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ABSTRACT

Thirty-two coastal salt marshes were surveyed for state-endangered Belding's Savannah sparrows (*Passerculus sandwichensis beldingi*), 18 March – 30 May 2001. Belding's Savannah sparrows exhibiting breeding behavior were detected in 30 of these wetlands from Goleta Slough in Santa Barbara County on the north to Tijuana Slough National Wildlife Refuge on the Mexican border. A minimum total of 2,902 pairs was detected. This is the highest state total reported since periodic counts began in 1973 and is 23.5% higher than the next highest count, reported in 1996. Point Mugu alone accounted numerically for this difference, wherein twice as many Belding's were recorded in 2001 than previously.

The major need of this little endangered songbird remains habitat restoration, security, and management. At least 75% of southern California's former coastal wetlands have been lost and the remainder suffers ongoing degradation. The long-term fate of a few of the occupied wetlands is still uncertain and most are affected by trespass and the side effects of so many millions of people living on their edges and in their watersheds. Counteracting these problems by rebuilding a larger habitat base, with better security, and increased management would greatly benefit a significant suite of species with which the Belding's Savannah sparrow shares its habitat.

Contract Final Report (S0150019) to California Department of Fish and Game

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INTRODUCTION

The Belding's Savannah sparrow (*Passerculus sandwichensis beldingi*) is one of few species of birds that reside year-round in the coastal salt marshes of southern California. This subspecies of Savannah sparrow is a salt marsh endemic, ranging from Goleta in Santa Barbara County, California on the north, south to El Rosario, Baja California, Mexico (American Ornithologists Union 1983, Grinnell and Miller 1944, and Van Rossem 1947). Over 75% of the coastal wetland habitats within this range have been lost or highly degraded (Wiley and Zembal 1989) and the remainder suffer from the effects of increasing human populations. The greatly reduced habitat base, increasing human impacts in the remnants, and small population sizes led to the listing as endangered of this little songbird by the State of California in 1974.

Belding's Savannah sparrows are ecologically associated with dense pickleweed, particularly *Salicornia virginica*, within which most nests are found. Breeding territories can be very small and they nest semi-colonially or locally concentrated within a larger block of habitat, all of which may appear generally suitable. They can be difficult to count accurately since they are secretive and forage throughout a marsh, often well away from nesting sites (Bradley 1973, Massey 1979). Consequently, only half the nesting population may be manifesting territorial behavior near nests at any given time (Massey 1979).

There were five surveys of the California population of breeding Belding's Savannah sparrows prior to the current study. The first in 1973 (Bradley 1973) resulted in a total count of 1,084 pairs but excluded several occupied marshes. Massey (1977) counted in all of the occupied wetlands but relied upon extrapolations for portions of the population estimates and reported 1,610 pairs. In 1986, 2,274 pairs were counted in 27 marshes (Zembal et al. 1987). There were late rains in 1991 and the state population estimate was 1,844 pairs, although the largest subpopulation was incompletely surveyed (James and Stadtlander 1991). The state population was counted again in 1996 for a total of 2,350 pairs (Zembal, unpublished data). The purpose of this report is to document the 1996 and 2001 surveys and update the status and distribution of the endangered Belding's Savannah sparrow in California.

METHODS

Territorial Belding's Savannah sparrows were counted in 32 wetlands in coastal southern California, 18 March – 23 May 2001. However, all but 4 of the surveys were conducted in March and April. The counts were done in the early morning from sunrise to a maximum of 4 hours later. If overcast or other conditions led to prolonged morning activity, occasionally the surveys continued into the later morning hours.

The survey results are a compilation of breeding territories in each marsh. Manifestation of territoriality was through their singing, scolding, extended perching together of mates, nest building, feeding young, aerial chases, and prolonged posting under certain circumstances. Aerial chases that were straight line indicated a single territory, with the bird being chased leaving the area. Aerial chases that were circular often indicated two territories, with the bird being chased holding its ground once removed from the original site of confrontation. Occasionally a third adjacent territory holder would get involved but again the chase would loop back over territorial boundaries. Adjacent territory holders would sometimes spar at boundaries, flying straight up and occasionally locking their feet together. Sometimes they fluttered back down into the vegetation, still locked together and sparring. Mates perched together regularly but one of the pair, probably the female, remained mostly hidden below the top of the vegetation. Regularly spaced individuals that were perched high and fully exposed in the *Salicornia* were all counted as

territory holders, including the few not singing at the time. Prolonged high perching during stronger territorial manifestations by other birds all around the exposed individual is a good indication that the perched individual holds the territory there. Observations on plots at the mouth of the Santa Margarita River demonstrated the need for including these perched birds for an accurate total count (Zembal 1986). Given ample observation time, birds that were perched high and exposed eventually sang or were joined by mates.

