

*Putah Creek
Terrestrial Wildlife
Monitoring Program*

*2004 Landowner
Report*



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**Putah Creek
Terrestrial Wildlife Monitoring Program
2004 Report**

Prepared for
**The Center for Land-based Learning Site
(Monitoring Transect)
(Middle Reach, Grid 14)**

and the

**Sierra Farms Orchard Site
(Nest Box Program)
(Middle Reach, Grid 13)**

Landowner
Craig McNamara

by the

UC Davis Museum of Wildlife and Fish Biology

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Andrew Engilis, Jr.
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October 2005

Contributors and Acknowledgements

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One of the most important elements contributing to the success of this project has been a high level of participation by landowners along the creek. Through their generous participation and outreach efforts of Putah Creek Streamkeeper Rich Marovich, we have been able to survey large areas of the creek, ensuring that representation is fair and broad across the lower creek corridor. Documentation of these regions is important to the various stakeholder efforts to preserve and enhance Putah Creek's unique natural resources. In addition to providing baseline and post-project information for local land owners and site stewards, the data we derive from our surveys is being used to develop habitat models to better guide restoration actions across the Sacramento Bay-Delta region.

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Cover Photo: Green Heron (with Bullfrog tadpole) on Putah Creek, by Jim Dunn

1 INTRODUCTION

1.1 BACKGROUND

Riparian land is any land that adjoins or directly influences a body of water. It includes:

- The land immediately alongside small creeks and rivers, including the river bank itself;
- Gullies and dips that sometimes run with water;
- Areas surrounding lakes; and
- Wetlands and river floodplains which interact with the river in time of flood.

Riparian habitats are among the world's most productive ecosystems. They are especially important to plants and wildlife in Mediterranean climates because they are often the only permanent source of water during the hot, dry summer and fall months. Riparian lands also perform valuable ecosystem services such as:

- Reducing sediment and nutrient export from adjacent lands;
- Improving water quality by trapping soil and nutrients that would otherwise move into the stream;
- Decreasing erosion by stabilizing riverbanks and protecting agricultural land and infrastructure such as roads, bridges, and buildings in times of flood;
- Recharging regional groundwater tables;
- Decreasing insect pests by supporting insect-eating birds and insect parasites;
- Providing shelter to livestock and reducing wind damage to crops;
- Reducing algal growth by lowering light and temperature levels of stream ecosystems;
- Maintaining fish stocks;
- Providing aesthetic and recreational values;
- Increasing capital values (e.g. it has been estimated that riparian riverfront acreage can add at least 10% to the value of a property)¹.

Riparian forests are also highly endangered. It has been estimated that only 5-10% of California's historic riparian habitat remains, over half of which is disturbed and/or degraded (Katibah 1984).

A major step towards protection of riparian habitat in the lower Sacramento Valley was the completion of the Putah Creek Water Accord (SCWA 2000). This action resulted in increased stream flow volume along lower Putah Creek and the initiation of long-term restoration and habitat enhancement projects. Ecological monitoring, directed by the Accord settlement, is a critical component of these efforts.

1.2 ECOLOGICAL MONITORING

Ecological monitoring may be defined as the measurement of environmental characteristics over an extended period of time to determine status or trends in some aspect of environmental quality. In general, monitoring data are intended to detect long-term environmental change, provide insight into the

¹ Lovett, S., Price, P. & Cork, S. 2004. Riparian ecosystem services, Fact Sheet 12, Land & Water Australia, Canberra. www.rivers.gov.au/acrobat/facts12.pdf

ecological mechanisms and consequences of that change, and help decision makers determine if the observed changes dictate a correction to management practices.

Monitoring is often facilitated by the use of indicator species (bioindicators) that, due to their life history requirements, provide information on the structure and function of the ecosystem (Agosti *et al.* 2000). For example, aquatic macroinvertebrates are commonly used to gauge water quality, chemistry, temperature, and flow patterns in rivers and streams (Chessman 1995). Ant and beetle diversity have been used to assess the effect of certain land use patterns on biodiversity (Heyer *et al.* 2003, Irmiler 2003, Andersen *et al.* 2002, Read and Andersen 2000, Majer 1984). Finally, bird diversity and relative abundance are frequently used as indicators of habitat quality, food availability and nesting resources (Frederick *et al.* 2002, Read *et al.* 2000, Louette and Bijmens 1995).

1.3 GOALS AND OBJECTIVES

In 2003, the UC Davis Museum of Wildlife and Fish Biology (MWFB) initiated a Biomonitoring Program for lower Putah Creek (Truan *et al.* 2003) to address information needs and management objectives critical to the assessment of ecosystem health, and to provide information and recommendations for present and future habitat enhancement projects. The goals of this program include:

- Formulating a set of practical success criteria against which habitat enhancement and/or restoration project progress can be measured;
- Defining a set of bioindicators to signal successful habitat enhancement and/or restoration actions;
- Testing assumptions about the utility and information value of using different taxonomic groups as bioindicators;
- Documenting spatial and temporal patterns of biodiversity for these bioindicators and assessing their interrelationships;
- Assessing the importance to wildlife of riparian plant structure and composition, corridor width, and connectivity;
- Assessing the effects of exotic plant removal on wildlife;
- Determining whether patterns of diversity, abundance, and community composition for terrestrial riparian organisms correlates with that of aquatic organisms;
- Determining the utility of artificial nest boxes to enhance habitat, assess reproductive success, survivorship, dispersal, and philopatry, and documenting changes in the abundance and composition of the cavity nesting bird community;
- Developing metrics to measure wildlife response to infilling of vegetation designed to serve as a deterrent to trash dumping.

Results from projects outlined in this document include the Breeding Bird Atlas project (initiated in 2003) and the Putah Creek Nestbox Trail (initiated in 2000). In 2004, we added year-round avian transect surveys to collect data on bird diversity and abundance across seasons. Entomological surveys for native ants and bees, conducted through the University of California, Berkeley, were also added in 2004. Incidental observations of mammals and other taxonomic groups were collected via field journals and landowner contacts. Surveys and monitoring for butterflies, terrestrial arthropods, and riparian vegetation are scheduled to begin in 2005.

2 METHODS

All biomonitoring surveys were spatially referenced to one-mile-long segments of the creek (“grids”) extending from the Solano Diversion Dam to the Yolo Bypass (Fig. 1). These grids were established by EDAW in developing the Lower Putah Creek Watershed Management Action Plan (in preparation). Surveys were conducted on every grid for which we had access. We also conducted surveys at a site not included in the EDAW grid system, the California Department of Fish and Game’s Fishing Access #5 off highway 128 in the foothills west of Winters. Surveys were conducted within the leveed or floodplain portion of the creek.

We used both qualitative and quantitative survey methods to address different research and management questions. Qualitative surveys included breeding bird atlas surveys and incidental observations of mammals and other taxonomic groups. Field assistants walked (or canoed) each grid, based on access permission, collecting data on species presence/absence, abundance, and reproductive status. Data included presence-absence and breeding status of birds, locations of raptor nests and beaver dams, aquatic mammal observations, and nests of bank-nesting species. All observations were georeferenced using GPS (UTM, Garmin E-Trek Legend). For quantitative, finer-scale surveys, we established 500-meter walking transects on selected grids throughout the riparian corridor. Data from these surveys yielded information on species density, relative abundance, community composition, and interspecies relationships.



Punit Lalbhai conducting bird surveys on Putah Creek. Photo: I. Torres

For analysis, we divided the entire survey area into three contiguous reaches, corresponding with previously-defined reaches identified through fish monitoring studies (Marchetti and Moyle 2001). Each reach contained a number of grids and transects. The upper reach contained all grids and transects ranging from CDFG Fishing Access #5 to Highway 505. The middle reach contained all grids and transects between Highway 505 and Pedrick Road. The lower reach contained all grids and transects between Pedrick Road and the Putah Creek Sinks.

This report contains information for the Center for Land-based Learning (LBL) and Sierra Farms Orchard (SFO) sites, two non-contiguous parcels. LBL encompasses the riparian strip adjacent to the Center for Land-based Learning/Audubon California headquarters and agricultural lands. SFO is a small triangular parcel west of LBL where nest boxes were installed in 2003. Both sites fall within the middle reach. SFO is encompassed by grid 13 and LBL is encompassed by grid 14. Geographic coordinates: 593983; 4265092 (Northing; Easting).

