

Using Songbird Monitoring to Guide and Evaluate Riparian Restoration in Salmonid-Focused Stream Rehabilitation Projects¹

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Abstract

A restoration effort, primarily focused on reducing stranding and improving passage of anadromous fish, has been undertaken along sections of lower Clear Creek, Shasta County, California. Similar projects are occurring throughout California and, indeed, all of North America. To monitor the effects of these efforts at Clear Creek we implemented a multi-faceted songbird monitoring study. We have collected three years of data on abundance, diversity, reproductive success, and habitat associations of songbird populations at Clear Creek study plots where extensive watershed/salmonid restoration activities are in progress or slated to occur and at several reference sites where no restoration is planned. We used preliminary site-specific results and the California Partners in Flight Riparian Bird Conservation Plan to provide multi-level management recommendations. Monitoring songbirds on this and other restoration sites has proven a pragmatic approach on several levels. Songbird monitoring can (1) measure the effectiveness of restoration; (2) provide the necessary feedback for adaptive management; (3) guide restoration design by providing information on the health and habitat associations of the local bird populations; (4) be cost effective; and (5) provide education and outreach opportunities.

Key words: adaptive management, Clear Creek, monitoring, restoration, riparian, songbird.

Introduction

The extensive human-caused loss and degradation of functioning ecosystems has made clear the need to accelerate their recovery. Species associated with the

most impacted ecosystems have suffered local extirpations and/or population declines. In California, for example, riparian habitat is the single most important habitat type for landbirds (Gaines 1977, Manley and Davidson 1993); unfortunately, it is estimated that less than 5 percent of the state's riparian habitat remains (Smith 1980). Species such as the Least Bell's Vireo (*Vireo bellii pusillus*) and Willow Flycatcher (*Empidonax traillii*), once common breeders in riparian habitat throughout the Sacramento River Valley, have been extirpated from the region, and several others are rare or declining (Grinnell and Miller 1944, Gaines 1977, RHJV 2000).

Hence, numerous riparian restoration efforts have recently been undertaken in the Central Valley of California and throughout the state.³ Integral to restoration projects is the inclusion of monitoring to evaluate the objectives of the project (SER 2002). Unfortunately, many restoration projects focus on only a single threatened or endangered species, and the project goals and objectives reflect this bias. In such situations, restoration efforts probably are not addressing the needs of the majority of species within an ecosystem. Conversely, the entire host of ecological variables in a system influenced by restoration is too great to measure in a reasonable timeframe and at a reasonable cost.

With the current threats to riparian songbirds 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, Rich 2002). Along with the relative ease of study (e.g., nationally standardized protocols and relative abundance of songbirds) and the cost effectiveness of a monitoring program, songbird monitoring provides 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.

Songbird monitoring of riparian restoration projects can provide data on several different levels. Here we

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describe how songbird monitoring can limit negative impacts and increase the benefits of a restoration project to songbirds and potentially other riparian dwelling taxa as well. We then describe the Clear Creek Project as an example of the effectiveness of songbird monitoring in riparian restoration, including site-specific examples of how this data has been used to enhance restoration so that its benefits extend beyond just salmonids.

Uses of Songbird Monitoring Data

Songbird monitoring can provide the following components key to a successful ecosystem-based restoration project:

- 1) Data on the current distribution and habitat uses of birds specific to a site before restoration begins, in order to avoid disturbing hot spots of bird diversity or abundance or sites used by species of special conservation interest
- 2) Feedback on the short-term negative effects restoration activities may have on songbirds, in order to find ways to minimize these effects for future phases of a project
- 3) Species- and site-specific habitat associations that can be used to develop restoration design and revegetation planting mixes
- 4) An excellent outlet to the public for educating the local community about a restoration project
- 5) Feedback on the overall success of restoration in improving habitat for songbirds and, perhaps, a broad range of taxa although the latter needs formal testing. This last is most important.

