Studies in Avian Biology No. 15:316–327, 1994.

ENDEMIC SONG SPARROWS AND YELLOWTHROATS OF SAN FRANCISCO BAY

JOE T. MARSHALL AND KENT G. DEDRICK

Abstract. Three field-identifiable subspecies of the Song Sparrow (*Melospiza melodia*) still occupy remnants of the original 302.7 square miles (784 sq. km) of tidal marsh vegetation in the San Francisco estuary. They are the Alameda Song Sparrow (*M. m. pusillula*), Samuel's Song Sparrow (*M. m. samuelis*), and the Suisun Song Sparrow (*M. m. maxillaris*). Their areas and their numbers are 15.1% of 1850s size due to man-made hindrance to tidal flow. The breeding range of another bay area bird, the San Francisco Common Yellowthroat (*Geothlypis trichas sinuosa*), is undefined. It could be determined by netting molting birds from July through September, before they migrate.

Key Words: Song Sparrow; Common Yellowthroat; San Francisco Bay; tidal marsh; habitat loss; endemic subspecies.

The three subspecies of the Song Sparrow (*Melospiza melodia*) and the three San Francisco Bay estuaries whose tidal marshes they inhabit are among the great, unappreciated, natural wonders of California. They are the Alameda Song Sparrow (*Melospiza melodia pusillula*) in South San Francisco Bay, Samuel's Song Sparrow (*M. m. samuelis*) in San Pablo Bay, and the Suisun Song Sparrow (*M. m. maxillaris*) of Suisun Bay. Field identification characters of the birds and their original distributions of about one hundred square miles (259 sq. km) each are shown in Figure 1. Requirements for the small territory of each pair are met by frontage upon a tidal slough, the banks of which support rich growth of *Grindelia, Salicornia, Spartina foliosa,* or *Scirpus.* By obstructing tidal flow, mankind has reduced this habitat by 84.9 percent to 45.8 mi^2 (118.7 km^2; Table 1). Priceless tidal marshes have become monotonous salt evaporation ponds (hereafter called salt ponds), pastures, cities, factories, and game refuges for fresh-water ducks.

In 1986, S. Gregory advised J. Marshall that fresh water from sewage treatment was eliminating salt marsh plants from the south end of San Francisco Bay, jeopardizing the Alameda Song Sparrow. Marshall found Song Sparrows still at Dumbarton Point, in South San Francisco Bay, that June. In the fall of 1986, when the birds had just acquired their new, distinctive earth colors, L. R. Mewaldt, J. and E. Marshall, M. Rippey, and R. Leong netted Song Sparrows in all three estuaries, with results detailed below.

Fearing that the Suisun Song Sparrow, *M. m. maxillaris,* was the most vulnerable, we who netted, joined by H. Cogswell, K. Dedrick, S. Gregory, H. T. Harvey, R. F. Johnston, and S. Senner, petitioned the Department of Interior on 20 November 1987 to give *maxillaris* protection under the Endangered Species Act. But federal action was "precluded" because of lack of personnel to evaluate the petition. In the spring of 1990, J. Marshall, R. Johnston, J. Collins, M. Rippey, and S. Hadley joined in slogging and boating through the Suisun marshes so as to present the State with a better population estimate, the subject of this paper. The petition, presented by Mewaldt, was unanimously rejected by the California Fish and Game Commission.

OBJECTIVE

This paper aims to compare present tidal marsh acreage with the original areas in which the San Francisco Bay Song Sparrows lived in the 1850s. The present fragments are not all in the position of former marsh. Some, especially those in Suisun Bay, are accretions to the former shore, due to the heavy sediment load from Sierra Nevada hydraulic mining following the 1849 gold rush.