Surveys were completed in all of the coastal wetlands containing a few acres or more of *Salicornia* within the California range of the Belding's Savannah sparrow. A few of the smaller wetlands on the coast of Camp Pendleton, the Ventura River mouth, and Malibu Lagoon are not listed on the table. The habitat at these locations is too marginal, scant, and/or disturbed to support true subpopulations of the sparrows. The situation at McGrath State Beach and Aliso Creek is similar, but they are still included because sightings are more regularly reported therein.

Some of the count participants reported foraging and other non-territorial individuals. These birds were not included in the tally because they could have been counted before or after when they were on territory. This survey is intended to give an accurate indication of the breeding potential of the state population by reporting those individuals manifesting breeding behavior. Consequently, territories are tallied on the basis of observed behavior and reported as pairs.

The authors conducted most of the counts but many other individuals participated. The total observation time expended surveying was approximately 346 field-hours. Refer to the marsh summaries below for the count participants, times, dates, and observations.

RESULTS AND DISCUSSION

The 2001 census resulted in a population estimate of 2,902 pairs of Belding's Savannah sparrows in 30 marshes (Table 1). This is 23.5% higher than the next highest population estimate reported in 1996. The most significant increase was in Mugu Lagoon, where twice as many territorial individuals were observed as in 1996. Point Mugu accounted for 17% of the state population in 1996 and 27.8% in 2001. There have been numerous restoration projects at Point Mugu that have brought a considerable acreage of wetland under enhanced tidal influence. Consequently, this single marsh may represent 20% - 25% of the available marsh habitat in southern California. Furthermore, Belding's are widespread throughout the marsh, perhaps a product of dampened tidal amplitude (see below).

There were 8 marshes with more than 100 pairs each, totaling 2,154 pairs, or 74.2% of the population. Six additional wetlands held more than 50 pairs each, accounting for 448 territories, or 15.4% of the total. Finally, 10 marshes housed fewer than 25 pairs, together comprising a total of 101 pairs, or 3.4% of the state population. Although the long-term viability of these little subpopulations may be questionable, it is noteworthy that they have persisted. This may be due to the proximity of larger subpopulation for most of them and potential re-colonization after extirpation. For example, Belding's in 2001 were once again defending territories in 4 marshes, where they were undetected in 1996.

Although Belding's Savannah sparrows occurred in greatest numbers and density in marshes with full tidal flushing (Zembal et al. 1987), they did not appear to nest abundantly on frequently wetted substrate. For example, in each of the marshes with remaining higher marsh habitat, there are invariably local concentrations of Belding's therein. High marsh goes on for miles still in some of the marshes in northern Baja California, Mexico but was greatly reduced in southern California, because it was the easiest filled and converted to other uses. Most of the high marsh

Table 1. Six Surveys Of Breeding Pairs of Belding's Savannah Sparrow in California, 1973 – 2001

