



Songbird Monitoring of Lower Clear Creek Floodway Restoration Project
2002 Report



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EXECUTIVE SUMMARY

Through long-term landbird monitoring, the Clear Creek Songbird Monitoring Project, initiated in 1999, endeavors to provide meaningful biological feedback on the response of landbird populations to restoration activities in the lower Clear Creek floodway. The goal of this feedback is to find the most appropriate restoration actions in order to have the greatest benefit on songbirds and other riparian dwelling taxa, while limiting the negative impacts to these populations.

In this progress report, we provide information songbird productivity from nest monitoring and mist-netting data, abundance, diversity, and richness data from point count surveys; and density estimates of focal species from territory mapping data, for the 2002 breeding season.

Nest monitoring and mist-netting data from 2002 suggests it was a productive year for songbird populations at study sites along Clear Creek. Overall proportional reproductive success for all nests found was 51%, including above average productivity for Song Sparrow and Yellow-breasted Chat, two riparian focal species (RHJV 2000).

The highest abundance of Yellow Warbler, Yellow-breasted Chat, and Song Sparrow, three rare and declining species in the Sacramento Valley, were recorded on the new point count transect established below Whiskeytown Dam.

Songbird nesting attempts were recorded for the first time on the Reading Bar and 2A restoration plots, both of which were unsuccessful. The abundance indices of important riparian species at restoration sites in the project area are still well below indices downstream in unaltered sections of the project area.

In 2002 we implemented an education and outreach component to our project (Appendix A). Products of these efforts included an International Migratory Bird Day Event in partnership with the Horsetown Clear Creek Preserve and a feature article in the Redding Record Searchlight.

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INTRODUCTION

In centuries past, the complex and diverse riparian habitats within in the Sacramento River Valley supported a vast array and abundance of landbirds (Grinnell and Miller 1944). In fact, riparian habitat is the single most important habitat type for landbirds in California (Gaines 1977, Manley and Davidson 1993); unfortunately it is estimated that less than 5% of the states original riparian habitat remains (Smith 1980).

Many landbird species once believed to be abundant breeders in riparian habitat in the Sacramento Valley are now rare, declining, and in several cases even extirpated (Gaines 1977, Small et al. 2000). Species such as Least Bell's Vireo and Willow Flycatcher no longer breed in the Sacramento Valley, while other species such as Yellow Warbler and Song Sparrow have become extremely rare (Gaines 1977, Small et al. 2000).

With the current threats to riparian birds in California, it is paramount that restoration efforts take into account these and other riparian taxa when planning, implementing, and monitoring such projects. Because birds occupy an extremely diverse range of niches within an ecosystem and a relatively high position in the food chain, they are ideal indicators of environmental conditions (DeSante and Geupel 1987, Temple and Wiens 1989).

Along with the relative ease of study (e.g., nationally standardized protocols) and the cost effectiveness of a monitoring program, songbird monitoring provide researchers with feedback from a whole community of organisms, not just a single species. Thus, birds are a model organism for measuring the success of restoration and changes in land management.

In 1999, PRBO Conservation Science (PRBO), as part of the Clear Creek restoration team, implemented a multifaceted riparian songbird monitoring project as part of the Lower Clear Creek Floodway Restoration Project. This report summarizes the fourth year of data collection and some of the preliminary results obtained in 2002, and relates them to some results in previous years. This project was designed in order to meet the following five objectives:

- 1) Gather baseline data on the health and composition of the riparian bird community at Clear Creek.
- 2) Provide "state-of-the-science" knowledge of the requirements of riparian birds (specifically the birds of Clear Creek) to the Clear Creek Restoration Team to help guide restoration efforts.
- 3) Measure the effects of restoration efforts over time to specific sites as well as to the Clear Creek bird community as a whole and provide feedback to the Restoration Team.
- 4) Provide data to the Riparian Habitat Joint Venture (RHJV) and the MAPS biomonitoring program in order to enhance the overall understanding of the status and requirements of riparian birds throughout California.

- 5) Provide outreach to educate the community about conservation, restoration, and the specifics of the Clear Creek project.

In order to meet these objectives we have employed five bird monitoring methods at Clear Creek: Point Counts, Mist Netting, Nest Monitoring, Territory Mapping, and Area Searches (Table 1).

Table 1. Monitoring methods employed at each study site, Clear Creek 2002.

Site	Point Count	Mist-net	Nest Monitoring	Territory Mapping	Area Search
Reading Bar	X		X	X	X
Shooting Gallery	X				
Saeltzer Dam	X	X	X	X	
Old Mill	X				X
Project Area	X	X	X	X	
2A Restoration Site	X		X	X	
2B Restoration Site				X	
Sac. River Confluence	X				
Whiskeytown Dam	X				X

METHODS

STUDY AREA

All data was collected along the lower Clear Creek Floodway , Shasta County, California, with sites from the confluence with the Sacramento River to the base of Whiskeytown Dam. The focus of the monitoring efforts were centered around an area from Reading Bar to the eastern end of the Project Area (see Burnett and DeStaebler 2002 for maps of nest plots).

POINT COUNT CENSUSES

The point count method can be used to monitor multiple aspects of songbird populations. The method makes possible studies of yearly changes of bird populations, comparison of species composition between habitats, and assessments of breeding status and abundance patterns of species.

Point count methodology followed guidelines described in Ralph et al. (1993). In summary, we used five minute, fifty meter, fixed radius point counts in 1999-2001, and began using a

variable circular plot (VCP) point count method in 2002 that is fully compatible with previous methods (Reynolds 1980). All stations were located at 200-meter intervals and were censused three times during peak months of the breeding season (see Table 2 for census dates). Counts were conducted from local sunrise until approximately 3 hours after sunrise (i.e., peak singing hours). All birds detected were recorded. Detections were placed within one of six categories based on the initial detection distance from observer: less than 10 meters, 10-20 meters, 20-30 meters, 30-50 meters, 50-100 meters, and greater than 100meters. Birds flying over the study area but not observed landing were recorded separately. The method of detection (song, visual, or call) was also recorded. PRBO field biologists, with extensive knowledge of songs and calls of the birds in the area, conducted all censuses.

