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LANDBIRD MIGRATION AT THE SALTON SEA: THE VALUE OF DESERT RIPARIAN HABITAT

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Abstract. The detection of long-term population declines in some species of Neotropical migrant passerines has prompted recent efforts to better understand the use of stopover habitats by birds. Such investigation is important in the development of comprehensive conservation strategies for migrants. In 1999, we mist-netted birds at the Salton Sea during spring and fall migration periods to determine the use of this area's desert riparian habitats by landbirds as migratory stopover sites. During spring, we captured 51 species at an overall rate of 215.6 birds/100 net-hrs, while in fall we captured 49 species at an overall rate of 73.4 birds/100 net-hrs. Migrants accounted for 89% of the spring and 80% of the fall captures. The capture rates for some migrant species were higher at the Salton Sea than at other migration monitoring stations in California during the month of May and in the fall. Over half of recaptured individuals showed positive changes in mass during the stopover period. Warbling Vireo (*Vireo gilvus*), and Orange-crowned (*Vermivora celata*), Yellow (*Dendroica petechia*), and Wilson's (*Wilsonia pusilla*) warblers showed a negative relationship between mass change and date of capture in spring. In fall, Orange-crowned and Yellow warblers showed a positive relationship for mass change and time of day. These preliminary results suggest that the desert riparian areas of the Salton Sea serve as important stopover sites for passerines during migration.

Key Words: desert riparian habitat; migration; mist-netting; neotropical migrants; Orange-crowned Warbler; Salton Sea; stopover ecology; Warbling Vireo; Wilson's Warbler; Yellow Warbler.

MIGRACIÓN DE AVES TERRESTRES EN EL MAR SALTON: EL VALOR DE HÁBITATS RIBEREÑOS DE DESIERTO

Resumen. La detección de reducciones a largo plazo en las poblaciones de algunas especies de paseriformes migratorias del Neotrópico ha impulsado recientes esfuerzos para entender mejor el uso de hábitats de parada por estas aves. Dicha investigación es importante para el desarrollo de amplias estrategias de conservación de aves migratorias. En 1999, capturamos aves con redes de niebla en el Mar Salton durante los periodos de migración de primavera y otoño para determinar el uso de los hábitats ribereños de desierto como sitios de parada. Durante la primavera, capturamos 51 especies a una tasa total de 215.6 aves/100 horas/red, mientras que durante el otoño capturamos 49 especies a una tasa total de 73.4 aves/100 horas/red. Las aves migratorias constituyeron 89% de las capturas de primavera y 80% de las de otoño. La tasa de captura de algunas especies fue mayor en el Mar Salton que en otras estaciones de monitoreo de migración en California durante el mes de Mayo y durante el otoño. Más de la mitad de los individuos recapturados mostraron cambios positivos en la masa corporal durante el período de parada. El Vireo Gorjeador (*Vireo gilvus*) y los Chipes Corona Naranja (*Vermivora celata*), Amarillo (*Dendroica petechia*) y Corona Negra (*Wilsonia pusilla*) mostraron una relación negativa entre el cambio de masa corporal y la fecha de captura en la primavera. En el otoño, los Chipes Corona Naranja y Amarillo mostraron una relación positiva entre el cambio de masa corporal y la hora del día. Estos resultados preliminares sugieren que las áreas ribereñas de desierto en el Mar Salton sirven como importantes sitios de parada para paseriformes durante la migración.

Palabras claves: captura con redes de niebla; Chipe Amarillo; Chipe Corona Naranja; Chipe Corona Negra; ecología de sitios de parada; hábitats ribereños de desierto; Mar Salton; migración; migratorias Neotropicales; Vireo Gorjeador.

Long-term population declines detected in some species of neotropical migrant passerines (Robbins et al. 1989, Askins et al. 1990, Finch and Stangel 1993) have helped to focus recent research efforts on the migration ecology of these species. In addition to events on the wintering grounds and during the breeding season, changes in habitat at migration stopover sites contribute to the pressures affecting the population dynamics of migrant birds (Moore 2000). Information on stopover habitat use by birds is important in the development of comprehensive strategies to reverse these population declines. The identification of high quality habitat types and specific sites as well as understanding the habitat use, behavioral ecology, and energy constraints on passerines during migration may be critical to long-term conservation efforts (Moore 2000, Petit 2000).

The Salton Sea, located within the Colorado Desert of southern California, is well known as an important migratory stopover and wintering site for many species of shorebirds and waterbirds (Garrett and Dunn 1981, Rosenberg et al.

1991, Shuford et al. *this volume*), yet little is known about the value of surrounding riparian areas to migrating passerines. Here, we present species capture rates by site and age obtained during mist-netting operations in 1999 to assess the use of the area as a stopover site for migrant landbirds. We examined changes in mass to determine the extent to which birds were able to replenish their fat reserves at the Salton Sea. Since most transients at stopover sites are not recaptured, changes in mass cannot always be compared over a stopover period (Winker et al. 1992a). Thus, similar to studies by Woodrey and Moore (1997) and Yong et al. (1998), we examined the relationship between body mass and time of day, making the prediction that birds at a stopover site will show diel fluctuations in mass. We also predicted that changes in mass would differ between migrating individuals and birds overwintering in the area, as migrants replenish and store fat reserves necessary to meet the energetic requirements of migration. We also examined the relationship between changes in mass and date of capture to determine if they reflected differences in individual condition.