LOCATION	NUMBER OF PAIRS					
	1973	1977	1986	1991	1996	2001
Santa Barbara County						
Goleta Slough	50	28	50	81	48	68
Carpinteria Marsh	100	34	74	52	64	75
Ventura County						
McGrath Beach State Park	-	12	0	1	0	0
Ormond Beach Wetlands	-	17	20	15	61	33
Mugu Lagoon	175	250	446	239	400	809
Los Angeles County						
Playa del Rey	25	37	32	5	37	13
Los Cerritos Marsh	-	5	2	9	4	19
Orange County						
Seal Beach National Wildlife Refuge	125	267	244	138	234	293
Sunset Aquatic Park	-	6	0	0	0	2
Bolsa Chica Wetland	40	186	163	110	193	154
Newland Avenue Marsh	-	-	24	32	20	18
Huntington Beach Strip Marsh	-	34	47	19	87	71
Santa Ana River Mouth (Newport Slough)	-	-	0	0	17	36
Upper Newport Bay	130	83	245	199	252	206
San Diego County						
Aliso Creek Marsh	-	-	5	5	0	1
Santa Margarita River Estuary	125	106	107	120	185	172
Buena Vista Lagoon	0	5	1	0	0	6
Agua Hedionda Lagoon	37	16	45	13	29	22
Batiquitos Lagoon	0	20	47	50	36	66
San Elijo Lagoon	17	30	31	47	42	75
San Dieguito Lagoon	0	9	39	39	42	40
Los Penasquitos Lagoon	160	52	156	108	115	129
(Mission Bay)						
Kendall-Frost Reserve	-	45	13	9	28	38
San Diego River Flood Control Chan.	-	70	28	9	8	26
FAA (Beacon) Island	-	4	0	0	0	4
(San Diego Bay)						
Paradise Marsh	-	16	19	14	6	7
Sweetwater Marsh NWR	-	40	118	141	78	93
F Street Marsh	-	18	8	15	12	9
Western Salt. Co. Dikes/Otay River	-	100	70	29	71	102
South Bay Marina Reserve	-	25	15	42	31	26
Tijuana Marsh NWR	100	95	225	303	250	289
TOTALS	**1084**	**1610**	**2274**	**1844**	**2350**	**2902**

left in southern California is artificially separated from full tidal influence by berms and roads. The dampened tidal conditions result in drier substrate that is probably more conducive to successful incubation and early chick survival, particularly during unusually cold, wet springs. However, enough tidal influence to retain salt marsh vegetational and hydrologic characteristics is required to keep upland plants and birds from replacing the Belding's and its habitat (Zembal et al. 1985).

Recognizing the disproportionate destruction of high marsh habitat, the infrequently inundated upper zone should be integrated amply into marsh restoration plans. This would help compensate for some of the historic losses of Belding's habitat, require the least grading of all the marsh zones, and provide areas for marsh vegetation to spread when sea level rises.

Nearly all of the wetlands occupied by Belding's Savannah sparrows are lacking in sufficient resources and oversight to help counteract the effects of so many millions of people living on their edges. Many of these people would gladly be part of a solution for the issues reported in "The Marshes" herein and the other problems confronting our wetlands and wetland wildlife. Vesting the public in their neighborhood wetland is something that numerous "friends" groups have already begun in an excellent way. However, most of them do not have the training or expertise available to them to prioritize and implement sound adaptive management strategies.

The activities that public servants and concerned citizens engage in are extremely beneficial, but mostly they do not have the resources to implement sound wildlife management to help maintain maximum viability of our coastal resources. Funding, expertise, and/or staff time are deficient or directed elsewhere

THE MARSHES

Santa Barbara County

Goleta Slough – 68 territories
Goleta Slough was surveyed by David Compton on 21 May 2001 for 3.5 field-hours. Over half (57%) of the Belding's were in the marsh that is most tidal; 29% were in the weakly tidal area; and 13% were in the non-tidal marsh. Belding's were most abundant along the upland edge of the marsh and the high side of the major creeks. Much of the tidal area is influenced by dampened tides that do not drain completely from low spots, rendering these unsuitable, although the pickleweed is rank. Goleta is totally fenced and human intrusions uncontrolled by the University are infrequent. There are ample signs of terrestrial predators, including feral cats, along with ongoing disturbance from the adjacent airport. Also, expansion of the airport into the marsh has been threatened for at least 25 years. Periodic closure of the ocean inlet and muted tides are ongoing, major issues.

Carpinteria Marsh – 75 territories
Carpinteria Marsh was counted by Dick Zembal on 19 April 2001 for 4 field-hours. Slightly fewer than half of the sparrows, 29 pairs, were in the smaller central basin between Santa Monica Creek and the Apple Street Drain. Although the larger west basin contains 4 – 5 times more salt marsh vegetation heavily dominated by pickleweed, tidal flow is dampened by 30 cm in the smaller basin (Onuf 1984) apparently favoring nesting Belding's. The sparrows were concentrated on the upland edges of the marsh and higher sides of the main creeks.

