virtually every part of the nesting area, but apparently still preferred the continuous pickleweed sections. However, flocks of up to 20 BSS were repeatedly seen (on 7 different days) feeding in a small pickleweed/grass clump 25 square M in size adjacent to Plot 3.

More areas of Ballona Wetland were used in the winter for feeding than during the breeding season; on 5 different days in the fall and winter of 1989/90, 3-8 BSS feeding were observed in area A; in area B south of Culver Blvd., 3 BSS were observed in November 1989. (These areas are not shown on any of our figures.)

Banded Population

Thirty two BSS were banded, 26 in the summer and fall of 1989 (Table 4), the rest during the 1990 breeding season. Only 10 of these banded birds were seen in 1990 at Ballona (Table 5), all in the breeding area (Fig. 3). SM-MM and WR-SG were confirmed as a pair on T5, and SM-WK, KR-WS, GK-RS, SR-RR, and MK-SK were confirmed as males on T1,8,6,3, and 11

respectively. The other 3 banded birds seen were probably females; they were secretive, rarely seen and not observed singing. Determination of territory size was much clearer in 1990 when 6 were occupied by banded males; T11, a very large territory, would have been considered two were the territorial male not banded. Banding also enabled us to document the demise of SR-RR on T3, impossible without indivudually color-marked birds.

DISCUSSION

Previous population censuses of the Ballona wetlands showed 37 pairs in area B in 1977 (Massey 1977); 21, 18, and 13 in 1979-80-81 (Schreiber 1981); 32 pairs in 1986 (Zembal et al 1986); and 29 pairs in 1987 (Massey 1987). There were breeding birds on both sides of the main channel (X in Fig. 5) on all censuses. Locations of territorial males in 1987 are shown in Fig. 5. Thirteen territories were concentrated in the northeastern part of area B east of the channel Y (Fig. 5), closely comparable to the 1989-90 pattern of nesting. But there was an equal number of pairs nesting on the west side of channel X where only one pair nested in 1989.

The dredge spoil north of Ballona Creek (Area A) had 18 breeding pairs in 1979, 10 in 1980, 10-13 in 1981 (Schreiber 1981), and 5 in 1987 (Massey 1987). In the present study, no BSS were found nesting in area A. The saltmarsh vegetation has been invaded by upland weeds, apparently a result of the prolonged drought.

The breeding population in area B has shown considerable variation over the last 20 years, with the largest population in 1977 and very small numbers in 1981 and 1989-90. In 1981, standing water from heavy winter rains covered much of the salt flat, and may have impaired feeding (Schreiber 1981), thus limiting the nesting capacity.

The greatest change occurred between 1987 (29 pairs) and 1989 (9 pairs) and is thought to be the end result of lack of tidal flow and the long drought that southern California has been experiencing over the past 4 years. Much of the

Salicornia is in a dessicated state. Fig. 6 shows the contrast in October 1990 between vegetation adjacent to a channel edge (T3) where some tidal flow currently occurs and the pickleweed appears healthiest, and an area of high ground (T7) where the vegetation is struggling to survive. Fig. 6 also shows a completely exposed BSS nest in dry pickleweed as it was found in October 1990. Earlier in the breeding season this was a healthier stand of pickleweed and was part of T7 (Fig. 3). While there is nothing that can be done about rainfall, opening the tide gates on a regular basis during the winter would be salutory for the vegetation, and thus for the BSS. During the nesting season, however, tidal inundation would have to be carefully controlled so as not to impact nests.

Territory size has been documented in several other BSS studies. In Anaheim Bay, Massey (1979) documented 14 pairs in a 1-acre study plot where the habitat was considered to be optimum. The range of territory sizes was 250-375 m^2. At Camp Pendleton, Zembal (1986) found BSS densities ranging from 2.5-42 territorial males per hectare (238-4000 m^2/territory). Study plots were located in saltmarsh of variable plant composition, ranging from monotypic stands of *S. virginica* to upland edge marsh containing 9 plant species. In what was considered 'prime habitat', territory size was 540 m^2. At Ballona, we found that the smallest territory size (856 m^2) was larger than at either Anaheim Bay or Camp Pendleton. There is nothing that could be considered 'prime habitat' in the Ballona wetland.

The size, shape, and immediate location of BSS territories changed from 1989 to 1990 contrary to what Massey reported in 1979. In 1990, T1, T11, and T12 were located in areas not used in 1989 while T8 of 1989 was not used again in 1990. There was almost a complete redistribution of territorial boundaries (Figs. 2 & 3). One breeding pair was in marginal habitat which contained only isolated patches of pickleweed surrounded by saltflat (T11).

The increase in the number of BSS in the fall after the breeding season is not easy to explain, although there is documentation in other marshes of influxes of sparrows in winter (Massey, field notes). We banded 26 BSS between July and October 1989, and did not catch all birds that were present; the wintering population was estimated at 40-50. Yet with the onset of the 1990

breeding season, a maximum of 24 sparrows remained in the wetland, and only 10 individuals on 11 territories were banded. Molt patterns on 7 of the sparrows we banded indicated that they were adults; some of the others could have been first-year birds that hatched at Ballona in 1989. There were, however more wintering sparrows than can be accounted for in this way, and an influx from other marshes is the only explanation.