Putah Creek
Resource Assessment Map Index

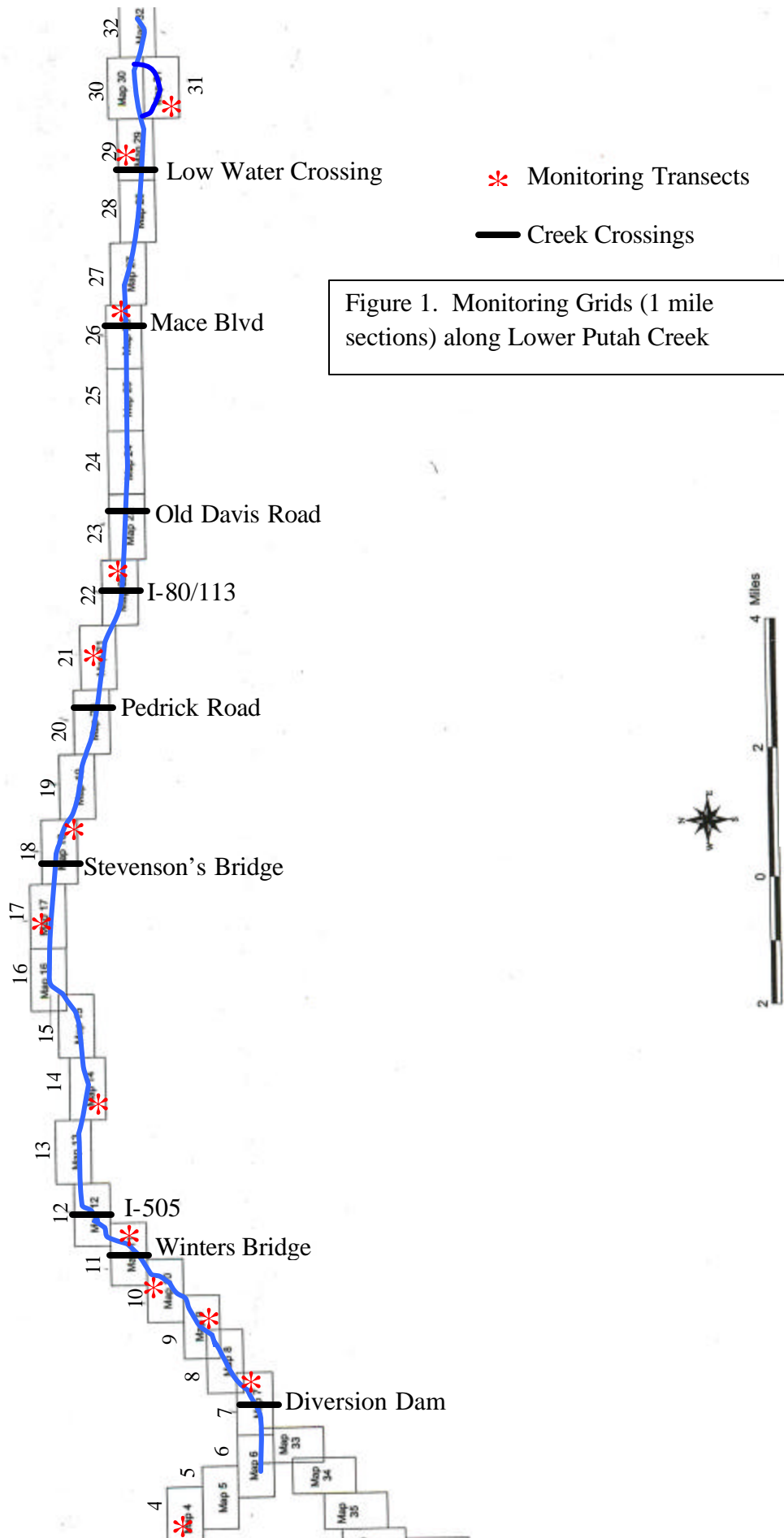


Figure 1. Monitoring Grids (1 mile sections) along Lower Putah Creek

3 RESULTS

3.1 BIRDS

To date, 190 bird species have been recorded along lower Putah Creek, representing 58% of all species recorded for Yolo County (Yolo Audubon Society 2004). **Of these, 102 species have been recorded at the Center for Land-based Learning site (Table 1, Appendix A). As of December 2004, 12 species were confirmed as breeding there (Table 1, Appendix A).**

Table 1. Number of bird species recorded and confirmed breeding by site

SITE	GRID(S)	NUMBER SPECIES RECORDED	NUMBER SPECIES CONFIRMED BREEDING
Solano Diversion Dam (DVD)	7, 8	124	20
Winters Oxbow (OXB) *	9	92*	7*
Dry Creek Confluence (DCC)	10	124	29
Winters Putah Creek Park (WIN)	11	95	23
Center for Land-based Learning (LBL)	14	102	12
UCD Russell Ranch (RRR)	16, 17	111	25
Stevenson's Bridge West (SBW)	18	83	14
Stevenson's Bridge East (SBE)	18, 19	93	22
UCD Picnic Grounds (PIC)	20, 21	111	24
UCD Old Davis Rd/Restoria (DRR)	22, 23	109	23
Mace Blvd. North (MBN)	26, 27	106	20
Los Rios Farms (LRF)	29	114	19
Putah Creek Sinks (PCS)	31	98	13

* Site surveyed only since 2004.

3.1.1 Guild-level Analysis

We classified bird species into guilds based on dietary and migratory status. Guilds or functional groups are species with similar ecological resource requirements and/or life history strategies, and so occupy similar places in the community. Analyzing species composition by guilds facilitates a detailed, functional analysis and can help shed light on community-structuring mechanisms. For example, a high percentage of omnivores can indicate a degraded habitat, while a high percentage of insectivores and carnivores often denotes better quality habitat and a more complex food web. High percentages of nectarivores often occur adjacent to residential areas due to food subsidies from feeders and ornamental plantings. Riparian areas often have high proportions of insectivores due to high densities of aquatic and terrestrial insects in these well-watered areas.

3.1.1.1 Dietary Guild

Creekwide, 37% of species were insectivores, 25% were granivores or herbivores, 19% were carnivores, and 17% were omnivores (Fig. 2). Nectarivores comprised only 2% of species. Omnivore species richness was slightly higher in the upper reach sites, and carnivore species richness was substantially lower in the middle reach sites. Carnivore importance values for the Center for Land-based Learning were lowest of all sites, contributing strongly to the low overall carnivore species richness observed for the middle reach sites (Table 2).

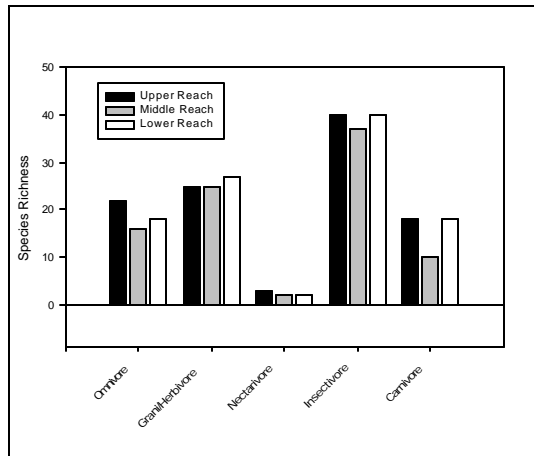


Figure 2. Species richness for avian dietary groups by reach. Piscivores (fish-eaters) are included in the carnivore guild.

3.1.1.2 Migratory Guild

Creekwide, resident, non-migratory birds comprised roughly half of the total species recorded, while winter visitors, summer visitors, transients, and vagrants comprised 20%, 13%, 11%, and 5% of the species pool, respectively (Fig. 3). A preliminary month-by-month comparison of species richness values (see Truan *et al.* 2005) suggested that resident species richness remained relatively constant throughout the year (37 to 54 species), but was complemented by shifting abundances of winter and summer visitors and transients. Site-specific patterns of migratory bird use require additional data and will be included in future reports.

