

**Bird species composition, phenology, nesting substrate, and
productivity for the Owens Valley alluvial fan,
Eastern Sierra Nevada, California 1998-2002**

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INTRODUCTION

The Owens Valley alluvial fan region of California's eastern Sierra Nevada acts as a geologic integration between the higher elevations of the steep eastern Sierra escarpment and the valley bottomlands of the Owens River to the east (Fig. 1), and it is at the interface of the Sierra Nevada, Great Basin, and Mojave Desert bioregions. The area presents a land management challenge since it is almost entirely managed by two federal agencies (Bureau of Land Management Bishop Resource Area (BLM) and Inyo National Forest (INF)), and the Los Angeles Department of Water and Power (LADWP) owns water rights to most of its streams. Thus, the alluvial fan region provides distinctive opportunities and challenges to songbird populations because of its position in this unique landscape and management context.

In order to make informed management decisions regarding localized activities that result in habitat alteration such as water diversions, grazing practices, fire management, installation or management of new campgrounds and roads or off-road vehicle use, several details about the region's avifauna are required. No previous work comprehensively describes bird use of the alluvial fan region, though at least three other efforts have described avian use of some parts of the region: surveys by the Bureau of Land Management, Bishop Field Office (BLM, Jones 1978, Fatooh 1996), California Department of Fish and Game (CDFG, Laymon and Williams 1994), and Inyo county bird record compilers (T. & J. Heindel pers. comm.). The avifauna of discreet areas adjoining the Owens Valley alluvial fan have been described previously, including the Mono Lake Basin and environs (Fisher 1902, Grinnell and Storer 1924, Dixon 1934, Rowley 1939, Gaines 1992), Glass Mountains (Shuford and Metropulos 1996), Owens River Valley (Fisher 1893), and White / Inyo Mountains (Johnson and Cicero 1986, 1991, Morrison et al. 1993, Hall and Morrison 2003).

During the 1998-2002 songbird breeding seasons, the Point Reyes Bird Observatory (PRBO), BLM, INF, California Department of Fish and Game (CDFG) and several other partners initiated an intensive baseline riparian bird monitoring program in the Owens Valley alluvial fan region of the eastern

Sierra Nevada. The goals of this effort were to 1) establish a standardized and repeatable monitoring study to collect data on breeding bird use of riparian habitat in this relatively undocumented region; 2) to collect and interpret data to inform regional habitat and wildlife management efforts and 3) to contribute data to statewide riparian bird conservation efforts (e.g. California Partners in Flight (CA PIF) and Riparian Habitat Joint Venture (RHJV)).

Here we present data on the basic distribution and species composition for birds nesting and migrating through riparian habitats of the Owens Valley alluvial fan region, and discuss the annual variation we observed in breeding species richness, 1998-2002. We describe the phenology of migration and breeding, and describe the nesting substrates, so that the timing and nature of management activities can be considered in the context of potential impacts to bird populations. We also present estimates of productivity as indexed by ratios of young to adult captures in mist nets (DeSante and Geupel 1987, DeSante et al. 1993, Nur et al. 2000). We combine results from the first five years of the study to characterize these details, but also discuss annual variation of some parameters. Preliminary results from this study have been presented in several unpublished reports (Heath and Ballard 1999a, 1999b; Heath et al. 2001, Heath et al. 2002a, 2002b).

STUDY AREA AND METHODS

The study area consists of riparian and adjacent sagebrush habitat along 12 separate creeks encompassing a 100 km latitudinal stretch of the eastern Sierra Nevada and western Great Basin region of Inyo county, California (37° 05' N, -118° 21' W to 36° 23' N, -118° 02' W, Fig. 1 and Table 1). Study site streams flow generally west to east - incising the alluvial fan of the eastern Sierra escarpment in destination to the Owens River Valley - and range in elevation from 1230m to 2022m. Widths of streamside riparian vegetation average 23m, and range from 5m to > 100m (PRBO data). These streams are quick-flowing watercourses comprised primarily of water birch (*Betula occidentalis*) and a mixture of shrub willow species (mostly *Salix exigua* and *S. lasiolepis*) with patches of black cottonwood (*Populus trichocarpa*) and rarely oak (*Quercus kelloggii* or *Quercus wislizeni*). Upland habitats are dominated by a mixture of sagebrush-associated species (*Artemisia tridentata*, *Purshia tridentata* and *Chrysothamnus* spp).

Alluvial fan lands are primarily managed by the BLM and INF, and one study site stream is owned and managed by the LADWP. Most stream sections within the study area have comparatively little human visitation (pers. obs.). Developments at these sites include 2 and 4 wheel drive roads running parallel to and occasionally fording the streams. Two sites experience high human visitation, having paved campgrounds, vacation cabins and paved roads running parallel to the streams. The region is grazed by cattle on a rotational basis, though with the exception of one location, we did not observe cattle on site during the course of the study. Most streams are used as water sources for 1 to 2 days per season by sheep passing through the alluvial fan region, and grazing of riparian

Table 1. Stream name, elevation, number of point count stations, and number years by method. Streams listed from North to South.