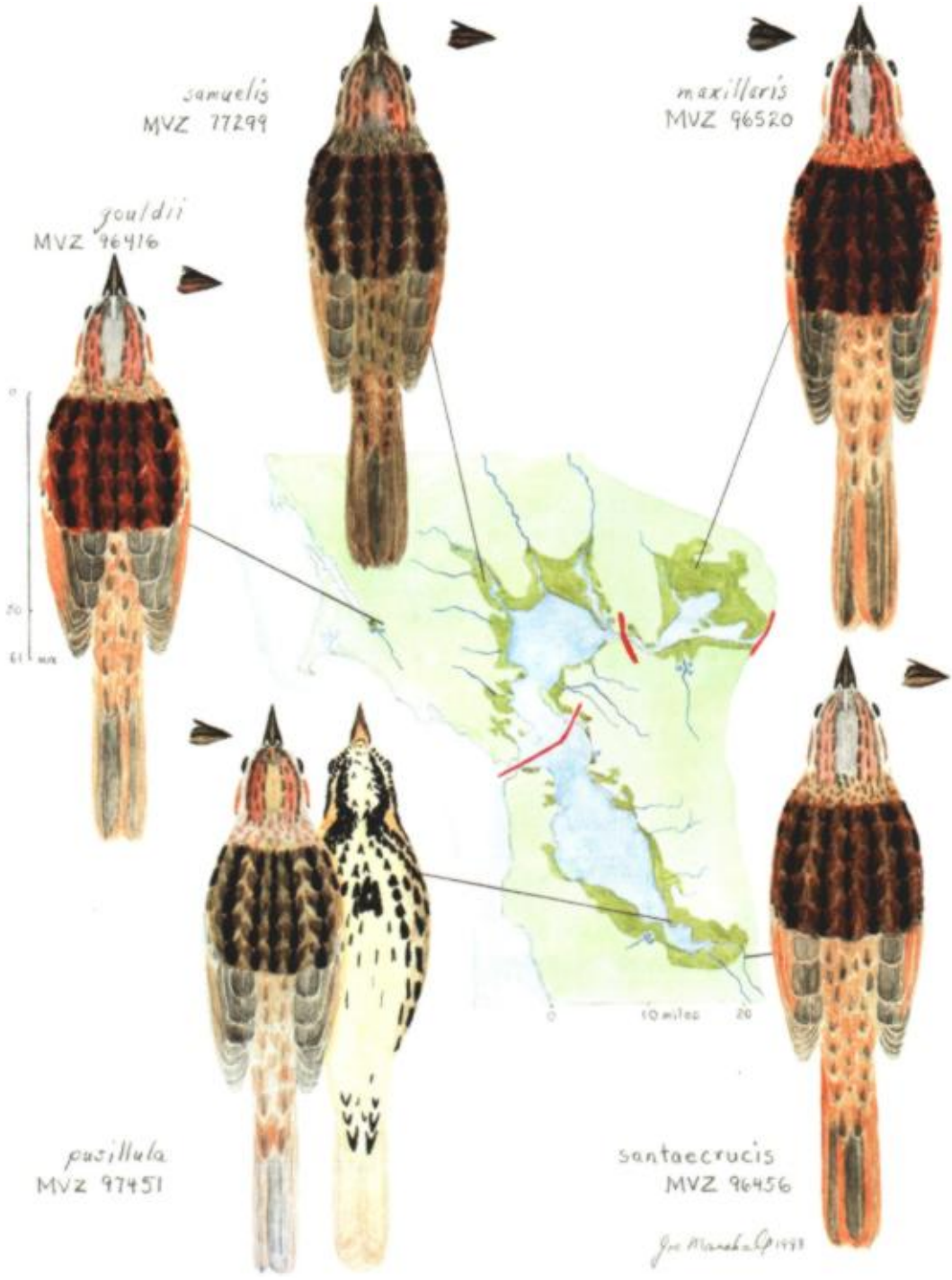

FIGURE 1. Song Sparrow subspecies of the San Francisco Bay. Another, reddish-brown race with blurry streaks, *P. m. rufina* from the northwest coast of North America, winters here.

TABLE 1. HISTORIC AND PRESENT TIDAL MARSHLAND HABITAT ACREAGES, SAN FRANCISO BAY, CALIFORNIA

Song Sparrow subspecies	Historic habitat area:[1] acres (sq. km)	Present habitat area:[2] acres (sq. km)	Per cent of historic habitat
Alameda Song Sparrow (*M. m. pusillula*)	65,811.0 (266.3)	6677.6 (27.0)	10.2%
Samuel's Song Sparrow (*M. m. samuelis*)	63,690.5 (257.8)	14,060.2 (56.9)	22.1%
Suisun Song Sparrow (*M. m. maxillaris*)	64,254.9 (260.0)	8585.7 (34.8)	13.4%
Totals	193,756.4 (784.1)	29,323.5 (118.7)	15.1%

[1] Planimeter results by KGD of map by Nichols and Wright (1971).
[2] Revision by Dedrick (1993) of results by Dedrick (1989).

We can state precisely what percent of former habitat remains for today's sparrows. From there we tackle the murky problem of estimating current populations, in number of pairs or singing males (= territories).

METHODS

Hydraulic mining debris from the Sierra Nevada in the late 1800s poured into the San Francisco estuary, and threatened Bay navigation by shoaling and loss of tidal prism. The marshlands contribute to the tidal prism, and Gilbert (1917) gave us an early breakdown of historic marsh areas for various portions of the Bay. Later, Nichols and Wright (1971) and others independently determined historic acreages (Dedrick 1989). For this paper, we needed detailed acreages for small marsh segments; we thus planimetered the Nichols and Wright map at scale 1/62,500 to obtain the results in Table 1; these areas correspond to the subspecies distributions given in Figure 1.

Recent estimates of Bay marsh acreages vary excessively according to author, for reasons that remain a mystery. Because of this, Dedrick (1989) performed a detailed planimeter study of 1980 aerial photos taken at scale 1/24,000 for the California State Lands Commission. Recently, over 540 individual Bay marsh tracts from the 1989 study have been traced onto USGS quadrangle maps (Dedrick 1993). These results are also used in Table 1 and in Figures 2–4 along with the Nichols and Wright (1971) historical marsh maps. The 540 parcels show how fragmented the marsh has become, with continuity destroyed among groups of Song Sparrow territories.

Population estimates herein for pristine marsh (acres × 1.11 territories per acre) are based on a mapped census of color-banded Song Sparrows on 100 acres (40.5 ha) at Richmond (San Pablo Marsh) by Johnston (1956:255, table 2). The average number of territories during his four years of total counts is 111, with 80% to 90% of the higher marsh unoccupied because it is more than a territory's width from a slough. This density is entirely different from the theoretical maximum, not applicable here, of 9.45 territories per acre (23.4 per ha) if all the sloughs were 30 feet apart and lined with territories 30 by 153.6 feet (9.1 m by 46.8 m) (Johnston 1956:255, table 1). Collins and Resh (1985) studied a similar but much older marsh along the Petaluma River, where they found territory size and territory alignment along sloughs to be the same as Johnston's. Thus, our estimate of original populations is 71,000 pairs of each subspecies, each of which had an original area of 100 mi^2 (259 km^2).

Marshall netted Song Sparrows in fall of 1986 in order to identify subspecies in the hand, then released them. In the 1940s and in spring 1990 he mapped pairs and singing males on Geological Survey topographic sheets, with best results from a kayak, to which the birds were oblivious. Birds hidden because of undercover nesting or foraging duties were called up, if needed, by imitating the song. We inspected habitats from kayak, rowboat, outboard, Baykeeper patrol yacht, airplane, car, and on foot.

DEFINITIONS

We mainly use the English system for terrain measurements because it is the stan-

dard on all charts, maps, and documents pertaining to the San Francisco Bay and its wildlife (metric in parentheses). Names of triangular-stemmed *Scirpus* from Marshall (1948) are changed: *Scirpus campestris* is now *S. robustus* and *Scirpus olneyi* becomes *S. americanus* (Rice et al. 1982).