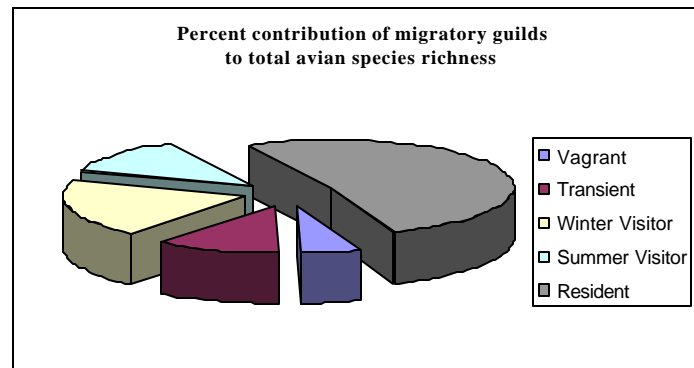


Figure 3. Percent contribution of migratory guilds to total avian species richness for 2004 (creekwide, transects pooled – 134 species).

Table 2 . Importance percentage values^a for carnivorous species by site

Carnivorous Species	INT	DVD	OXB	DCC	WIN	LBL	RRR	SBW	SBE	PIC	DRR	MBN	LRF	PCS
Hooded Merganser	2.25	0.00	0.78	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Common Merganser	1.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.07
Pied-billed Grebe	0.00	0.00	0.52	0.61	0.00	0.24	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
American White Pelican	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Double-crested Cormorant	1.35	0.35	0.00	0.37	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
American Bittern	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Blue Heron	0.55	0.46	0.41	0.93	1.82	0.33	0.27	0.51	0.00	0.00	0.69	0.00	0.48	0.41
Great Egret	0.00	0.00	0.26	0.19	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.48	0.48	0.00
Snowy Egret	0.00	0.00	0.52	0.00	0.00	0.00	0.34	0.00	0.00	0.35	0.00	0.00	0.00	0.00
Cattle Egret	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.00
Green Heron	0.55	0.00	0.85	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.53	0.48	0.00	0.00
Black-crowned Night-Heron	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.37
White-faced Ibis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Turkey Vulture	0.00	1.36	1.76	0.88	0.45	0.00	0.34	0.00	0.00	0.59	0.00	0.00	0.00	0.00
Osprey	0.00	0.28	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
White-tailed Kite	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.30	0.41	0.00	0.00	0.00
Northern Harrier	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.59	0.00
Sharp-shinned Hawk	0.00	0.00	0.52	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cooper's Hawk	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.37
Northern Goshawk	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Red-shouldered Hawk	0.76	1.83	0.41	0.85	0.83	0.56	1.62	0.83	0.92	1.07	1.40	0.64	0.44	1.12
Swainson's Hawk	0.00	0.35	0.00	0.37	0.00	0.48	0.54	0.28	0.46	0.52	0.60	1.03	0.59	0.77
Red-tailed Hawk	0.00	0.36	0.67	0.48	0.00	0.48	0.00	0.41	0.00	0.30	1.63	0.99	0.82	0.46
Ferruginous Hawk	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rough-legged Hawk	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Golden Eagle	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
American Kestrel	0.00	0.18	0.00	0.29	0.00	0.00	0.36	0.00	0.92	1.04	0.94	0.00	0.36	0.74
Merlin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60
Peregrine Falcon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00
Prairie Falcon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Barn Owl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00
Western Screech-Owl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Horned Owl	0.00	0.00	0.78	0.42	0.00	0.00	1.40	0.41	0.00	0.00	0.79	0.80	1.60	0.31
Northern Pygmy-Owl	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Long-eared Owl	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Belted Kingfisher	1.84	0.76	1.09	1.22	1.13	0.57	0.81	0.41	0.64	0.47	0.69	0.51	0.77	1.15
Loggerhead Shrike	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.31
Northern Shrike	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Carnivorous Species	9.21	6.32	8.59	6.97	4.68	3.30	6.02	4.48	3.39	5.27	7.69	4.95	6.82	7.68
														Mean carnivorous species -> 6.10

^a IPV = (relative frequency across visits + relative density across sites)/2 * 100.

3.1.2 Species of Local or Regional Concern

We analyzed avian community composition for three different groups of species of regional conservation concern: species that have been designated as riparian focal species by the United States Fish & Wildlife Service's Partners in Flight Riparian Habitat Joint Venture (RHJV), local focal species identified by MWFB staff, and species endemic to the California Floristic Province (Table 3). Table 3 also contains importance percentage values by site for each species of local or regional concern, based on estimates of relative frequency and relative abundance derived from transect surveys. Sixteen of the 17 (94%) Partners in Flight Riparian Habitat Joint Venture (RHJV) focal species were recorded along the creek, all 11 (100%) local focal species were recorded, and 8 of 9 (89%) California endemic species were recorded.

For the Center for Land-based Learning site, 35% of all RHJV, 73% of all local focal, and 67% of all California endemic species were recorded. This site ranked last out of 14 sites with respect to its overall abundance of species of local or regional concern. However, Western Tanager and Fox Sparrow were most abundant at this site (Table 3).

3.1.3 Site Conservation Scores

To create a basis for between-site comparison of habitat quality and composition of species with high conservation value, we ranked species based on scores derived from functional group rankings (Truan *et al.* 2005). For example, species with high conservation value had high specificity for and dependence on riparian habitats, a high trophic status, resident or neotropical migratory status, local or regional conservation status, and/or a high level of endemism. Of the 134 species recorded on our transects, nine had particularly high conservation values: Willow Flycatcher, Pacific-slope Flycatcher, Tree Swallow, Bank Swallow, American Dipper, Orange-crowned Warbler, Yellow Warbler, Common Yellowthroat, and Yellow-breasted Chat.

Next, we chose to identify those species of conservation concern which were ubiquitous enough to respond to conservation and restoration efforts, and to assess their relative frequency and abundance at each site. We created an index of species "importance" for each site by multiplying species conservation values by site-specific importance values (relative frequency * relative density / 2) to rank species in terms of their conservation value and presence along the creek (Table 4). For example, the top ranked species usually had high conservation rankings *and* high relative frequency and abundance. This was not always the case, however, since species such as the Bank Swallow, which has a very high conservation ranking, had relatively low site conservation scores, since it was so rare along the creek. Thus, Tree Swallows, Yellow Warblers, Orange-crowned Warblers, Song Sparrows, and Willow Flycatchers were relatively abundant creekwide and may occur in numbers sufficient to respond to habitat enhancement efforts (see RHJV 2004 for a discussion of what constitutes suitable habitat for these species).



Ornithologist Ron Melcer, assessing the reproductive status and age of a Yellow-breasted Chat. Photo D. Tsao Melcer.

Site conservation scores were used to rank sites by their conservation value (Fig. 4). Scores differed between sites, even within the same reach. There was a slight, but nonsignificant decrease in scores along the longitudinal (upstream-downstream) gradient, suggesting that conservation value of sites decreased slightly with distance downstream from the Coast Range foothills. This relationship may become

stronger at larger sample sizes, as suggested by previous studies (Truan 2004). **Site conservation scores for the Center for Land-based Learning were lowest of all sites, indicating that species with high conservation scores were less abundant here than at any of the other sites surveyed.**

Table 3. Importance percentage values (IPV)^a for species of local and regional concern^b.

