State of California
The Resources Agency
Department of Fish and Game
Habitat Conservation Planning Branch

A SURVEY OF THE BELDING'S SAVANNAH SPARROW

(*Passerculus sandwichensis beldingi*)

IN CALIFORNIA 2006

By

Richard Zembal, John Konecny, and Susan M. Hoffman

Clapper Rail Recovery Fund
Huntington Beach Wetlands Conservancy
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Cover photograph courtesy Loren Hays

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ABSTRACT

Thirty-two coastal salt marshes were surveyed for state-endangered Belding's Savannah sparrows (*Passerculus sandwichensis beldingi*), 16 March – 5 June 2006. Belding's Savannah sparrows exhibiting breeding behavior were detected in 29 of these wetlands from Devereux and Goleta Sloughs in Santa Barbara County on the north to Tijuana Slough National Wildlife Refuge on the Mexican border. A minimum total of **3,135** breeding territories was detected during approximately 342 field-hours. This is the highest state total reported since periodic counts began in 1973 and is **8.2%** higher than the next highest count, reported in 2001. The Point Mugu subpopulation alone accounted numerically for this difference; after doubling in size by 2001, it increased another 28.8% by 2006, comprising 33.2% of the state total.

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.

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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 historically 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 Rossen 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 six 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 territories 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 territories. In 1986, 2,274 territories were counted in 27 marshes (Zembal et al. 1987). There were late rains in 1991 that interfered with Belding's behavior and survey efforts and the state population estimate was 1,844 territories, although the largest subpopulation was incompletely surveyed (James and Stadtlander 1991). The state population was counted again in 1996 and 2001, yielding totals of 2,350 and 2,902 pairs, respectively (Zembal and Hoffman 2001). The purpose of this report is to document the 2006 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, 16 March – 5 June 2006. The survey period was much more prolonged than usual due to atypical spring rains and cold weather conditions. The counts were done in the early morning from sunrise to usually no more than 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 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 situations at McGrath State Beach and Aliso Creek are similar but these marshes 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 territories or presumed pairs.

The authors conducted most of the counts but many other individuals participated. The total observation time expended surveying was approximately **342** field-hours. Refer to the marsh summaries below for the count participants, times, dates, and observations.

RESULTS AND DISCUSSION

The 2006 census resulted in a population estimate of **3,135** pairs of Belding's Savannah sparrows in **29** marshes (Table 1). This is 8.2% higher than the previous highest population estimate reported in 2001. Fourteen of the subpopulations were larger in 2006, compared to 2001 and 18 were smaller. The subpopulation in Mugu Lagoon alone doubled between 1996 and 2001 and was another 28.8% larger in 2006. Point Mugu accounted for 17% of the state population in 1996, 27.9% in 2001, and 33.2% in 2006. 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 10 marshes with more than 100 pairs each, totaling 2,609 pairs, or 83.1% of the population. Five additional wetlands held more than 50 pairs each, accounting for 283 territories, or 9% of the total. Finally, 11 marshes housed fewer than 25 pairs, together comprising a total of 139 pairs, or 4.6% 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 subpopulations 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; these subpopulations persisted through 2006.

Although Belding's Savannah sparrows occurred in greatest numbers and densities in marshes with full tidal flushing (Zembal et al. 1987), they did not appear to nest abundantly on frequently