METHODS

STUDY AREA

The Salton Sea lies within the Coachella and Imperial valleys of California (Fig. 1), one of the most important agricultural areas in the state (Hurlbert 1997). Here an elaborate network of irrigation canals and a few natural waterways support a highly modified but extensive riparian system, especially along the southeastern shore.

We monitored passerine migration at two sites along the southeastern shoreline of the Salton Sea (Fig. 1). In spring our study area was located at the Wister Unit of the Imperial Wildlife Area (33°18′N, 115°35′W). Here, the riparian habitat was dominated by exotic tamarisk (*Tamarix ramosissima*), with some saltbush (*Atriplex lentiformes*) in the understory. In fall we mist-netted at the Sonny Bono Salton Sea National Wildlife Refuge (SSNWR) headquarters (33°10′N, 115°37′W). The habitat at this site consisted predominantly of native species including Fremont cottonwood (*Populus fremontii*), blue palo verde (*Cercidium floridium*), honey and screwbean mesquite (*Prosopsis glandulosa* and *P. pubescens*), and willow (*Salix* spp.), with an understory of arrow weed (*Tessaria sericea*), saltbush, and tamarisk. Both study locations were approximately 70 m below sea level.

NETTING PROTOCOL

We operated ten standard mist-nets in spring from 6 April to 26 May and in fall from 3 September to 29 October 1999. Nets were at least 10 m apart within contiguous and homogenous habitat, and were opened 15 min after sunrise and checked every 30 min for five hrs during the spring. In fall, to avoid heat stress, nets were opened at first light, usually 15 min before sunrise, and checked every 20 min for five hrs. Each bird received a standard United States Geological Service (USGS) aluminum leg-band, and was identified to species, age, and, when possible, subspecies and sex following Pyle (1997). Each individual was weighed on a Pesola spring scale to the nearest 0.1 g.

DATA ANALYSIS

We standardized our results by calculating the number of initial captures/100 net-hrs of mist-netting effort, which allowed us to compare capture rates between sites at the Salton Sea and with other sites in California.

We estimated the stopover length for three species in each season following the methods by Biebach et al. (1986). Minimum stopover length was estimated by calculating the time interval between the date of initial capture and final capture (Moore and Kerlinger 1987). Hence, our estimate of stopover length is conservative. We omitted from recapture analysis two individual Orange-crowned Warblers (see Appendix for scientific names) with stopover lengths of 13 d and 40 d, assuming that birds with a stopover length greater than 10 d are most likely winter residents, based on previously published data and stopover duration of known migrants at the Salton Sea (see references in Gardali et al. 2000; PRBO, unpubl. data). We estimated change in body mass as the difference between mass at initial capture and mass at final capture.

We restricted our analysis of the relationship between mass change and time of day and between mass change and date of capture to six species with a sample size of at least 50 captures in a season. We used linear regression to describe the relationships between mass and date of capture and mass and age at capture. We then examined the relationship between mass and time of capture controlling for date in the spring and age in the fall because linear regression revealed a relationship between these factors and changes in mass. We investigated whether these relationships were non-linear by testing for a significant quadratic coefficient for time of capture in the presence of a linear term. In no case was there a significant quadratic coefficient for time of capture. Data were log transformed when necessary to satisfy assumptions of normality and variance homogeneity. All regression analyses were carried out using the program STATA (STATA Corp. 1997). Significance was assumed at the $P < 0.05$ level. Values presented are mean ± SE.

RESULTS

During spring 1999, we mist-netted for a total of 723.5 net-hrs. We captured 1,560 individuals of 51 species, for a total capture rate of 215.6 birds/100 net hrs. In addition, 106 individuals were recaptured. Migrants accounted for 89% of total captures, while residents accounted for 11%. The most numerous spring migrant species were Warbling Vireos and Orange-crowned, Yellow, Audubon's, and Wilson's warblers (Appendix).

In fall 1999, we mist-netted for a total of 1161 net-hrs. We captured 852 individuals of 49 species, for a total capture rate of 73.4 birds/100