Predator tracks encountered included dog, cat, opossum, and large raccoon. Cats were observed along the marsh edge at Sandyland Road, where they are allowed to roam freely in and out of the wetland. Cats are an ongoing problem in this marsh, where homeowners will not be told what to do with their pets, and the marsh manager (University of California) will not argue too strongly for fear of losing support to manage this privately owned part of the wetland. Nursery operations continue to drain into the Apple Street Drain and the marsh, raising concern for potential effects from pesticides and fertilizers, as well as introduced species. A small-statured species of nonnative *Limonium* was found growing in the upper marsh at the end of the drain, where it took over several hundred square meters of marsh.

The marsh has a high potential for restoration, particularly the eastern end. However, it is in dire need of active management, particularly regular predator control.

Ventura County

McGrath Beach State Park - 0
The small wetland at the park transitions over time between freshwater marsh and pickleweed. Occasionally in the pickleweed state, Belding's are detected. The area and potential are small. The Ventura River mouth has small patches of pickleweed as well, within which Savannah sparrows are occasionally reported.

Ormond Beach Wetlands – 33 territories
Ormond Beach was covered by Lyn Perry and Martin Ruane on 10 May 01 in about 2 hours. The habitat along the beach contained 6 pairs with 27 pairs in the larger patch of marsh between the Edison and Haleco properties. This entire area is still heavily impacted by human recreation and a portion of the marsh will be destroyed to build a housing tract.

Mugu Lagoon (Naval Base Ventura County) – 809 territories
Mugu Lagoon was surveyed on March 26 – 29, April 3 – 6, 9 – 11 by Sue Hoffman, Tom Keeney, Kristin O'Connell, David Pereksta, Lyn Perry, Martin Ruane, Roy Vandehoek, Joy Yoon, and Dick Zembal with 12 field-days and approximately 85 hours of observation. The large number of territorial Belding's encountered represents 27.8% of the state total. There were 164 pairs in the eastern arm of the lagoon, 57 pairs in the central arm, and 588 pairs in the western arm. All but 11 of the central arm pairs were in cells isolated from the tides by berms and roads.

More than twice as many Belding's were tallied in 2001, compared with the next highest count taken in 1996. The huge increase in Belding's probably resulted from a variety of factors, particularly restoration projects that have resulted in limited tidal access to many formerly isolated patches of marsh that were very dry or too wet. There has also been an intensive predator management program employed annually since 1996. Unfortunately, there are signs of enough sedimentation to render much of the Mugu marsh under muted tidal regime and the hydrological equivalent of high marsh. Belding's now seem to be everywhere in the marsh. This is great for the Savannah sparrow in the short term but may eventually lead to loss of marsh with upland encroachment.

Los Angeles County

Playa del Rey – 13 territories
Playa del Rey was surveyed by Kathy Keane on 29 April and 9 May for 2 field-hours and on 2 May by Dan Cooper and Roy Vandehoek for 1 field-hour. All of the territorial sparrows were in the wetland between Culver Boulevard and Ballona Creek. A few non-singing individuals were

observed in the wetland south of Culver Boulevard. This little wetland is in major need of restoration and management. The Belding's resurged in 1996 only to be beaten back again by pervasive non-native predators, including red foxes and feral cats.

Los Cerritos – 19 territories
Los Cerritos Marsh was surveyed on 10 April by Lenny Arkinstall and Sue Hoffman for 2 hours. This little wetland has received major management attention by Lenny and one manifestation is a high count of breeding Belding's in 2001.

Orange County

Seal Beach National Wildlife Refuge – 293 territories
The Seal Beach NWR was counted on 26 March by Tim Andersen, Lenny Arkinstall, Leslie Ballou, John Bradley, John Fitch, Sue Hoffman, Dick Kust, Don May, and Dick Zembal for 36 field-hours. Most of the Belding's were concentrated in the rank pickleweed north of Bolsa Avenue (144 pairs), including 15 pairs on the edge of the 3 islands in the north restoration area. There were also concentrations east of Case Road and in the southeast corner of the NWR in the area restored in 1980. The northern part of the area east of Case Road and the entire concentration north of Bolsa Avenue are subject to extremely muted tidal regimes. This is the highest count reported for the Seal Beach NWR and probably reflects successful restoration and ongoing management strategies, which include predator management during the breeding season. The count was 25.2% higher than in 1996.