Red foxes are in residence at Ballona, and a den with 5 kits was located adjacent to the BSS breeding site. No interactions were observed between foxes and sparrows. However this study was not directed at examining such interactions and it is possible that foxes preyed on eggs or chicks, particularly at night when no one was watching. The role of the Red Fox as predator on the sparrows is unclear, and a study to answer this question would have to be designed with care. Location and monitoring of nests could attract foxes to them. Radiotelemetry would be the best means of determining the hunting practices of the fox. Red foxes are of such concern in California's saltmarshes that a separate study should be done on this subject.

RECOMMENDATIONS

Tidal flow should be reintroduced as soon as possible, preferably before the 1991 BSS nesting season. When the culverts have been opened, the breeding area should be monitored to determine the reach of the tide. During the nesting season the culverts should be closed during high tides to prevent flooding of nests.

A census of the BSS breeding population should be done each spring to monitor any changes that may occur.

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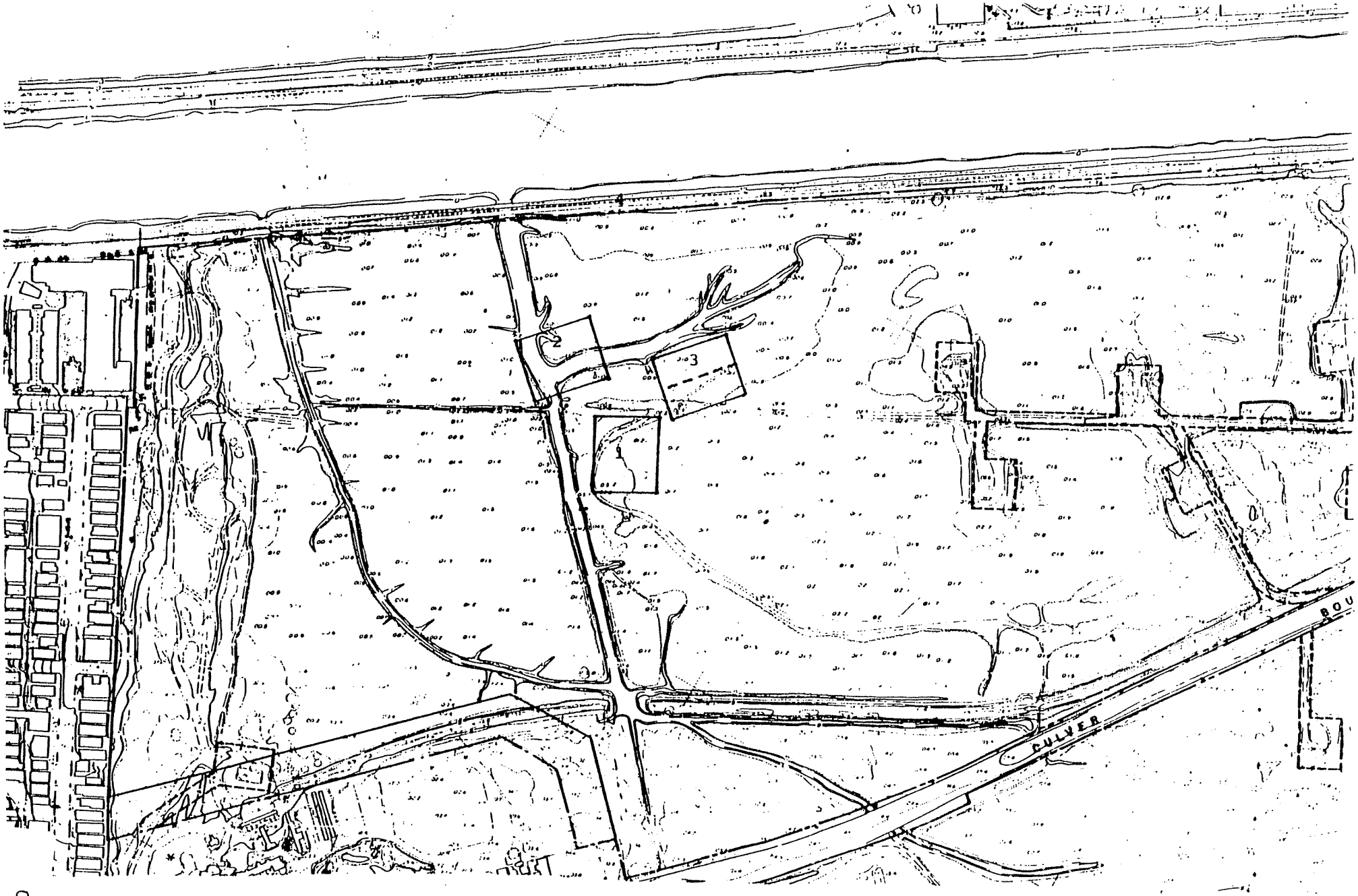


Figure 1. Area B showing feeding Plots 1-4. Vegetational transect is shown in Plot 3 as hatched line.