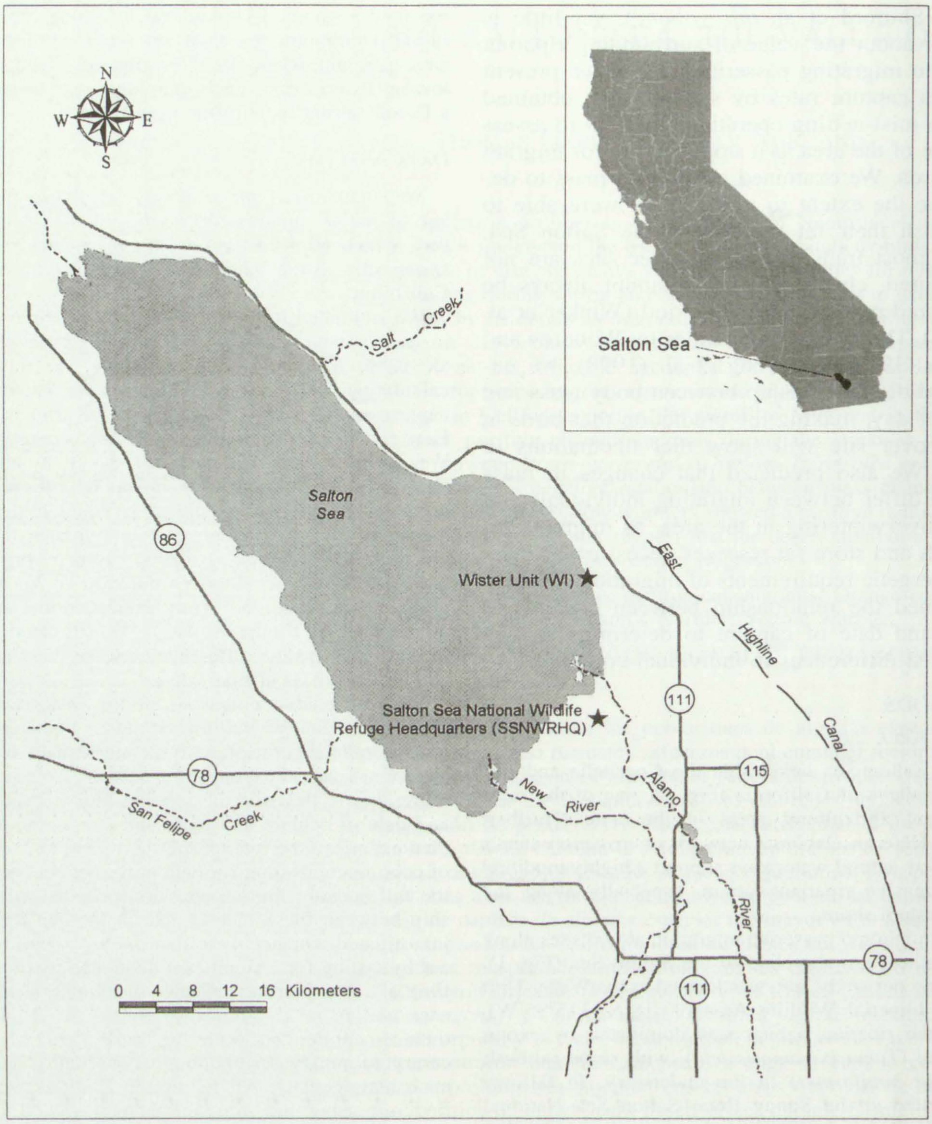

FIGURE 1. Mist-netting locations at the Salton Sea, California, in spring and fall 1999.

net-hrs. In addition, 88 individuals were recaptured. Migrant birds accounted for 80% of all captures, while resident birds accounted for 20%. The most numerous fall migrant species were Orange-crowned, Yellow, Audubon's, and Wilson's warblers (Appendix). In fall, hatch-year birds accounted for 45% of total captures, after-hatch-year birds 35%, and birds that could not be reliably aged 20%.

Capture rates of Yellow and Audubon's warblers were similar at the Wister Unit and the SSNWR, but capture rates of Warbling Vireos and Orange-crowned and Wilson's warblers were much greater at the Wister Unit than at the SSNWR (Table 1). At the Wister Unit, Wilson's Warblers were mist-netted at a rate of 84.31 birds/100 net-hrs representing 39% of total captures, whereas at SSNWR they accounted for only 5.4% of captures at a rate of 3.96 birds/100 net-hrs.

The timing of migration varied among species (Fig. 2a–e). In spring, peak capture rates of Warbling Vireos and Yellow and Wilson's warblers occurred in May, while higher rates for Orange-crowned and Audubon's warblers occurred in April. In fall, migration for all species peaked in

TABLE 1. CAPTURE RATES (BIRDS/100 NET-HRS) OF FIVE OF THE MOST COMMON MIGRANT SPECIES AT THE SALTON SEA DURING SPRING (723.5 NET-HRS) AND FALL (1161.0 NET-HRS) 1999

Species	April	May	Spring mean	September	October	Fall mean
Warbling Vireo	6.09	42.00	19.21	0.34	0.00	0.17
Orange-crowned Warbler	35.70	7.56	25.43	12.96	12.01	12.49
Yellow Warbler	1.74	29.51	11.89	16.88	3.66	10.34
Audubon's Warbler	13.28	0.00	8.43	0.68	29.59	14.47
Wilson's Warbler	99.28	171.77	84.31	6.48	1.39	3.96