The large-billed Savannah sparrow (*Passerculus sandwichensis rostratus)* occurs with the Belding's in some of the wetlands in winter. A count was done in the Seal Beach NWR on 12 December 2000 by Loren Hays, Sue Hoffman, Peter Knapp, Jim Pike, and Dick Zembal. The edge of the wetland was walked slowly during a tide high enough to inundate most of the marsh. A minimum total of 47 large-billed Savannah sparrows was counted.

Sunset Aquatic Park – 2 territories
This little isolated patch of pickleweed is adjacent to the Seal Beach NWR and was counted by Dick Zembal for one-half hour on 26 March. It is treated separately herein because it is supposed to be included eventually in a restoration plan for the entire Sunset Aquatic Park. It is a tiny patch of habitat that is probably dependant upon the adjacent refuge for consistent presence of Savannah sparrows.

Bolsa Chica – 154 territories
Bolsa was counted on 3 April by Jack Fancher, Loren Hays, Sue Hoffman, Peter Knapp, and Dick Zembal with 20 field-hours. The count was lower than expected based on a 12-count mean of 175 pairs, 1986 – 1998. Late rains inundated several cells that probably had territorial Belding's in them later in the season. The 1996 count of 249 pairs was the 6-count high.

Newland Avenue Marsh – 18 territories
This little isolated wetland was surveyed by Sue Hoffman on 8 April for 2 field-hours. The pickleweed is maintained by seepage from the flood control channel and rainfall. The wetland is impacted by use as a neighborhood playground in the drier parts of the field. Trucks from the adjacent oil tank farm occasionally drive into the habitat area. Public ownership of the wetland is needed along with adequate fencing and monitoring of the habitat for implementation of appropriate management measures. The field is regularly visited by red foxes and other introduced predators.

Huntington Beach Strip Marsh – 71 territories
The Huntington Beach Wetlands were counted March 18 and 24 by Sue Hoffman and Dick Zembal for 6 field-hours. These isolated pickleweed patches are subject to highly variable rainfall and limited seepage resulting in unpredictable habitat conditions. The Talbert Marsh restored wetland at the south end of the strip has yet to vegetate adequately to accommodate Belding's. There were automobile tracks through the patch at the north end and bicycle tracks; joggers, cats, and dogs were observed in the marsh.

Santa Ana River Mouth (Newport Slough) – 36 territories
Newport Slough was surveyed on 18 March by Sue Hoffman and Dick Zembal for 3 field-hours. This is a restoration success story for Belding's and this little wetland. Prior to 1996 the only Savannah sparrows detected in the wetland were of the inland race. New tide gates and culverts were installed transforming the once-isolated wetland into a healthy marsh. The U.S. Fish and Wildlife Service is tasked with management of the wetland and monitors it for problems. It is fenced and much of the trespass has been alleviated.

Upper Newport Bay – 206 pairs
The Ecological Reserve at Newport was surveyed on April 1 and 8 for 20 field-hours by John Bradley, Sue Hoffman, Dick Kust, Phil Smith, and Dick Zembal. Most of the birds, 119 pairs, were observed in the high marsh on the northwest side of the Bay above the dike and below the YMCA toward Jamboree Road. This area has accumulated sediment from storm flows out of San Diego Creek and is now inundated only during very high tides. The Newport count was low partly because of overcast, drizzly weather. Very little Belding's activity was noted in the lower end of the Bay, along the islands, compared to past years.

The problems at Upper Newport Bay are the same as they have been since the first Belding's count. There is little consistent control of human and pet trespass into the marsh, no predator management, no consistent monitoring of predator populations, and no focused wildlife management program. Additionally, sporadic sediment removal activities right in the reserve are greatly disruptive of the endangered and other inhabitants of the wetland.

San Diego County

Aliso Creek Marsh – 1 territory
This little remnant of a salt marsh was surveyed by Deborah Bieber on 22 April over 1 field-hour. In 1984 there were 11 territories in this tiny wetland that sits in a sump behind the beach, sustained by seepage. Since then, military vehicles and personnel have moved through the marsh often enough to destroy most of it. The little that remains is disturbed too regularly to support breeding Belding's.