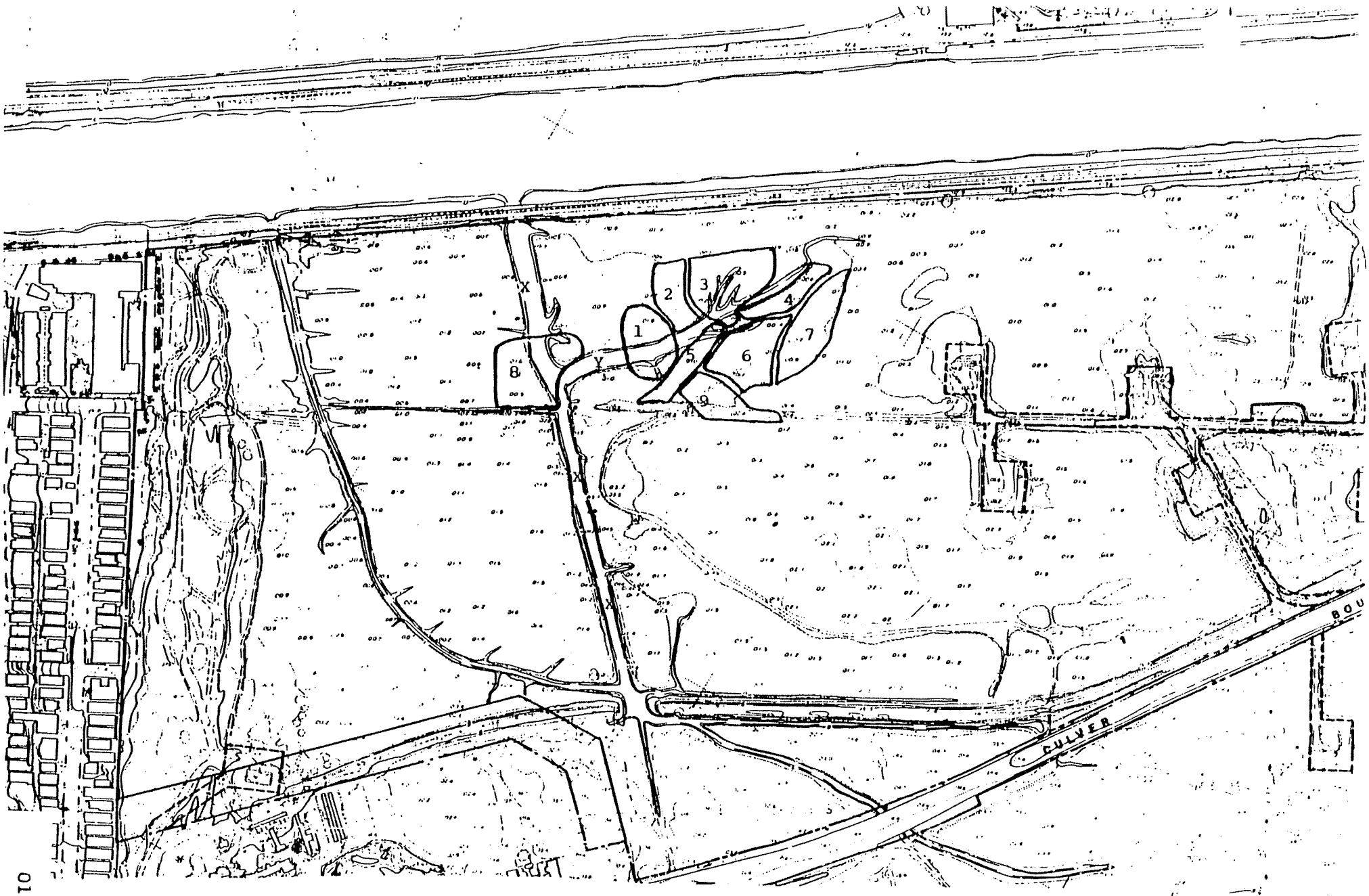


Fig. 2. Territory sizes in 1989, in square meters. T1 - 1411, T2 - 1439, T3 - 2040, T4 - 984, T5 - 1247, T6 - 2178, T7 - 1573, T8 - 2540, T9 - 1522.