	INT	DVD	OXB	DCC	WIN	LBL	RRR	SBW	SBE	PIC	DRR	MBN	LRF	PCS	Mean
RHJV															
Swainson's Hawk	0.00	0.35	0.00	0.37	0.00	0.48	0.54	0.28	0.46	0.52	0.60	1.03	0.59	0.77	0.43
Spotted Sandpiper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellow-billed Cuckoo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Willow Flycatcher	0.00	0.00	1.55	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.79	0.00	0.48	0.37	0.27
Bell's Vireo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.00	0.00	0.04
Warbling Vireo	0.80	0.35	0.52	0.37	0.41	0.00	0.68	0.00	1.97	0.00	0.53	0.48	0.73	0.93	0.56
Tree Swallow	1.84	1.83	2.42	3.26	3.07	1.58	2.37	2.11	2.73	1.52	2.40	2.22	2.33	2.23	2.28
Bank Swallow	0.00	0.35	0.00	0.00	1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
Swainson's Thrush	0.00	0.00	1.30	0.37	0.00	0.00	0.00	0.51	1.06	0.47	0.00	1.41	0.00	0.00	0.37
Yellow Warbler	1.03	0.72	1.96	3.60	0.68	0.00	1.81	1.86	2.73	2.82	3.18	1.81	2.17	1.53	1.85
Common Yellowthroat	0.00	0.35	0.78	0.37	1.02	0.33	0.27	0.51	1.36	0.35	0.53	0.00	1.28	0.65	0.56
Wilson's Warbler	1.11	0.70	1.04	1.83	1.47	1.27	1.97	0.69	2.07	0.93	1.06	0.78	1.54	1.02	1.25
Yellow-breasted Chat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.03	0.03
Song Sparrow	2.31	1.51	2.81	1.67	1.97	2.01	0.89	0.51	0.00	1.43	2.39	1.17	3.38	2.59	1.76
Black-headed Grosbeak	0.80	0.96	1.68	1.17	2.24	1.78	0.74	1.26	1.47	0.98	0.27	0.39	0.73	0.23	1.05
Blue Grosbeak	0.00	0.00	0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00	1.28	0.85	0.23
Tricolored Blackbird	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Local Focal															
Long-eared Owl	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Black-chinned Hummingbird	0.00	0.52	1.81	0.78	1.47	0.00	0.34	0.51	0.76	0.47	0.00	0.99	0.00	0.00	0.55
Western Wood-Pewee	0.00	0.00	0.52	0.55	0.00	0.40	0.34	0.00	0.76	0.00	0.00	0.00	0.48	0.00	0.22
Pacific-slope Flycatcher	1.11	1.07	3.62	0.55	0.64	0.40	0.52	0.58	0.76	0.35	0.80	0.74	0.96	0.74	0.92
Winter Wren	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.00	0.06
Western Bluebird	0.00	0.46	0.83	1.14	1.68	0.86	0.18	0.51	0.76	1.07	0.95	0.00	0.00	0.00	0.60
Hermit Thrush	2.30	1.30	0.00	1.60	0.60	1.39	0.68	0.41	0.00	0.35	0.53	0.25	1.04	1.40	0.85
Orange-crowned Warbler	0.55	0.35	1.89	1.44	2.51	1.42	1.62	0.69	2.28	1.16	1.06	0.63	1.18	1.50	1.31
Western Tanager	0.45	1.03	2.23	1.61	1.12	2.37	0.86	1.60	1.44	0.93	0.42	1.20	0.22	0.74	1.16
Fox Sparrow	2.28	1.44	0.52	1.65	0.60	2.27	0.83	0.41	0.00	0.67	1.33	0.00	0.99	0.85	0.99
Dark-eyed Junco (Oregon)	2.01	2.90	0.00	2.60	0.68	1.28	1.70	7.18	0.00	1.39	0.80	2.48	1.46	2.30	1.91
California Endemics															
Anna's Hummingbird	2.04	1.98	1.04	1.27	2.57	0.33	1.04	1.07	1.22	1.85	0.53	0.48	0.48	0.00	1.14
Allen's Hummingbird	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Nuttall's Woodpecker	1.53	2.17	2.26	1.71	1.91	2.29	2.64	2.94	2.56	2.37	2.62	2.59	2.82	1.94	2.31
Yellow-billed Magpie	0.00	0.00	0.98	0.47	1.22	0.24	0.98	1.10	0.92	1.42	2.20	1.40	0.00	1.37	0.88
Oak Titmouse	2.48	2.01	1.57	2.09	1.72	0.40	0.00	0.00	0.00	1.34	0.00	0.48	0.44	0.00	0.90
Wrentit	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
California Towhee	1.11	2.01	0.93	1.30	0.92	1.39	2.02	2.20	1.68	1.38	0.53	2.68	1.36	0.37	1.42
Tricolored Blackbird	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
American Goldfinch	3.43	0.68	0.66	5.24	2.80	1.72	3.51	1.65	0.81	1.02	1.89	2.32	1.44	1.61	2.06
Total >>>	27.61	25.21	33.70	37.38	33.06	24.19	27.11	28.62	27.80	24.79	26.18	25.55	27.86	24.35	0.76

^a IPV = (relative frequency across visits + relative density across sites)/2 * 100.

Species that have been designated as riparian focal species by the Partners in Flight Riparian Habitat Joint Venture (RHJV), local focal species designated by the MWFB, and species endemic to the California Floristic Province.

Table 4. Top 20% of species (27 species) ranked by Site Conservation Score

Species	Conserv'n	INT	DVD	OXB	DCC	WIN	LBL	RRR	SBW	SBE	PIC	DRR	MBN	LRF	PCS	Mean
Tree Swallow	720	1328	1320	1739	2348	2210	1136	1708	1521	1964	1094	1726	1598	1676	1605	1641
Yellow Warbler	720	740	516	1408	2593	489		1305	1339	1964	2034	2291	1307	1565	1100	1332
Orange-crowned Warbler	600	332	211	1135	863	1503	851	973	415	1369	698	636	381	707	901	784
Pacific-slope Flycatcher	800	885	854	2900	441	513	317	414	461	608	278	638	591	765	591	733
Song Sparrow	360	831	544	1010	601	710	724	322	185		516	861	420	1217	933	634
Black Phoebe	240	661	463	592	504	571	582	416	701	786	435	847	402	624	594	584
Nuttall's Woodpecker	240	366	520	543	411	459	550	633	707	615	569	629	621	677	467	555
Bewick's Wren	300	1092	699	497	744	728	478	461	474	456	278		310	353	254	487
Common Yellowthroat	720		253	561	266	731	238	192	369	982	251	381		920	467	401
Black-headed Grosbeak	360	287	344	603	423	805	640	267	455	530	351	96	140	264	83	378
Wilson's Warbler	288	319	202	300	527	423	366	567	199	595	267	305	224	443	293	359
Red-shouldered Hawk	300	229	550	124	255	249	169	487	249	275	320	421	193	133	337	285
Belted Kingfisher	300	551	228	327	367	338	171	244	124	191	140	207	152	231	344	258
California Towhee	180	199	362	168	234	165	250	364	396	302	249	95	482	245	66	256
Warbling Vireo	360	287	127	188	133	149		243		708		191	175	264	334	200
Black-chinned Hummingbird	360		187	653	281	529		122	185	274	168		357			197
Willow Flycatcher	600			931				349				475		287	222	162
Spotted Towhee	90	228	244	218	221	37	157	91	102	56	114	54	142	252	197	151
Bushtit	40	221	176	168	152	227	57	138	105	81	90	62	242	107	96	137
Ash-throated Flycatcher	96	159	119	159	106	129	145	134	177	206	116	191	136	35	103	137
Wood Duck	120	403	44	156	108		48	64	102	410	113		151	66	61	123
House Wren	60	52	169	51	94	25	69	117	101	146	120	115	212	208	159	117
Downy Woodpecker	120	92	172	81	102	165	126	41	166	177	118	32	47	146	92	111
Fox Sparrow	108	246	155	56	178	65	245	90	45		72	143		107	91	107
Bank Swallow	960		337			1116										104
Northern Rough-winged Swallow	192				116	126	106	87	106	88	67	304	182			84
Blue Grosbeak	360			280								96		460	304	82
		9508	8797	14848	12066	12465	7425	9828	8684	12786	8458	10794	8465	11752	9696	

^a Calculated as product of ordinal ranks across functional groups.

^b Calculated as product of species conservation ranking and importance percentage value (IPV), where IPV equals average of relative frequency and relative density * 100.