Santa Margarita River Lagoon – 172 territories
The Santa Margarita River Marsh was surveyed on 13 April by Deborah Bieber, Sue Hoffman, Tara Schoenwetter, Christy Wolf, and Dick Zembal over 13.75 field-hours. The saltpan habitat and pickleweed behind the beach are being sustained by seepage and rainfall. The mouth of the river has been mostly closed to the ocean since 1987. This has led to the periodic submergence and destruction of what used to be lush Belding's habitat along the river edge. This wide swath is now brown and dead but used to sustain 28% - 72% of the Belding's at the river mouth. The Belding's have moved onto the saltpan and hind dune areas and in 2001 were sustaining their numbers. However, with river mouth closure will come wide swings in environmental conditions and big annual variations. There will be years when most of the pickleweed and substrate are too wet for successful nesting.

The river mouth used to sustain productive estuarine conditions for a wide variety of wildlife—birds and fishes in particular. It is now a shallow lagoon that is being allowed to gradually fill with sediment. This is occurring at a time when all of the other public agencies responsible for wetlands on the coast of southern California are strategizing with multiple partners for wetland restoration that includes open river mouths for maximum wetland function. Tanks and other vehicles regularly move across the river mouth; when the lagoon is open to the ocean, some of the vehicles are inconvenienced by deeper water.

Buena Vista Lagoon – 6 territories
Buena Vista Lagoon was surveyed on April 7 and 13, independently by Jerry Smith and Dick Zembal for a total of 3 field-hours. The salt marsh vegetation forms a narrow veneer along high spots bordering the dominant cattails and bulrushes. The patch reported to contain one territory in 1986 has been so badly tracked by vehicles and fishermen that it is uninhabitable. A patch more isolated from such disturbance has developed to the west and most of the Belding's were found therein. Elsewhere in the central lagoon between the freeway and Pacific Coast Highway there is a thick edge of pickleweed along much of the brackish marsh but it is too thin and disturbed by fishermen and other visitors to support breeding Savannah sparrows.

Agua Hedionda Lagoon – 22 territories
Agua Hedionda was surveyed by Lyann Comrack, David Lawhead, Dave Mayer, Kim McKee, and Seth Schulberg on 28 March for 12 field-hours. All of the territorial Belding's were detected on the edge of the inland lagoon. Seventy-seven percent were in the largest expanse of pickleweed on the inland extreme of the inner lagoon.

Regular dredging keeps this lagoon open to the ocean giving it a very high potential for restoration of salt marsh habitat. However, people and pet traffic are regular and uncontrolled and the lagoon now suffers from an introduction of an invasive aquarium alga, *Caulerpa taxifolia*, which threatens aquatic life and habitats. Furthermore, tidal access, although consistent, appears to be heavily muted, probably due to the narrowness of the maintained ocean entrance.

Batiquitos Estuary – 66 territories
Batiquitos Lagoon was surveyed by Holly D. Henderson, Clay Reed, and Rachel A. Woodfield on April 23, 24, 26, and 27 for a total of 26 field-hours. All but one territory were detected along the edge of the inner lagoon. Forty-one percent of all territories were on the inland edge of the inner lagoon. Since the restoration and management of the lagoon toward a full tidal system began, pickleweed has continued to expand and the Belding's have nearly doubled since the 1996 count.

San Elijo Estuary – 75 territories
San Elijo Lagoon was counted by Monica Alfaro, Maryanne Bache, Andy Mauro, and Robert Patton on 23 May for approximately 11 field-hours. This is a 79% increase over the 1996 count and attests to the positive effects of the re-establishment of constant tidal influence and estuarine conditions for more than two years prior to the 2001 survey. There could actually be 20 more territories than reported herein. Fifty-four of those reported are based upon strong territorial indications, whereas an additional 41 Belding's were posted. To be conservative, we treat only about half of those as true territories, recognizing that there could be more. As reported previously, the Belding's are fairly evenly distributed in suitable habitat along all three subsections of the lagoon. The inner lagoon still has problems with flooding after late rains that pond behind the dike, flooding the inland pickleweed flats, disrupting nesting Savannah sparrows.

San Dieguito Lagoon – 40 territories
San Dieguito Lagoon was surveyed by Robert James and Kim Miller on April 3 and 4 for 12 field-hours. Approximately 53% of the Belding's were detected on the southeast edge of the main lagoon. This area is attached to the mainland and the least influenced by flooding, because the river mouth is often closed. Six pairs were found inland of the freeway in habitat patches that are inconsistently occupied by Belding's. There have been habitat restoration efforts in San Dieguito that have resulted in an increase in salt marsh vegetation. However, the lagoon is seldom fully open to the ocean and the main island which often houses the majority of this subpopulation is flooded with the backup of late rains as in 2001. Fishermen, cyclists, joggers, and pet walkers were observed or left sign in the marsh patch holding most of the Belding's in 2001.