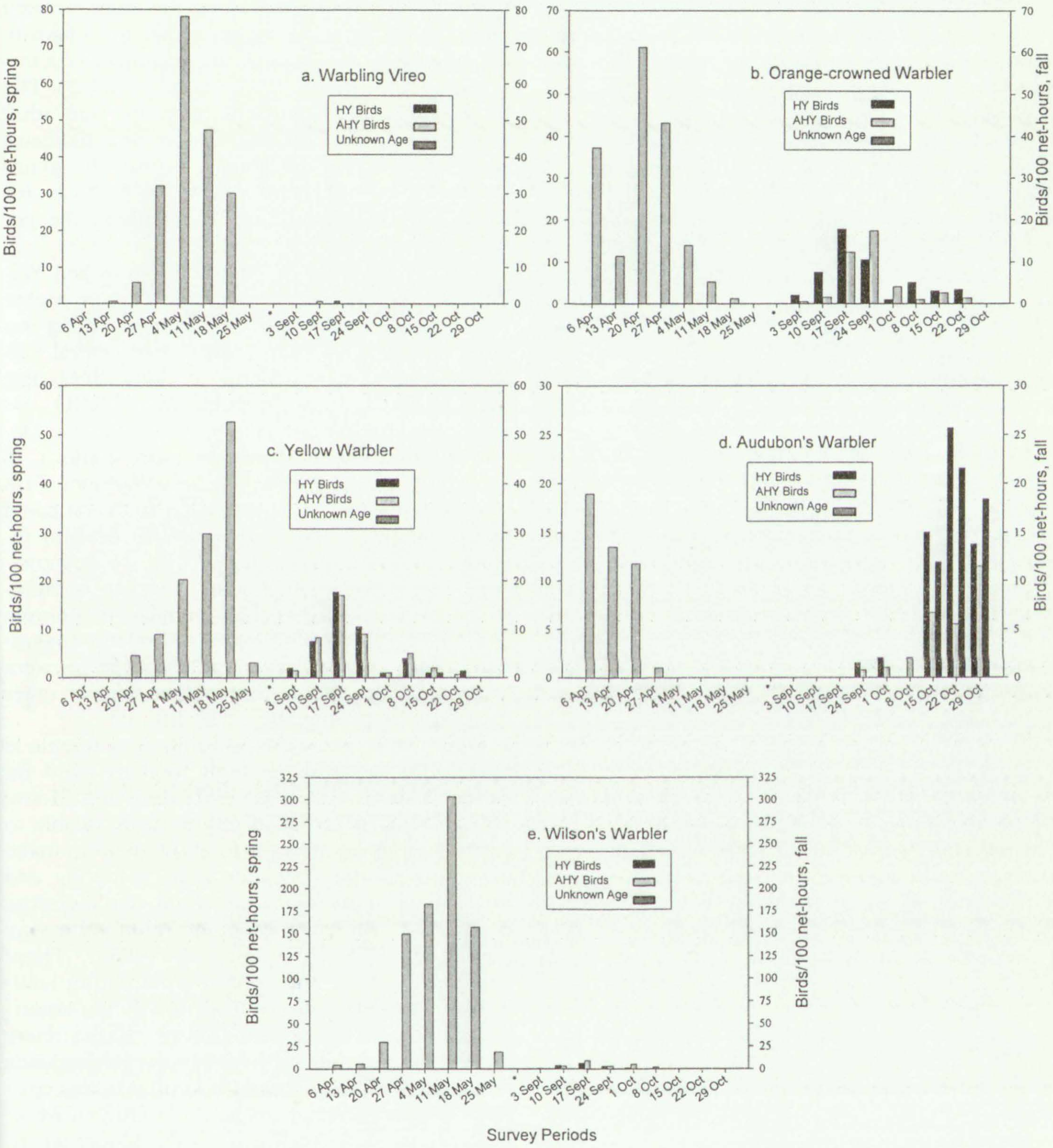

FIGURE 2. Phenology of the (a) Warbling Vireo, (b) Orange-crowned Warbler, (c) Yellow Warbler, (d) Audubon's Warbler, and (e) Wilson's Warbler at the Salton Sea in spring and fall 1999.

mid-September except for Audubon's Warblers, which peaked in late October.

In spring, the average stopover length for Warbling Vireo (N = 3), Orange-crowned Warbler (N = 5), and Wilson's Warbler (N = 12) was 4 d ± 1.53, 6.4 d ± 1.40, and 3.9 d ± 0.50, respectively. In fall, stopover lengths averaged 4.6 d ± 0.69 for Orange-crowned Warbler (N = 9), 3.7 d ± 0.67 for Yellow Warbler (N = 3), and 3.8 d ± 1.11 for Wilson's Warbler (N = 5). The overall mean gain in mass for all recaptures was 0.67 g ± 0.12 while overall loss was 0.37 g ± 0.06. Of the 37 recaptured individuals, 51.4% gained mass, 32.4% lost mass, and 16.2% had no change in mass (Fig. 3a–f). Maximum gains of 1.6 g were observed in one Wilson's Warbler in spring and two Orange-crowned Warblers in fall.