<i>Study Site</i>	<i>Elevation (m)</i>	<i>Number Point Count Stations</i>	<i>Point Count (yrs)</i>	<i>Mist Netting (yrs)</i>	<i>Nest Searching (yrs)</i>
<i>Birch Creek (Upper and Lower)</i>	<i>1535 - 1888</i>	<i>19</i>	<i>98-02</i>	<i>--</i>	<i>98-00</i>
<i>Taboose Creek</i>	<i>1250 - 1567</i>	<i>19</i>	<i>98-02</i>	<i>98-00</i>	<i>98-00</i>
<i>Sawmill Creek</i>	<i>1230 - 1488</i>	<i>12</i>	<i>98-00</i>	<i>--</i>	<i>--</i>
<i>Thibaut Creek</i>	<i>1300 - 1590</i>	<i>15</i>	<i>98-02</i>	<i>--</i>	<i>--</i>
<i>Independence Creek</i>	<i>1537 - 1878</i>	<i>15</i>	<i>98-02</i>	<i>98-00</i>	<i>98-00</i>
<i>Shepherd Creek</i>	<i>1583 - 1818</i>	<i>15</i>	<i>98-00</i>	<i>--</i>	<i>--</i>
<i>Bairs Creek</i>	<i>1600 - 1850</i>	<i>15</i>	<i>98-02</i>	<i>98-00</i>	<i>98</i>
<i>Hogback Creek (Upper)</i>	<i>1290 - 2022</i>	<i>15</i>	<i>98-00</i>	<i>--</i>	<i>--</i>
<i>Hogback Creek (Lower)</i>	<i>1290 - 1402</i>	<i>15</i>	<i>99-02</i>	<i>--</i>	<i>--</i>
<i>Lone Pine Creek</i>	<i>1590 - 1800</i>	<i>15</i>	<i>98-00</i>	<i>--</i>	<i>98</i>
<i>Tuttle Creek</i>	<i>1700 - 1975</i>	<i>15</i>	<i>98-02</i>	<i>98-00</i>	<i>98</i>
<i>Lubken Creek</i>	<i>1720 - 1980</i>	<i>9</i>	<i>98-00</i>	<i>--</i>	<i>--</i>
<i>Ash Creek</i>	<i>1167 - 1295</i>	<i>9</i>	<i>98-02</i>	<i>--</i>	<i>--</i>

herbaceous vegetation likely occurs. Three of the streams reach the Owens River while the remaining nine are entirely diverted into the Los Angeles Aqueduct. Several thousand acres of the region are included in the Eastern Sierra Citizens' Wilderness Proposal for the John Muir Wilderness Additions (FOI 2003).

Point counts. We conducted 5-minute, 50-m fixed-radius point counts at 188 stations on 12 streams, following standards recommended by Ralph et al. (1993, 1995, Table 1). We placed points 250 m apart and visited each site 3 mornings each season (1998 - 2000) and two times each season (2001–2002). We separated visits to the same site by at least 7 days. We conducted all counts in June, except for in 1998 when we began May 25.

Mist netting and banding. We operated ten mist nets (30 mm mesh, 12 m long) once every ten day period between May 1 and August 15, for a total of 11 visits to each of four streams each year (Table 1). When conditions permitted, we operated nets each day for 5 hours, therefore accumulating 50 net-hours of effort per banding day and totaling 6392.26 net hours for all sites and all years combined. We followed guidelines described in Ralph et al. (1993) and the Monitoring Avian Productivity and Survivorship (MAPS) protocol (DeSante et al. 2002). All birds captured were given a uniquely numbered USFWS aluminum band, and several measurements were recorded, including age and sex of all individuals (Pyle 1997).

Nest searching. We searched for nests of all species at all stages (construction, egg laying, incubation and nestling) at six streams May 1 – August 15 (Table 1). We followed nest searching and monitoring protocol as described in Martin and Geupel (1993) and BBIRD (Martin et al. 1997), taking special care to minimize human induced predation probability and disturbance to adults at nest sites. We checked nests every 4 days to determine timing of clutch initiation, hatching, fledging, or failure. When necessary, first egg dates were calculated from

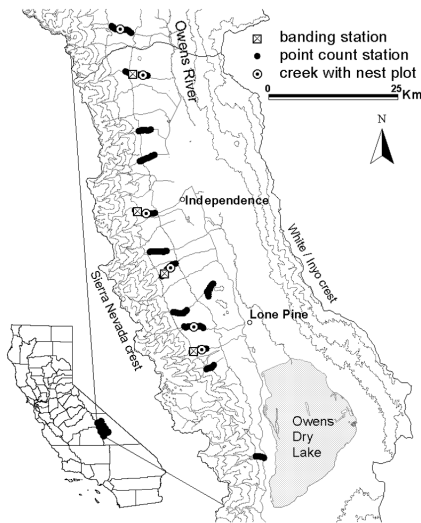


Figure 1. Study area: Owens Valley alluvial fan, Inyo County, CA 1998-2002.

known clutch completion, hatch or fledge dates. We also recorded the plant species that provided structural support and/or direct cover for each nest.

Breeding status. We determined breeding status for all species encountered in the study area May 1 – August 15, 1998-2002, using modified criteria described by DeSante et al. (2002) and PRBO (2003a). We characterized species as breeders (B) if at least one individual met one or more of the following criteria on any of the 12 study streams or within 0.5 km of upland adjacent to study sites: 1) singing individual encountered twice at same point count station at least ten days apart during peak breeding season; 2) active territory observed for at least three days and at least one week between observations; 3) active nest or nesting material, food or fecal sack being carried or independent juveniles with adults observed; 4) captured female with eggs in oviduct. Species characterized as transients (T) were those that did not breed on our study sites, but whose breeding ranges occur within the Owens River and Mono Lake watershed environs (Johnson and Cicero 1991, Shuford and Metropulos 1996, Heath et al. 2002, and T. & J. Heindel pers. comm.), or in the headwater region of the East Walker River watershed (Gaines 1992). Species characterized as migrants (M) were those that used the study area exclusively along their migratory route in either the spring or late summer, and whose breeding ranges occur outside of the watersheds and region described above. We contributed breeding status data to the California Partners In Flight Study Areas and Focal Species Range Map databases (PRBO 2003b).

We characterized breeding status for an entire species complex in order of preference of B, T and M, despite subspecies status differences. For example, at least 3 subspecies of Yellow Warbler could occur in the eastern Sierra.

Dendroica petechia marcomi and *D.p. brewsteri* have historically bred in the Owens Valley and Mono Lake region, and *D.p. rubiginosa* breeds exclusively in Canada and Alaska but occurs in the Owens Valley along its migratory route (Grinnell and Miller 1944, Dunn and Garrett 1997). We characterized Yellow Warblers as B because we found nests within the study area, even though most Yellow Warbler observations were most likely of individuals using the study area along their migratory route.