A total of 62 permanent point count stations were censused in 2002: fourteen at the primary Project Area, four at Reading Bar Borrow Site, five at the former Shooting Gallery, five at the Saeltzer Dam site, fourteen at the Old Mill site above Saeltzer Dam, 13 at the site below Whiskeytown Dam, and eight at the confluence with the Sacramento River (Table 2). All point count census stations were geo-referenced using a handheld Garmin II Plus GPS unit.

Table 2. Point count transect, site name, site code, and visit date, Clear Creek 2002.

Site	Code	Year Established	# of points	Visit 1	Visit 2	Visit 3
Sacramento Confluence	SACC	1999	8	05/14/02	06/02/02	06/19/02
Old Mill	OLMI	2000	14	05/15/02	06/01/02	06/21/02
Project Area	PRAR	1999	13	05/16/02	06/03/02	06/20/02
Saeltzer Dam	SEDA	2000	5	05/13/02	05/31/02	06/20/02
Shooting Gallery	SHGA	1999	5	05/13/02	05/31/02	06/20/02
Reading Bar	REBA	1999	4	05/13/02	05/31/02	06/20/02
Whiskeytown Dam	WHDA	2002	13	05/19/02	06/04/02	06/22/02

POINT COUNT VEGETATION ASSESSMENT

The objective of point count vegetation assessment is to relate the differences in bird composition and abundance with the variation in vegetation structure and composition.

Vegetation at each point count station was assessed using the relevé method, following procedures in Ralph et al. (1993). A 50-meter radius plot centered on each census station was used. General habitat characteristics of the site were recorded (canopy cover, slope, aspect, etc.); and the cover of each vegetation stratum (tree, shrub, herb) and of bare ground was estimated. Within each vegetation stratum, the heights and DBHs were estimated and species composition was determined, with each species' relative cover recorded as a percentage of total cover for that stratum. For a complete description of the relevé method see Ralph et al. (1993).

POINT COUNT ANALYSIS

Point count census data yields information on relative abundance, species richness and species diversity. For a species to be included in our analyses they had to meet the following set of criteria: 1) known to breed at Clear Creek, 2) native to North America, and 3) accurately

censused by the point count method. Species that did not meet the third criteria include raptors, waterfowl, and shorebirds.

Abundance

Abundance indices provide information on the relative density of birds in an area. We define the index of abundance as the mean number of individuals detected per station per visit within 50 meters of the observer. This number is obtained by dividing the total number of detections by the number of stations in a given transect and the number of visits.

Species Richness

Species richness is the total number of species detected within 50 meters. Richness can be presented as cumulative species richness (total number of species detected within a habitat or along a transect) or as mean species richness (average number of species detected per point within a habitat or transect). In this report we have presented the mean species richness. Presenting the mean species richness allows for comparison between transects with different numbers of points.

Diversity

Species diversity measures the number of species detected (<50m; species richness) weighted by the number of individuals of each species. A high diversity score indicates high ecological (species) diversity, or a more equal representation of the species. Species diversity was measured using a modification of the Shannon-Wiener index (also called Shannon-Weaver index or Shannon index; Krebs 1989). We used a transformation of the usual Shannon-Weiner index (symbolized H'), which reflects species richness and equal distribution of the species. This transformed index, introduced by MacArthur (1965), is N_1 , where $N_1 = 2^{H'}$.

As with richness, diversity can be presented for the entire transect or habitat; and it can also be presented as the mean diversity per point, to allow for comparisons. As with richness we chose to present only the mean diversity in this report due to the inappropriateness of comparing total diversity between transects containing different numbers of points.

NEST MONITORING

Nest monitoring measures nesting success in specific habitats and provides information on population health. Measurement of vegetation associated with nests may identify habitat features that influence breeding productivity (see below). Examination of nests also allows collection of life history data (e.g., clutch size, number of broods, number of nesting attempts) that provide important insight into “vulnerability of species to decimation or perturbations” (Martin and Geupel 1993).

In 2002, we continued monitoring nests at the Saeltzer Dam and Project Area plots, established in 1999. Each plot is approximately 800 meters in length. The Project Area plot encompasses approximately 19 hectares in total area, while the narrower Saeltzer Dam plot covers approximately 15 hectares in total area. We also canvassed the 2A and Reading Bar restoration plots for evidence of nesting birds.

Nest finding and monitoring followed the specific guidelines outlined in Martin and Geupel (1993). Nests were located at all stages (construction, egg-laying, incubation, and nestling). Careful attention was given to minimizing human disturbance when checking nests. These precautionary measures included keeping visits brief, minimizing disturbance to the area around a nest and staying clear of nest sites when predators were detected nearby.

NEST VEGETATION ASSESSMENT

As soon as a nesting attempt terminated, whether successful or unsuccessful, we measured the vegetation associated with it (i.e., nest substrate and surrounding patch). We used a slightly modified version of the BBIRD (Martin and Conway 1995) method for vegetation measurements. The basic units for vegetation sampling were a five-meter radius plot (for shrubs and forbs) and an 11.3-meter radius plot (for trees) centered on the nest. Visual estimates of percent vegetation, bare ground, water, logs, and litter were made. The percent cover that each plant species made up of the entire plot was estimated.

MIST-NETTING

Constant-effort mist-netting can provide demographic information that helps to assess the viability of bird populations. For example, the proportion of young captured has been shown to be a good measure of breeding productivity for some species, and recaptures can measure adult over-winter survival and recruitment of young to the site. These data can be used to determine whether birth rate is sufficient to offset adult mortality. Upon collection of more data in subsequent years we will be able to analyze the data in an effort to answer this question.

Mist-netting was conducted in 2002 at the Project Area site established in 1999 and at the Saeltzer Dam site established in 2001. Mist-netting was conducted once during each of nine ten-day periods, at each location throughout the breeding season (see Appendix D for dates). Netting procedures followed guidelines described in Ralph et al. (1993). Ten nets were unfurled 15 minutes after local sunrise, checked every 30 to 45 minutes (more often in hot weather), and were operated for five hours. Birds captured were removed from the net and processed nearby. All birds captured (except hummingbirds and game birds) were given a uniquely numbered USGS Biological Resource Division band and released after several measurements were taken.