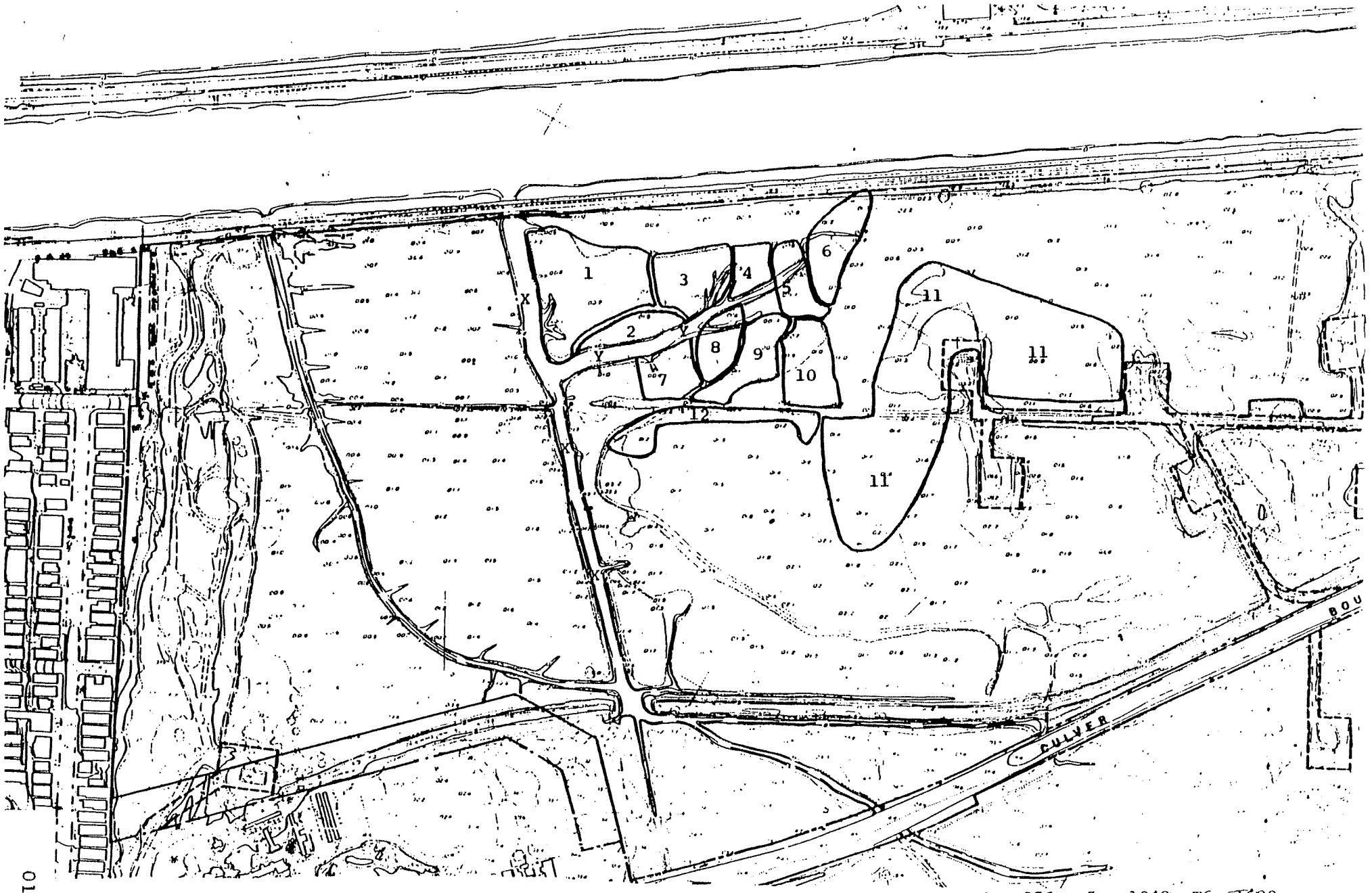
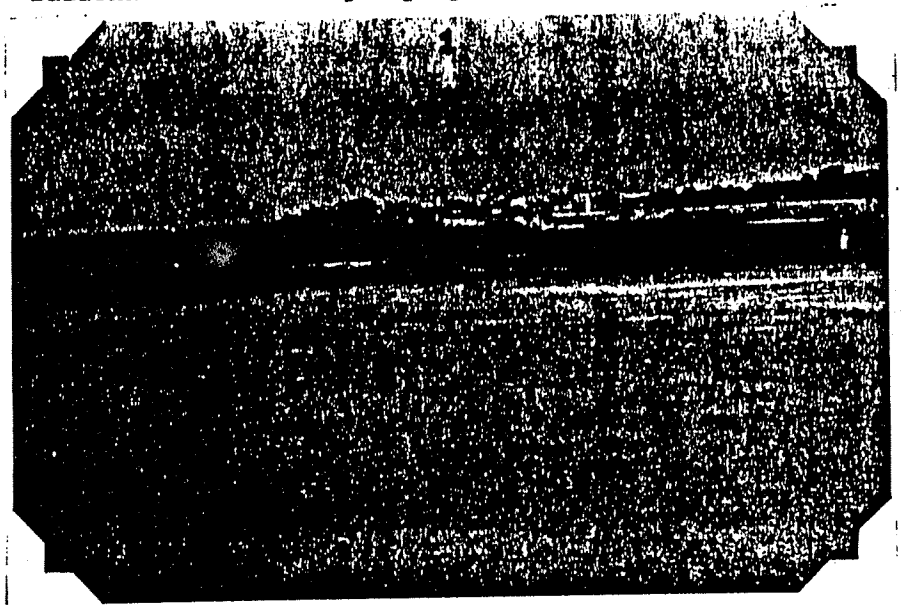
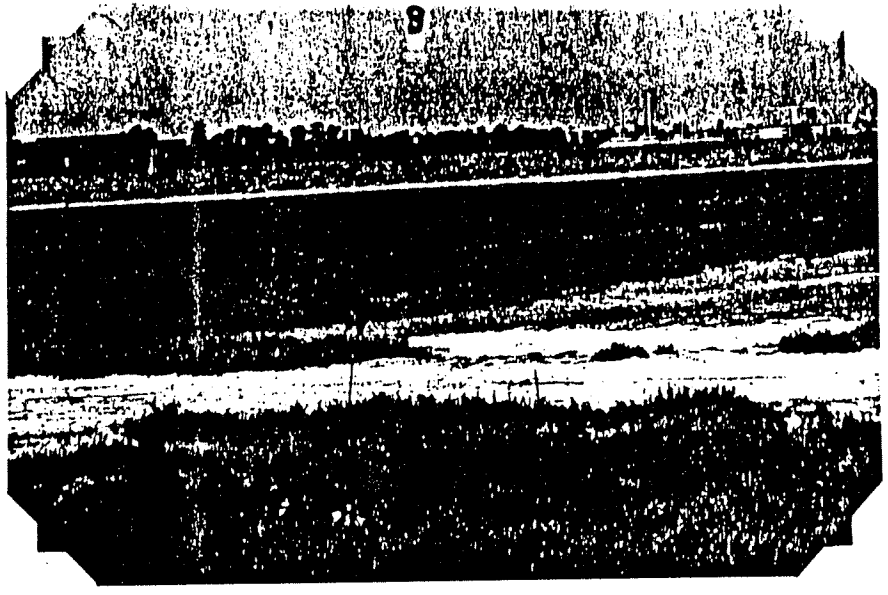
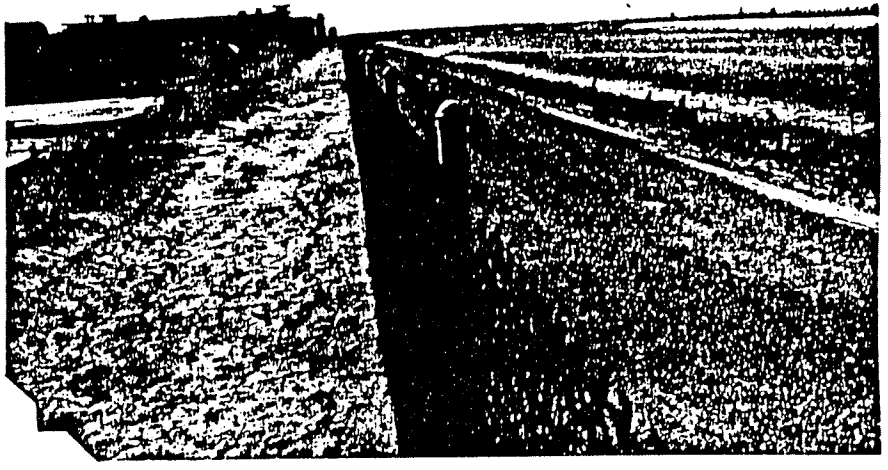