Our scientific trinomials apply to field-identifiable subspecies (Marshall 1964) except that for convenience we also recognize the Santa Cruz Song Sparrow (*M. m. santaecrucis,* Grinnell 1901b), easily identified in the hand during banding operations (Fig. 1). The three San Francisco Bay Song Sparrows were defined by their original describers (Baird 1858, Ridgway 1899, Grinnell 1909). Marshall (1948) quantified their colors and measurements, and Allan Brooks (Grinnell and Miller 1944, frontispiece) painted them in realistic side view.

ALEMEDA SONG SPARROW
(*M. m. pusillula*)

Mewaldt and Marshall netted 11 Song Sparrows in fresh fall plumage on 25–26 October 1986 at Dumbarton Point salt marsh. Nine were buffy gray-brown on the back, yellow beneath; two were plainer gray, white beneath. Wing chords averaged 56.2 mm and five weights averaged 18.06 grams. These hand-held birds proved that *M. m. pusillula* still exists in its classic colors and proportions, the smallest and yellowest subspecies in the species.

The marsh of 906.1 acres (366.7 ha) at Dumbarton Point includes luxuriant *Salicornia* with *Grindelia* lining the branchlets of Newark Slough, more of that habitat just southeast of the Refuge Headquarters hill, and a great tract of native *Spartina foliosa* at the shore. Song Sparrows are dense there; we estimated the population as 1006 pairs. We saw excellent tidal habitat at Hoffmann Marsh (30.2 acres = 12.2 ha), beside Albany Hill. At Redwood Point, across the Bay northwest from Dumbarton, are other pristine remnants of *Salicornia* marsh, enriched with *Jaumea, Distichlis,* and *Spartina* at Bird Island (89.3 acres = 36.1 ha) and Corkscrew Slough (75.2 acres = 30.4 ha). Greco Island (730.6 acres = 295.7 ha) reverted to salt marsh decades ago; since a 1976 levee break, part of Bair Island (475.5 acres = 192.4 ha) is rapidly reverting to marsh.

We also saw the tame Song Sparrows in extensive *Scirpus californicus* and *Typha* at the Alviso Marina and heard two good singers at Emeryville Marina, with no natural habitat. Mewaldt and Marshall banded 11 breeding birds at Triangle Marsh, north of Alviso, on 3 April 1987. The entire Alviso area had been *Salicornia* and *Grindelia* marsh during an earlier study (Marshall 1948). Now 167,000,000 gallons a day of treated fresh water effluent from San Jose-Santa Clara Water Pollution Control Plant (CH2M-HILL 1987) emerges at Artesian Slough, converting Triangle Marsh to brackish-loving *Scirpus robustus.* The Alameda Song Sparrow is adapted to salty intake (Basham and Mewaldt 1987); nevertheless, it remains abundant in Triangle Marsh. Six of our banded birds were buffy gray-brown with yellow belly; five were more grayish on the back, with white or cream underparts. Wings of these seven males and four females averaged 57.1 mm, weights 19.30 g. At Artesian Slough, a band of fresh-water *Scirpus californicus* several miles long and 100 yards wide yielded only one Song Sparrow, heard and not seen. Mewaldt and Marshall also examined several hundred yards of *Typha* emanating along a leak of the Hetch-Hetchy Aqueduct at the Tri-City Animal Shelter just off Thornton Road. No Song Sparrows occurred along that fresh-water habitat; it connects to a *Salicornia* ditch where *pusillula* is common. For unknown reasons, the upland, brown Song Sparrow of the East Bay and Peninsula hills (*M. m. santaecrucis,* Fig. 1) is not yet invading fresh-water habitats on the bayshore. Were it to do so in numbers, made possible by its huge population relative to the remnants of *pusillula,* it could easily hybridize the Alameda Song Sparrow out of existence.

At Coyote Creek Riparian Station, also near Alviso and 2.2 miles (3.5 km) upstream from the salt marsh, Song Sparrows being banded are the plain brown of East Bay *santaecrucis*. One adult near headquarters, however, had a yellow belly.

Dedrick planimetered 102.8 mi² (266.3 km²) of 1850s habitat and 10.4 mi² (27.0 km²) for the present area of the Alameda Song Sparrow (Fig. 2). Our past and present population estimates are 73,050 and 7412 pairs, respectively.

SAMUEL'S SONG SPARROW
(*M. m. samuelis*)

In 1986 E. Marshall, J. Marshall, M. Rippey, and R. Leong netted Song Sparrows at the north rim of San Pablo Bay: three at Lower Tubbs Island, 28 October 1986; four under and south of the bridge on Skaggs Island Road, 1 November 1986; and nine at Dutchmans Slough off the Napa River on 2 November 1986. These small, blackish-olive birds all typify *M. m. samuelis,* the blackest population of the species. Wings and weights of 15 average 58.2 mm and 18.31 g; 13 bill depths average 6.56 mm.

Birds were established along a stagnant ditch beside Tubbs Island. None of the verdant marsh on Tubbs is inhabited, except for two males singing in *Spartina* by the pond and "plenty of Song Sparrows" along the one little slough, which receives some water through a tide gate. At Dutchman Slough, the birds utilize *Baccharis pilularis* on the levee next to the marsh. Most remaining salt marshes in the range of *samuelis,* even the rims of salt ponds, look good for Song Sparrows. We found none while crossing the ditched *Spartina* bay front of Sears Point Road (2416.5 acres = 977.9 ha). Marshall's field notes at the Museum of Vertebrate Zoology state that in fall 1947 this bay-side habitat along the Sears Point Cutoff was tall *Salicornia* with a fringe of *Spartina,* whose seeds the abundant Samuel's Song Sparrows were eating. At the head of Richardson's Bay, Marin County, is good salt marsh (12.1 acres = 4.90 ha) northeast of Tamalpais High School, with no Song Sparrows. On 26 June 1987, when this marsh should have been swarming with juvenile *samuelis,* we saw only two singing males, in peripheral weeds; one of them, however, did go out to sing from a *Grindelia.* The largest present home of *samuelis* is the magnificent Petaluma Marsh (3196.2 acres = 12.94 km², upstream from the mouth of San Antonio Creek), with at least 3548 pairs.