In 2002, we began color banding five species on the Project Area and Saeltzer Dam nest plots, Yellow Warbler, Yellow-breasted Chat, Spotted Towhee, Song Sparrow, and Black-headed Grosbeak. Color banded populations allow for identification of individuals without having to capture them and makes territory mapping more accurate. Color banding these focal species will also allow us to better understand their movements within seasons and between season at Clear Creek.

All mist-netting data will be submitted to the USGS Bird Banding Lab (BBL Patuxent, MD) and the MAPS program of the Institute for Bird Populations (Point Reyes Station, CA (DeSante et al. 1998).

TERRITORY MAPPING

Territory Mapping, also known as Spot Mapping, is a census method used for determining the density of breeding pairs in a given area. The same observer covers the entire plot at least eight times during peak activity hours during the breeding season. Singing, conspecific aggression, or any other territorial behavior is noted and marked on a detailed map. Using the data collected from all visits over the season, it is possible to estimate the location and number of breeding pairs in an area. The density of breeding pairs can also be used as an indicator of habitat quality, though it needs to be supported by nest monitoring. We spot mapped on the two nest plots (Project Area and Saeltzer Dam) as well as on the three restoration plots (2A, 2B, and Reading Bar).

AREA SEARCH

Area search protocol followed Ralph et al (1993). In this method the observer thoroughly canvasses a plot for twenty minutes, recording all birds detected within the plot and the type of detection, (call, song or visual). This method is useful for censusing species that are not adequately detected using the point count method, including waterbirds and raptors. Area Searches were conducted at the Old Mill wetland restoration site, Reading Bar restoration site, and just below Whiskeytown Dam, by volunteers from the Wintu Audubon Society.

RESULTS AND DISCUSSION

POINT COUNT CENSUSES

A summary of the species diversity, species richness, and mean number of individuals per station is presented for each site in Table 3.

Community Indices

Overall indices in 2002 remained high compared to other Sacramento River tributary sites (PRBO unpublished data), further providing evidence of the regional importance of Clear Creek for riparian songbirds. As in 2001, the highest mean abundance and species richness was along the Saeltzer Dam transect. Other areas with high riparian bird indices included lower portions of the project area transect, outside the footprint of recent restoration activities, as well as along the newly established Old Mill transect.

Table 3. Mean species diversity, richness, and abundance (<50m) at Clear Creek point count transects in 2002.

STATION	Mean Diversity	Mean Abundance	Mean Species Richness
Sac.Clcr. Confluence	8.09	6.13	9.63
Project Area	7.77	4.07	8.92
Old Mill	8.17	6.40	9.64
Saeltzer Dam	7.68	8.27	9.80
Shooting Gallery	6.89	6.13	8.40
Reading Bar	8.16	5.75	9.50
Whiskeytown Dam	6.55	5.41	7.31
CLCR Total Mean	7.62	6.02	9.03

Indices at the confluence of Clear Creek and the Sacramento River transect have dropped due to portions of the riparian habitat along our survey route being destroyed as part of a housing development. This area is the only spot along the Sacramento River north of Colusa where Song Sparrow breeds. Yellow Warbler and Yellow-breasted Chat, two rare breeders elsewhere along the Sacramento River, are fairly common here.

Focal Species Abundance

We analyzed the abundance of six important riparian species that breed at Clear Creek to better understand their patterns of distribution (Table 4).

The three breeding songbird species of greatest conservation interest at Clear Creek, Yellow Warbler, Yellow-breasted Chat, and Song Sparrow, were found to be most abundant on the newly established transect in the alluvial stretch below Whiskeytown Dam. The connectivity of suitable habitat in the foothills may be part of the explanation for the continued presence of some of these species at Clear Creek. Foothill populations of these species may have lower incidence of cowbird parasitism and predation and may therefore provide a source population for recolonization of restoration sites.

Here we provide a description of the sites, other than Whiskeytown Dam transect, where these three rare focal species are most abundant and what restoration measures might positively influence their abundance at Clear Creek.

Yellow Warbler continued to be most common along the White Alder lined sections of the creek at Reading Bar and Saeltzer Dam and in the Cottonwood/Willow gallery forest at the extreme eastern end of the Project Area directly south of the former Bentley property. An increase in structurally complex Cottonwood-Willow forest in the Project Area and an increase in habitat at the Reading Bar site should benefit this species.

Yellow-breasted Chat were most abundant in 2002 at the Saeltzer Dam transect, the Old Mill transect and at the eastern end of the Project Area transect, described above. As point count habitat association data has shown this species is most abundant in areas with extensive blackberry cover (Burnett and DeStaebler 2002). Structurally complex habitat with a well developed understory that includes blackberry should benefit this species.