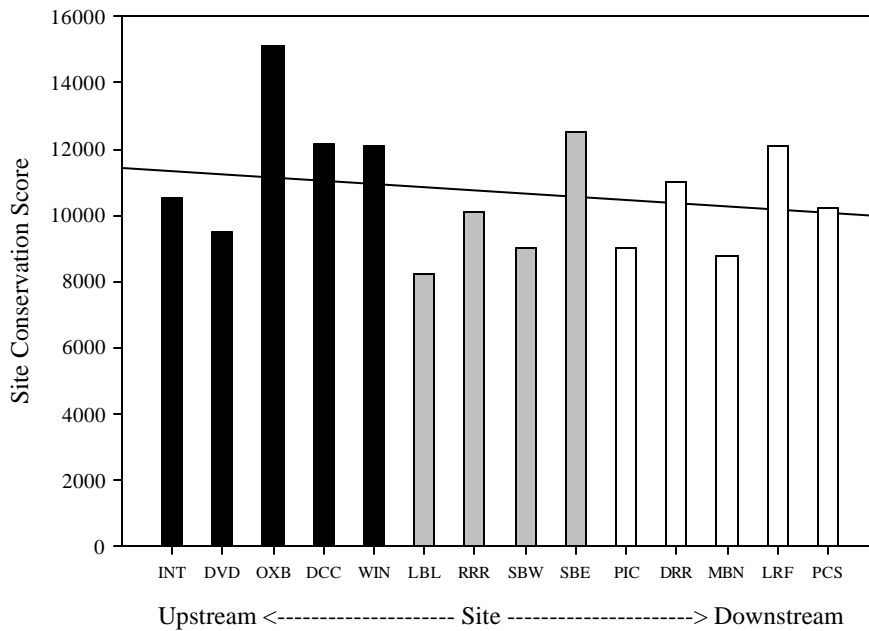


Figure 4. Site conservation scores (StCS) for Putah Creek survey sites derived from 2004 transect data, species and months pooled. $StCS = ?$ (species conservation ranking (SpCS) x species importance percentage value (IPV)) where $SpCS = (\text{rank ordinal for habitat specificity} \times \text{riparian dependence} \times \text{dietary/trophic guild} \times \text{migratory status} \times \text{conservation status} \times \text{endemicity})$ and $IPV = ((\text{relative frequency} \times \text{relative density} / 2) \times 100)$. Upper reach sites in black, middle reach sites in gray, lower reach sites in white. Site codes: INT=Interdam (CDFG Fishing Access #5), DVD=Solano Diversion Dam, OXB=Oxbow, DCC=Dry Creek Confluence, WIN=Winters Putah Creek Park, LBL=Center for Land-Based Learning, RRR=Russell Ranch Riparian, SBW=Stevenson's Bridge West, SBE=Stevenson's Bridge East, PIC=Picnic Grounds, DRR=Old Davis Road/Restoria, MBN=Mace Blvd. North, LRF=Los Rios Farms, PCS=Putah Creek Sinks.

3.1.4 Putah Creek Nestbox Highway

No nest boxes are installed at the Center for Land-based Learning site, however ten boxes have been installed at the Sierra Farms Orchard site to the west. We present some project-wide results for 2004, then some site-specific results for the Sierra Farms Orchard site.

Seven species nested in the artificial nest boxes of the Putah Creek Nest Box Highway (PCNH) in 2004 (Fig. 5). As in 2003, Tree Swallows were the most abundant nesting species, followed by Ash-throated Flycatchers, House Wrens, and Western Bluebirds. The four most common species (TRES, ATFL, HOWR, and WEBL) nested widely, but not uniformly along the creek. While productivity for all species was highest in the upper reach, House Wrens and Tree Swallows also nested heavily in the lower reach (Fig. 6). Out of 164 total nest boxes, 144 nesting attempts yielded 718 eggs, 534 nestlings and 440 fledglings, with an overall hatching success of 79% and fledging success of 82%.

House Wrens appear to be colonizing the upper reach in ever greater numbers. While only one House Wren clutch was produced in the upper reach in 2003, 13 clutches were produced in 2004. House Wren production was greatest at the upper reach Diversion Dam site. This range expansion may have conservation ramifications for the Bewick's Wren, a species whose declines in the eastern United States has been attributed to competition with the House Wren.

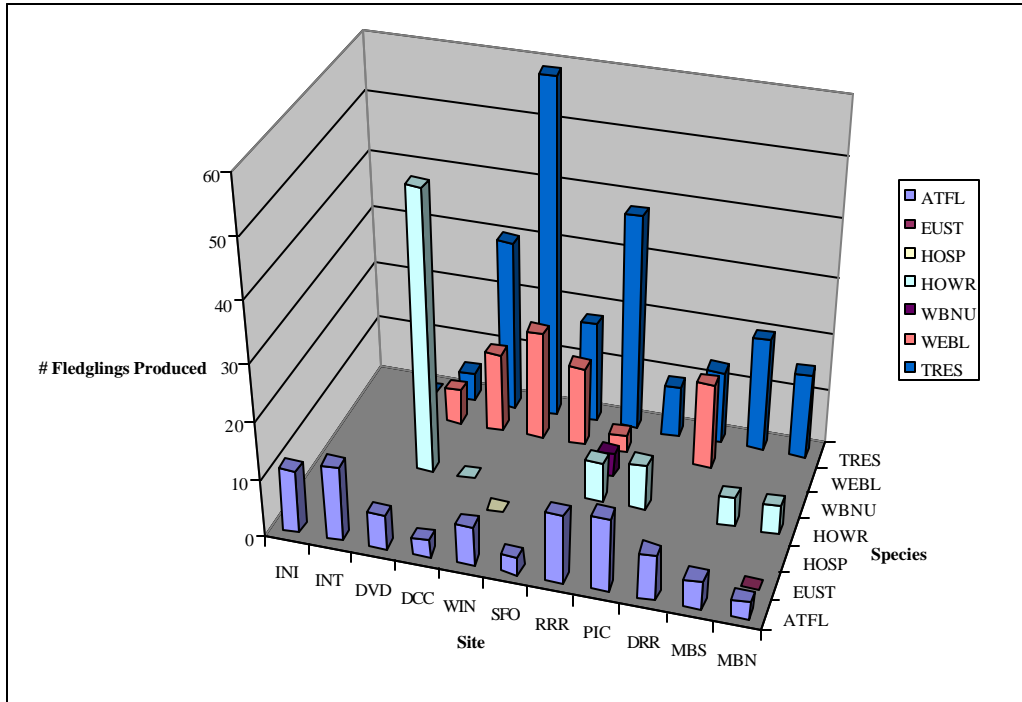


Figure 5. Fledgling productivity by site and species. Sites arranged from upstream (left) to downstream (right): INI=Interdam Island, INT=Interdam, DVD=Solano Diversion Dam, DCC=Dry Creek Confluence, WIN=Winters Putah Creek Park, SFO=Sierra Farms Orchard, RRR=UCD Russell Ranch, PIC=UCD Picnic Grounds, DRR=Old Davis Road/Restoria, MBS=Mace Blvd. South, MBN=Mace Blvd. North. Species codes: ATFL=Ash-throated Flycatcher, EUST=European Starling, HOSP=House Sparrow, HOWR=House Wren, WBNU=White-breasted Nuthatch, WEBL=Western Bluebird, TRES=Tree Swallow.

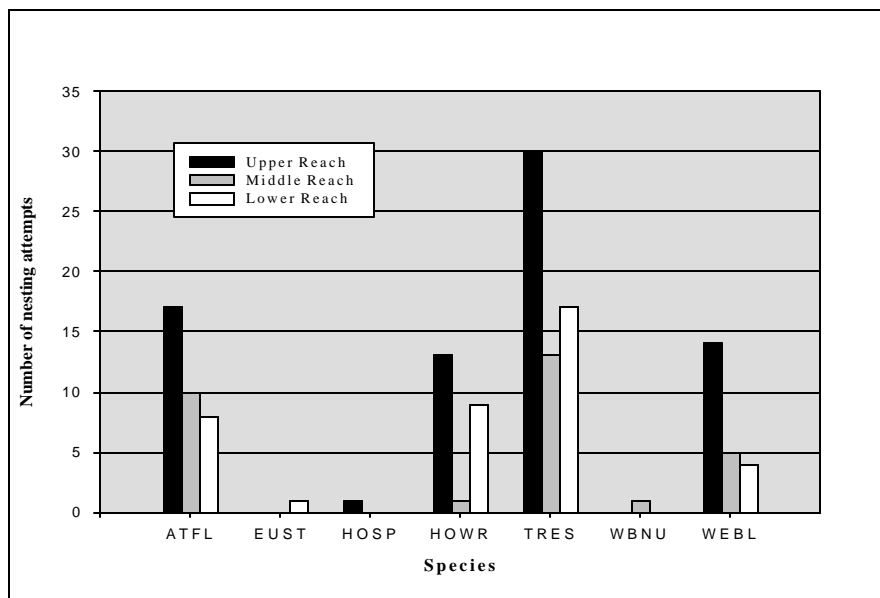


Figure 6. Number of nesting attempts per species by reach for the Putah Creek Nestbox Highway, 2004 breeding season. The upper reach produced 75 nests, the lower reach 39, and the middle reach 30 nests. Upper reach contains sites from Fishing Access #5 to I-505, middle reach contains sites from I-505 to Pedrick Road, lower reach contains sites from the UC Davis Picnic Grounds to the Yolo Bypass. ATFL=Ash-throated Flycatcher, EUST=European Starling, HOSP=House Sparrow, TRES=Tree Swallow, WBNU=White-breasted Nuthatch, WEBL=Western Bluebird.