SEVEN SURVEYS OF TERRITORIAL BELDING'S SAVANNAH SPARROW IN CALIFORNIA, 1973 – 2006

LOCATION	NUMBER OF TERRITORIES						
	1973	**1977**	**1986**	**1991**	**1996**	**2001**	**2006**
Santa Barbara County							
Devereux Slough	-	-	-	-	-	-	**1**
Goleta Slough	50	28	50	81	48	68	52
Carpinteria Marsh	100	34	74	52	64	75	53
Ventura County							
McGrath Beach State Park	-	12	0	1	0	0	0
Ormond Beach Wetlands	-	17	20	15	61	33	50
Mugu Lagoon	175	250	446	239	400	809	1042
Los Angeles County							
Ballona Wetlands	25	37	32	5	37	13	12
Los Cerritos Marsh	-	5	2	9	4	19	33
Orange County							
Seal Beach National Wildlife Refuge	125	267	244	138	234	293	289
Sunset Aquatic Park	-	6	0	0	0	2	6
Bolsa Chica Wetland	40	186	163	110	193	154	201
Newland Avenue Marsh	-	-	24	32	20	18	6
Huntington Beach Wetlands	-	34	47	19	87	71	117
Santa Ana River Marsh (Newport Slough)	-	-	0	0	17	36	34
Upper Newport Bay	130	83	245	199	252	206	105
San Diego County							
Aliso Creek Marsh	-	-	5	5	0	1	0
Santa Margarita River Estuary	125	106	107	120	185	172	122
Buena Vista Lagoon	0	5	1	0	0	6	5
Agua Hedionda Lagoon	37	16	45	13	29	22	24
Batiquitos Lagoon	0	20	47	50	36	66	37
San Elijo Lagoon	17	30	31	47	42	75	137
San Dieguito Lagoon	0	9	39	39	42	40	58
Los Penasquitos Lagoon	160	52	156	108	115	129	203
(Mission Bay)							
Kendall-Frost Reserve	-	45	13	9	28	38	21
San Diego River Flood Control Chan.	-	70	28	9	8	26	16
FAA (Beacon) Island	-	4	0	0	0	4	0
(San Diego Bay)							
Paradise Marsh	-	16	19	14	6	7	20
Sweetwater Marsh NWR	-	40	118	141	78	93	119
F Street Marsh	-	18	8	15	12	9	7
Western Salt. Co. Dikes/Otay River	-	100	70	29	71	102	70
South Bay Marina Reserve	-	25	15	42	31	26	21
Tijuana Marsh NWR	100	95	225	303	250	289	274
TOTALS	**1084**	**1610**	**2274**	**1844**	**2350**	**2902**	**3135**

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 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) and perhaps to temper depredation, particularly by snakes.

Most of the southern California marshes are flooded during rains and in those with poor tidal exchange, the impounded water lingers. When the rains come late, slowly draining or stagnant impoundments preclude Belding's nesting in vast areas of upper marsh. San Elijo and Los Penasquitos Lagoons are examples but portions of the high marsh in most wetlands are rendered unsuitable after spring rains. Local runoff from increasing development has had the same effect at several wetlands. Batiquitos Lagoon for example, is so wet and poorly draining on the inland edge that many acres of pickleweed are being invaded by freshwater reeds and marsh birds such as song sparrows (*Melospiza melodia*), common yellowthroats (*Geothlypis trichas*), and marsh wrens (*Cistothorus palustris*).

On the upper edge of the saltmarsh, Belding's are limited by both the extent and vigor of pickleweed cover and the proximity of other, particularly upland, habitats and associated species. Belding's were observed being displaced from narrow bands of pickleweed by song sparrows three times in 2006: a Belding's flushed as a song sparrow approached and took over the song perch; a Belding's was chased 40 m; and in the final incidence a song sparrow actually body-slammed a Belding's off a song perch and then sang from the same perch. In most instances, narrow habitat belts and edges near uplands and freshwater marsh are simply not occupied by Belding's.

Based upon the 2006 surveys, Belding's Savannah sparrows are doing well within their range in California but particularly at Point Mugu, Los Penasquitos, and San Elijo Lagoons. This is associated in part with the levels and quality of hands-on efforts at these wetlands. Point Mugu has one of the most active and successful Natural Resources Management programs of any of the coastal wetlands in the southern California Bight. At San Elijo and Los Penasquitos Lagoons the ocean inlets are being monitored and kept open. This minimizes flooding and hyper-saline conditions that greatly reduce reproductive success.

In comparing the 2006 and 2001 surveys, there were 20% more wetlands with reduced numbers of Belding's than with increased populations. However, most of those reductions were insignificantly small. Eighteen marshes held a total of 324 fewer Belding's while 12 marshes increased collectively by 556 breeding pairs. The reductions varied from 1 to 32 pairs at individual wetlands but for two, Upper Newport Bay and the Santa Margarita River Estuary with 101 and 50 fewer pairs, respectively. The Newport Belding's have lost lower bay habitat to encroaching fresh water marsh and in the upper end, where the birds are now concentrated, sedimentation and human disturbance are affecting productivity. The Santa Margarita River Estuary is mostly closed to the ocean now and suffers the effects of prolonged flooding followed by hyper-salinity and prolonged drying.

Based upon the 2006 observations in 32 coastal wetlands, the most critical management issues for the Belding's Savannah sparrow remain the maintenance or enhancement of tidal flushing, and

the control of sediment, people, and their pets. However, there have also been many accomplishments in securing, restoring, and managing our coastal wetlands. As a result, the overall population trend has been positive and there are nearly three times as many breeding Belding's Savannah sparrows in 2006 than were documented in 1973.