The former area of Samuel's Song Sparrow (Fig. 3) was 99.5 mi² (257.7 km²) with 70,696 pairs. Currently 22.0 mi² (56.9 km²) of tidal marsh are available, with 15,607 pairs (optimistic, considering that we could not find the species on the Sears Point Road shore, Solano County).

SUISUN SONG SPARROW
(*M. m. maxillaris*)

On 30 October 1986, M. Rippey and J. Marshall netted five Song Sparrows in the dense population at Pelican Point, near the west end of Roaring River Slough. These birds had chocolate back color, average wing of 60.0 mm, weight 19.10 g, and bill depth of 7.52 mm. Bills flared laterally at nostril level as viewed from above. These attributes typify the isolated subspecies, *M. m. maxillaris.*

The original range of the Suisun Song Sparrow was in brackish marsh from Southampton Bay and Martinez east to Collinsville and Pittsburg (Fig. 4) for a total of 100.4 mi² (260.0 km²) and at least 71,323 pairs. Because the easternmost remnants at Collinsville (7.0 acres = 2.8 ha) and mouth of Montezuma Slough (9.8 acres = 4.0 ha) may be too small and too isolated by fields to support the birds, we draw present limits farther up Montezuma Slough and on Van Sickle Island opposite Pittsburg. Apparently the Song Sparrow is absent from the Delta, where Marshall found none in fall of 1942; in the nesting season M. Josselyn found no Song Sparrows on Lower Sherman Island (pers. comm. to S. Hadley) and J. Collins notes that only a few exist at Browns

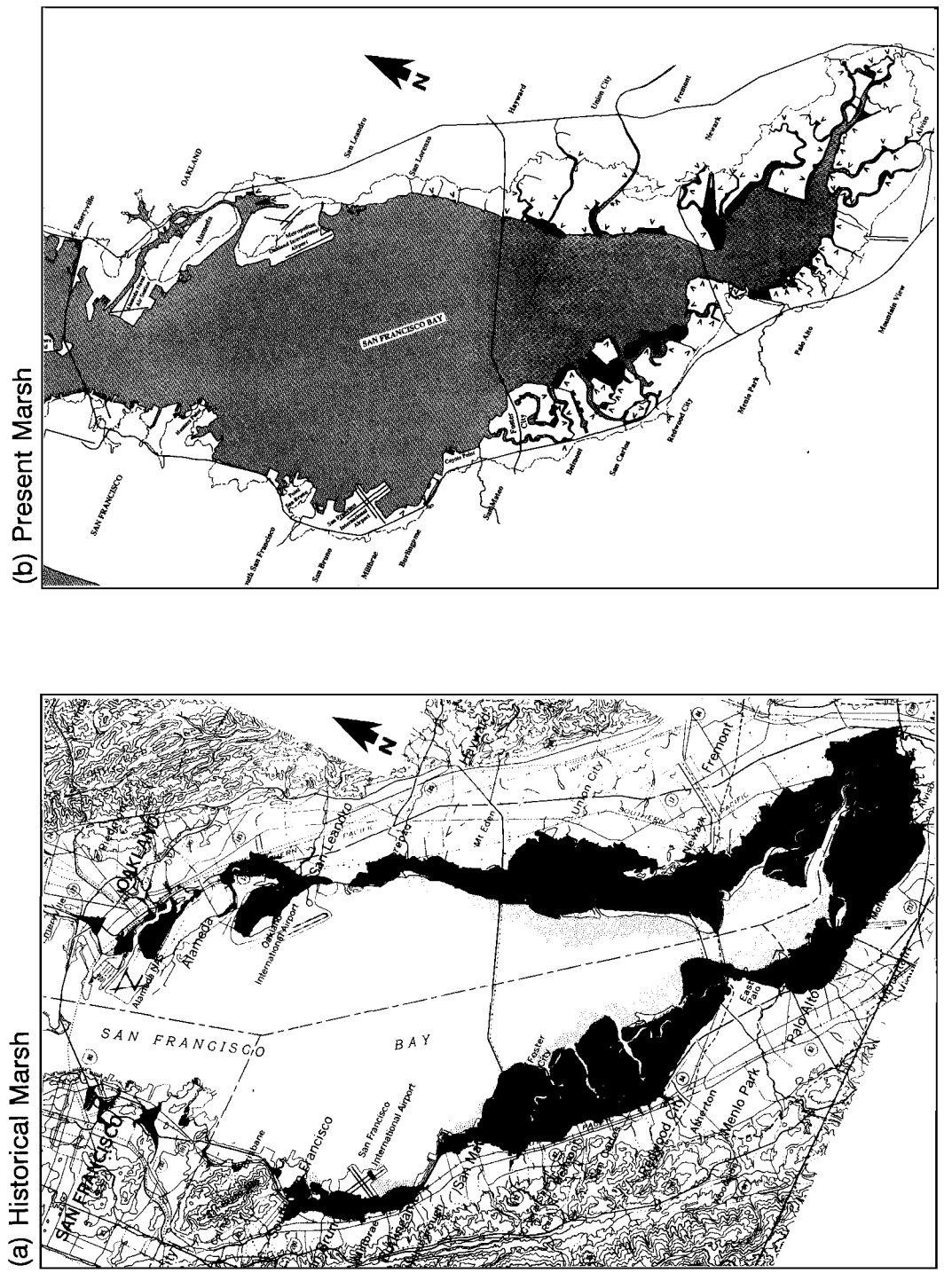

FIGURE 2. Historical and present tidal marshlands of Southern San Francisco Bay. Historical marsh is darkened area in (a); adapted from Nichols and Wright (1971). Present marsh is shaded area in (b); the apexes of letters "v" point to marsh parcels in Dedrick (1989, 1993).