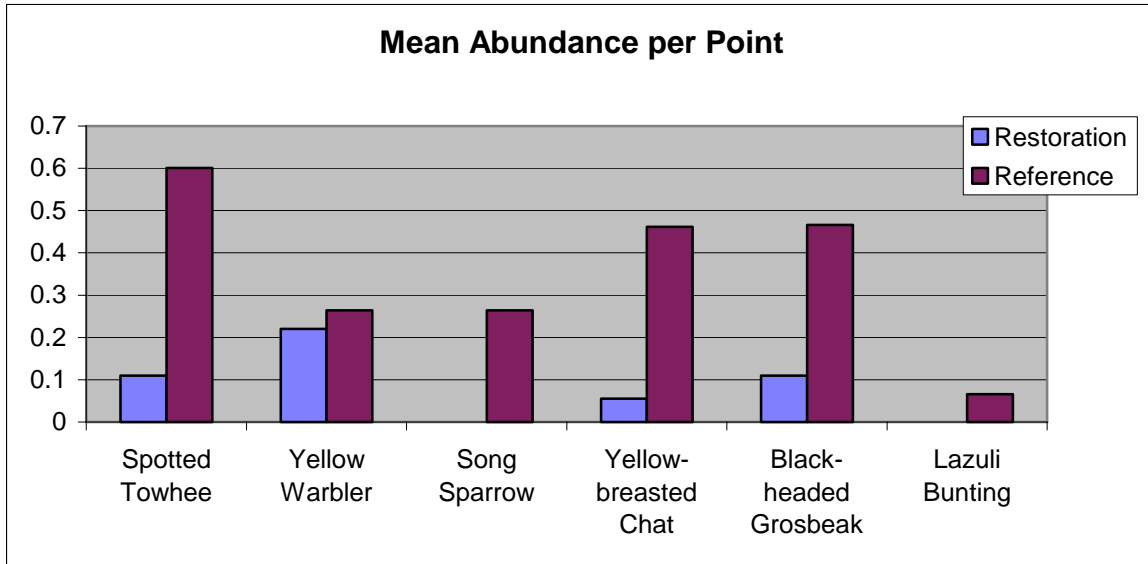
Song Sparrow were most abundant at Saeltzer Dam, followed by the Reading Bar and Project Area transects. Point count and territory mapping data have shown that breeding territories for this species are almost always associated with wet areas, most often within close proximity of the creek. Specific sites where we have found them to be most abundant are at the Saeltzer Dam nest plot, along the Creek just upstream from the Reading Bar restoration plot, and in the eastern portions of the project area where territories are rather tightly packed around a wet area associated with a beaver pond. Creating oxbows, backwater/scour channels, emergent wetlands, and other mesic habitats at Clear Creek should benefit this species.

Table 4. Abundance of important riparian species at each point per visit (<50m) at the seven point count transects along Clear Creek in 2002.

Species	Old Mill	Project Area	Reading Bar	Sac./Clcr Confluence	Saeltzer Dam	Shooting Gallery	Whiskeytown Dam
Spotted Towhee	0.55	0.31	0.33	0.50	0.13	0.67	0.36
Yellow Warbler	0.31	0.21	0.92	0.17	0.47	0.07	1.28
Song Sparrow	0.24	0.13	0.25	0.17	0.47	0.00	0.92
Yellow-breasted Chat	0.24	0.21	0.17	0.04	0.47	0.07	0.72
Black-headed Grosbeak	0.10	0.23	0.17	0.17	0.40	0.00	0.08
Lazuli Bunting	0.12	0.05	0.08	0.00	0.13	0.00	0.00

We compared the abundance of these important six riparian species at point count station located in revegetation at the 2A, 2B south, and 3A restoration sites with point count stations located on the nest plot downstream in undisturbed habitat. As expected, the abundance of all six species was lower on restoration points than at the control sites downstream. In fact, all detections of these species were from points where portions of the count circle included remnant habitat outside the footprint of the restoration. As restoration sites mature we would expect to see the abundance of these species increase. We predict that the abundance of Black-headed Grosbeak, which has been found to readily nest in sites where the vegetation structure is similar to the 2A and Reading Bar sites, will be the first to significantly increase in abundance in coming years. We expect species such as Spotted Towhee and Song Sparrow to require a denser understory at these sites before their numbers approach those detected downstream.

Figure 1. Comparison of the mean abundance per point (<50m) for six important riparian songbird species breeding at restoration sites (n=6) and untreated areas (n=5) in the primary project area.



As restoration sites located at the 2A, Reading Bar, and 2B sites mature we will be able to compare point count indices at lower sections of the project area as well as those at other control sites to help evaluate the effectiveness of restoration efforts on providing high quality riparian songbird habitat.

NEST MONITORING

A total of 88 nests of 22 species were located and monitored at Clear Creek in 2002 (Table 5 and 6). In general, 2002 was a productive year for songbirds at Clear Creek, with many species showing high reproductive success. Although sample sizes were fairly small, 2002 appeared to be an above average year for Song Sparrow and Yellow-breasted Chat and an average year for Spotted Towhee, Black-headed Grosbeak, and Yellow Warbler (Table 6). While restoration efforts have undoubtedly had temporary negative impacts on songbird habitat within the restoration areas (see figure 1 above), nesting success data collected on our plots outside of the treated areas suggests that restoration activities have not had a discernable impact on the breeding success of songbirds in adjacent areas.

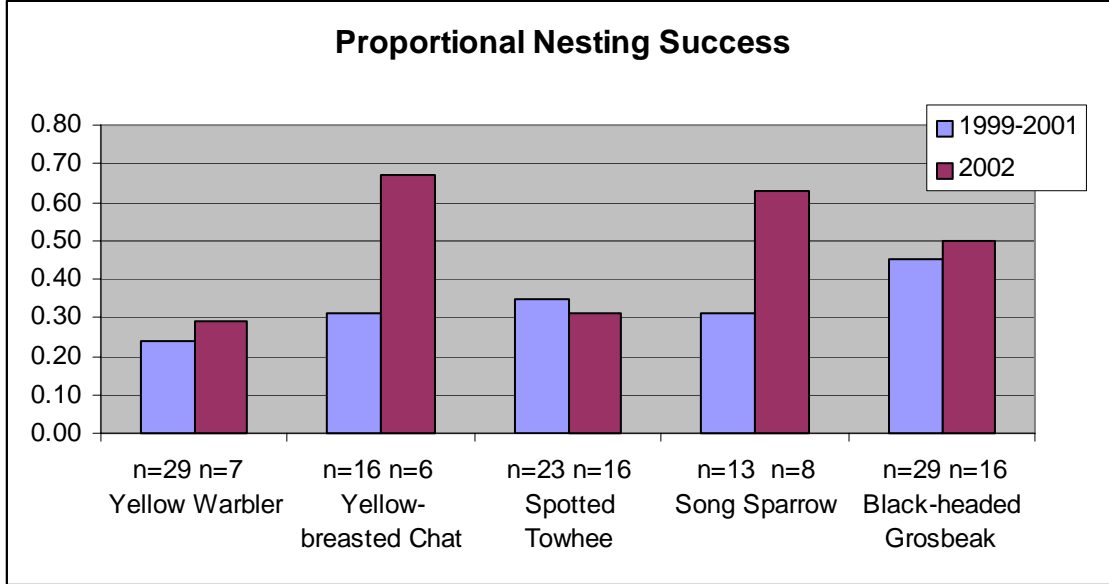
Table 5. Proportional reproductive success of all nests for all species monitored at Clear Creek in 2002 at the Saeltzer Dam and Project Area nest plots.