Statistical analysis. We used the computer program Point cnt 2.75 (Ballard 2002) to calculate breeding species richness by year for each of 106 point count stations that we censused 1998-2002 (Table 1) and calculated the mean by point richness for each year. We summarized all detections within 50m summed over two visits, excluding migrant or transient species and those that we determined were not reliably recorded with the point count method. Thus we removed species whose territories are typically so large that we could not assure independence of individual observations among points (swallows [*Hirundinidae*], swifts [*Apodidae*], waterfowl [*Anatidae*], wading birds [*Ardeidae*], shorebirds [*Scolopacidae* and *Charadriidae*], vultures [*Cathartidae*], hawks [*Accipitridae*], falcons [*Falconidae*], Common Ravens [*Corvus corax*], and Clark's Nutcrackers [*Nucifraga columbiana*]), and nocturnal species (owls [*Strigidae* and *Tytonidae*] and nightjars [*Caprimulgidae*]). We used the program CONTRAST (Hines and Sauer 1989) to compare total richness on the study area (mean from all points) among years. Estimates of productivity were determined by calculating the ratio of young to adult captures (summarized in Nur et al. 1993).

RESULTS

Bird species composition, frequency of occurrence, breeding status and breeding species richness: We observed 154 species on the study area and assessed breeding status for each (Table 2). Fifty-nine species were breeders, 75 were transients, and 20 were spring or late summer migrants. Out of 1909 mist net captures, adult and hatch year breeders accounted for 1018 while adult and hatch year transients or migrants accounted for 891.

Spotted Towhees (scientific names provided in Table 2) were detected at nearly all point count stations (94%) and were the most frequently captured breeding species. Among other breeding species, adult Black-headed Grosbeak, Sage Sparrow and Warbling Vireo were also captured in high numbers. Most young were Spotted Towhees, Sage Sparrows, Bushtits and Bewick's Wrens.

Among migrants and transients, Wilson's Warblers and Empidonax flycatchers were the most commonly detected on point counts and by mist nets. Adult Swainson's Thrushes were also captured in high numbers. Rufous Hummingbirds accounted for 73% of all young transient or migrant captures (Table 2).

Table 2. Bird species detected within the study area 1998-2002. Status for each species is breeder (B), transient (T) or migrant (M) as described in methods. Percent of total point count stations where at least one individual of each species was detected within 50m 1998-2002; number of new adult, young or unknown age mist net captures, and young to adult ratio for breeders 1998-2000; and number of nests found on nest plots and monitored 1998-2000.

Common Name	Latin Name	Status	% stations present (n = 188)	Number of new captures		young to adult ratio	Number nests found
				adult	young		
Great Blue Heron	<i>Ardea herodias</i>	T	--	--	--	--	--
Turkey Vulture	<i>Cathartes aura</i>	T	--	--	--	--	--
Gadwall	<i>Anas strepera</i>	T	--	--	--	--	--
Mallard	<i>Anas platyrhynchos</i>	T	--	--	--	--	--
Northern Harrier	<i>Circus cyaneus</i>	B	1	--	--	--	--
Sharp-shinned Hawk	<i>Accipiter striatus</i>	T	--	--	--	--	--
Cooper's Hawk	<i>Accipiter cooperii</i>	T	2	--	--	--	--
Swainson's Hawk	<i>Buteo swainsoni</i>	T	--	--	--	--	--
Red-tailed Hawk	<i>Buteo jamaicensis</i>	B	2	--	--	--	3
Golden Eagle	<i>Aquila chrysaetos</i>	T	--	--	--	--	--
American Kestrel	<i>Falco sparverius</i>	B	2	--	--	--	--
Prairie Falcon	<i>Falco mexicanus</i>	T	--	--	--	--	--
Chukar	<i>Alectoris chukar</i>	B	1	--	--	--	--
Mountain Quail	<i>Oreortyx pictus</i>	B	2	--	--	--	--
California Quail	<i>Callipepla californica</i>	B	18	--	--	--	--
Spotted Sandpiper	<i>Actitis macularia</i>	T	1	--	--	--	--
California Gull	<i>Larus californicus</i>	T	--	--	--	--	--
Rock Dove	<i>Columba livia</i>	T	--	--	--	--	--
Mourning Dove	<i>Zenaidura macroura</i>	B	27	1	--	--	2
Yellow-billed Cuckoo ^b	<i>Coccyzus americanus</i>	T	--	--	--	--	--
Greater Road-runner	<i>Geococcyx californianus</i>	B	2	--	--	--	--
Great-horned Owl	<i>Bubo virginianus</i>	T	--	--	--	--	--
Long-eared Owl	<i>Asio otus</i>	T	--	--	--	--	--
Lesser Nighthawk	<i>Chordeiles acutipennis</i>	T	--	--	--	--	--
Common Nighthawk	<i>Chordeiles minor</i>	T	6	--	--	--	--
Common Poorwill	<i>Phalaenoptilus nuttallii</i>	T	--	--	--	--	--
Black Swift	<i>Cypseloides niger</i>	T	1	--	--	--	--
Vaux's Swift	<i>Chaetura vauxi</i>	M	--	--	--	--	--
White-throated Swift	<i>Aeronautes saxatalis</i>	T	4	--	--	--	--
Black-chinned Hummingbird	<i>Archilochus alexandri</i>	B	26	24	11	0.46	42
Anna's Hummingbird	<i>Calypte anna</i>	T	2	3	10	--	--
Costa's Hummingbird	<i>Calypte costae</i>	B	27	12	6 ^a	0.50	35
Calliope Hummingbird	<i>Stellula calliope</i>	B	5	11	3	0.27	47
Broad-tailed Hummingbird	<i>Selasphorus platycircus</i>	T	1	--	--	--	--
Rufous Hummingbird	<i>Selasphorus rufus</i>	M	--	1 ^a	40	--	--
Unidentified Hummingbird	--	--	28	--	4	--	--
Belted Kingfisher	<i>Ceryle alcyon</i>	T	--	--	--	--	--
Lewis's Woodpecker	<i>Melanerpes lewis</i>	T	--	--	--	--	--
Acorn Woodpecker	<i>Melanerpes formicivorus</i>	B	--	--	--	--	--
Red-breasted Sapsucker	<i>Sphyrapicus rubber</i>	T	--	--	--	--	--
Nuttall's Woodpecker	<i>Picoides nuttallii</i>	T	1	--	2	--	--
Downy Woodpecker	<i>Picoides pubescens</i>	T	--	1	--	--	--
Hairy Woodpecker	<i>Picoides villosus</i>	B	3	5	1	0.20	1
Red-shafted Flicker	<i>Colaptes auratus</i>	B	8	1	1	1.00	12
Olive-sided Flycatcher	<i>Contopus cooperi</i>	T	12	3	--	--	--
Western Wood-Pewee	<i>Contopus sordidulus</i>	B	51	25	--	0.00	35
Willow Flycatcher	<i>Empidonax traillii</i>	T	3	15	--	--	--
Hammond's Flycatcher	<i>Empidonax hammondi</i>	T	17	161 ^a	--	--	--
Gray Flycatcher	<i>Empidonax wrightii</i>	T	1	5	--	--	--
Dusky Flycatcher	<i>Empidonax oberholseri</i>	T	11	75	--	--	--
"Western" Flycatcher ^c	<i>E. occidentalis</i> or <i>difficilis</i>	T	5	41	--	--	--
Empidonax Species	<i>Empidonax spp.</i>	--	14	--	--	--	--
Black-phoebe	<i>Sayornis nigricans</i>	B	4	--	--	--	--
Say's Phoebe	<i>Sayornis saya</i>	B	1	--	--	--	--
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>	B	11	--	--	--	--
Western Kingbird	<i>Tyrannus verticalis</i>	B	6	1	--	0.00	1
Loggerhead Shrike	<i>Lanius ludovicianus</i>	B	2	1	2	2.00	--
"Solitary" Vireo ^d	<i>Vireo cassinii</i> or <i>plumbeus</i>	M/T	3	18	--	--	--
Warbling Vireo	<i>Vireo gilvus</i>	B	24	78	2	0.03	32
Steller's Jay	<i>Cyanocitta stelleri</i>	B	16	4	--	0.00	3
Western Scrub-Jay	<i>Aphelocoma californica</i>	B	28	1	1	1.00	4
Pinyon Jay	<i>Gymnorhinus cyanocephalus</i>	T	1	--	--	--	--
Clark's Nutcracker	<i>Nucifraga columbiana</i>	T	2	--	--	--	--
American Magpie	<i>Pica hudsonia</i>	T	--	--	--	--	--
American Crow	<i>Corvus brachyrhynchos</i>	T	--	--	--	--	--
Common Raven	<i>Corvus corax</i>	B	4	--	--	--	2
Horned Lark	<i>Eremophila alpestris</i>	T	--	--	--	--	--
Tree Swallow	<i>Tachycineta bicolor</i>	T	--	--	--	--	--
Violet-green Swallow	<i>Tachycineta thalassina</i>	T	9	--	--	--	--
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	T	1	--	--	--	--
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	B	5	--	--	--	--