In spring, Audubon's Warblers exhibited a positive relationship between mass and date of capture while all others exhibited a negative relationship (Table 2). In fall, we found no such relationship for any species. In spring, no species showed a relationship between mass and time of capture (Table 3) except for Warbling Vireo, which approached significance and exhibited a positive relationship ($P = 0.057$). In fall, we also examined the relationship between mass and age at capture and found the only significant relationship in Wilson's Warblers ($\beta = 0.74 \pm 0.17$, $P < 0.001$, N = 51), with a mean mass of 7.9 g ± 0.10 for adults and 7.2 g ± 0.14 for young birds. Both adult and young Yellow Warblers exhibited significant positive relationships between mass and time of capture. Orange-crowned Warblers overall showed a significant relationship between mass and time of capture, but when examined separately by age class only adults demonstrated a significant positive relationship (Table 4).

DISCUSSION

Capture rates showed differences in overall abundance between the two mist-netting sites with three times as many birds captured at the Wister Unit than at the SSNWR. But because differences in capture rates may be attributed to differences in season, habitat type, migratory route, annual weather patterns, and/or methodology, we cannot conclude whether these differences in abundance represent site-differences, seasonal-differences or an interaction of both site and season. However, in both seasons and at both sites, species richness and composition were similar and positive changes in mass occurred overall, suggesting that our study sites were of similar quality.

Peak periods of migration varied among species with the majority of spring migrants recorded during the month of May (Fig. 2a–e). The patterns that we observed for Yellow and Wilson's warblers are similar to those recorded for these species in the Colorado River Valley, a desert riparian area also recognized as an important migratory stopover site (Rosenberg et al. 1991).

The relatively high percent of after-hatch-year birds (35%) recorded in the fall at the Salton Sea contrasts markedly with sites along coastal routes in California where percentages of after-hatch-year birds ranged from 5–15% (Ralph 1971, Stewart et al. 1974). The higher proportion of young migrating along the coast, termed the "coastal effect," suggests that the majority of young migrants occupy the periphery of a migration route (Ralph 1981, Woodrey 2000). The more equitable proportions of young and adult migrants captured at the Salton Sea indicates that the area may be located within the mainstream of an important migratory pathway for many species, rather than lying along the periphery.

Our capture rates of Warbling Vireos and Yellow and Wilson's warblers (Table 1) were higher than those observed at five other mist-netting stations in California (two coastal, two central valley, and one eastern Sierra) in May 1999 (Big Sur Ornithology Lab, unpubl. data; PRBO, unpubl. data) and at one station in the Mojave Desert in fall 1999 (S. J. Myers, pers. comm.). In May, our capture rate for Wilson's Warbler (171.8 birds/100 net-hrs) was particularly high compared to the range (5.3 to 24.0 birds/100 net-hrs) recorded at these other sites. While we acknowledge that variation in capture rates can be influenced by factors other than abundance (Remsen and Good 1996), these large differences suggest that in May of 1999, several migrant species were more abundant at the Salton Sea than at other riparian mist-netting sites in California.

One of the greatest constraints to migrants is the ability to obtain enough food to build fat stores (Moore et al. 1995, Woodrey and Moore 1997). Many neotropical migrants are unable to carry enough fat reserves to allow them to make the entire journey between their wintering and breeding grounds in a single flight, and therefore need to stop at various points along the way (Berthold 1975, Winker et al. 1992a). These stopover sites are important for migrating landbirds, especially if those birds are facing significant ecological barriers. Many studies have shown that accumulation of fat reserves for birds migrating over vast deserts is similar to that over large bodies of water, such as the Gulf of Mexico (Moore and Kerlinger 1987, Moore et al. 1995, Finch and Yong 2000). Thus, the desert riparian habitat surrounding the Salton Sea may