Species	Fledged	Total	Proportion Successful
American Robin*	2	3	0.67
Ash-throated Flycatcher	2	2	1.00
Bewick's Wren*	1	1	1.00
Black-headed Grosbeak*	7	14	0.50
Bullock's Oriole	1	2	0.50
Bushtit	2	5	0.40
Common Yellowthroat*	0	2	0.00
Downy Woodpecker	1	1	1.00
House Wren	4	4	1.00
Lazuli Bunting*	0	1	0.00
Lesser Goldfinch*	0	3	0.00
Oak Titmouse	2	2	1.00
Orange-crowned Warbler*	0	1	0.00
Song Sparrow*	5	8	0.63
Spotted Towhee*	5	16	0.31
Tree Swallow	2	2	1.00
Western Kingbird*	0	1	0.00
Western Wood-Pewee*	2	2	1.00
Wild Turkey	1	1	1.00
Yellow-breasted Chat*	4	6	0.67
Yellow Warbler*	1	6	0.17
Total	42	83	0.51

* = Open Cup nesting species.

In 2002, we located and monitored the first nesting attempts on restoration plots. Several nests were located adjacent to the 2A restoration plot in remnant habitat, where birds have undoubtedly nested throughout restoration activities (Yellow Warbler, Black-headed Grosbeak, and Anna's Hummingbird). However, the first nests within the footprint of the restoration were a Black-headed Grosbeak nest in the naturally recruited White Alder patch at Reading Bar and a Bushtit nest at the 2A site. Both of these nests were unsuccessful, having failed due to predation.

Figure 2. Comparison of the proportional reproductive success of five riparian focal species breeding at Clear Creek between 2002 and the previous three years combined (1999-2001).



We would expect the number of species and individuals establishing territories at these sites to increase in subsequent years as more suitable nesting habitat develops through natural successional processes.

Table 6. Proportional reproductive success for nests monitored on restoration plots in 2002 at Clear Creek.

Species	Site	Fledged	Total	Proportion Successful
Anna's Hummingbird	2A	1	1	1.00
Black-headed Grosbeak	2A, REBA*	1	2	0.50
Bushtit	2A*	0	1	0.00
Yellow Warbler	2A	1	1	1.0

* Nests found within footprint of restoration.

Nest monitoring results of riparian restoration sites on the Sacramento and Cosumnes River have shown that these sites can have relatively high reproductive success in the first few years following recolonization (Small et al. 1999, Haff et al. 2000). By monitoring the nests on restoration plots, we will be able to determine if, and when, these sites are providing habitat capable of sustaining or increasing populations of local songbirds.

TERRITORY MAPPING

The 2002 breeding season was our fourth year of intensive territory mapping on the Saeltzer Dam and Project Area sites (Table 7), and second year of mapping on 2A and Reading Bar restoration plots.

Reference Sites (Nest Plots)

With the increased accuracy territory mapping with color banded birds, were able to determine that there are quite a few more territories for Song Sparrow on the project area than previous estimates had suggested. However, many of these territories at the Project Area, contained only males, suggesting this site may not be favored habitat for breeding females. Estimates of

the number of territories of other focal species were similar to previous years (Burnett and DeStaebler 2002). Densities of Yellow Warbler, Yellow-breasted Chat, Black-headed Grosbeak, and Song Sparrow continue to be higher at Clear Creek than at other Sacramento Valley sites (PRBO unpublished data). The breeding densities of these species, as determined by territory mapping data, will be used as reference for determining the success of restoration efforts in creating high quality songbird habitat.

Table 7. Number of territories of Focal Species on two reference site nest plots at Clear Creek, 2002.

Plot	# of hectares	Spotted Towhee	Song Sparrow	Yellow-breasted Chat	Black-headed Grosbeak	Yellow Warbler
Project Area	19	10.00	7.50	7.50	6.00	2.00
Saeltzer Dam	15	8.00	5.25	9.25	7.00	3.16

Restoration Plots

Territory mapping of the restoration plots will allow us to document the response of birds to restoration. Songbird breeding densities determined from territory mapping, along with a measure of reproductive success, can be used as an indicator of breeding habitat quality. In 2002 a larger number of birds were found to be incorporating portions of the 2A restoration plot into their territories including a Lazuli Bunting, several Black-headed Grosbeaks, and Bushtits; of these pairs, the Bushtits were the only ones for which we confirmed a nesting attempt in the revegetation (see Table 6). Numerous species, including five Riparian Focal Species (RHJV 2000), were documented adjacent to the 2A restoration plot in remnant Cottonwood-Willow and White Alder habitat. These territories were outside the footprint of the restoration plot and were therefore not included in mapping data.

We documented an increased use of the 2A site by many non-territorial birds at the end of the breeding season. Many of these birds were identified as juveniles, probably locally produced birds dispersing from nearby their natal grounds. Restoration sites may provide a unique opportunity for young birds to forage free from competition and harassment of territorial adults. We hypothesize that in 2003, with continued maturation of restoration plot vegetation, there will be an increase in the number of breeding songbird territories at these sites.

MIST NETTING

A summary of the 2002 mist-netting effort is provided in Appendix C. An index of productivity can be obtained by comparing the number of young (hatching year) to adult captures, and provide insight into the reproductive output of a local population. We compared the Hatching Year/After Hatching Year (HY/AHY) ratio for the ten most commonly captured species at our netting sites (Table 8). The HY/AHY ratio for all ten species combined at the Project Area site in 2002 was 0.66. The HY/AHY ratio for all ten species combined at the Saeltzer Dam site was 0.60. Many species we captured had high HY/AHY ratios, continuing to prove that Clear Creek is a relatively productive riparian site for the breeding birds.

Table 8. Captures at Project area and Seltzer Dam by species and age in 2002.