THE MARSHES

Santa Barbara County

Devereux Slough – 1 territory
Devereux Slough comprises about one-third of the 158 acre Coal Oil Point Reserve, managed by the University of California, Santa Barbara. According to Mark Holmgren, Reserve Manager, Belding's have been nesting in the slough since at least 1993. Nesting success has been documented annually since then and there are up to 5 singing males present in any one year. In 2006, one territorial male was documented on several dates but was displaced from the slough by flooding. The inclusion of Devereux Slough splits the historically cited northern distribution of the Belding's Savannah sparrow between Devereux and Goleta Sloughs and extends it west approximately 1.5 miles. This narrow little wetland had coyote (*Canis latrans*) tracks along the edge of the pickleweed and all over the mudflat as well as human footprints on 9 March 2006.

Goleta Slough – 52 territories
Goleta Slough was surveyed by David Compton on 5 June 2006 for 5.5 field-hours. Half (50%) of the Belding's were in the marsh that is most tidal; 33% were in the weakly tidal area; and 17% were in the non-tidal marsh. Basin A (tidal) held 26 territories, Basins B – D (weakly tidal) held 17 territories, Basin L/M (non-tidal) held 8 territories, and Tecolotito Creek bank west of the runway (non-tidal) held 1 territory. In the tidal areas, Belding's were most abundant along the upland edge of the marsh. Much of the tidal area is influenced by dampened tides that do not drain completely from low spots, rendering these unsuitably wet, even though the pickleweed is tall and thick. Goleta is totally fenced and human intrusions are mostly controlled by the University. Noise disturbance from the adjacent airport is an ongoing issue. The main runway of the airport is to be shifted west partly into a non-tidal area that had a Belding's singing from it sporadically in 2006. However, tidal circulation was restored into an area that won't be affected by the runway shift and should support 2 or 3 Belding's territories. Periodic closure of the ocean inlet, muted tides, and stagnant water under otherwise suitable pickleweed are ongoing, major issues. However, the County of Ventura is currently tasked with keeping the ocean inlet open. Ponded water from late rains in 2006 probably accounted for some of the 23.5% reduction in Belding's territories.

Carpinteria Marsh – 53 territories
Carpinteria Marsh was counted by Peter Gaede on 5 May 2006 for 3.25 field-hours. The majority of the birds were found in fairly dense clusters at three main locations: 20 territories in the small central basin west of Santa Monica Creek; 25 territories in the western third of the west basin, most along the north side; and a small cluster of 6 territories was located in the west basin at the southern end of the dirt road. The sparrows were concentrated on the higher edges of the marsh.

Predator tracks encountered included opossum (*Didelphis marsupialis*), long-tailed weasel (*Mustela frenata*), raccoon (*Procyon lotor*), and red fox (*Vulpes fulva*). Cats, a continuing and significant problem in this marsh, were observed along the marsh edge at Sandyland Road where they are allowed to roam freely in and out of the wetland. Of greater concern is the residency and successful breeding of red foxes. Sightings have been regular in 2006: three pups were seen in April by Kim Kathol, and one in May by Gaede. Gaede reported seeing one or two adults on 5 of

8 visits to Carpinteria Marsh in 2006. The fox den is probably located along Santa Monica Creek. Given the residency of this non-native predator, the 29.3% decrease in Belding's territories in 2006 is probably due to increased predation. A small, densely clumped species of nonnative lavender *Limonium* was found growing in the upper marsh at the end of the drain where it took over several hundred square meters of marsh; control efforts have been largely successful. This same species of *Limonium* has now turned up in several of the San Diego wetlands. Carpinteria Marsh has a high potential for restoration, particularly the eastern end. However, it is in dire need of active management, particularly regular predator management.

Ventura County

McGrath Beach State Park - 0
The small wetland at the park shifts over time between freshwater marsh and pickleweed. It was checked briefly by Dick Zembal on April 17. Occasionally in the pickleweed stage, Belding's are detected. The potential for restoration is low. The adjacent Santa Clara River and proximal Ventura River mouth have patches of pickleweed as well, within which Savannah sparrows are occasionally reported. The patches of habitat are so narrow, however; territorial song sparrows preclude the Belding's from becoming firmly established.

Ormond Beach Wetlands – 50 territories
Ormond Beach was covered by Carly Gocal on 22 and 23 April 2006 in about 5 hours. The habitat along the beach adjacent to Arnold Road contained 31 pairs with an additional 19 pairs in the patch of marsh between the Edison and Haloco properties. Although the Coastal Conservancy has purchased the property, it is still heavily impacted by human recreation, trash dumping, and homeless encampments. There were dog and human tracks throughout the habitat detected during the survey. The area adjacent to the power plant north of Arnold Road has high potential for future Belding's habitat but is now very open, still wearing the scars of past power paragliding and ultra light aircraft activity. The Belding's population has fluctuated from 15 to 61 territories since the 1977 survey. The 2006 total is up 51.5% from 2001 but down 18% from the high in 1996. There appears to be very little control of human activity on Ormond Beach; it is in dire need of people-management.