Table 2 Cont.

Barn Swallow	<i>Hirundo rustica</i>	T	--	--	--	--	--
Mountain Chickadee	<i>Parus gambeli</i>	T	2	--	--	--	--
Bushtit	<i>Psaltirparus minimus</i>	B	45	50	35	0.70	59
Red-breasted Nuthatch	<i>Sitta canadensis</i>	T	--	--	--	--	--
White-breasted Nuthatch	<i>Sitta carolinensis</i>	T	--	--	--	--	--
Brown Creeper	<i>Corthis americana</i>	T	1	--	--	--	--
Rock Wren	<i>Salpinctes obsoletus</i>	B	5	--	--	--	1
Canyon Wren	<i>Catherpes mexicanus</i>	B	--	--	--	--	--
Bewick's Wren	<i>Thryomanes bewickii</i>	B	64	47	49	1.04	12
House Wren	<i>Troglodytes aedon</i>	B	9	24	11	0.46	14
American Dipper	<i>Cinclus mexicanus</i>	B	--	--	--	--	2
Ruby-crowned Kinglet	<i>Regulus calendula</i>	T	--	14	--	--	--
Blue-gray Gnatcatcher	<i>Poliophtila caerulea</i>	B	16	4	--	0.00	15
Western Bluebird	<i>Sialia mexicana</i>	B	1	--	--	--	3
Townsend's Solitaire	<i>Myadestes townsendii</i>	T	--	--	--	--	--
Swainson's Thrush ^b	<i>Catharus ustulatus</i>	T	2	88	--	--	--
Hermit Thrush	<i>Catharus guttatus</i>	T	1	21	--	--	--
American Robin	<i>Turdus migratorius</i>	B	15	25	--	0.00	46
Wrentit	<i>Chamaea fasciata</i>	B	--	--	--	--	--
Gray Catbird	<i>Dumetella carolinensis</i>	M	--	1	--	--	--
Northern Mockingbird	<i>Mimus polyglottos</i>	B	1	--	--	--	--
Sage Thrasher	<i>Oreoscoptes montanus</i>	T	1	--	--	--	--
European Starling	<i>Sturnus vulgaris</i>	B	1	--	--	--	3
Cedar Waxwing	<i>Bombicilla cedrorum</i>	M	2	--	--	--	--
Phainopepla	<i>Phainopepla nitens</i>	B	9	--	--	--	--
Tennessee Warbler	<i>Vermivora peregrina</i>	M	--	--	--	--	--
Orange-crowned Warbler	<i>Vermivora celata</i>	B	14	82	21	0.28	7
Nashville Warbler	<i>Vermivora ruficapilla</i>	T	--	3	--	--	--
Yellow Warbler	<i>Dendroica petechia</i>	B	22	14	2	-- ^h	5
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	M	--	--	--	--	--
Yellow-rumped Warbler ^o	<i>Dendroica coronata</i>	T	3	9	--	--	--
Black-throated Gray Warbler	<i>Dendroica nigrescens</i>	T	1	--	--	--	--
Townsend's Warbler	<i>Dendroica townsendi</i>	M	9	16	--	--	--
Hermit Warbler	<i>Dendroica occidentalis</i>	M	--	1	1	--	--
Black-and-white Warbler	<i>Mniotilta varia</i>	M	--	2	--	--	--
American Redstart	<i>Setophaga ruticilla</i>	M	1	--	--	--	--
Kentucky Warbler	<i>Oporornis formosus</i>	M	--	--	--	--	--
MacGillivray's Warbler	<i>Oporornis tolmiei</i>	B	8	60	2	0.03	--
Common Yellowthroat	<i>Geothlypis trichas</i>	T	1	1	--	--	--
Northern Waterthrush	<i>Seiurus noveboracensis</i>	M	--	1	--	--	--
Wilson's Warbler	<i>Wilsonia pusilla</i>	T	39	337	--	--	--
Yellow-breasted Chat	<i>Icteria virens</i>	B	5	2	--	0.00	--
Summer Tanager	<i>Piranga rubra</i>	M	--	--	--	--	--
Western Tanager	<i>Piranga ludoviciana</i>	B	33	32	6	0.19	13
Green-tailed Towhee	<i>Pipilo chlorurus</i>	B	2	4	1	0.25	--
Spotted Towhee	<i>Pipilo maculatus</i>	B	94	101	30	0.30	57
Chipping Sparrow	<i>Spizella passerina</i>	B	2	3	--	0.00	2
Brewer's Sparrow	<i>Spizella breweri</i>	B	6	--	--	--	--
Black-chinned Sparrow	<i>Spizella atrogularis</i>	T	--	--	1	--	--
Lark Sparrow	<i>Chondestes grammacus</i>	B	1	--	--	--	--
Black-throated Sparrow	<i>Amphispiza bilineata</i>	B	33	1	1	1.00	8
Sage Sparrow	<i>Amphispiza belli</i>	B	46	71	53	0.75	7
Savannah Sparrow	<i>Passerculus sandwichensis</i>	T	--	--	--	--	--
Fox Sparrow	<i>Passerella iliaca</i>	T	--	2	1	--	--
Song Sparrow	<i>Melospiza melodia</i>	B	10	5	2	0.40	14
Lincoln's Sparrow	<i>Melospiza lincolni</i>	T	--	5	--	--	--
White-throated Sparrow	<i>Zonotrichia albicollis</i>	M	--	--	--	--	--
White-crowned Sparrow ^f	<i>Zonotrichia leucophrys</i>	T	2	2	--	--	--
Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>	M	--	--	--	--	--
Oregon Junco	<i>Junco hyemalis thurberi</i>	T	1	1	--	--	--
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	M	--	--	--	--	--
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	B	32	82	1	0.01	26
Blue Grosbeak	<i>Guiraca caerulea</i>	B	13	1	--	0.00	3
Lazuli Bunting	<i>Passerina amoena</i>	B	40	17	1	0.06	17
Indigo Bunting	<i>Passerina cyanea</i>	B	3	1	--	-- ^h	1
Indigo / Lazuli Hybrid	<i>Passerina cyanea/amoena</i>	B	--	--	--	--	--
Dickcissel	<i>Spiza americana</i>	M	--	--	--	--	--
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	T	1	--	--	--	--
Western Meadowlark	<i>Sturnella neglecta</i>	T	--	--	--	--	--
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>	T	--	--	--	--	--
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	T	3	--	--	--	--
Brown-headed Cowbird	<i>Molothrus ater</i>	B	41	4	--	0.00	--
Hooded Oriole	<i>Icterus cucullatus</i>	M	--	--	--	--	--
Scott's Oriole ^b	<i>Icterus bullockii</i>	M	--	--	--	--	--
Bullock's Oriole	<i>Icterus parisorum</i>	B	14	6	--	0.00	4
Gray-crowned Rosy Finch	<i>Leucosticte tephrocotis</i>	T	--	--	--	--	--
Lawrence's Goldfinch	<i>Carduelis lawrencei</i>	T	1	--	--	--	--
Cassin's Finch	<i>Carpodacus cassinii</i>	T	1	--	--	--	--
House Finch	<i>Carpodacus mexicanus</i>	T	4	--	--	--	--
Red Crossbill	<i>Loxia curvirostra</i>	T	--	--	--	--	--
Lesser Goldfinch	<i>Carduelis psaltria</i>	B	27	6	--	0.00	10

Table 2 Cont.

Cassin's Finch	<i>Carpodacus cassinii</i>	T	1	--	--	--	--
House Finch	<i>Carpodacus mexicanus</i>	T	4	--	--	--	--
Red Crossbill	<i>Loxia curvirostra</i>	T	--	--	--	--	--
Lesser Goldfinch	<i>Carduelis psaltria</i>	B	27	6	--	0.00	10
American Goldfinch	<i>Carduelis tristis</i>	M	--	--	--	--	--
Evening Grosbeak	<i>Coccothraustes vespertinus</i>	T	--	--	--	--	--
House Sparrow	<i>Passer domesticus</i>	T	--	--	--	--	--
Total	154 ^a species			1640	301 ^a		551

^a not including one unknown age capture for 3 species.
^b current breeding status in wider defined Transient region uncertain. T for historic breeder, M for possible, very rare and localized, but unconfirmed breeding.
^c 27 of captures identified to *Empidonax difficilis*, otherwise not differentiated between *E. difficilis* (potential T) and *E. occidentalis* (T).
^d 16 captures and most point count detections identified to *Vireo cassinii*. 2 mist net captures not differentiated between *V. cassinii* (M) or *V. plumbeus* (T).
^e 2 captures identified *Dendroica coronata coronata*, 7 captures and most point count detections identified *D. c. auduboni*.
^f all captures identified to *Zonotrichia leucophrys oriantha*, point counts not always differentiated between *Z.l. oriantha* and *Z.l. gambelii*.
^g includes both 2 "Solitary" *Vireo* spp. and both 2 "Western" *Flycatcher* spp.
^h breeding species that did not breed at banding site.

Mean by point breeding species richness ranged between 1.77 and 3.11 in each of five years, and was significantly higher by a mean of 0.95 species per point in 1998 than in the next highest year ($P < 0.001$, $df = 1$, $\chi^2 = 17.03$, Fig. 2). Richness did not vary significantly 1999 – 2002 ($P = 0.16$, $df = 3$, $\chi^2 = 5.4$).

Migration and Breeding Phenology: Adults of migrant and transient species were captured throughout the banding season, and the majority of the captures were in May (Fig. 3). Migrant and transient young first arrived in late June and were captured through August.