Species	Project Area			Saeltzer Dam		
	HY	AHY	Ratio	HY	AHY	Ratio
Bewick's Wren	12	6	2.00	9	1	9.00
Black-headed Grosbeak	2	15	0.13	7	10	0.70
Bushtit	25	5	5.00	6	5	1.20
Lesser Goldfinch	0	4	0.00	6	21	0.29
Oak Titmouse	13	8	1.63	11	4	2.75
Orange-crowned Warbler	7	10	0.70	5	6	0.83
Song Sparrow	9	12	0.75	6	14	0.43
Wrentit	7	2	3.50	4	4	1.00
Yellow-breasted Chat	6	15	0.40	6	22	0.27
Yellow Warbler	0	4	0.00	0	4	0.00
TOTAL	104	157	0.66	60	100	0.60

AREA SEARCHES

Area search data collected in 2002 at the Old Mill wetland restoration site has shown the area is not supporting breeding wetland species such as waterfowl, wading birds, and shorebirds. Undoubtedly this is due to the sites lack of standing water through the breeding season.

CONCLUSIONS

Nest monitoring and mist-netting data suggest 2002 was an above average year for productivity of the local songbird populations at Clear Creek. Recent restoration work in the western portions of the Project Area do not appear to have had negative effects on the productivity of songbirds at sites 300 meters downstream.

2002 marked the first year we have documented nesting attempts on restoration plots. There was an increase in use of these sites by non-breeding birds, both before and after the breeding season. However, point count and territory mapping data has shown that restoration plots are not yet being used as breeding habitat by more than a few pairs of birds.

A newly established point count route below Whiskeytown Dam had the highest abundance of Yellow-breasted Chat, Song Sparrow, and Yellow Warbler of all the sites we have surveyed in the lower watershed. These upstream sites may be important source populations for recolonization of restoration sites in the lower watershed and may be part of the reason why these three rare Sacramento valley breeders are still present at Clear Creek.

In future years, with continued monitoring, we will be able to use reproductive success, annual survival, abundance, species richness, and breeding densities at restoration plots and reference

sites in order to gain a better understanding of habitat associations and determine the effectiveness of the restoration in creating high quality songbird habitat. Furthermore, by comparing songbird monitoring data with fish monitoring data we will be able to evaluate whether this restoration effort, and potentially other projects, can be mutually beneficial to salmonids and songbirds.

RECOMMENDATIONS

Based on the data collected from 1999 – 2002 at Clear Creek, long-term research conducted at restoration sites on the lower Sacramento River by PRBO (Small et al. 1999), and the Riparian Bird Conservation Plan (RHJV 2000), we submit the following recommendations:

Limit restoration and management activities during the breeding season: Restoration activities that involve vegetation clearing, mowing, spraying or cutting should be confined to the non-breeding season (mid-August to mid-March). Planned disturbance events should be timed to minimize impacts to nesting bird species (Appendix B). If activities that will disturb nesting birds absolutely must be conducted during the breeding season we recommend they take place before May 1 or after August 1. We continue to recommend that PRBO be consulted on the potential impacts any restoration activity may have on birds at Clear Creek during any time of the year.

Maintain and create emergent wetlands: With current restoration efforts resulting in the loss of wetland and marsh habitat within the floodplain, we recommend the creation and restoration of other wetland sites in the floodway. Wetlands provide unique and important habitat for numerous species of birds and other riparian dwelling taxa. We support efforts such as leaving old channels as backwater wetlands. We recommend that future restoration designs increase the acreage and depth of scour channels in the flood plain. These features have been the sites of increased natural recruitment of native vegetation and result in habitat diversity.

Restore natural processes: At Clear Creek there is a unique opportunity through salmonid management to create high water events simulating historical flood regimes. PRBO data from restoration sites in the Central Valley has shown that flooding promotes recruitment of native woody and herbaceous species, such as the White Alder patch at the Reading Bar restoration plot, and has the potential to maintain early successional habitat. We support the efforts to restore processes that will create a naturally dynamic riparian system.

Promote system-wide high structural and plant species diversity: Planting a wide array of native tree, shrub, forb, and grass species is recommended in order to provide a more diverse and structurally complex plant community for the wide range of riparian bird species.

Plant in mosaic design: Planting dense shrub patches, interspersed with tree/shrub patches, achieves a semi-open canopy, which invigorates under and middlestory growth, increasing foliage volume and potential nesting and foraging locations for many bird species.

Promote natural recruitment of early successional habitat: Encourage natural recruitment between planted rows of both 1) tree and shrub species, and 2) native herb and sedge species, through experimental management regimes, in order to provide more wildlife cover and as an alternative weed control method.

Preserve old trees: Retain as many existing native trees on restoration sites as possible, constructing and planting around them to promote occupancy of the site by species requiring mature trees (e.g., cavity nesters, orioles). Clear Creek supports many cavity nesting species that require older trees, including four species of woodpecker, Oak Titmouse, and Ash-throated Flycatcher.

Recommended planting mix:

Trees: Box Elder (*Acer negundo*), Fremont Cottonwood (*Populus fremontii*), Interior and/or Canyon Live Oak (*Quercus wislizenii*, *Q. chrysolepis*), Valley Oak (*Q. lobata*), Oregon Ash (*Fraxinus latifolia*), White Alder (*Alnus rhombifolia*), and Willow species (*Salix* spp.).

Shrubs: Blue Elderberry (*Sambucus mexicana*), Wild Rose (*Rosa californica*), Arroyo Willow (*Salix lasiolepis*), and Coyote Bush (*Baccharis pilularis*). These species provide excellent nest substrate and/or positively influence bird diversity (Burnett and DeStaebler 2002, Small et al. 1999).

Forbs, Sedges, Grasses and Vines: California Blackberry (*Rubus ursinus*), Mugwort (*Artemisia douglasiana*), California Grape (*Vitis californica*), Sedge species (*Carex barbareae*, etc.) and native grasses. These species are frequently used as nest substrate by Spotted Towhee, Song Sparrow, and Common Yellowthroat, and may inhibit invasion of non-native plant species in the restoration sites.