Mugu Lagoon (Naval Base Ventura County) – 1,042 territories
Mugu Lagoon was surveyed on 9, 21 – 24, 29, 30 March and 7, 12, 13, 16, 17, 20 April 2006 by Carly Gocal, Sue Hoffman, Michelle Kuter, Nate Lang, Martin Ruane, and Dick Zembal, totaling over 14 field-days and approximately 65 hours of observation. There were 345 territories in the eastern arm of the lagoon, 337 territories in the central arm, and 360 territories in the western arm.

Two hundred thirty-three additional territories were observed during the 2006 surveys compared to 2001. This is a 28.8% increase and represents 33.2% of the entire state population. More than twice as many Belding's were tallied in 2001, compared with the previous highest count taken in 1996. The 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. Belding's now seem to be everywhere in the marsh. Unfortunately, there are signs of enough sedimentation to render much of Mugu marsh under muted tidal regime, resulting in the hydrological equivalent of high marsh. This habitat is great for the Savannah sparrow in the short term but may eventually lead to loss of marsh with upland encroachment.

Los Angeles County

Ballona Wetlands (Playa del Rey) – 12 territories
Ballona Wetlands, also known as Playa del Rey, was surveyed by Kathy Keane and Brad Henderson on 13 May 2006 for 8 field-hours. All of the territorial sparrows were in the wetland between Culver Boulevard and Ballona Creek. A few non-singing individuals have been observed in the past in the wetland south of Culver Boulevard. This little wetland is in major need of restoration and management, the planning for which is still underway. The quality of the habitat has actually improved slightly because of recent modifications to the tide gates from Ballona Creek. The water level was raised by 0.1 m and will be raised another 0.1 m by the U.S. Army Corps of Engineers in September 2006. Populations of non-native plants decreased in the marsh with the first modification and the increased tidal flushing appears to be improving the vigor of the pickleweed along the north-south channel from the tide gate. There also may be fewer western meadowlarks (*Sturnella neglecta*) in the area (Keane), reducing potential egg predation. Non-native predators remain a pervasive problem at Ballona including red foxes and feral cats.

Los Cerritos – 33 territories
Los Cerritos Marsh was surveyed on 27 April 2006 by Lenny Arkinstall and Eric Zahn for 3.25 hours. This little wetland has received major management attention by Arkinstall and one manifestation is a high count of breeding Belding's in 2006. The numbers were up 73.7% from 2001 levels which was the previous high count. Twenty-six of the territories were detected in the main marsh, the area surveyed in previous counts; 7 territories were documented in habitat patches scattered throughout the oil fields. Coyote tracks were present and a heavily-used raptor perch has been removed, both to the benefit of the Belding's. Trash is a problem in the scattered habitat patches. However, with tidal influence and habitat restoration, the patches could become significant habitat.

Orange County

Seal Beach National Wildlife Refuge – 289 territories
The Seal Beach NWR was counted on 12 April 2006 by Tim Andersen, Kristen Bender, John Fitch, Sue Hoffman, Bob Schallmann, Matt Teutimez, and Dick Zembal for 28 field-hours. Many of the Belding's were concentrated in the rank pickleweed north of Bolsa Avenue (86 pairs), including 19 pairs on the edge of the 3 islands in the north restoration area. There were also concentrations near the intersection of Case and Nasa Roads 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 muted tidal regimes. This is nearly the identical high count reported for the Seal Beach NWR in 2001, reflecting successful restoration and ongoing management strategies, which include predator management during the breeding season. The count was 23.5% higher than in 1996 but 1.3% lower than the 2001 count.

The large-billed Savannah sparrow (*Passerculus sandwichensis rostratus*, a California Species of Special Concern, 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. There has been no known update of the status of this subspecies.

Sunset Aquatic Park – 6 territories
This little isolated patch of marsh is adjacent to the Seal Beach NWR and was counted by Sue Hoffman for one hour on 30 April 2006. 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 small patch of habitat that is probably dependant upon the adjacent refuge for consistent presence of Savannah sparrows.