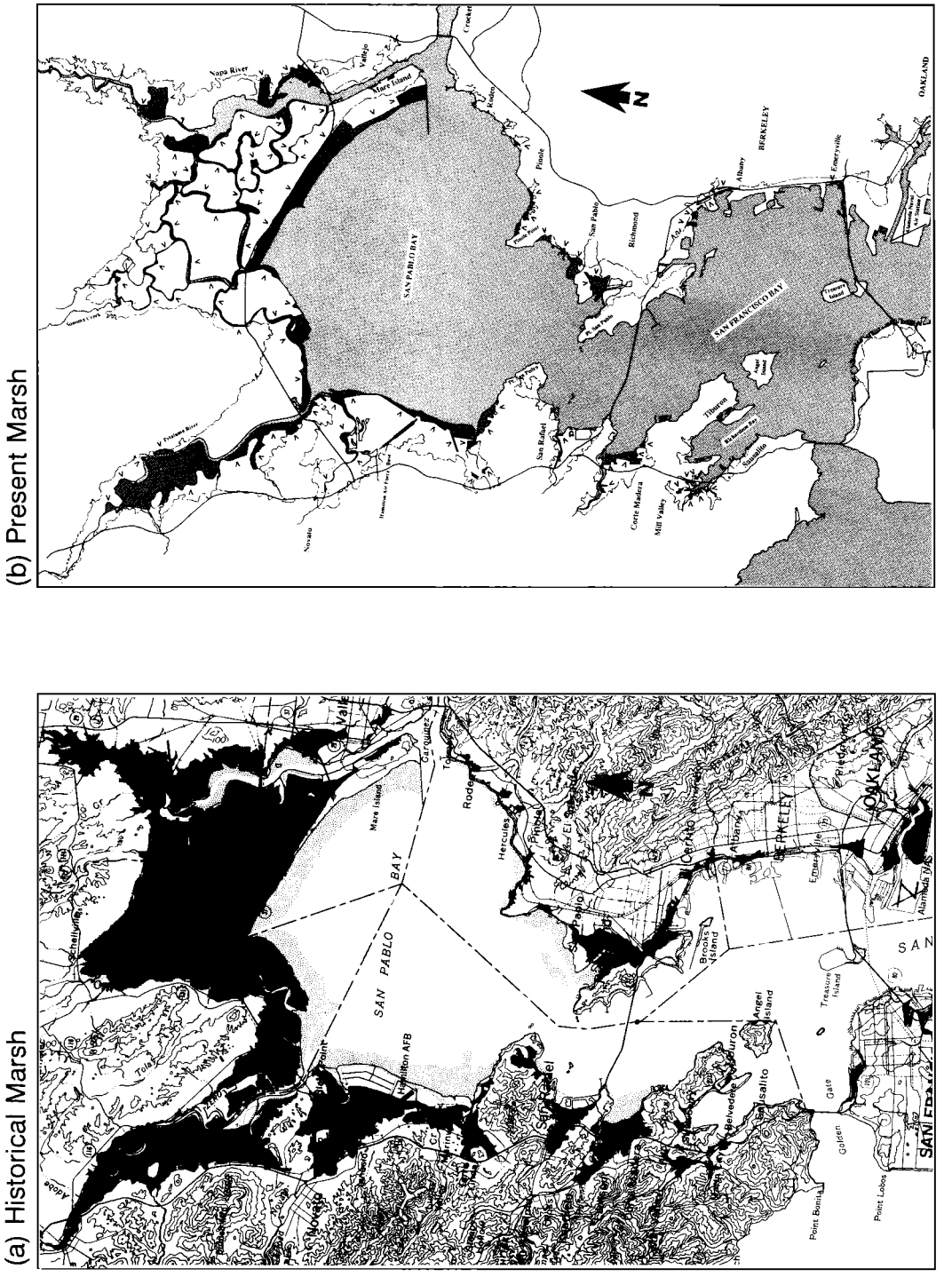

FIGURE 3. Historical and present tidal marshlands of San Pablo Bay and central San Francisco Bay (See caption, Fig. 2 for details).

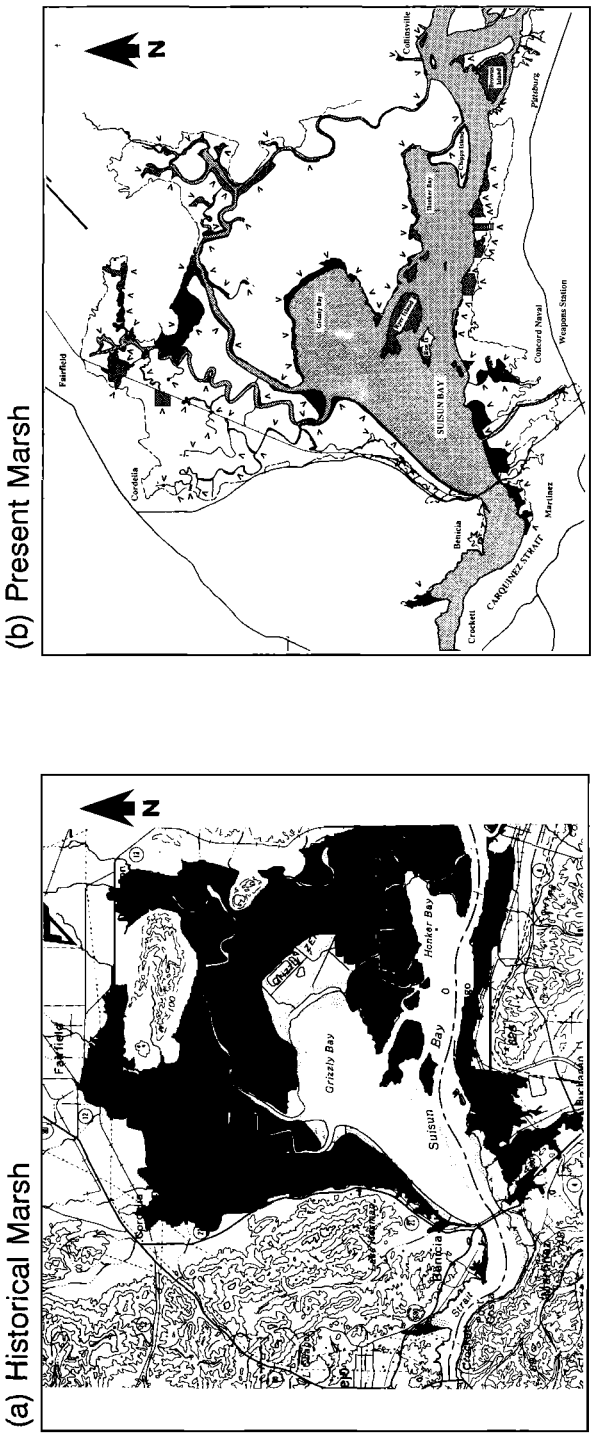

FIGURE 4. Historical and present tidal marshlands of Suisun Bay and Carquinez Strait (See caption, Fig. 2 for details).