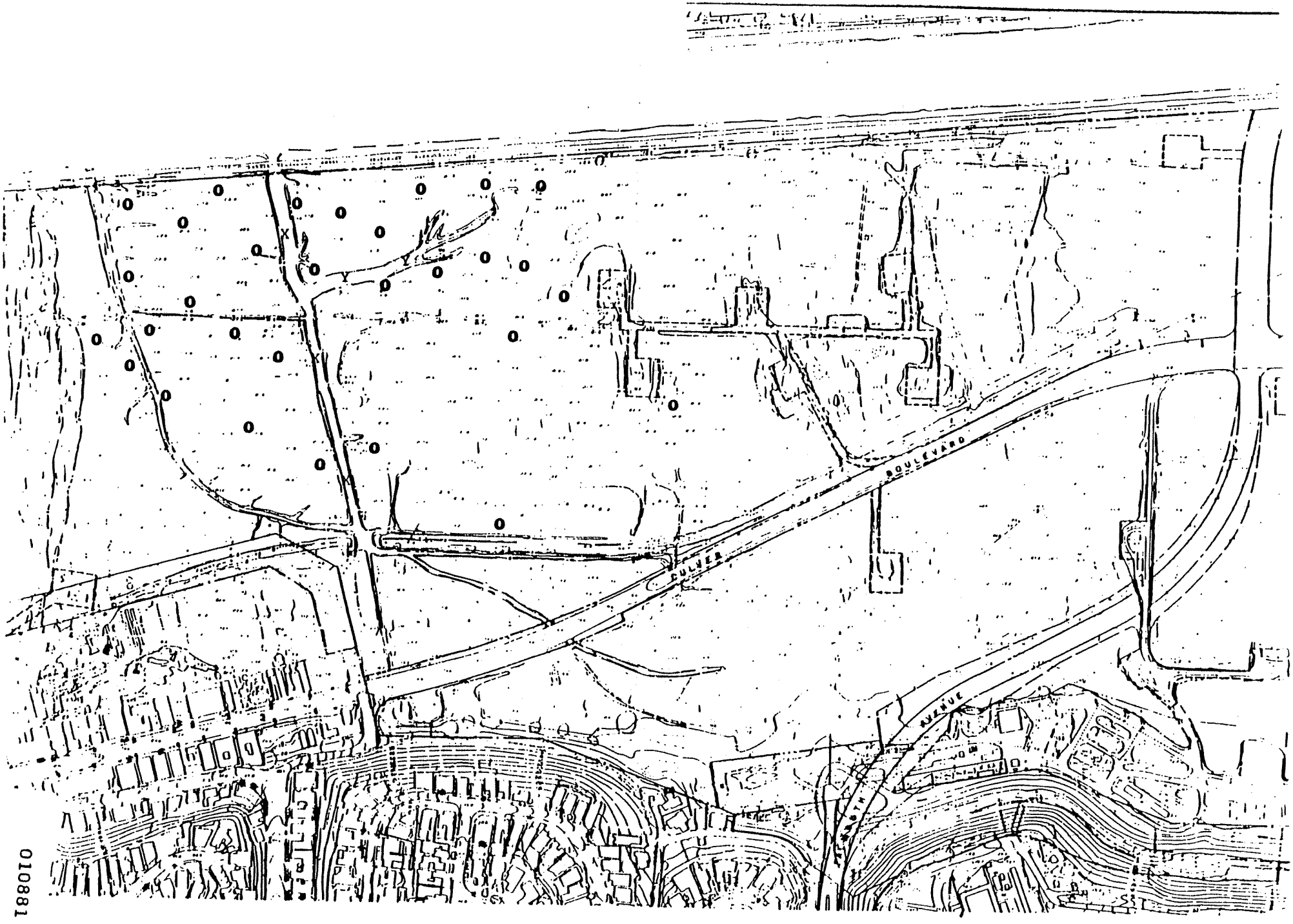
Fig. 3. Territory sizes in 1990, in square meters. T1 - 5468, T2 - 1220, T3 - 2122, T4 - 856, T5 - 1049, T6 - 1682, T7 - 1583, T8 - 1779, T9 - 1654, T10 - 1994, T11 - 19081, T12 - 1506.