Bolsa Chica – 201 territories
Bolsa Chica was counted on 30 March 2006 by Lyann Comrack, Jack Fancher, Loren Hays, Peter Knapp, Brian Shelton, and Dick Zembal in approximately 24 field-hours. The Belding's have been surveyed in Bolsa Chica by the U.S. Fish and Wildlife Service 16 times since 1986. The 2006 count exceeded the mean of 175 pairs (1986 – 2006) by 15% and is the highest count tallied of all counts reported herein. In summary, the totals were: Inner Bolsa, 19 territories; Outer Bolsa, 11 territories; cells 30–42, 63, 67 territories; cells 50–55,59, 60, 67, 17 territories; cells 45-49, 61, 62, 39 territories; cells 2-29, 48 territories. Late rains inundated cells isolated by roads in Bolsa Chica, rendering some habitat marginal for nesting. In spite of the late rains in 2006 and the disruption caused by major restoration activity, the Belding's are doing well.

Newland Avenue Marsh – 6 territories
This little isolated wetland was surveyed by Lena Hyashi and Dick Zembal on 16 March and 19 April 2006 for 2.5 field-hours. Between the 2001 and 2006 surveys, there was a 67% reduction in territorial Belding's. The pickleweed is maintained poorly by seepage from the flood control channel and rainfall. The plants were largely dry and brittle and heavily invaded by upland weeds. The wetland is used as a neighborhood playground and vehicle tracks course across the site. 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 (Zembal observation).

Huntington Beach Wetlands – 117 territories
The Huntington Beach Wetlands were counted on 16 March and 19 April 2006 by Lenny Arkinsall, Sue Hoffman, Lena Hayashi, Eric Zahn, and Dick Zembal for 16.5 field-hours. These isolated pickleweed patches are subject to highly variable rainfall and limited seepage resulting in unpredictable habitat conditions. In spite of late rains in 2006, the count was 64.8% higher than in 2001 and the highest of the surveys since 1977. The restored Talbert Marsh, located at the south end of the strip, now has sufficient marsh vegetation to accommodate Belding's. In summary, there were 41 territories in the Beach Marsh (fenced parcel adjacent to Beach Boulevard and owned by Caltrans); 35 territories in the Magnolia Marsh (patch north of Magnolia Street); 38 territories in the Brookhurst Marsh; and 3 territories in the Talbert Marsh. There were automobile tracks through the patch at the north end as well as bicycle tracks. Joggers, cats, and dogs were also observed in the marsh. The Huntington Beach Wetlands Conservancy owns 93 acres of the wetlands and is developing plans for their restoration by improving tidal access.

Santa Ana River Marsh (Newport Slough) – 34 territories
Santa Ana River Marsh was surveyed on 16 March 2006 by 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, non-endangered race. New tide gates and culverts were installed, transforming the once isolated wetland into a healthier marsh. The U.S. Fish and Wildlife Service is tasked with management of the wetland and monitors it for problems although ownership is still under the U.S. Army Corps of Engineers. The area is fenced but the fence is in disrepair, and the main access gate is always open. Trash heaps associated

with homeless encampments are scattered about the property. This property is actually part of what used to be a much larger wetlands system at the mouth of the Santa Ana River.

Additionally, Loren Hays, reported a lone singing male on 10 February 2006 south of Santa Ana River Marsh in a small remnant patch of pickleweed on the north side of Pacific Coast Highway adjacent to Cappy's Restaurant in Newport Beach.

Upper Newport Bay Ecological Reserve– 105 pairs
Upper Newport Bay Ecological Reserve was surveyed on 24-27 March 2006 for 37 field-hours by Rob Baker, Sue Hoffman, Sue McIntire, Sheri Megery, Don Millar, Jennifer Naegele, Win Rhodes, Jim Robins, Brian Shelton, Matt Yurko, and Dick Zembal. Most of the birds, 74 pairs, were observed in the high marsh on the northwest side of the Bay above the breached salt dike and below the Muth Center toward Jamboree Road. This same area held 105 territories in 2001 and the overall count is down almost 50%. The historic area most important to Belding's above the dike has accumulated sediment from storm flows out of San Diego Creek and is now inundated only during very high tides. This area is now occupied by about 50% Belding's. Very little Belding's activity was noted in the lower end of the Bay compared to past years; the high marsh is mostly a narrow belt bordered by uplands and freshwater marsh with abundant song sparrows and other birds that outcompete Belding's for use of the habitat.