Island (at its west end, pers. comm.), where fresh-water marsh plants hold sway.

Suisun Marsh is in three separate pieces. First is Southampton Bay, with the richest variety of brackish plant species and densest population of Song Sparrows that Marshall has seen. The unique, isolated genotype is doomed because the marsh is turning fresh and the first Marin Song Sparrow (*M. m. gouldii*) has appeared in Benicia (summer 1992, R. Leong, pers. comm.). Originally 168.6 acres (68.2 ha) and 187 pairs, by 1947 it was 158 acres (63.9 ha) and 176 pairs (Marshall 1948), accessed by way of Spenger's famous houseboat restaurant. In 1990 Marshall and R. Johnston found several birds in *Salicornia, Lepidium,* and a central area of *Salix* and *Typha* springing up due to freshwater runoff from the adjacent suburb. The lower half is still brackish marsh of high quality (M. Rippey, pers. comm.). Therefore the present 134.0 acres (54.2 ha) should support 149 pairs.

The second portion of Suisun Marsh is the South Side, formerly 7768.2 acres (31.4 km^2) supporting an estimated 8623 pairs. J. Collins, R. Johnston, and J. Marshall examined Point Edith on 25 May 1990 and in the thick *Baccharis* on the levee of the old shore heard more Song Sparrows singing simultaneously than we could count. There were also birds on large territories in the great arc of *Scirpus robustus* growing into the Bay, a spectacular accretion from the gold rush. Collins studied the South Suisun marshes and its Song Sparrows using sophisticated technology not only in analyzing cores 18 feet deep containing the same plants as present, but in mapping territories by flipping driftwood at each male to press it around its territorial perimeter. He found tightly-packed territories along some *Scirpus acutus* shores. We eagerly await his publication, but for the present estimate the population as 1945 pairs on 1752.0 tidal acres (7.09 km^2).

Estimating the present numbers of the Suisun Song Sparrow in its third and major enclave is so complicated by differences in habitat quality that we now realize it would have been best to count every pair rather than to sample. Historic brackish marshes of North Suisun Bay (88.0 mi^2 = 227.9 km^2) present a graded series of habitats from tall *Scirpus acutus* at the bay shore and banks of larger sloughs upward to broad expanses of *Salicornia* with smaller species of *Scirpus* down in the narrowing sloughs and *Grindelia* in a row up on their banks. Such are conditions at the Rush Ranch at the upper reaches of First Mallard Branch. Though it is the best surviving example of a complete marsh, its upper dendrites, where Song Sparrows should be densest, have been ruined by a series of parallel mosquito abatement ditches that bleed the tidal force just as in a human case of shock, where one bleeds to death into one's own capillary bed. The dendrites have become overgrown and filled in. This is offset by marked abundance of Song Sparrows in the devious windings of Spring Branch and in the broad borders of *Scirpus acutus* along First Mallard Branch (99 pairs in 36 acres = 14.6 ha), such that our mapped census of about 154 acres (62 ha) on the Rush Ranch is 159 pairs, nearly the same as San Pablo Marsh. J. Marshall, R. Johnston, and M. Rippey made this census during 12 days from 1 to 28 May 1990 by plotting the birds and keeping track of simultaneous singers day after day so as to divide up territories.

The coterminous Rush Ranch with Second Mallard Branch, 1241.5 acres (502.4 ha), is the largest tidal marsh remaining in North Suisun, with about 1378 pairs. Along with the islands, it is a two-dimensional habitat. The rest of North Suisun habitat is mostly linear, consisting of the rich *Scirpus acutus* fringe of beach and levee. It supports large populations at Nurse, Hastings, Luco, and Hill Sloughs. Marshall's sum of counts in the fringe is 207 pairs in single file along 11.32 miles (18.2 km) of slough border, 18 to the mile.

The linear and two-dimensional tidal populations are not the whole story. The oval, concentrated shape of the marsh en-