Los Penasquitos Lagoon – 129 territories
Los Penasquitos was surveyed by Peter Beck, Christine Collier, Lyann Comrack, Dave Lawhead, and Dave Mayer on April 6, 13, and 14 for 17.5 field-hours. The count total was slightly up from recent counts, 12% higher than in 1996, but 19% lower than in 1973. Belding's were fairly evenly distributed on both sides of the railroad trestle.

Los Penasquitos Lagoon is still largely a lagoon and subject to dramatic fluctuations in drying and ponding. Late rains in 2001 flooded the inland pickleweed marsh and may have wetted many nests. If it is ever possible to establish a consistent hydrologic regime in Los Penasquitos, it would be of great benefit to wildlife.

Mission Bay

Kendall-Frost Reserve – 38 territories
The University of California's Kendall-Frost Reserve was surveyed by Sue Hoffman and Dick Zembal on 28 April over 3 field-hours. Belding's have been concentrated around the high salt flat on the inland edge of the marsh near Campland in the past. In 2001, however, they were very evenly distributed throughout much of the marsh, and only 18% were in the high corner. This relatively uniform distribution of an increased number of Belding's, the presence of 20 Forster's tern (*Sterna forsteri*) nests in the outer marsh, and reduced vigor in the cordgrass lead to suspicion that the marsh is not being as tidally influenced as formerly.

The Kendall-Frost Reserve is extremely isolated from supporting habitats or corridors. As a result, it is plagued with urban predators. Three different cats were observed on the marsh edge during the count. An effective barrier to animals that have been relocated or rehabilitated and released on the marsh edge, abandoned or allowed to roam "free" by owners would help protect the Belding's and other wildlife of this little wetland. It has been an annual ordeal to identify funds for predator management to protect nesting listed species. In some years, there is no funding and in others it has come too late to prevent the destruction of endangered light-footed clapper rail (*Rallus longirostris levipes*) nests.

San Diego Flood Control Channel – 26 territories
The Flood Control Channel was counted by Sue Hoffman and Dick Zembal on 28 April over 6 field-hours. Salt marsh vegetation again dominates the flats west of Interstate 5, but the dominant plant is *Jaumea carnosa*. *Salicornia* that is lush enough to support Belding's nests is limited to the fringe of the channel and a few high spots. Thick cordgrass (*Spartina foliosa*) has colonized the western flats and the cattails are confined to patches further inland.

Prior to 1980 the vegetated flats were dominated by pickleweed (Zedler 1982). Following heavy rainfall and prolonged releases of fresh water from El Capitan Reservoir, cattails almost totally replaced the pickleweed for a brief period. The pickleweed never recovered to its former extent. Since then, when the freshwater marsh periodically invades and then recedes, the *Jaumea* prevails in the subsequent salt marsh phase. The periodic disturbance and brackish conditions have apparently favored it over the pickleweed.

FAA (Beacon) Island – 4 territories
FAA Island was counted by Lyann Comrack on 11 April for 0.3 field-hours. Management of the island for California least terns (*Sterna albifrons browni*) includes weed removal. Recently, care has been taken to avoid the veneer of pickleweed around the edge and the Belding's are back in a small way.

San Diego Bay

Paradise Marsh – 7 territories
Paradise Creek Marsh was counted by Sue Hoffman and Dick Zembal on 14 April for 1 field-hour. There are a few high spots of thick pickleweed and nesting Belding's. However, this little wetland is very narrow and heavily impacted by the noise of Interstate 5. The freeway is loud enough to mask cues from predator that otherwise would alert the Belding's. One of the territorial males was singing from the edge of the "connector" marsh, which is even closer to the freeway and narrower. There were abundant signs of people, cats, and dogs in the marsh and on its edge. One makeshift shelter under a Myoporum shrub held 5 new (stolen?) bicycles.