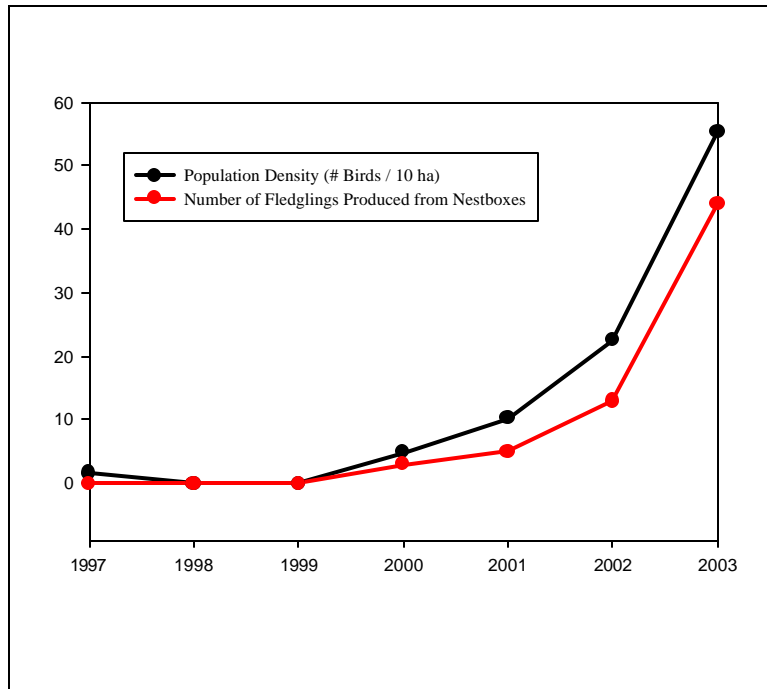


Figure 7. Relationship between Western Bluebird population density and nest box output. Nest boxes installed in 2000.

Western Bluebird production more than doubled in 2004 compared with 2003. In the five years since the Nestbox Highway was created, the Western Bluebird population along the creek has increased exponentially, with species density correlating very strongly with nest box output (Fig. 7). Western Bluebirds were very rare in the area prior to the installation of nest boxes. A survey conducted in 1999 failed to turn up a single bluebird. By 2003, however, the population had grown to approximately 55 birds per 10 hectares (2.5 acres).

Table 5. PUTAH CREEK NESTBOX HIGHWAY -- Reproductive Output 2004

Sierra Farms Orchard		
SPECIES	# BOXES AVAILABLE	10
Ash-throated Flycatcher	# Eggs Produced	9
	# Chicks Produced	8
	# Fledglings Produced	3
European Starling	# Eggs Produced	
	# Chicks Produced	
	# Fledglings Produced	
European House Sparrow	# Eggs Produced	
	# Chicks Produced	
	# Fledglings Produced	
House Wren	# Eggs Produced	
	# Chicks Produced	
	# Fledglings Produced	
Tree Swallow	# Eggs Produced	24
	# Chicks Produced	20
	# Fledglings Produced	18
White-breasted Nuthatch	# Eggs Produced	
	# Chicks Produced	
	# Fledglings Produced	
Western Bluebird	# Eggs Produced	16
	# Chicks Produced	14
	# Fledglings Produced	14
Total # Eggs Produced		49
Total # Chicks Produced		42
Total # Fledglings Produced		35

The 10 nest boxes located at the Sierra Farms Orchard site produced 49 eggs, 42 chicks, and 35 fledglings of three different species in 2004 (Table 5). This site produced a proportionately large number of eggs, chicks and fledglings, especially Western Bluebirds (Fig. 5), compared to the other sites, most of which had at least twice as many boxes. Sierra Farms Orchard has produced 10% of all Western Bluebird fledglings since 2000.

These numbers are especially impressive considering the site has only been operative since 2003. Average clutch size at SFO (3.5 fledglings per box) was also higher than the creekwide average (3.0 fledglings per box). It may be that orchards provide better foraging habitat for bluebirds, perhaps due to high densities of fossorial insects, especially if orchards are managed to minimize use of insecticides and to provide some ground litter for insects to hide in.

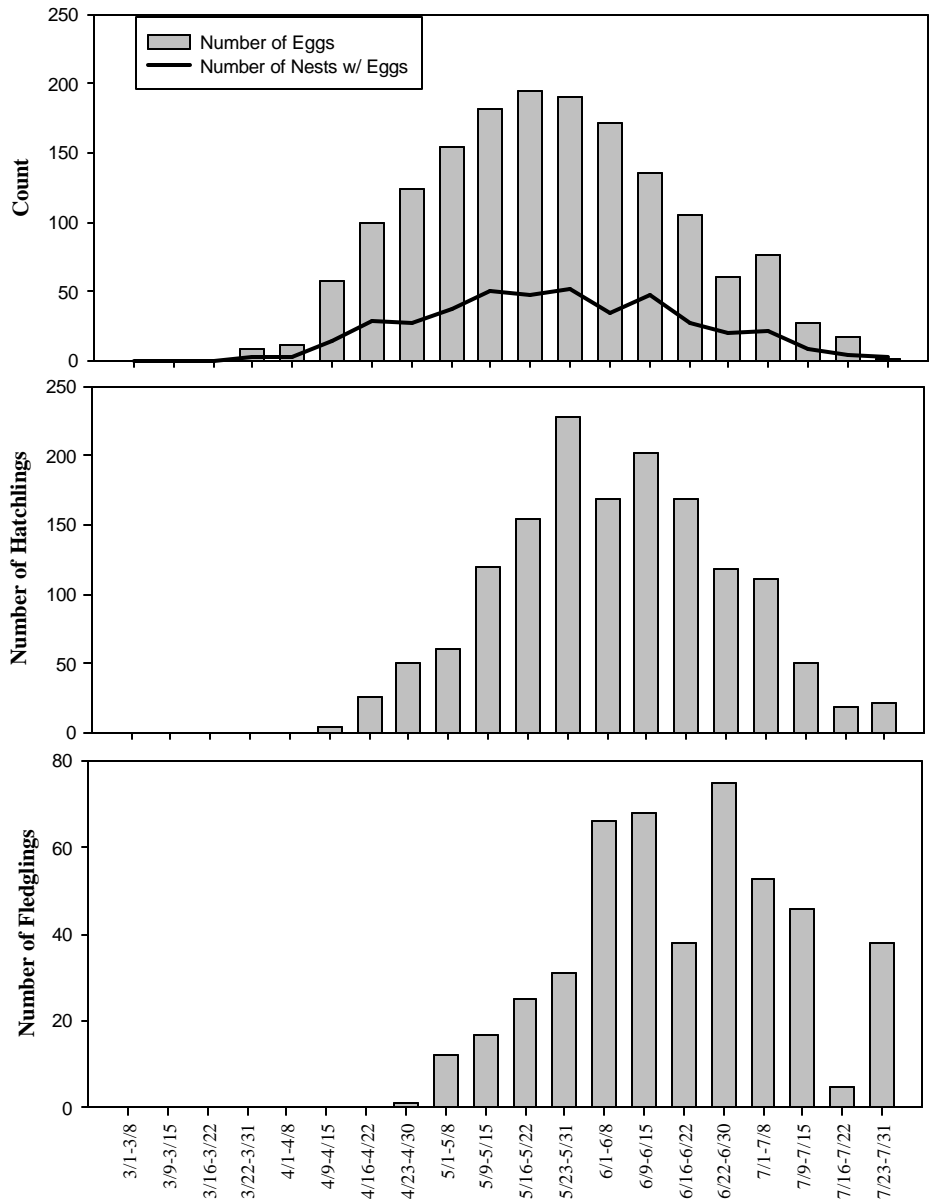


Figure 8. Reproductive chronology depicting number of active nests, eggs, chicks, and fledglings plotted against time for the entire creek.

Nesting activity occurred between March and July, peaking in mid-May (Fig. 8). Two periods of fledgling production occurred: a first wave of nesters (Tree Swallows, wrens, first-brood bluebirds) and a second wave consisting primarily of Ash-throated Flycatchers and second-brood bluebirds. This nesting chronology should be observed in formulating management decisions to avoid disturbance to nesting birds.