Adults of breeding species Warbling Vireos, Orange-crowned Warblers and Black-headed Grosbeaks demonstrated May capture peaks (Fig. 4). Warbling Vireos had a second peak in early August, while adult Orange-crowned Warblers were not captured after the first period of July. Adult Spotted Towhee captures fluctuated throughout the season. Adult Sage Sparrow

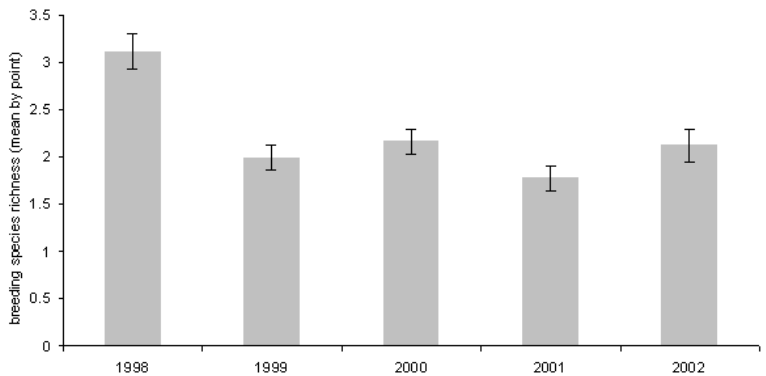


Figure 2. Mean by point species richness and standard error bars for breeding species detected within 50m during 5-minute point counts at 106 Owens Valley alluvial point count stations, 1998-2002.

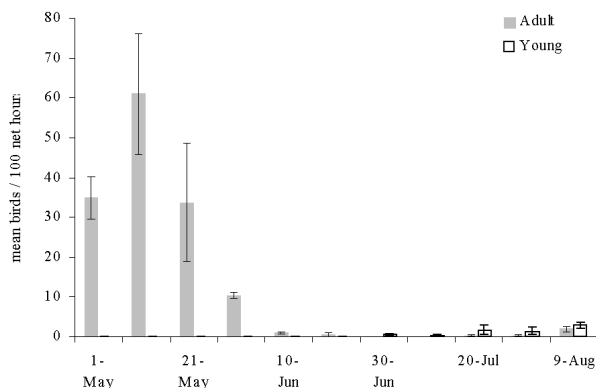


Figure 3. Mean number of adult and young migrant and transient captures per 100 net hours, and standard error bars, by ten-day census period at Owens Valley alluvial fan sites, 1998-2000.

captures markedly increased in early July, while Bewick's Wrens peaked in early May (Fig. 4).

The range of date of first egg laid among all species was the third week of March through the last week of July in each year, with most first eggs laid in May and June (Fig. 5). The earliest egg laid in all years was by a Red-tailed Hawk on March 24, 1999 (Table 3). Other early nesters included resident species American Dipper, Western Scrub-Jay, Bewick's Wren, Spotted Towhee, Bushtit, Common Raven and Song Sparrow, and all species of migratory hummingbirds. Species that did not initiate nests until late May and early June included species that winter at southern latitudes: Warbling Vireos, Western Wood-Pewees, Yellow Warblers, Blue-gray Gnatcatchers and Lazuli Buntings. First egg dates in the second half of June and in July were, with the exception of Indigo Bunting and Blue Grosbeaks, comprised of additional nesting or multiple brood attempts (PRBO data).

Breeding phenology results for upland species should be treated with caution since the study was designed with a riparian-breeding species bias. For example, earlier nesting dates have been observed in the alluvial fan for upland breeding species Black-throated Sparrow and Sage Sparrow (pers. obs., T. & J. Heindel pers. comm.).

First captures of young birds in mist nets should be related to the timing of first fledging in the area. Black-headed Grosbeak, Warbling Vireo and Orange-crowned Warbler young were first captured in early to mid June (Fig. 4). Captures of young resident species began as early as mid May (Bewick's Wrens), while Sage Sparrows and Spotted Towhee young were first captured from mid to late June (Fig. 5).

Table 3. Timing of nest initiation, based on date of first egg laid for 36 species at all Owens Valley alluvial fan sites, 1998-2000.

<i>Species</i>	<i>Number of nests</i>	<i>Mean date of first egg</i>	<i>Earliest first egg date</i>	<i>Latest first egg date</i>
<i>Red-tailed Hawk</i>	2	March 29	24-Mar-99	3-Apr-00
<i>American Dipper</i>	2	April 20	3-Apr-00	7-May-98
<i>Common Raven</i>	2	April 30	16-Apr-00	15-May-99
<i>Rock Wren</i>	1	May 3	3-May-00	3-May-00
<i>Western Scrub-Jay</i>	4	May 3	9-Apr-00	9-Jun-00
<i>Hairy Woodpecker</i>	1	May 10	10-May-99	10-May-99
<i>Bewick's Wren</i>	12	May 11	11-Apr-00	27-Jun-00
<i>Bushtit</i>	48	May 17	20-Apr-00	4-Jul-98
<i>Red-shafted Flicker</i>	9	May 18	3-May-98	12-Jun-99
<i>Mourning Dove</i>	1	May 21	21-May-98	21-May-98
<i>Orange-crowned Warbler</i>	7	May 22	5-May-00	16-Jun-98
<i>Calliope Hummingbird</i>	36	May 24	19-Apr-00	23-Jun-98
<i>Costa's Hummingbird</i>	33	May 24	30-Apr-00	17-Jun-98
<i>Spotted Towhee</i>	55	May 25	14-Apr-00	8-Jul-99
<i>Sage Sparrow</i>	6	May 26	15-May-00	6-Jun-00
<i>American Robin</i>	32	May 27	1-May-00	1-Jul-98
<i>House Wren</i>	11	May 31	8-May-00	22-Jun-99
<i>European Starling</i>	3	May 9	7-May-98	11-May-98
<i>Song Sparrow</i>	13	June 2	22-Apr-00	7-Jul-99
<i>Black-chinned Hummingbird</i>	38	June 3	23-Apr-00	15-Jul-98
<i>Lesser Goldfinch</i>	7	June 4	19-May-98	18-Jun-98
<i>Black-headed Grosbeak</i>	22	June 9	19-May-98	29-Jun-98
<i>Black-throated Sparrow</i>	7	June 10	23-May-00	6-Jul-00
<i>Western Kingbird</i>	1	June 10	10-Jun-00	10-Jun-00
<i>Bullock's Oriole</i>	3	June 12	26-May-98	25-Jun-99
<i>Chipping Sparrow</i>	2	June 12	12-Jun-98	13-Jun-98
<i>Western Bluebird</i>	2	June 14	12-Jun-00	15-Jun-00
<i>Western Tanager</i>	12	June 19	3-Jun-00	16-Jul-98
<i>Warbling Vireo</i>	22	June 20	29-May-00	19-Jul-98
<i>Yellow Warbler</i>	3	June 21	13-Jun-98	29-Jun-98
<i>Blue-gray Gnatcatcher</i>	10	June 22	1-Jun-98	15-Jul-99
<i>Lazuli Bunting</i>	15	June 24	1-Jun-98	20-Jul-99
<i>Steller's Jay</i>	3	June 25	28-May-98	17-Aug-98
<i>Western Wood-pewee</i>	30	June 26	3-Jun-00	21-Jul-00
<i>Blue Grosbeak</i>	2	June 28	23-Jun-00	3-Jul-00
<i>Indigo Bunting</i>	1	June 30	30-Jun-98	30-Jun-98