Figure 4. Photographs of the four feeding plots taken in October 1990. Plot 1) 60% pickleweed, 40% saltflat; Plot 2) 60% pickleweed, 40% tidal channels; Plot 3) 95% pickleweed, 5% saltflat; Plot 4) south edge of Ballona Creek showing riprap where Belding's Savannah Sparrows fed.









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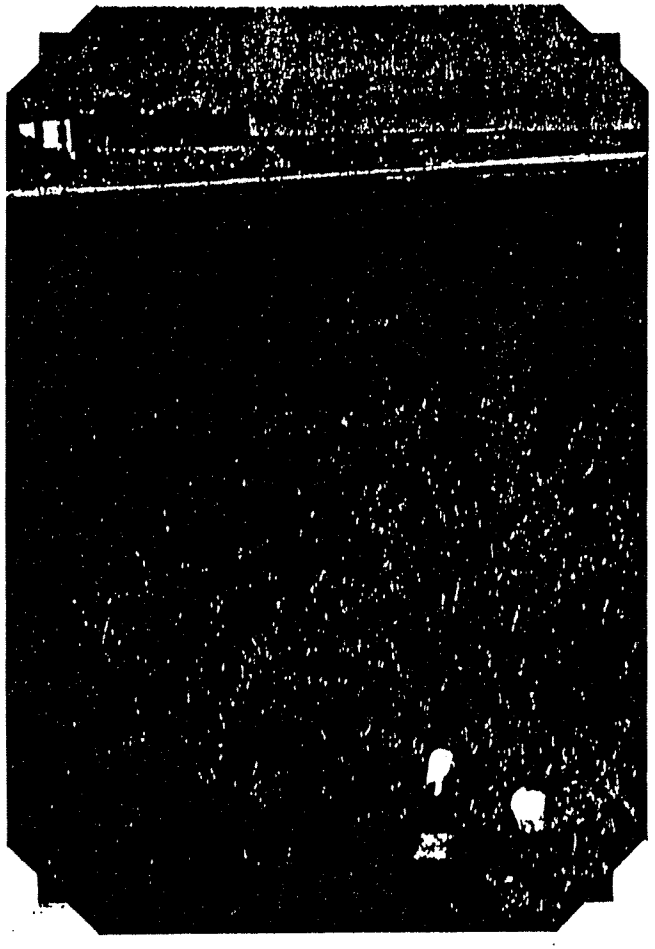
Figur BSS census of Ballona wetlands, April 1987, showing locations of 30 territorial males.

Figure 6. Portions of the area where Belding's Savannah Sparrows nested, photographed in October 1990, and showing: A) fairly healthy saltmarsh vegetation bordering a tidal channel in T3, B) dessicated pickleweed in T7, and C) nest in T7 which could not be seen during the breeding season when the vegetation provided more cover.