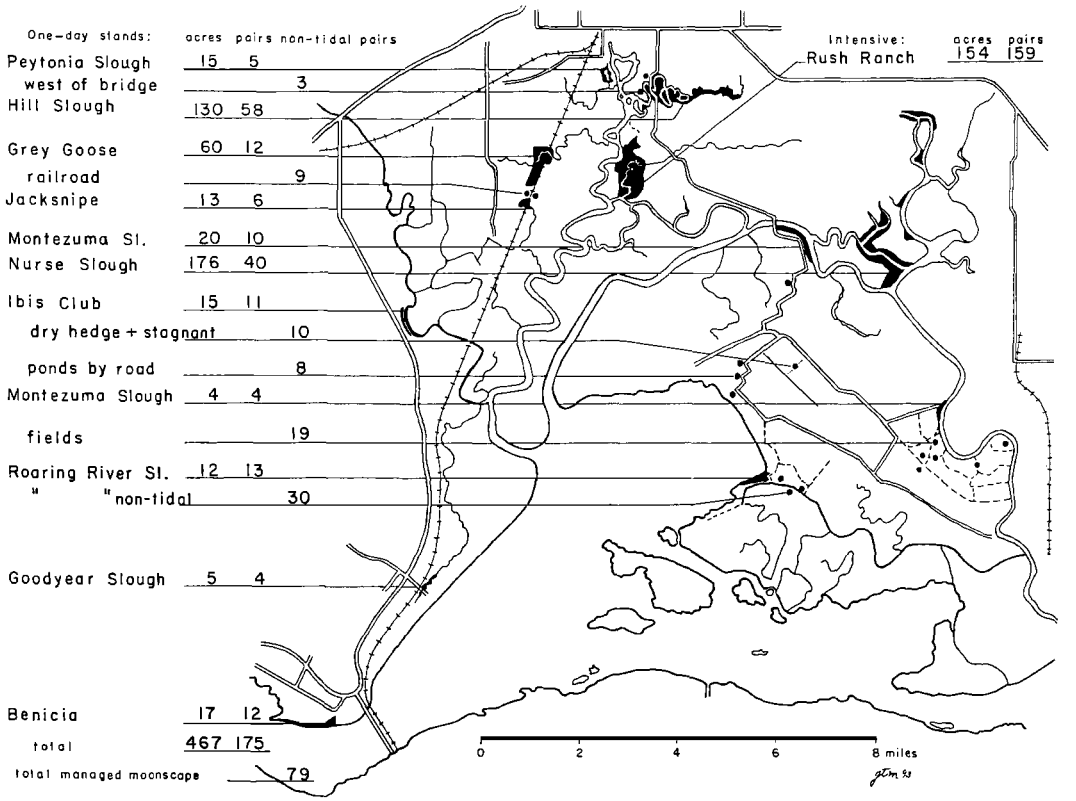

FIGURE 5. Pairs and singing males of Song Sparrows of North Suisun Marsh mapped by Marshall in spring 1990 with help in the field from J. Collins, S. Hadley, R. Johnston, J. Richardson, and M. Rippey. Based on Marshall's unbound field notes with sketch maps in Library, Bird Division, Smithsonian Institution. The numbers show that Marshall actually mapped 334 pairs on 9.3% of the tidal marsh, for an estimate of 3603 pairs on the 6699.7 tidal acres plus 200 on the scorched earth of Grizzly Island = 3803 *maxillaris* pairs in North Suisun.

courages dispersing Song Sparrows to spill into the center from dense peripheral populations of the duck clubs and shores. That non-tidal center, mostly dry and behind levees, is Grizzly Island, a moonscape devoted to obscene monocultures (elk, pheasant, and mallard). Here the Song Sparrows swarm in *Baccharis pilularis* and roses on perimeter levees close to a tidal slough, and a few establish on large, dangerously open territories in dry fields that have scattered clumps of unsubmerged tules. J. Richardson heard some in a hedge of giant *Atriplex*, alerting Marshall to find seven territories along 2800 feet (853 m) of hedge in the dry grass back of Fish and Game Headquarters (ditch between E and F in field 13), with surface water only at the two ends. Dots on Figure 5 show where these situations, unusual for the species, were found.

Our tentative count for North Suisun's 6699.7 tidal acres × 1.11 pairs per acre, plus 200 spilled-over, non-tidal territories is 7637 (but see Fig. 5 for a different approach). The total for the subspecies, *M. m. maxillaris* is thus 13.4 mi² (34.8 km²) and 9530 pairs.

SAN FRANCISCO COMMON YELLOWTHROAT
(*Geothlypis trichas sinuosa*)

Much of the habitat of the San Francisco Common Yellowthroat is also lost when tidal flow is blocked. Grinnell (1901a, 1913) distinguished this endemic, partly migratory, west-central California representative

of the Common Yellowthroat by its dark colors and small size. Its exact breeding area was never delimited. We offer a suggestion as to how that can be done.

The subspecies *sinuosa* is identified by its dark back and brown flank feathers of fall. Its breeding distribution is mapped from molting birds, because they do not wander or migrate until the fall molt is complete. So, net the birds from July through September and map those dark ones that are obviously molting or that still have sheaths or sheath duff on the auriculars, which are the last feathers replaced.

When museum specimens of the Common Yellowthroat in molt from California are looked at under north light, age and sexual differences disappear, and racial differences are enhanced, if attention is directed only upon the back and flanks. Marshall searched for such examples among all summer and fall California specimens of the Common Yellowthroat in the collections of the California Academy of Sciences, Los Angeles County Museum, Museum of Vertebrate Zoology, San Jose State University, and Smithsonian Institution. He found the following handful of specimens that illuminate our problem. They are so rare in collections that they must be listed. They enable us to begin a sketchy map of fresh fall plumages: dark in scattered localities around the San Francisco Bay; pale in remote, peripheral counties.

The Bay Area group of 14 museum specimens and one live bird are the molting *G. t. sinuosa* with dark back and brown flanks, from just four localities: Museum of Vertebrate Zoology 37787, 37790–37793, collected by Joseph Grinnell from 29 August to 6 September in 1900 and 1901 at the mouth of San Francisquito Creek, Palo Alto; California Academy of Sciences 15016 and 15028 also from Palo Alto, 22 July 1901 and 8 August 1899, and 54808 from Daughters, Alameda County on 18 August 1881; Smithsonian Institution 476255–476260, collected by Tom Burleigh on 14 and 19 August 1960 at Martinez, Contra Costa County. A live bird netted in *Salicornia* marsh at Dumbarton Point, Alameda County, 25 October 1986, was an immature molting to adult female that was dull, dark olive on back and crown, wing 54 mm.

The remote group of 16 molting specimens from seven counties represents *G. t. occidentalis* (also called *arizela*) with pale back and flanks: Museum of Vertebrate Zoology, 11 July to 23 September and one from 13 October, in various years, Humboldt County (16984, 87652, 87654–87656), Lassen County (44432), Mono County (28651), Lake County (126344), Sacramento County (Courtland, 51649), San Joaquin County (41100, 41103), and Monterey County (31167–31169, 37798, 92389). Thus is *sinuosa* hemmed in on the north, east, and south by pale birds from as close as Lake, Sacramento, and Monterey counties. The color of Point Reyes, Marin County, birds on the west should be determined!