Nests and nesting substrate. We found 551 nests for 36 bird species and identified 30 plant species or types of substrate that supported or concealed nests (Table 2, Table 4).

Estimates of productivity. Ratios of young to adults for breeding species with high capture rates were as high as 1.04 (Bewick's Wrens), 0.75 (Sage Sparrows) and 0.70 (Bushtits), and as low as 0.01 (Black-headed Grosbeaks) and 0.02 (Warbling Vireos, Table 1).

DISCUSSION

Species richness in the alluvial fan region was generally low compared to other regions in the eastern Sierra Nevada (Heath et al. 2001). However, comparisons of this nature are probably not appropriate due to the geomorphological, elevational and habitat differences that occur within the eastern Sierra's various sub regions (Heath and Ballard in press). The

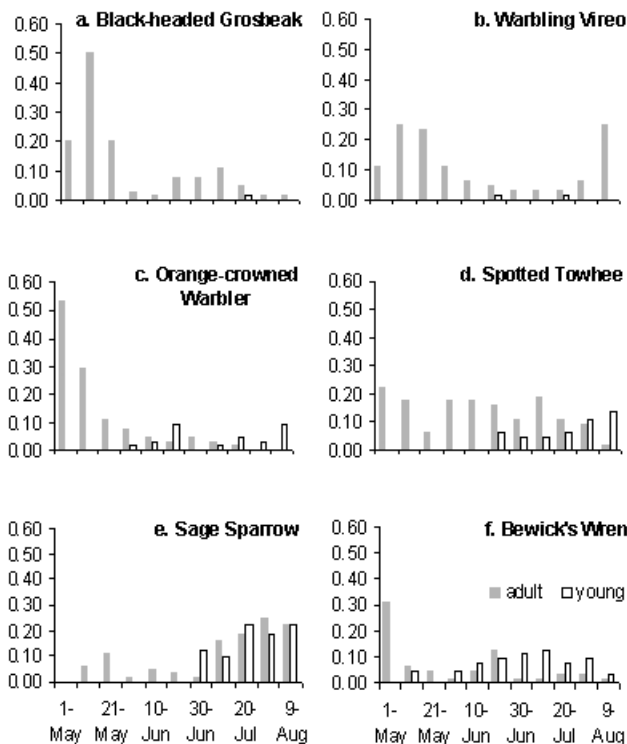


Figure 4. Timing and number of adult and young captures per 100 net hours by eleven census periods for select breeding species a. Black-headed Grosbeak, b. Warbling Vireo c. Orange-crowned Warbler, d. Spotted Towhee, e. Sage Sparrow, and f. Bewick's Wren at Owens Valley alluvial fan sites, 1998-2000. Y axis is birds captured per 100 net hours, x axis is eleven census periods as shown in e. and f., and adults capture bars shaded and young not shaded as shown in f.

characteristically narrow and incised riparian strips of the alluvial fan (Taylor 1982) may not provide ample habitat for riparian nesting sites or room for territorial spacing. Indeed, investigations of relationships between riparian habitat features and breeding bird diversity in this region demonstrated a positive correlation between breeding diversity and the width of the riparian corridor (Heath and Ballard in press). Additionally, the quick flowing, incised, and therefore dry nature of riparian habitat in this region may not provide the microclimate needed for productive insect hatching. Consequently, adequate foraging opportunities for breeding birds may be limited.

We found relatively few bird species breeding in the riparian vegetation along alluvial fan streams. The majority of riparian nests were those of the Warbling Vireo, American Robin, Black-headed Grosbeak, Western Wood-

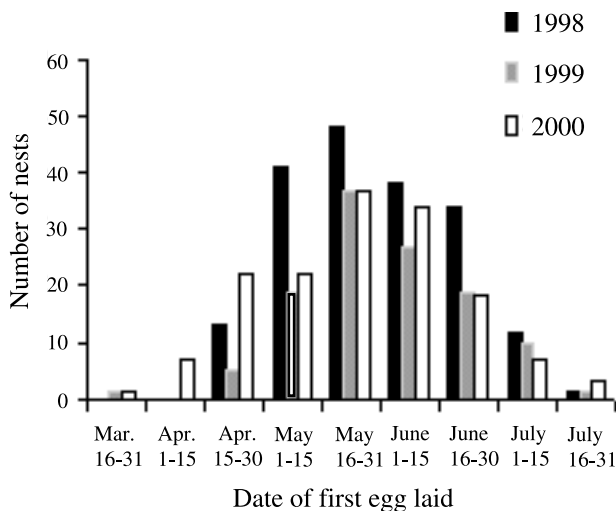


Figure 5. Date of first egg laid for nests of all species at Owens Valley alluvial fan sites, 1998-2000.

Peewee and Western Tanager at Independence Creek, which harbors a diverse tree canopy including black oak, an unusual tree species in the region (Taylor 1982). Calliope and Black-chinned Hummingbird were the most numerous riparian nesters we found among the remaining water birch and willow shrub-lined drainages, and the importance of riparian shrub habitat for these species should not be overlooked. Because hummingbirds are not easily detected or identified during point counts, their presence was probably not adequately reflected in the species richness index presented here.