Based on data from Cornell Laboratory of Ornithology's Birdhouse Network (TBN), birds along Putah Creek often nested earlier than birds in other parts of North America (Table 6). This may reflect climatic regimes in which birds must nest earlier to avoid heat-related mortality later in the season. Egg-laying dates correspond with desert southwest regions that also experience extremely hot temperatures during the breeding season.

Putah Creek birds also produced large clutches (see Truan *et al.* 2005). Large clutch sizes often indicate good quality habitat and abundant food resources. As we collect more data, we will examine variation in clutch sizes and reproductive success between sites to determine which sites support high quality habitat and which sites might be good candidates for restoration.

ALL REGIONS				SOUTHWEST	
2005	Ash-throated Flycatcher	4/11/2005	TX	5/2/2005	Winters
	House Wren	4/2/2005	Winters	-----	
	Tree Swallow	3/11/2005	WY	4/10/2005	Davis
2004	Ash-throated Flycatcher	4/11/2005	TX	4/30/2004	Winters
	Tree Swallow	3/21/2004	CT	3/30/2004	Davis
	White-breasted Nuthatch	4/4/2004	Winters	-----	
2003	Oak Titmouse	3/1/2003	Winters	-----	
	Tree Swallow	3/29/2003	Winters	-----	
2002	Bewick's Wren	2/21/2002	TX	4/1/2002	Davis
	European Starling	4/9/2002	Davis	-----	
	House Wren	4/15/2002	Winters	-----	
	Tree Swallow	4/1/2002	Winters	-----	
2001	House Wren	4/5/2001	Davis	-----	

Table 6. First egg dates for selected species nesting in artificial nest boxes in North America and southwest United States. Data are from Cornell Laboratory of Ornithology's Bird House Network (>50,000 submissions). Records in red are from the PCNH.

3.2 HERPETOFAUNA

Fourteen species of reptiles and amphibians have been recorded along the creek, characteristic of the limited herpetofauna known to inhabit California's Central Valley (Table 7). All of these species were recorded in the upper reach, 10 were recorded in the middle reach, and 8 were recorded in the lower reach. Creekwide, population density of the Western Pond Turtle (*Emys marmorata*), a California Species of Special Concern, was found to be moderate, but is probably limited by insufficient breeding habitat.

Table 7. List of Reptiles and Amphibians recorded on Putah Creek.

Common Name	Scientific Name	Upper Reach	Middle Reach	Lower Reach
Slender Salamander	<i>Batrachoseps sp.</i>	X	X	
Western Toad	<i>Bufo boreas</i>	X	X	X
Pacific Treefrog	<i>Hyla regila</i>	X	X	X
Bullfrog	<i>Rana catesbeiana</i>	X	X	X
Western Pond Turtle	<i>Emys marmorata</i>	X	X	X
Red-eared Slider	<i>Pseudemys scripta</i>	X	X	X
Western Fence Lizard	<i>Sceloporus occidentalis</i>	X	X	X
Gilbert's Skink	<i>Eumeces gilberti</i>	X		
Southern Alligator Lizard	<i>Elgaria multicarinatus</i>	X		
Western Yellow-bellied Racer	<i>Coluber constrictor</i>	X		
Gopher Snake	<i>Pituophis melanoleucus</i>	X	X	X
California Kingsnake	<i>Lampropeltis getulus</i>	X	X	X
Western Aquatic Garter Snake	<i>Thamnophis couchi</i>	X	X	
Pacific Rattlesnake	<i>Crotalus viridis</i>	X		

3.3 MAMMALS

Thirty-one species of mammals have been confirmed along the creek, including mink, black bear, and mountain lion (Table 8). Of these, 26 species were recorded in the upper reach, 28 were recorded in the middle reach, and 25 were recorded in the lower reach.

Table 8. List of Mammals recorded on Putah Creek (following Jameson and Peters 2004).

Common Name	Scientific Name	Upper Reach	Middle Reach	Lower Reach
Opossum	<i>Didelphis virginiana</i>	X	X	X
Ornate Shrew	<i>Sorex ornatus</i>		X	X
Broad-footed Mole	<i>Scapanus latimanus</i>	X	X	
Yuma Bat	<i>Myotis yumanensis</i>	X	X	X
Mexican Freetail Bat	<i>Tadarida brasiliensis</i>	X	X	X
Coyote	<i>Canis latrans</i>	X	X	X
Gray Fox	<i>Urocyon cinereoargenteus</i>	X	X	X
Red Fox	<i>Vulpes vulpes</i>		X	X
Black Bear	<i>Ursus americanus</i>	X	X	
Raccoon	<i>Procyon lotor</i>	X	X	X

River Otter	<i>Lutra canadensis</i>	X	X	X
Mink	<i>Mustela vison</i>	X	X	X
Striped Skunk	<i>Mephitis mephitis</i>	X	X	X
Mountain Lion	<i>Panthera concolor</i>	X		
House Cat	<i>Felis domesticus</i>	X	X	X
Black-tailed Deer	<i>Odocoileus hemionus</i>	X		
Porcupine	<i>Erethizon dorsatum</i>		X	
Beechey's Ground Squirrel	<i>Spermophilus beecheyi</i>	X	X	X
Western Gray Squirrel	<i>Sciurus griseus</i>	X	X	X
Fox Squirrel	<i>Sciurus niger</i>		X	
Beaver	<i>Castor canadensis</i>	X	X	X
Botta's Pocket Gopher	<i>Thomomys bottae</i>	X	X	X
Western Harvest Mouse	<i>Reithrodontomys megalotis</i>	X	X	X
Deer Mouse	<i>Peromyscus maniculatus</i>	X	X	X
Muskrat	<i>Ondatra zibethica</i>	X	X	X
California Vole	<i>Microtus californicus</i>	X	X	X
Black Rat	<i>Rattus rattus</i>	X	X	X
Norway Rat	<i>Rattus norvegicus</i>			X
House Mouse	<i>Mus musculus</i>	X	X	X
Black-tailed Jackrabbit	<i>Lepus californicus</i>	X	X	X
Audubon's Cottontail	<i>Sylvilagus audubonii</i>	X	X	X

4 FUTURE DIRECTIONS

Surveys for butterflies, terrestrial arthropods, and riparian vegetation began in 2005. Once sufficient data is collected, it will be possible to compare diversity patterns within and between these different taxonomic groups. These comparisons will enable us to investigate possible mechanisms for observed patterns and to develop models of ecosystem structure and function.

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Appendix A. Center for Land-based Learning—Grid 14 Checklist

The following table represents the bird species checklist for the stretch of Putah Creek fronting the Center for Land-based Learning/Audubon California parcel. Geographic coordinates: 593983; 4265092 (Northing; Easting). The first column is the checklist of Putah Creek adapted from the *Checklist of the Birds of Yolo County, California*, April 2004, edited to show only those species we have recorded throughout our biomonitoring efforts. The second column shows the breeding status for the species across the entire creek. The second column shows the breeding status for the species for this particular site. Breeding status codes are as follows; "OB" means the species has been observed on the creek corridor or observed flying overhead, "PO" means the species is a possible breeder, "PR" means the species is a probable breeder, and "CO" means the species is a confirmed breeder.