The problems at Upper Newport Bay include human and pet trespass into the marsh (observed by Zembal on most weekend visits) and a lack of predator monitoring and management. However, the Department let contracts for surveys of Belding's, light-footed clapper rails (*Rallus longirostris levipes*) and California least terns (*Sterna albifrons browni*) in 2006. Invasive plants are identified and removed by agency personnel and volunteers. Land management planning is underway including invasive plant control and restoration components. Dredging occurred in the bay in late 1998 and again in April 2006. This project, when completed, should result in removal of accumulated sediments and creation of additional channels that will benefit salt marsh species.

San Diego County

Aliso Creek Marsh – 0 territories
In 1984, there were 11 territories in this remnant salt marsh 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 or critically disturb most of it. The bit of pickleweed marsh that remains is disturbed too regularly to support breeding Belding's as observed by Zembal on 5 May 2006.

Santa Margarita River Lagoon – 122 territories
The Santa Margarita River Marsh was surveyed on 5 May 2006 by John Konecny, Sue Hoffman, and Dick Zembal over approximately 13 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 as many as 72% of the Belding's at the river mouth. The Belding's still occupy pickleweed clumps on the saltpan and along the hind dune, and are concentrated in the remnant pickleweed along the lagoon nearest the hind dune channel, but they are not sustaining their former numbers. With river mouth closure comes wide swings in environmental conditions and big annual variations in habitat conditions. There have been years when most of the pickleweed and substrate were too wet for successful nesting by Belding's and other years when it was far too dry. As a result, in 2006 (a year with late rains), the Belding's suffered a 29% population reduction.

The river mouth once sustained far more 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. Approximately 30 % of the formerly most viable habitat is now covered in upland weeds. The former density of Belding's in this habitat was not exceeded anywhere in its range.

Buena Vista Lagoon – 5 territories
Buena Vista Lagoon was surveyed on 17 April 2006 by Lyann Comrack, Kim McKee, and Terri Stewart for a total of 6.75 field-hours. The occupied salt marsh vegetation forms a narrow veneer along high spots bordering the dominant cattails and bulrushes on the islands and in the north-east corner of the inner lagoon. The patch that contained one territory in 1986 has been protected by fencing from former vehicle tracking and now supports two territories. Elsewhere in the central lagoon between the freeway and Pacific Coast Highway there is an edge of robust pickleweed along much of the brackish marsh but the habitat is too narrow and disturbed by fishermen and other visitors to support breeding Savannah sparrows. The highest potential for restoration is on the islands and in the north-east quarter of the inner lagoon and some measures are in progress. Important habitat enhancement could be achieved with continued control of invasive plants and the cleanup of trash and homeless encampments therein.

Agua Hedionda Lagoon – 24 territories
Agua Hedionda was surveyed by Lyann Comrack, John Konecny, and Kim McKee on 6 and 13 April 2006 for 12 field-hours. All of the territorial Belding's were detected on the inland edges of the inner lagoon. The habitat and Belding's were widely scattered with one small concentration in a Salicornia patch along the creek, a few hundred meters inland of the lagoon. The survey revealed 25% fewer territories than in 2001.

Regular dredging keeps this lagoon open to the ocean giving it a very high potential for restoration of salt marsh habitat. However, tidal access, although consistent, appears to be heavily muted probably due to the narrowness of the maintained ocean entrance and tidal access under the freeway. Human trespass, off-road bicycles, and dogs off leash are regular and continuing problems. The Department of Fish and Game successfully eradicated *Caulerpa* (killer algae) which threatened aquatic life and habitats and is planning to use fencing to protect the salt marsh in the near future.

Batiquitos Lagoon – 37 territories
Batiquitos Lagoon was surveyed by Sue Hoffman, John Konecny, and Dick Zembal on 19 March 2006 for 6 field-hours. Seventy percent of all territories were on the extreme inland edge of the inner lagoon. With the restoration and management of the lagoon toward a fully tidal system, pickleweed expanded into previously brackish marsh areas and the Belding's doubled between 1996 and 2001. The 44% reduction in Belding's since 2001 is a manifestation of the condition of the upper marsh habitat lining the inner lagoon. Most of the lagoon has a pickleweed belt that is too narrow to adequately accommodate Belding's. Where it is amply wide on the eastern edge of the lagoon, most of the habitat had standing water under it and the pickleweed-dominated upper marsh is reverting to brackish marsh, fed by increased urban run-off. There also was good upper marsh habitat historically located adjacent to Pacific Coast Highway that was dredged as part of the restoration project to increase fisheries habitat, or has eroded because of wave action.