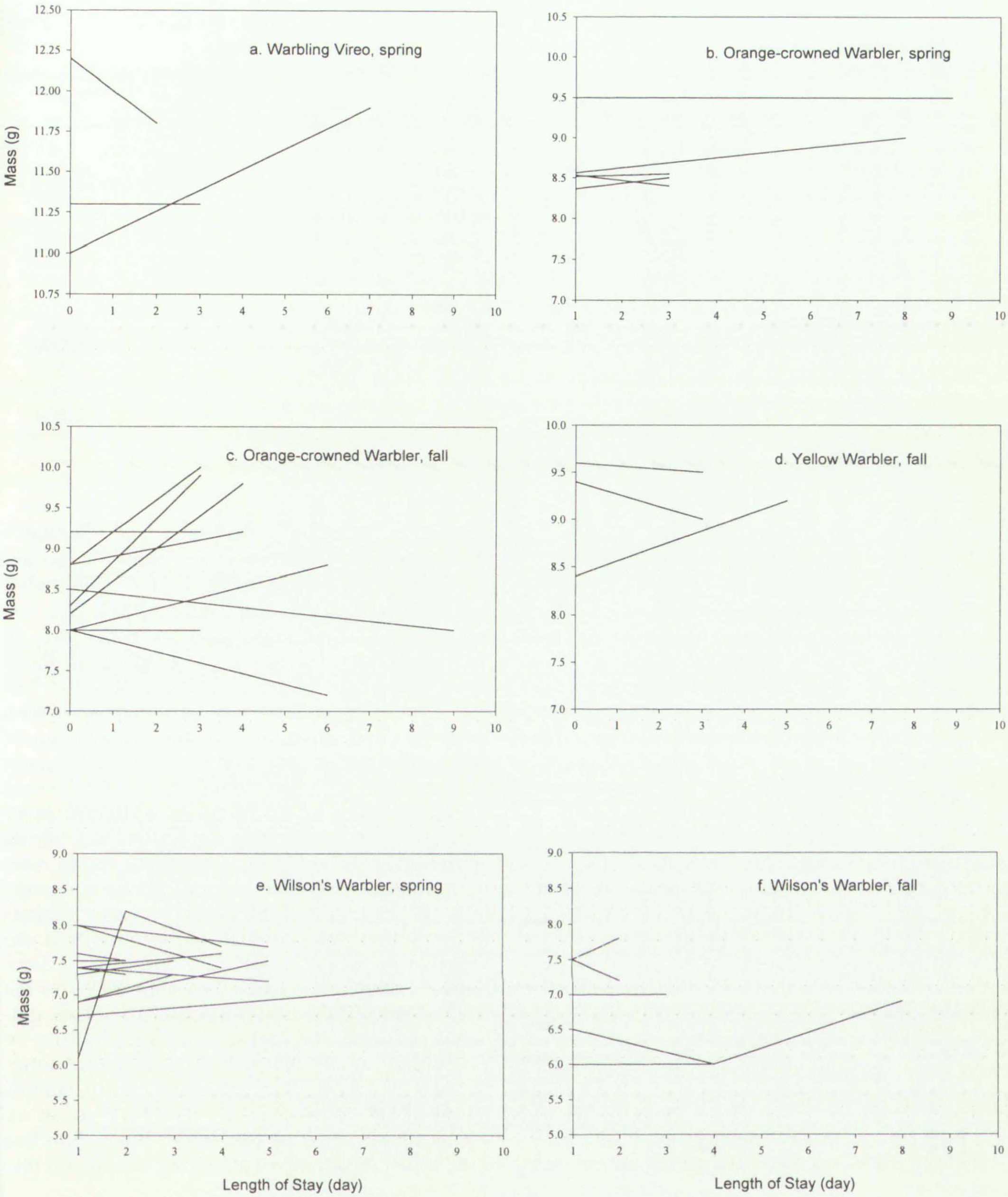

FIGURE 3. Changes in mass of recaptured individuals of (a) Warbling Vireo in spring, (b) Orange-crowned Warbler in spring, (c) Orange-crowned Warbler in fall, (d) Yellow Warbler in fall, (e) Wilson's Warbler in spring, and (f) Wilson's Warbler in fall during their stopover period at the Salton Sea.

be especially important for western birds during migration since it may be one of the last stopover sites before encountering major ecological barriers—the Sonoran Desert if heading south, or the Mojave Desert if heading north.

Based on our recapture analysis, most individuals showed average gains in mass from the time of their initial capture to their final capture while at the Salton Sea (Fig. 3a–f). In Wilson's Warbler, our most common spring migrant, we detected no relationship between mass change and stopover length. As has been suggested in other studies (Bibby and Green 1980, Moore and Yong 1991, Petit 2000), the late arrival of Wil-

TABLE 2. RELATIONSHIP BETWEEN MASS AND DATE OF CAPTURE FOR SPECIES WITH ≥50 INDIVIDUALS; SALTON SEA SPRING AND FALL, 1999

Species	N	Slope (g/d)	SE	P	Adjusted[a] R^2
Spring					
Warbling Vireo	106	−0.031	0.0095	0.002	0.082
Orange-crowned Warbler	165	−0.018	0.0052	0.001	0.060
Yellow Warbler	79	−0.032	0.0080	<0.001	0.160
Audubon's Warbler	57	0.004	0.0017	0.020	0.078
Wilson's Warbler[b]	515	−0.027	0.0021	<0.001	0.250
Fall					
Orange-crowned Warbler	158	0.005	0.005	0.35	−0.001
Yellow Warbler	123	0.004	0.008	0.59	−0.006
Audubon's Warbler	167	−0.018	0.011	0.11	0.016
Wilson's Warbler	51	0.016	0.014	0.24	0.009
Gambel's White-crowned Sparrow	63	0.024	0.027	0.38	−0.004

[a] Adjusted R^2 refers to the statistical model that includes the effect of date.
[b] Adjusted R^2 and P-values reported are derived from statistical tests carried out on log transformed mass (see text).

son's Warblers relative to other species (Fig. 2e) and their high concentration may have increased competition for already diminished food resources at the Salton Sea in spring. Wilson's Warblers in fall were the only species that showed a significant relationship between age and mass, with older birds heavier than younger birds, which may have been another confounding factor affecting trends in mass change. More study is needed to examine the relationships among phenology, abundance, and food resources for birds during migration.