PUTAH CREEK CHECKLIST SPECIES	Putah Creek Breeding Status	Center for Land-based Learning Breeding Status
ANATIDAE		
Greater White-fronted Goose	OB	OB
Snow Goose	OB	
Canada Goose	CO	OB
Tundra Swan	OB	OB
Wood Duck	CO	CO
Gadwall	PR	
American Wigeon	OB	
Mallard	CO	CO
Blue-winged Teal	OB	
Cinnamon Teal	PR	
Northern Shoveler	OB	
Ring-necked Duck	OB	
Bufflehead	OB	
Common Goldeneye	OB	
Hooded Merganser	CO	
Common Merganser	PR	
PHASIANIDAE		
Ring-necked Pheasant	CO	
Common Peafowl	CO	
Wild Turkey	CO	
ODONTOPHORIDAE		
California Quail	CO	PR
PODICIPEDIDAE		
Pied-billed Grebe	PR	OB
PELECANIIDAE		
American White Pelican	OB	
PHALACROCORACIIDAE		
Double-crested Cormorant	OB	OB
ARDEIDAE		
American Bittern	OB	
Great Blue Heron	OB	OB
Great Egret	OB	OB
Snowy Egret	OB	OB
Cattle Egret	OB	
Green Heron	PR	OB
Black-crowned Night-Heron	CO	
THRESKIORNITHIDAE		
White-faced Ibis	OB	
CATHARTIDAE		
Turkey Vulture	OB	OB
ACCIPITRIDAE		

PUTAH CREEK CHECKLIST SPECIES	Putah Creek Breeding Status	Center for Land-based Learning Breeding Status
Osprey	OB	OB
White-tailed Kite	CO	PO
Northern Harrier	CO	
Sharp-shinned Hawk	OB	OB
Cooper's Hawk	PO	
Northern Goshawk	OB	
Red-shouldered Hawk	CO	PR
Swainson's Hawk	CO	PR
Red-tailed Hawk	CO	CO
Ferruginous Hawk	OB	
Rough-legged Hawk	OB	
Golden Eagle	OB	
FALCONIDAE		
American Kestrel	CO	OB
Merlin	OB	
Peregrine Falcon	OB	
Prairie Falcon	OB	
RALLIDAE		
Virginia Rail	OB	
Common Moorhen	CO	
American Coot	PR	
GRUIDAE		
Sandhill Crane	OB	
CHARADRIIDAE		
Killdeer	CO	PO
RECURVIROSTRIDAE		
Black-necked Stilt	OB	
SCOLOPACIDAE		
Greater Yellowlegs	OB	
Spotted Sandpiper	OB	
Whimbrel	OB	
Long-billed Curlew	OB	
Long-billed Dowitcher	OB	
LARIDAE		
Bonaparte's Gull	OB	
Ring-billed Gull	OB	
California Gull	OB	OB
Herring Gull	OB	
COLUMBIDAE		
Rock Pigeon	OB	OB
Mourning Dove	CO	PR
TYTONIDAE		

PUTAH CREEK CHECKLIST SPECIES	Putah Creek Breeding Status	Center for Land-based Learning Breeding Status
Barn Owl	CO	
STRIGIDAE		
Western Screech-Owl	CO	
Great Horned Owl	CO	CO
Northern Pygmy-Owl	OB	
Long-eared Owl	OB	
CAPRIMULGIDAE		
Common Poorwill	OB	
APODIDAE		
Vaux's Swift	OB	OB
White-throated Swift	OB	
TROCHILIDAE		
Black-chinned Hummingbird	CO	PR
Anna's Hummingbird	CO	PR
Calliope Hummingbird	OB	OB
Rufous Hummingbird	OB	OB
Allen's Hummingbird	OB	
ALCEDINIDAE		
Belted Kingfisher	CO	PO
PICIDAE		
Lewis's Woodpecker	OB	OB
Acorn Woodpecker	PR	
Yellow-bellied Sapsucker	OB	
Red-breasted Sapsucker	OB	
Nuttall's Woodpecker	CO	PR
Downy Woodpecker	CO	PO
Hairy Woodpecker	PR	
Northern Flicker (Red-shafted)	CO	PR
TYRANNIDAE		
Olive-sided Flycatcher	OB	
Eastern Wood-Pewee	OB	
Western Wood-Pewee	PR	OB
Willow Flycatcher	OB	
Least Flycatcher	OB	
Hammond's Flycatcher	OB	
Gray Flycatcher	OB	
Dusky Flycatcher	OB	
Pacific-slope Flycatcher	CO	PO
Black Phoebe	CO	CO
Eastern Phoebe	OB	
Say's Phoebe	OB	OB
Ash-throated Flycatcher	CO	CO
Western Kingbird	CO	CO
LANIIDAE		
Loggerhead Shrike	PO	
VIREONIDAE		
Bell's Vireo	OB	
Cassin's Vireo	OB	OB
Hutton's Vireo	PO	OB
Warbling Vireo	OB	OB
CORVIDAE		
Steller's Jay	OB	

PUTAH CREEK CHECKLIST SPECIES	Putah Creek Breeding Status	Center for Land-based Learning Breeding Status
Western Scrub-Jay	CO	CO
Yellow-billed Magpie	CO	CO
American Crow	CO	CO
Common Raven	PR	
ALAUDIDAE		
Horned Lark	OB	OB
HIRUNDINIDAE		
Purple Martin	OB	
Tree Swallow	CO	CO
Violet-green Swallow	PR	
Northern Rough-winged Swallow	CO	PR
Bank Swallow	OB	
Cliff Swallow	CO	PO
Barn Swallow	CO	PO
PARIDAE		
Chestnut-backed Chickadee	OB	
Oak Titmouse	CO	PO
AEGITHALIDAE		
Bushtit	CO	CO
SITTIDAE		
Red-breasted Nuthatch	OB	
White-breasted Nuthatch	CO	PR
CERTHIDAE		
Brown Creeper	OB	
TROGLODYTIDAE		
Bewick's Wren	CO	PR
House Wren	CO	PO
Winter Wren	OB	
Marsh Wren	PO	
REGULIDAE		
Golden-crowned Kinglet	OB	OB
Ruby-crowned Kinglet	OB	OB
SYLVIIDAE		
Blue-gray Gnatcatcher	PO	OB
TURDIDAE		
Western Bluebird	CO	PR
Swainson's Thrush	OB	OB
Hermit Thrush	OB	OB
American Robin	CO	PR
Varied Thrush	OB	
TIMALIIDAE		
Wrentit	PO	
MIMIDAE		
Northern Mockingbird	CO	PR
STURNIDAE		
European Starling	CO	PR
MOTACILLIDAE		
American Pipit	OB	OB
BOMBYCILLIDAE		
Cedar Waxwing	OB	OB
PTILOGONATIDAE		
Phainopepla	PR	

PUTAH CREEK CHECKLIST SPECIES	Putah Creek Breeding Status	Center for Land-based Learning Breeding Status
PARULIDAE		
Orange-crowned Warbler	CO	PO
Nashville Warbler	OB	
Northern Parula	OB	
Yellow Warbler	PR	OB
Yellow-rumped Warbler (Audubon's)	OB	OB
Black-throated Gray Warbler	OB	OB
Townsend's Warbler	OB	OB
Hermit Warbler	OB	OB
Blackpoll Warbler	OB	
Northern Waterthrush	OB	
MacGillivray's Warbler	OB	OB
Common Yellowthroat	PR	OB
Wilson's Warbler	OB	OB
Yellow-breasted Chat	PO	
THRAUPIDAE		
Western Tanager	CO	OB
EMBERIZIDAE		
Spotted Towhee	CO	PR
California Towhee	CO	PR
Chipping Sparrow	OB	OB
Lark Sparrow	CO	
Savannah Sparrow	OB	OB
Grasshopper Sparrow	OB	
Fox Sparrow	OB	OB
Song Sparrow	CO	PR
Lincoln's Sparrow	OB	OB
Swamp Sparrow	OB	
White-throated Sparrow	OB	OB
White-crowned Sparrow	OB	OB
Golden-crowned Sparrow	OB	OB
Dark-eyed Junco (Oregon)	CO	OB
CARDINALIDAE		
Black-headed Grosbeak	CO	PR

PUTAH CREEK CHECKLIST SPECIES	Putah Creek Breeding Status	Center for Land-based Learning Breeding Status
Blue Grosbeak	CO	PO
Lazuli Bunting	PR	OB
ICTERIDAE		
Red-winged Blackbird	CO	PO
Tricolored Blackbird	OB	OB
Western Meadowlark	PR	
Yellow-headed Blackbird	OB	
Brewer's Blackbird	CO	PO
Brown-headed Cowbird	CO	PR
Hooded Oriole	CO	
Bullock's Oriole	CO	PR
FRINGILLIDAE		
Purple Finch	OB	OB
House Finch	CO	PR
Pine Siskin	OB	OB
Lesser Goldfinch	PR	PR
American Goldfinch	CO	PO
Lawrence's Goldfinch	OB	
PASSERIDAE		
House Sparrow	CO	
Totals		
Total Observed Species	102	53
Total Possible Breeding Species	7	14
Total Probable Breeding Species	17	23
Total Confirmed Breeding Species	64	12
Grand Species Totals	190	102
SUBSPECIES		
Northern Flicker (Yellow-shafted)	OB	
Yellow-rumped Warbler (Myrtle)	OB	OB
Dark-eyed Junco (Slate-colored)	OB	
Possible Misc. Species		
Yellow-throated Vireo	OB	