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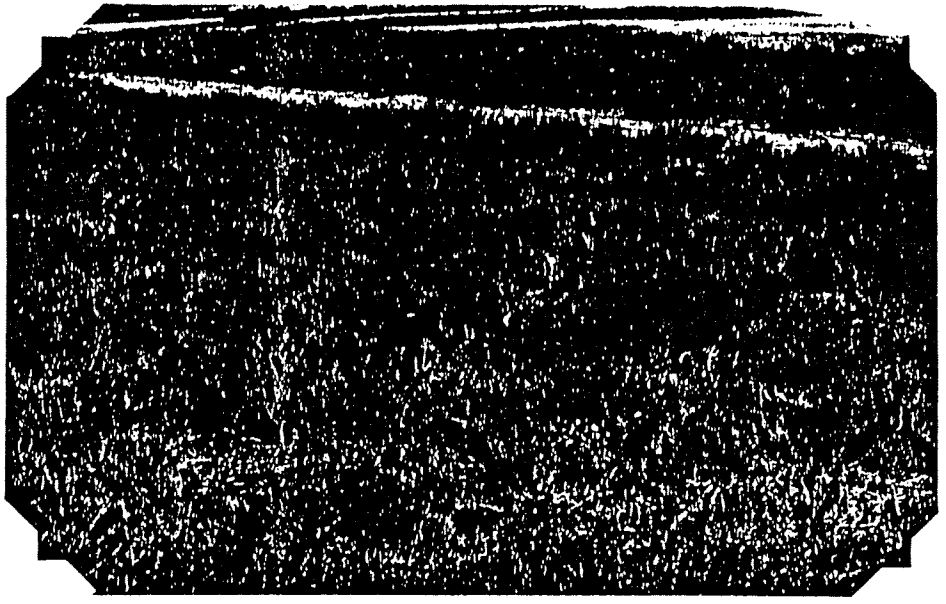

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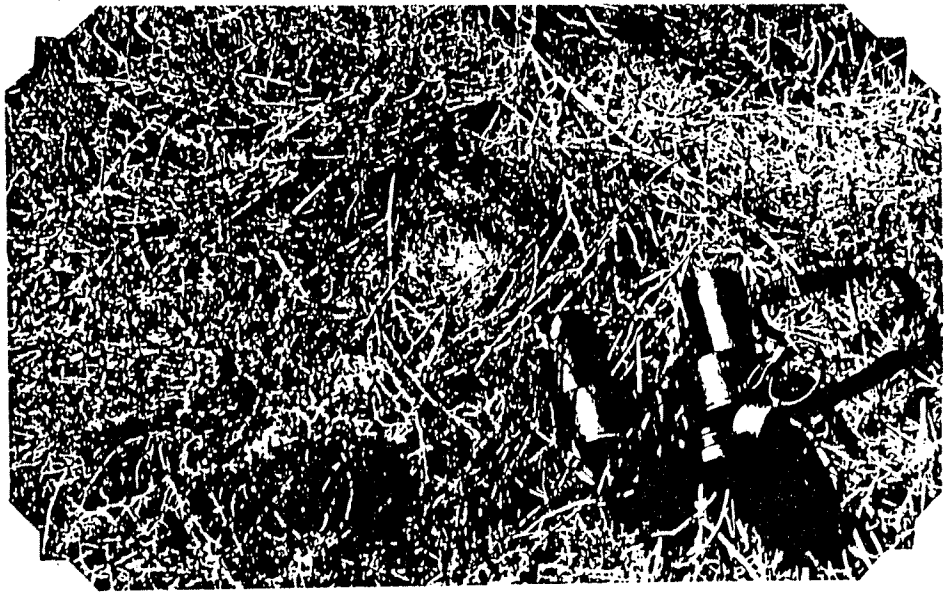

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Table 1. Territory sizes for 1989 and 1990 in square meters.

T	1989	T	1990
1	1411	1	5468
2	1439	2	1220
3	2040	3	2122
4	984	4	856
5	1247	5	1049
6	2178	6	1682
7	1522	7	1583
8	2540	8	1779
9	1573	9	1654
-		10	1994
-		11	19081
-		12	1506

Table 2. 1990 summaries of winter and summer index counts for BSS in Plots 1, 2, 3, and 4. Thirty six one minute surveys were conducted for each plot and Ballona Creek in each season.

	NUMBER OF SIGHTINGS	
Plot	Winter	Summer
1	19	12
2	37	48
3	49	71
4	26	28

Table 3. Data from vegetation transect in Plot 3.

	LINE TRANSECT			CIRCLE
	live *Salicornia* (cm)	bare ground (cm)	litter (cm)	% cover
0- 5M	0	75	425	70%L, 30%B
5-10M	0	10	490	85%L, 15%B
10-15M	0	0	500	95%L, 5%B
15-20M	0	120	380	100%L, 0%B
20-25M	0	310	190	60&L, 40%B
25-30M	0	420	80	5%L, 95%B
30-35M	0	100	400	70%L, 30%B
35-40M	62	40	392	95%L, 5%B
40-45M	150	40	310	35%L, 65%S
45-50M	180	0	320	75%L, 25%B
50-55M	160	20	320	45%L, 15%B, 40%S
55-60M	200	0	300	5%L, 20%B, 75%S
60-65M	60	60	380	60%L, 20%L, 20%S
65-70M	150	30	320	90%L, 10%B
70-75M	250	0	250	100%L, 0%B
75M				25%L, 75%S