In spring, birds that arrived later at the Salton Sea had significantly less mass than those that arrived earlier, suggesting that physical condition declined with arrival date (Marra et al. 1998). No such relationship was observed for any species in fall. Factors that may have confounded our results, however, include variation in body size due to age, sex, and subspecies. In fall, the Salton Sea area appeared to provide suitable foraging opportunities to replenish fat reserves over the course of a day for Orange-crowned and Yellow warblers (Table 4). We did not find similar trends for any other species in either season. The fact that Orange-crowned Warblers, Audubon's Warblers, and Gambel's White-crowned Sparrows are common winter residents at the Salton Sea may have confounded our results (Garrett and Dunn 1981). We expected the rate of mass gain for birds still on their migratory journey to be larger than those at or near their winter residence; thus the fact that Orange-crowned Warblers in fall showed a positive trend in change in mass over time of day suggests that our sample consisted mostly of transients.

Our preliminary results show a diverse community of landbirds using the Salton Sea during spring and fall migration. Our high capture rates in conjunction with an overall positive change in mass suggest that the desert riparian habitats of the Salton Sea, although highly modified, are valuable to many species of migrant passerines. Because abundance data alone cannot assess the suitability of habitats (Hutto 2000), we recommend seasonal, long-term monitoring efforts be established at the Salton Sea to examine songbird use of a variety of native and exotic habitats (Hutto 1985, Winker et al. 1992b, Yong et al. 1998). Desert riparian habitats of the Salton Sea should be considered in all conservation and res-

TABLE 3. RELATIONSHIP BETWEEN MASS AND TIME OF CAPTURE, CONTROLLING FOR LINEAR TREND IN DATE; SALTON SEA SPRING, 1999

Species	N	Slope (g/hr)	SE	P	Adjusted[a] R^2
Warbling Vireo	106	0.012	0.0062	0.057	0.100
Orange-crowned Warbler	165	0.0021	0.0040	0.61	0.056
Yellow Warbler	79	−0.0026	0.0060	0.67	0.150
Audubon's Warbler[b]	57	0.0020	0.0078	0.76	0.063
Wilson's Warbler[b]	515	0.0003	0.0017	0.85	0.250

[a] Adjusted R^2 refers to the statistical model that includes the effect of time of capture and date (df = 2).
[b] Adjusted R^2 and P-values reported are derived from statistical tests carried out on log transformed mass (see text).

TABLE 4. RELATIONSHIP BETWEEN MASS AND TIME OF CAPTURE, CONTROLLING FOR AGE; SALTON SEA FALL, 1999

Species	N	Slope (g/hr)	SE	P	Adjusted R^2	Adjusted r^2
Orange-crowned Warbler	121	0.015	0.0052	0.004	0.080	—
Adults	56	0.021	0.0077	0.008	—	0.110
Young	65	0.0093	0.0070	0.19	—	0.012
Yellow Warbler	120	0.025	0.0062	<0.001	0.130	—
Adults	59	0.026	0.0093	0.007	—	0.100
Young	61	0.024	0.0084	0.005	—	0.110
Audubon's Warbler	105	0.0096	0.0083	0.25	−0.006	—
Adults	30	0.016	0.016	0.32	—	0.001
Young	75	0.0068	0.0097	0.48	—	−0.007
Wilson's Warbler	51	−0.00032	0.0067	0.96	0.250	—
Adults	28	−0.0014	0.0080	0.86	—	−0.037
Young	23	0.0013	0.012	0.92	—	−0.047
Gambel's White-crowned Sparrow	63	0.014	0.026	0.59	−0.024	—
Adults	40	−0.012	0.033	0.72	—	−0.023
Young	23	0.063	0.040	0.13	—	0.061

Notes: Results reported include models that control for age effect, as well as for each age class separately. Adjusted R^2 refers to results from a statistical model that includes age, Adjusted r^2 refers to results of analysis for each age class separately.

toration plans because of their importance to migratory passerines.

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APPENDIX. SPRING (723.5 NET-HRS) AND FALL (1161.0 NET-HRS) CAPTURE RATES (BIRDS/100 NET-HRS) OF BIRDS AT THE SALTON SEA IN 1999