CONCLUSIONS AND RECOMMENDATIONS

Intergradation between Bay Area Song Sparrows of the salt marshes with those in the uplands (Marshall 1948), due to crowding against the Bay by hills with their riparian connections (such as Walnut Creek contacting the marsh at Avon), decrees that the racial traits are diluted in the marshes of Marin and Contra Costa Counties. On the other hand, those marshes sequestered from the hills by broad, grassy plains are archives of the supreme flourishing of the subspecific characteristics. This adds a new dimension to conservation. If future generations are to savor these unique examples of diversity, then we must recognize the importance of subspecies and their exemplary populations: Dumbarton Point (*pusillula*: 906 acres = 366.7 ha) in the San Francisco Bay National Wildlife Refuge, Petaluma Marsh (*samuelis*: 3196 acres = 1293.4 ha) administered by the California Department of Fish and Game, and Rush Ranch (*maxillaris*: 1241.5 acres = 502.4 ha) managed by

Solano County Farmlands and Open Space Foundation. This is simple triage: write off Alviso and Southampton Marshes going fresh, and all the little marshes of intergrades to be wiped out in one marine accident. Add restored acres to the populations at Dumbarton, Petaluma, and Rush Ranch. Rehabilitate Rush Ranch Marsh to full capacity. Secure and conjoin Redwood Point Marshes (Greco Island and Corkscrew Slough) as back-up to pitifully small, strung-out Dumbarton. Enlarge upper Newark Marsh to protect *pusillula* from spills that would destroy the Bay edge; fix the Hetch-Hetchy leak and burn the offending cattails to protect the genotype from *santaecrucis*. Place oil booms to be flung across the mouths of Newark Slough, Sonoma Creek, and Suisun Slough in an emergency.

We have proved a reduction of San Francisco Bay tidal marshes to less than a sixth of former extent, which prompts serious concern about future prospects for their Song Sparrows. We have not even mentioned dangers from Norway rats (*Rattus norvegicus*), red foxes (*Vulpes vulpes*), house cats (*Felis cattus*), toxic spills, and exotic *Phragmites* and eastern *Spartina alterniflora*, because it is so obvious that the main threats are fresh water and levees. The three subspecies of Song Sparrows could be saved merely by knocking down a few levees and filling some mosquito ditches. The timidity and paralysis of those capable of carrying out this simple feat, which could be done with a hand shovel, is beyond belief!

ACKNOWLEDGMENTS

We thank the Coyote Creek Riparian Station, the California Department of Fish and Game's Grizzly Island Headquarters, the San Francisco Bay National Wildlife Refuge, N. Havlik and the Rush Ranch, and the University of California's Department of Entomology for access to natural habitats under their control and for permission to net (and release) representative birds. M. Rippey and S. Hadley (Bay Institute) arranged boat and air travel. The Bay Institute, International Council for Bird Protection, and State Lands Commission donated grants for Marshall's travel and museum research. J. N. Collins, R. F. Johnston, L. R. Mewaldt, and M. Rippey advised us from their profound knowledge of the tidal ecosystem.

LITERATURE CITED

BAIRD, S. F. 1858. Description of a new sparrow collected by Mr. Samuels in California. Proceedings of the Boston Society of Natural History 6:379–380.

BASHAM, M. P., AND L. R. MEWALDT. 1987. Salt water tolerance and the distribution of South San Francisco Bay song sparrows. Condor 89:697–709.

CH2M-HILL. 1987. Informational brochure: San Jose-Santa Clara Water Pollution Control Plant. San Jose, CA.

COLLINS, J. N., AND V. H. RESH. 1985. Utilization of natural and man-made habitats by the salt marsh song sparrow, *Melospiza melodia samuelis* (Baird). California Fish and Game 71:40–52.

DEDRICK, K. G. 1989. San Francisco Bay tidal marshland acreages: recent and historic values. Pp. 383–398 *in* O. T. Magoon et al. (eds.), Proceedings Sixth Symposium Coastal and Ocean Management (Coastal Zone–89). American Society of Civil Engineers, New York, NY.

DEDRICK, K. G. 1993. Atlas of present tidal marshland, San Francisco Bay, California. Pp. 2451–2463 *in*, O. T. Magoon et al. (eds.), Proceedings Eighth Symposium Coastal and Ocean Management (Coastal Zone–93). American Society of Civil Engineers, New York, NY.

GILBERT, G. K. 1917. Hydraulic mining debris in the Sierra Nevada. Professional Paper 105, U.S. Geological Survey, Department of the Interior. Government Printing Office, Washington, DC.

GRINNELL, J. 1901a. The Pacific Coast yellowthroats. Condor 3:65–66.

GRINNELL, J. 1901b. The Santa Cruz song sparrow, with notes on the salt marsh song sparrow. Condor 3:92–93.

GRINNELL, J. 1909. Three new song sparrows from California. University of California Publications in Zoology 5:265–269.

GRINNELL, J. 1913. Note on the palustrine faunas of west-central California. University of California Publications in Zoology 10:191–195.

GRINNELL, J., AND A. H. MILLER. 1944. The distribution of the birds of California. Pacific Coast Avifauna 27:1–608.

JOHNSTON, R. F. 1956. Population structure in salt marsh song sparrows. Condor 58:24–44, 254–272.

MARSHALL, J. T. 1948. Ecologic races of song sparrows in the San Francisco Bay region. Condor 50: 193–215, 233–256.

MARSHALL, J. T. 1964. R. W. Dickerman, The song sparrows of the Mexican plateau. Auk 81:448–451.

NICHOLS, D. R., AND N. A. WRIGHT. 1971. Preliminary map of historic margins of marshland, San Francisco Bay, California. U.S. Geological Survey, Open File Map.

RICE, W. E., S. F. SMITH, AND D. C. WASSHAUSEN. 1982. National list of scientific plant names. U.S. Soil Conservation Service, Washington, DC, Vol. 1, 416 pp.; Vol. 2, 438 pp.

RIDGWAY, R. 1899. New species, etc., of American birds.—iii. Fringillidae (continued). Auk 16:35–37.