San Elijo Lagoon – 137 territories
San Elijo Lagoon was counted by Maryanne Bache and Robert Patton on 8 and 12 May 2006 for approximately 11 field-hours. This is an 82.7% increase over the 2001 count and attests to the positive effects of the re-establishment of constant tidal influence and estuarine conditions for

more than 7 years prior to the 2006 survey. The Belding's continue to be fairly evenly distributed in suitable habitat along all three sections of the lagoon. The habitat and Belding's are most abundant in the middle lagoon, most concentrated in the outer lagoon, and most dispersed in the inner lagoon. The inner lagoon still has problems with flooding after late rains that pond behind the dike, flooding the inland pickleweed flats, and disrupting Savannah sparrows nesting.

San Dieguito Lagoon – 58 territories
San Dieguito Lagoon was surveyed by Robert James on 3 and 7 April 2006 for 4.3 field-hours. This is a 45% increase over 2001. Approximately 80% of the Belding's were detected in the main marsh and half of those were on the southeast edge of the main lagoon. This area is attached to the mainland and the least influenced by flooding which still occurs because the river mouth is often closed. Twelve territories were found in habitat patches inland of the freeway. There have been habitat restoration efforts in San Dieguito that have resulted in an increase in salt marsh vegetation. Major additional restoration is planned by Southern California Edison and other agencies. Currently, however the lagoon is seldom fully open to the ocean and most of the dense *Salicornia* that otherwise would accommodate Belding's is too wet, too often to be occupied. Fishermen, cyclists, joggers, and pet walkers were observed or left sign along the edge of the main lagoon.

Los Penasquitos Lagoon – 203 territories
Los Penasquitos Lagoon was surveyed by Lyann Comrack and Dick Zembal on 30 April and 8 May 2006 for 9 field-hours. The count total was 57% higher than in 2001 and 27% higher than the next highest count in 1973. Belding's were fairly evenly distributed on both sides of the railroad tressle.

Los Penasquitos Lagoon is still largely a lagoon and subject to dramatic fluctuations in drying and ponding although efforts are currently being made to keep the inlet open and the numbers documented in 2006 are probably a testament to some success therewith. Late rains in 2006 flooded the inland pickleweed marsh and precluded nesting in some areas. The southernmost marsh is gradually becoming more brackish. If it is ever possible to establish a consistent hydrologic regime in Los Penasquitos, it would be of great benefit to Belding's and other wildlife.

Mission Bay

Kendall-Frost Reserve – 21 territories
The University of California's Kendall-Frost Reserve was surveyed by Isabel Kay and Dick Zembal, mostly on 16 May 2006 over 3 field-hours. This is a 44.7% reduction from the number of territories detected in 2001. Belding's were quite concentrated around the high salt flat on the inland edge of the marsh near Campland on the north side of the Reserve. There were also two territories on the south end of the berm separating the restoration site from the main marsh and two territories including a nest on the berm slightly further east of the eastern restoration site berm.

The Kendall-Frost Reserve is extremely isolated from supporting habitats or corridors resulting in an abundance of small and medium-sized predators. Native top carnivores can no longer regularly access this little wetland and so their natural regulation of smaller predators is not happening. Cat tracks were observed all over the saltpan associated with the concentration of breeding Belding's. 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. To be effective, this would require new

fencing and enforcement of prohibition of animal dumping. 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 nests. The California Department of Fish and Game has secured funding in recent years and should be encouraged to establish a program that includes these much needed measures, so they are consistent and timely.

San Diego Flood Control Channel – 16 territories
The Flood Control Channel was counted by Charles Gailband, Sue Hoffman, John Konecny, and Dick Zembal on 1 April 2006 over 10 field-hours. This is a 38.5% reduction from 2001. Salt marsh vegetation again dominates the flats west of Interstate 5 but the dominant plant is *Jaumea carnosa* and cordgrass (*Spartina foliosa*) has increased dramatically in abundance since 2001 as well. *Salicornia* lush enough to support Belding's nests is limited to the fringe of the channel and a few high spots. In many of these places, there are territorial song sparrows present, not Belding's. Thick cordgrass 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 has not 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 and the cordgrass over pickleweed.

FAA (Beacon) Island – 0 territories
FAA Island was counted by Lyann Comrack on 21 April over 6 field-hours, incidental to preparation of the island for nesting California least terns. Management of the island for least terns includes vegetation control. Care is usually taken to avoid the veneer of vegetation around the edge of the island for the Belding's sake but in 2006, vegetation was much reduced and the Belding's were gone.