Productivity indices for Sage Sparrows, Bewick's Wrens and Bushtits was high, suggesting that the alluvial fan provides good breeding habitat for these species, and that predation in the region may be relatively low. This is a fairly untested assessment, however, as more rigorous population demography studies would be required to determine productivity rates sufficient to maintain the populations. Other species appeared to fare not quite so well. Black-headed Grosbeaks and Warbling Vireos had very low productivity indices. However, adult numbers of these species are inflated by the influx of spring and late summer migrants (Fig. 4), which makes estimations of productivity from mist net capture data less reliable.

The riparian tributaries of the Owens River also provide habitat for upland breeding birds, spring and late summer migrants, and dispersers from breeding grounds at higher or lower elevations. Breeding species most frequently detected by riparian mist nets and point counts were those that nested primarily in the upland sagebrush habitats adjacent to the riparian strips, demonstrating the importance of these two habitat types for species generally associated with upland habitats. Spotted Towhees nested, on average, 40m from the riparian

edge and all but three nests were placed in or under sagebrush or sagebrush-associated plant species (PRBO data). However, we often observed Spotted Towhee males frequenting water birch tops as singing perches, and females searching the riparian for nesting material and foraging. Similarly, Sage Sparrows nested on average 48m from the riparian edge but by late June, we observed an influx of 3-5 member family groups drinking, bathing, and foraging in the riparian area. This is also demonstrated by the high capture rates for adults and young of this species throughout July (Fig. 5).

The alluvial fan riparian zone also appears to provide important stop over habitat for migrants heading to higher elevation or northern nesting locations or south to their wintering grounds. Wilson's Warblers, Hammond's and Dusky Flycatchers and Swainson's Thrushes were all captured frequently in the spring, and young Rufous Hummingbirds frequented the alluvial fan in high numbers in the late summer. Further investigations of body mass change and stop over duration would provide insight into the importance of these sites for migrants, since frequency of capture does not always equate with habitat quality (Petit 2000, Flannery et al. in press).

Alluvial fan habitat may also serve as an important connector between high elevation montane and low elevation Owens River valley habitats. During the

Table 4. Number and percent of nests supported or concealed by each plant species or substrate type on nest searching plots, in order of frequency and then alphabetical by common name, 1998-2000.

Common name	Latin name	Number of nests	% nests
water birch	<i>Betula occidentalis</i>	164	30
black oak	<i>Quercus kelloggii</i>	111	20
big sagebrush	<i>Artemisia tridentata</i>	101	18
willow	<i>Salix exigua</i> , <i>S. laevigata</i> , <i>S. lasiolepis</i> or <i>S. lucida</i>	38	7
black cottonwood	<i>Populus trichocarpa</i>	32	6
Jeffrey pine	<i>Pinus jeffreyi</i>	30	5
wild rose	<i>Rosa woodsii</i>	11	2
grass	--	8	1
Mojave buckwheat	<i>Eriogonum fasciculatum</i>	7	1
bush lupine	<i>Lupinus</i> spp. (bush form)	6	1
goldenbush	<i>Haplopappus</i> spp.	6	1
rabbit brush	<i>Chrysothamnus</i> spp.	5	1
bracken fern	<i>Pteridium aquilinum</i>	4	< 1
litter	--	4	< 1
pinyon pine	<i>Pinus monophylla</i>	4	< 1
bitterbrush	<i>Purshia tridentata</i>	2	< 1
coffee berry	<i>Rhamnus rubra</i>	2	< 1
rock	--	2	< 1
stream bank	--	2	< 1
bitter cherry	<i>Prunus emarginata</i>	1	< 1
blackbrush	<i>Coleogyne ramosissima</i>	1	< 1
ceanothus	<i>Ceanothus</i> spp.	1	< 1
dogwood	<i>Cornus</i> spp.	1	< 1
horsebrush	<i>Tetradymia</i> spp	1	< 1
stump	--	1	< 1
Mormon tea	<i>Ephedra</i> spp	1	< 1
mountain mahogany	<i>Cercocarpus ledifolius</i>	1	< 1
mustard	BRASSICACEAE	1	< 1
wire lettuce	<i>Stephanomeria pauciflora</i>	1	< 1
white fir	<i>Abies concolor</i>	1	< 1

heavy, late spring and low elevation snow pack of 1998 (USDA 2002), alluvial fan sites provided breeding habitat for species that did not breed as densely, or at all, in subsequent years. This phenomenon may be reflected by higher breeding species richness in that year, and by the higher numbers of nests found. Despite standardized effort between years, most nests of Calliope Hummingbird and all Yellow Warbler nests were found in 1998. Yellow Warblers did not return to breed in any subsequent year. This may suggest that alluvial fan riparian served as alternative habitat when the preferred-higher elevation habitats were unavailable due to late spring snowpack.

Alluvial fan sites may also serve as dispersal habitat for lower elevation Owens River valley habitats: we captured dispersing juveniles of species that nested exclusively in the valley (Nuttall's Woodpeckers) and documented sporadic nesting by primarily valley-nesting species (Western Kingbirds and Blue Grosbeaks).

High May captures of breeding species (Fig. 4) probably reflect the use of the area by breeding, migrant and transient populations of the same species. Individuals of species such as Hammond's Flycatcher, "Western" Flycatcher and Wilson's Warbler may have been almost entirely migrants, as only scant breeding records for these species exist for the region (Gaines 1992, Heath et al. 2002b, T and J. Heindel pers. comm.).

CONCLUSIONS

The value of Owens Valley alluvial fan habitats for birds should not be judged by traditional indices of breeding species richness alone. This study was designed to document species abundance, diversity, richness, productivity and nest success of riparian breeding songbirds. Data on upland breeding species and transients and migrants are cursory, but demonstrate some striking patterns worth further investigation. Long-term monitoring of point count stations at these sites may further elucidate the role of alluvial fan habitats during years of varying weather conditions. Thus far, 1998 was the only anomalous weather year monitored. Further analysis of nest data will clarify productivity results and may provide insight as to why captures of young birds for some species were so low.

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