PERSONNEL

Project manager Ryan Burnett, field supervisor Jim DeStaebler and field biologists Brenda Blinn, Jennifer Millard, and Jolie Hendricks conducted all fieldwork in 2001. The Clear Creek project is carried out under the guidance of PRBO Terrestrial Program Director Geoffrey Geupel.

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Appendix A. Clear Creek Education Program 2002 Products.

In 2002 we expanded the public education component of the project to include outreach to school and community groups in the Redding area. The first year of the project allowed us to lay the groundwork towards continuing and expanding this essential component of the project in future years. The following was accomplished in 2002:

1. Established relationships with key community groups

Horsetown Clear Creek Preserve- Working with Gene Clark from the preserve, we coordinated and hosted an International Migratory Bird Day (May 11) event at our mist netting site on the preserve.

Public School community- Due to the late start of our outreach efforts (May), we were unable to host any schools at the mist netting sites in 2002. Teachers had already scheduled field trips for the remainder of the year when our education component began. As a result, the education intern began contacting schools for the 2003 season. Nineteen schools were contacted and invited to participate in field visits for the 2003 breeding season. Follow up will occur in February 2003 to ensure participation from teachers.

Wintu Audubon Society- Gave power point talk at monthly member meeting. Members of this group then volunteered to conduct area searches at several study sites along Clear Creek.

*Turtle Bay Museum-*We contacted Brian Joseph, the executive director of the museum, to arrange to have their volunteer docents attend field trip to mist-netting sites at Clear Creek to teach them about birds and the restoration project in general.

*Ca Native Plant Society-*We began work to organize a tour of restoration plots combined with mist-netting demonstrations to be publicized in the CNPS newsletter.

Boy Scouts of America, Redding Field Office- Working on the idea of creating a Bird Study Merit Badge opportunity.

2. International Migratory Bird Day Event

Working with Gene Clark from the Horsetown Clear Creek Preserve, we coordinated and hosted an International Migratory Bird Day (May 11) mist-netting and bird banding demonstration at our Saeltzer Dam mist netting station. Approximately 25 people of all age attended the event. The biologists on the project were available to speak about the Clear Creek restoration project and PRBO's bird monitoring project. We handed out migratory bird stickers, posters, and tip sheets for individuals on how to help birds at home and in their communities.

3. "A songbird in the hand"

Feature article in the Redding Record Searchlight paper. The writer is interested in doing future pieces.

4. Educational Materials

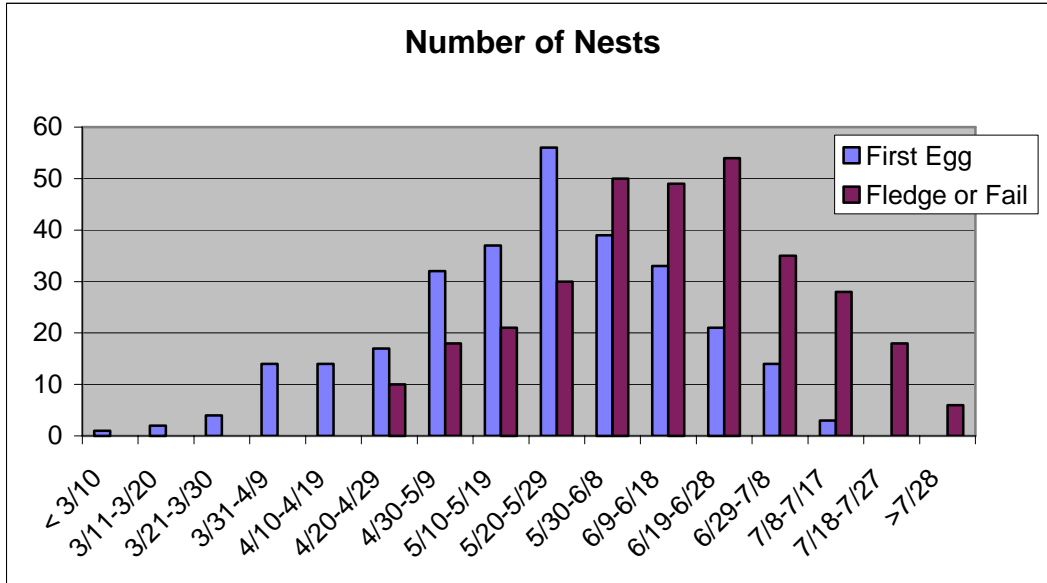
The education intern also developed the following education materials for use in future education programs:

Birds of Clear Creek checklist

Vegetation of Clear Creek handout

Focal Bird Profiles handout of the five focal birds of the Clear Creek watershed

Appendix B. Timing of songbird nesting at Clear Creek from 1999-2002 nest data.



Appendix C. Summary of captures and effort at Project Area and Saeltzer Dam, Clear Creek, 2001.

Site	Net Hours	Total Captures	New	Recaps.	Unbanded	Birds/100 Net-hours	Species Richness
Project Area	449.5	340	258	70	12	75.63	38
Saeltzer Dam	444.3	261	193	55	13	58.92	34

Appendix D. Dates of mist net operation, 2001.

Site	1	2	3	4	5	6	7	8	9
Project Area	4-May	11-May	24-May	5-Jun	17-Jun	27-Jun	3-Jul	11-Jul	21-Jul
Saeltzer Dam	5-May	12-May	25-May	6-Jun	18-Jun	29-Jun	4-Jul	12-Jul	22-Jul

Appendix E. Common name, scientific name, and breeding status of all species detected at Clear Creek, 1999-2002.