TABLE 4. BANDING DATA

BAND NUMBER	COLOR CODE	1ST BANDED	# RECAPS	MOLT	SEX
970 67001	RW-GS	7/27/89	1		
67002	KS-GW	7/27/89			
67003	WK-SG	8/03/89			
67004	WR-GS	8/03/89			
67005	RW-KS	8/03/89			
67006	WR-SG	8/05/89	1		
67007	KG-SR	8/05/89			
67008	KR-WS	8/05/89	1	+	M
67009	SK-GW	8/05/89			
67010	WK-KS	8/05/89			
67011	WR-RS	8/05/89			
67012	MB-KS	9/02/89			
67013	SM-WK	9/02/89		+	M
67014	bK-SG	9/02/89		+	
67015	RB-SB	9/02/89			
67016	KM-BS	9/02/89		+	
67017	GS-MB	9/02/89			
67018	BS-RG	9/02/89			
67019	bG-MS	9/02/89		+	
67020	MR-SB	9/02/89			
67021	Wb-SR	9/02/89			
67022	Sb-MB	9/02/89		+	
67023	Sb-RB	9/02/89			
67024	GB-WS	9/02/89		+	
67099	GK-RS	8/05/89	1		M
67100	KG-RS	7/27/89			
67025	NONE	2/27/90			
67026	MR-SG	2/27/90			
67027	SR-GK	2/27/90			
67028	SM-MM	3/03/90			M
67029	SR-RR	4/15/90			M
67030	MK-SK	5/28/90			M

Table 5. Banded B.S.S. observed in the field. Color combination, date of banding (in bold type), and dates the bird was observed in the field are given.

RW-GS	SM-WK	KR-WS	SK-GW	WR-SG	GK-RS	MB-KS	SM-MM	SR-RR	MK-SK
7/28/89	**8/05/89**	**8/05/89**	**8/05/89**	**8/05/89**	**9/02/89**	**9/02/89**	**3/03/90**	**4/15/90**	**5/28/90**
11/13/89	03/09/90	03/09/90	03/05/90	03/09/90	03/03/90	11/13/89	03/05/90	04/28/90	06/02/90
05/01/90	04/28/90			03/30/90	03/05/90		03/30/90	05/16/90	06/19/90
	07/02/90			04/15/90	03/09/90		06/12/90		06/20/90
	07/10/90			04/28/90	04/28/90		07/02/90		07/02/90
				06/07/90	05/01/90				07/10/90
				06/12/90	05/16/90				
				06/19/90	06/12/90				
				07/02/90	06/19/90				
				07/24/90	06/26/90				
					07/02/90				
					07/10/90				
					07/24/90				

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35-40M	62	40	392	95%L, 5%B
40-45M	150	40	310	35%L, 65%S
45-50M	180	0	320	75%L, 25%B
50-55M	160	20	320	45%L, 15%B, 40%S
55-60M	200	0	300	5%L, 20%B, 75%S
60-65M	60	60	380	60%L, 20%L, 20%S
65-70M	150	30	320	90%L, 10%B
70-75M	250	0	250	100%L, 0%B
75M				25%L, 75%S

TABLE 4. BANDING DATA

BAND NUMBER	COLOR CODE	1ST BANDED	# RECAPS	MOLT	SEX
970 67001	RW-GS	7/27/89	1		
67002	KS-GW	7/27/89			
67003	WK-SG	8/03/89			
67004	WR-GS	8/03/89			
67005	RW-KS	8/03/89			
67006	WR-SG	8/05/89	1		
67007	KG-SR	8/05/89			
67008	KR-WS	8/05/89	1	+	M
67009	SK-GW	8/05/89			
67010	WK-KS	8/05/89			
67011	WR-RS	8/05/89			
67012	MB-KS	9/02/89			
67013	SM-WK	9/02/89		+	M
67014	bK-SG	9/02/89		+	
67015	RB-SB	9/02/89			
67016	KM-BS	9/02/89		+	
67017	GS-MB	9/02/89			
67018	BS-RG	9/02/89			
67019	bG-MS	9/02/89		+	
67020	MR-SB	9/02/89			
67021	Wb-SR	9/02/89			
67022	Sb-MB	9/02/89		+	
67023	Sb-RB	9/02/89			
67024	GB-WS	9/02/89		+	
67099	GK-RS	8/05/89	1		M
67100	KG-RS	7/27/89			
67025	NONE	2/27/90			
67026	MR-SG	2/27/90			
67027	SR-GK	2/27/90			
67028	SM-MM	3/03/90			M
67029	SR-RR	4/15/90			M
67030	MK-SK	5/28/90			M

Table 5. Banded B.S.S. observed in the field. Color combination, date of banding (in bold type), and dates the bird was observed in the field are given.

RW-GS	SM-WK	KR-WS	SK-GW	WR-SG	GK-RS	MB-KS	SM-MM	SR-RR	MK-SK
7/28/89	**8/05/89**	**8/05/89**	**8/05/89**	**8/05/89**	**9/02/89**	**9/02/89**	**3/03/90**	**4/15/90**	**5/28/90**
11/13/89	03/09/90	03/09/90	03/05/90	03/09/90	03/03/90	11/13/89	03/05/90	04/28/90	06/02/90
05/01/90	04/28/90			03/30/90	03/05/90		03/30/90	05/16/90	06/19/90
	07/02/90			04/15/90	03/09/90		06/12/90		06/20/90
	07/10/90			04/28/90	04/28/90		07/02/90		07/02/90
				06/07/90	05/01/90				07/10/90
				06/12/90	05/16/90				
				06/19/90	06/12/90				
				07/02/90	06/19/90				
				07/24/90	06/26/90				
					07/02/90				
					07/10/90				
					07/24/90				