Sweetwater Marsh National Wildlife Refuge – 93 territories
The Sweetwater Marsh was surveyed by Sue Hoffman and Dick Zembal on 14 April for 5 field-hours. Belding's were territorial along the larger creek and channel margins and particularly abundant in the extensive high marsh on the inland third of the wetland, where salt marsh daisies (*Lasthenia glabrata coulteri*) still abound in the spring.

Trespass and feral animal problems are dealt with on a regular basis by the NWR staff and the wetland inhabitants have benefitted. Trash is still a problem because very large chunks of old hulls and other such bulky objects wash up into the marsh from wind lap and the push of the tide. Some of these objects are so large that they do great damage to the marsh but are extremely difficult to remove.

"F" Street Marsh – 9 territories
"F" Street Marsh was surveyed by Sue Hoffman and Dick Zembal on 14 April for 1 field-hour. This little wetland is just across from Sweetwater Marsh but separated by a few hundred feet of uplands and a road. It is still romped through occasionally by people and pets but not so much as in the past. Tidal access is through a culvert which was recently repaired, allowing better flushing. This marsh should be connected with the Sweetwater by excavating the uplands between them. It is now too small and isolated to offer the resident Belding's much security.

Western Salt Company Dikes/Otay River Mouth – 102 territories
The marsh veneer in south San Diego Bay was surveyed by Sue Hoffman and Dick Zembal on 12 May for 5 field-hours and by Debbie Good, Callie Mack, and Phil Roulliard for 4.75 field-hours. The Belding's were concentrated along the Otay River Channel, where there were 58 territories, 57% of the total; and the outer edge along the bay, where 18% of the territories were found. A small creek that runs south from the channel out of the SDG&E facility on the northeast extreme of the Saltworks held 13 pairs, and there were 4 territories in the "J" Street Marsh north of the

SDG&E channel. The NWR Plan for the Saltworks should result in increased marsh vegetation and Belding's habitat over time.

South Bay Marine Reserve – 26 territories
The Marine Reserve was surveyed by Sue Hoffman and Dick Zembal on 14 April for 2 field-hours. Belding's remain territorial in the southern portion of the wetlands along the western edge of south San Diego Bay. This area has a very high restoration potential and is in dire need of management and securing from human and domestic animal encroachment.

Tijuana Slough National Wildlife Refuge – 289 territories
The Tijuana Marsh was surveyed by Greg Abbott, Dennis Breedlove, Brian Collins, Lyann Comrack, Irvin Fernandes, Pamela Higgins, Sue Hoffman, John Konecny, Dave Lawhead, Callie Mack, Dave Mayer, Jim Peugh, Phil Roulliard, Talulah Wiater, Shanna Wolf, and Dick Zembal on March 20, 23 and April 14 for 33 field-hours. Belding's territories were almost evenly split by the Tijuana River, with 142 in the Oneonta Lagoon section north of the river and 147 to the south.

Tijuana Marsh has become a center for wetland research, restoration, and management activity. Sedimentation and contaminants are issues of major concern for the endangered species of the wetland. Tracking sediment accrual, removing sediment bottlenecks, and ensuring that the river mouth remains open and the tidal prism nearly full should be of very high priority. A repeat of the river mouth closure and ensuing ecological disaster of 1984 must be avoided. It is equally important to continue working with Mexico to curtail other water quality issues in the Tijuana River.

RECOMMENDATIONS

It is recommended that each of the wetlands occupied by Belding's have a qualified wildlife biologist assigned whose primary duty it is to implement sound wildlife management measures at that wetland for the betterment of selected wildlife populations, including the Belding's Savannah sparrow. The activities should be collaborated with wetland ecologists and managed by the wildlife agencies in cooperation with the wetland's public support group. It is further recommended that each of the wetlands have an endowment fund established to support the research and management activities in perpetuity.

Solving the ecological issues of our coastal wetlands and wildlife will take resources and focus over decades. Learning to counteract the effects of human land use and activities on these important habitats and inhabitants like the little endangered Savannah sparrow should be a top priority. Public education, vigilance, and security at the wetlands could prevent future costly disasters like the dumping of invasive algae in Agua Hedionda.

Additional funding should be sought from stakeholders including existing programs such as the transportation enhancement (ISTEA) and environmental enhancement and mitigation (EEM) managed by Caltrans and other agencies.

It is important to keep up on the status of the Belding's Savannah sparrow. We recommend the survey be conducted every five years.

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