San Diego Bay

Paradise Marsh – 20 territories
Paradise Creek Marsh was counted by Dick Zembal on 2 June 2006 for 1 field-hour. There were nearly three times as many Belding's manifesting territoriality as in 2001. The pickleweed is not extensive but there are several high spots covered in lush upper marsh vegetation. 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 predators. Half of the Belding's were concentrated in the northern part of the 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. At least 5 homeless men were encountered during the survey and there were three encampments including mounds of trash and fire pits. The palms, acacias, and *Myoporum* along the abandoned railroad tracks should be removed as part of the Fish and Wildlife Service's management of the NWR.

Sweetwater Marsh National Wildlife Refuge – 119 territories
The Sweetwater Marsh was surveyed by Charles Gailband, John Konecny, Barbara Moore, and Dick Zembal on 2 June 2006 for 9 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. The count was 28% higher than in 2001.

Trespass and feral animal problems are dealt with on a regular basis by the NWR staff and the wetland inhabitants have benefited. 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 tidal action. Some of these objects are so large that they do great damage to the marsh but are extremely difficult to remove.

"F" Street Marsh – 7 territories
"F" Street Marsh was surveyed by John Konecny and Dick Zembal on 2 June 2006 for 1 field-hour. This little wetland is separated from Sweetwater Marsh 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 is kept functional, maintaining some tidal flushing. This marsh should be connected with the Sweetwater by excavating out 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 – 70 territories
The marsh veneer along the Western Salt Company Dikes and Otay River (saltworks) in south San Diego Bay was surveyed by Sue Hoffman, John Konecny, John Martin, and Dick Zembal on 7 May 2006 for 14 field-hours. The Belding's were concentrated along the outer Otay River Channel where there were 27 territories and in a thick patch of *Salicornia* on the northeast extreme of the saltworks where there were 20 territories. This later site is along a small creek that runs south from the channel out of the San Diego Gas & Electric facility. The habitat along the outer edge of the saltworks has supported numerous territories in the past but the habitat in 2006 was very sparse with isolated *Salicornia* and shrubby weeds scattered widely. The occupied habitat has always been a narrow belt with very marginal marsh vegetation. However, the NWR plan for the saltworks should result in increased marsh vegetation and Belding's habitat over time.

South Bay Marine Reserve – 21 territories
The Marine Reserve was surveyed by John Konecny on 14 April 2006 for 2 field-hours. Belding's were only territorial in the southern portion of the wetland; the northern half is covered in sparse *Salicornia* that is too frequently inundated to support Belding's. This area has a very high restoration potential but it is in dire need of management and security from the encroachment of humans and their pets.

Tijuana Slough National Wildlife Refuge – 274 territories
The Tijuana Marsh was surveyed by Greg Abbott, Jeff Crooks, Mike Evans, Gjon Hazard, Sue Hoffman, John Konecny, and Dick Zembal on 27 March and 16 May 2006 for 23 field-hours. There were 169 Belding's territories in the Oneonta Lagoon section north of the river and 105 territories to the south of the river although the extreme southern part of the wetland, south of the trail to the beach, was not surveyed.

Tijuana Marsh has become a center for wetland research, restoration, and limited management activity. Some of these efforts are focused upon sedimentation and contaminants which 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 a very high priority. A repeat of the ecological disaster of 1984 when the river mouth closed and estuarine function ceased 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 important to monitor the abundance and distribution of the Belding's Savannah sparrow on a regular basis. The status of this little pickleweed endemic is also one of the better indicators of the conditions and health of the occupied wetlands. The state-wide survey has been conducted every 5 years since 1986. It is recommended that this be continued hereafter except for the very next count which should be done in 4 years in 2010. This will make it easier for the aging count participants to anticipate the following counts in 2010, 2015, 2020, etc.

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 loses 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. When ample upper marsh is not part of a restoration project and tidal amplitude is broadly increased, Belding's will decline in the short term in that wetland.

Where the encroachment of freshwater marsh is not desirable, managers should consider cutting small tidal creeks through the upper marsh to establish better drainage and tidal access. If done properly, this would benefit several wetland birds including the Belding's Savannah sparrow and the endangered light-footed clapper rail. Cutting small tidal creeks would also be beneficial through extreme high marsh, isolated upper marsh, and salt pan in several wetlands including Upper Newport Bay, the Santa Margarita River, and Agua Hedionda. The new creeks would provide additional tidal access, habitat vigor, and foraging opportunities for Belding's.

Millions of people make southern California their home and most of them clamor for recreational opportunities and other enjoyments provided by open space. Thousands of these people live on the edges of our wetlands, impacting them in many ways. 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 wildlife agencies should focus on filling that gap, where it exists, and in coordinating a range-wide strategy for the management of the Belding's Savannah sparrow.

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