Species	Spring	Fall	Status[a]
Least Bittern (*Ixobrychus exilis*)	0.14	0.00	R
Least Sandpiper (*Calidris minutilla*)	0.14	0.00	M
Sharp-shinned Hawk (*Accipiter striatus*)	0.14	0.00	M
Cooper's Hawk (*A. cooperii*)	0.00	0.09	M
American Kestrel (*Falco sparverius*)	0.00	0.17	R
Common Ground-Dove (*Columbina passerina*)	0.28	0.34	R
Mourning Dove (*Zenaida macroura*)	—[b]	—[b]	R/M
Lesser Nighthawk (*Chordeiles acutipennis*)	0.00	0.09	M
Anna's Hummingbird (*Calypte anna*)	0.00	0.09	R
Rufous Hummingbird (*Selasphorus rufus*)	0.14	0.00	M
Western Wood-Pewee (*Contopus sordidulus*)	0.55	0.00	M
Willow Flycatcher (*Empidonax traillii*)	2.21	3.36	M
Hammond's Flycatcher (*E. hammondii*)	0.97	0.00	M
"Western Flycatcher" (*E. difficilis/occidentalis*)	5.11	0.34	M
Black Phoebe (*Sayornis nigricans*)	0.14	0.95	R
Say's Phoebe (*S. saya*)	0.00	0.17	R
Ash-throated Flycatcher (*Myiarchus cinerascens*)	0.28	0.34	M
Eastern Kingbird (*Tyrannus verticalis*)	0.69	0.00	M
Loggerhead Shrike (*Lanius ludovicianus*)	0.00	0.17	R
Plumbeous Vireo (*Vireo plumbeus*)	0.00	0.09	M
Cassin's Vireo (*V. cassinii*)	0.55	0.00	M
Warbling Vireo (*V. gilvus*)	19.21	0.17	M
Verdin (*Auriparus flaviceps*)	1.52	1.89	R
Cactus Wren (*Campylorhynchus brunneicapillus*)	0.00	0.09	R
Bewick's Wren (*Thryomanes bewickii*)	0.00	0.52	R
House Wren (*Troglodytes aedon*)	0.14	0.17	R
Marsh Wren (*Cistothorus palustris*)	3.32	0.09	R
Ruby-crowned Kinglet (*Regulus calendula*)	2.35	0.86	M
Blue-gray Gnatcatcher (*Polioptila caerulea*)	0.41	0.43	M
Black-tailed Gnatcatcher (*P. melanura*)	0.83	0.09	R
Swainson's Thrush (*Catharus ustulatus*)	3.73	0.00	M
Hermit Thrush (*C. guttatus*)	0.69	0.43	M
Northern Mockingbird (*Mimus polyglottos*)	0.00	0.52	R
Orange-crowned Warbler (*Vermivora celata*)	25.43	12.49	M
Nashville Warbler (*V. ruficapilla*)	4.42	0.43	M
Western Palm Warbler (*Dendroica palmarum palmarum*)	0.14	0.00	M
Yellow Warbler (*D. petechia*)	11.89	10.34	M
Audubon's Warbler (*D. coronata auduboni*)	8.43	14.47	M
Myrtle's Warbler (*D. c. coronata*)	0.00	0.09	M
Unknown Yellow-rumped Warbler (*D. coronata*)	0.00	0.43	M
Black-throated Gray Warbler (*D. nigrescens*)	1.38	0.34	M
Townsend's Warbler (*D. townsendi*)	2.35	0.09	M
Hermit Warbler (*D. occidentalis*)	0.28	0.00	M
American Redstart (*Setophaga ruticilla*)	0.00	0.17	M
MacGillivray's Warbler (*Oporonis tolmiei*)	4.15	2.15	M
Common Yellowthroat (*Geothlypis trichas*)	8.71	5.51	R/M
Wilson's Warbler (*Wilsonia pusilla*)	84.31	3.96	M
Yellow-breasted Chat (*Icteria virens*)	1.11	0.00	M
Western Tanager (*Piranga ludoviciana*)	4.98	0.17	M
Green-tailed Towhee (*Pipilo chlorurus*)	0.00	0.09	M
Abert's Towhee (*P. aberti*)	1.11	2.30	R
Chipping Sparrow (*Spizella passerina*)	0.14	0.17	M
Brewer's Sparrow (*S. breweri*)	0.00	0.26	M
Sage Sparrow (*Amphispiza bellii*)	0.14	0.00	M
Savannah Sparrow (*Passerculus sandwichensii*)	0.00	0.09	R/M
Song Sparrow (*Melospiza melodia*)	6.77	0.09	R
Lincoln's Sparrow (*M. lincolnii*)	1.52	1.38	M

APPENDIX. CONTINUED

Species	Spring	Fall	Status[a]
Swamp Sparrow (*M. georgiana*)	0.14	0.00	M
Gambel's White-crowned Sparrow (*Zonotrichia leucophrys gambelii*)	0.69	5.08	M
Mountain White-crowned Sparrow (*Z. l. oriantha*)	0.28	0.43	M
Oregon Junco (*Junco hyemalis oreganos*)	0.00	0.26	M
Black-headed Grosbeak (*Pheucticus melanocephalus*)	0.55	0.00	M
Blue Grosbeak (*Guiraca caerulea*)	0.41	0.34	M
Lazuli Bunting (*Passerina amoena*)	0.97	0.00	M
Red-winged Blackbird (*Agelaius phoeniceus*)	0.00	0.34	R
Brown-headed Cowbird (*Molothrus ater*)	0.83	0.00	R
Hooded Oriole (*Icterus cucullatus*)	0.00	0.09	M
Bullock's Oriole (*I. bullockii*)	0.55	0.00	M
House Finch (*Carpodacus mexicanus*)	0.28	0.26	R
Lesser Goldfinch (*Carduelis psaltria*)	0.14	0.00	R
House Sparrow (*Passer domesticus*)	0.00	0.09	R

[a] R = resident, M = migrant, R/M = resident and migrant.
[b] Unbanded species not distinguishable to individual.