A.O.U. Common Name	Scientific Name	Breeding Status
Acorn Woodpecker	<i>Melanerpes formicivorus</i>	3
Allen's Hummingbird	<i>Selaphorus sasin</i>	1
American Coot	<i>Fulica Americana</i>	2
American Crow	<i>Corvus brachyrhynchos</i>	1
American Dipper	<i>Cinclus mexicanus</i>	3
American Goldfinch	<i>Carduelis tristis</i>	2
American Robin	<i>Turdus migratorius</i>	3
Anna's Hummingbird	<i>Calypte anna</i>	3
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>	3
Bald Eagle*	<i>Haliaeetus leucocephalus</i>	0
Band-tailed Pigeon	<i>Columba fasciata</i>	1
Bank Swallow*	<i>Riparia riparia</i>	1
Barn Swallow	<i>Hirundo rustica</i>	1
Belted Kingfisher	<i>Ceryle alcyon</i>	3
Bewick's Wren	<i>Thryomanes bewickii</i>	3
Black Phoebe	<i>Sayornis nigricans</i>	3
Black-chinned Hummingbird	<i>Archilochus alexandri</i>	2
Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	3
Black-throated Gray Warbler	<i>Dendroica nigrescens</i>	0
Blue Grosbeak	<i>Guiraca caerulea</i>	3
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	2
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	1
Brown-headed Cowbird	<i>Molothrus ater</i>	3
Bullock's Oriole	<i>Icterus bullockii</i>	3
Bushtit	<i>Psaltriparus minimus</i>	3
California Quail	<i>Callipepla californica</i>	3
California Towhee	<i>Pipilo fuscus</i>	3
Canada Goose	<i>Branta canadensis</i>	3
Cassin's Vireo	<i>Vireo cassinii</i>	1
Cedar Waxwing	<i>Bombycilla cedrorum</i>	0
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	0
Cliff Swallow	<i>Hirundo pyrrhonota</i>	3
Common Merganser	<i>Mergus merganser</i>	3

Songbird Monitoring in the Lower Clear Creek Floodway Restoration Project, 2002

A.O.U. Common Name	Scientific Name	Breeding Status
Common Moorhen	<i>Gallinula chloropus</i>	1
Common Nighthawk	<i>Chordeiles minor</i>	1
Common Raven	<i>Corvus corax</i>	1
Common Yellowthroat	<i>Geothlypis trichas</i>	3
Cooper's Hawk	<i>Accipiter cooperii</i>	3
Downy Woodpecker	<i>Picoides pubescens</i>	3
Dusky Flycatcher	<i>Empidonax oberholseri</i>	0
European Starling	<i>Sturnus vulgaris</i>	3
Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>	0
Great Blue Heron	<i>Ardea herodias</i>	1
Great Egret	<i>Casmerodius albus</i>	1
Great-horned Owl	<i>Bubo virginianus</i>	3
Green Heron	<i>Butorides striatus</i>	3
Hairy Woodpecker	<i>Picoides villosus</i>	3
Hammond's Flycatcher	<i>Empidonax hammondii</i>	0
House Finch	<i>Carpodacus mexicanus</i>	3
House Wren	<i>Troglodytes aedon</i>	3
Hutton's Vireo	<i>Vireo huttoni</i>	2
Killdeer	<i>Charadrius vociferous</i>	3
Lark Sparrow	<i>Chondestes grammacus</i>	3
Lazuli Bunting	<i>Passerina amoena</i>	3
Lesser Goldfinch	<i>Carduelis psaltria</i>	3
Lincoln's Sparrow	<i>Melospiza lincolni</i>	0
MacGillivray's Warbler	<i>Oporornis tolmiei</i>	0
Mallard	<i>Anas platyrhynchos</i>	3
Mourning Dove	<i>Zenaida macroura</i>	3
Nashville Warbler	<i>Vermivora ruficapilla</i>	0
Northern Flicker	<i>Colaptes auratus</i>	3
Northern Mockingbird	<i>Mimus polyglottos</i>	1
Northern Parula	<i>Parula americana</i>	0
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	3
Nuttall's Woodpecker	<i>Picoides nuttallii</i>	3
Oak Titmouse	<i>Parus inornatus</i>	3
Orange-crowned Warbler	<i>Vermivora celata</i>	3
Osprey	<i>Pandion haliaetus</i>	3

Songbird Monitoring in the Lower Clear Creek Floodway Restoration Project, 2002

A.O.U. Common Name	Scientific Name	Breeding Status
Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	0
Phainopepla	<i>Phainopepla nitens</i>	0
Pied-billed Grebe	<i>Podilymbus podiceps</i>	3
Red-shouldered Hawk	<i>Buteo lineatus elegans</i>	2
Red-tailed Hawk	<i>Buteo jamaicensis</i>	2
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	2
Rufous Hummingbird	<i>Selasphorus rufus</i>	0
Song Sparrow	<i>Melospiza melodia</i>	3
Spotted Sandpiper	<i>Actitis macularia</i>	3
Spotted Towhee	<i>Pipilo erythrophthalmus</i>	3
Swainson's Thrush	<i>Catharus ustulatus</i>	0
Tree Swallow	<i>Tachycineta bicolor</i>	3
Turkey Vulture	<i>Cathartes aura</i>	1
Violet-green Swallow	<i>Tachycineta thalassina</i>	3
Virginia Rail	<i>Rallus limicola</i>	1
Warbling Vireo	<i>Vireo gilvus</i>	0
Western Bluebird	<i>Sialia mexicana</i>	1
Western Kingbird	<i>Tyrannus verticalis</i>	3
Western Meadowlark	<i>Sturnella neglecta</i>	0
Western Scrub-jay	<i>Aphelocoma coerulescens</i>	3
Western Tanager	<i>Piranga ludoviciana</i>	0
Western Wood-pewee	<i>Contopus sordidulus</i>	3
White-breasted Nuthatch	<i>Sitta carolinensis</i>	3
Wild Turkey	<i>Meleagris gallopavo</i>	3
Willow Flycatcher*	<i>Empidonax traillii</i>	0
Wilson's Warbler	<i>Wilsonia pusilla</i>	0
Wood Duck	<i>Aix sponsa</i>	2
Wrentit	<i>Chamea fasciata</i>	3
Yellow Warbler	<i>Dendroica petechia</i>	3
Yellow-billed Magpie	<i>Pica nutalli</i>	1
Yellow-breasted Chat	<i>Icteria virens</i>	3
Yellow-rumped Warbler	<i>Dendroica coronata</i>	0

Breeding Status: 3 = confirmed breeder, 2 = probable breeder, 1 = possible breeder, 0 = detected but not believed to breed at Clear Creek. Asterisks indicate species listed as either threatened or endangered (state and /or federal). Species in bold indicate California Partners In Flight Riparian Focal Species.