The Clear Creek Restoration Project

In 1998 a team of Federal, State, and local officials came together in order to restore riparian habitat along the Lower Clear Creek Watershed in Shasta County, California. The watershed had been subjected to a long history of human-induced disturbance, starting with the discovery of gold in 1848. Since that time the creek has been extensively altered, first from gold mining, followed by the building of Whiskeytown Dam 17 miles upstream from its confluence with the Sacramento River, and most recently from aggregate mining. The primary focus of the restoration team was to create higher quality anadromous fish habitat in the floodway.

Despite extensive human alteration of the Clear Creek watershed, initial surveys of the riparian habitat indicated that it supported a rather intact riparian bird community, with several species that have disappeared

from much of the Sacramento Valley, such as Song Sparrow (*Melospiza melodia*), Yellow-breasted Chat (*Icteria virens*), and Yellow Warbler (*Dendroica petechia*), breeding in fairly high numbers.

To preserve what appeared to be a fairly healthy bird population and provide recommendations to create higher quality riparian habitat, in 1999 the Point Reyes Bird Observatory (PRBO), as part of the Clear Creek Restoration Team, initiated a project to monitor the effects of restoration on the songbird community at Clear Creek.

We implemented a multiple-method monitoring plan in order to gain information on abundance, distribution, reproductive success, survival, and habitat associations of songbirds and on how restoration efforts influenced each of these parameters. The five methods employed to meet these objective were nest monitoring, constant-effort mist-netting, territory mapping, point counts, and area searches (Ralph et al. 1993).

To assist in their restoration project, the Clear Creek restoration team has employed many of the recommendations we have made based on the results of our data collected at Clear Creek as well as data from other riparian restoration sites in the Central Valley and the riparian bird conservation plan (RHJV 2000). Here we provide examples of how our data have led to recommendations and on-the-ground implementation. (For a complete description of methods, results, and recommendations, see Burnett and DeStaebler 2002).

Songbird Habitat Associations

Using point count data, we related bird species richness and the abundance of each riparian focal species (RHJV 2000) to habitat characteristics. We then used the focal species correlations to build predictive models. When developed at the scale of a restoration project, habitat correlations and models can provide meaningful site-specific information about the influence of habitat features on the abundance, richness, and distribution of species, which can be used to help guide restoration design. The following two examples from Clear Creek illustrate how bird monitoring can influence restoration design.

First, positive correlations between mugwort (*Artemisia douglasiana*) and both species richness and the abundance of several focal species (*table 1*) led to the recommendation and inclusion of mugwort in planting mixes at Clear Creek. Second, a model predicting Yellow-breasted Chat abundance determined the habitat variables (e.g., California Blackberry, *Rubus ursinus*) that locally influence its distribution (*table 2*). Although the chat is a California Species of Special Concern (CDFG and PRBO 2001) and

Table 1— Bird variables positively influenced by the relative cover of mugwort at Clear Creek.

Variable	Correlation coefficient	P
Spotted Towhee (<i>Pipilo maculatus</i>) abundance	0.32	0.041
Song Sparrow (<i>Melospiza melodia</i>) abundance	0.47	0.003
Species richness	0.27	0.10

Table 2— Stepwise linear regression model predicting Yellow-breasted Chat abundance at Clear Creek.

Variable	Regression coefficient	se	P
Sedge species (<i>Carex</i> spp.)	0.01	0.005	0.01
California Blackberry (<i>Rubus ursinus</i>)	0.07	0.02	0.001
Sandbar Willow (<i>Salix exigua</i>)	0.01	0.005	0.01
Black Mustard (<i>Brasica nigra</i>)	0.03	0.01	0.03

Dependent variable = Log Yellow-breasted Chat abundance
 N = 39, F (4, 34) = 8.70, P < 0.001, Adj. R² = 0.51

an uncommon breeder in the Central Valley, it is fairly abundant at Clear Creek (Burnett and DeStaebler 2002), and, therefore, an important species to manage for at this site.

With these species-specific models, as well as correlations with broader population indices, we were better able to identify habitat components at Clear Creek associated with important focal species and the songbird community as a whole. With this information, restorationists at Clear Creek are able to address the needs of the local songbird community and thereby generate a more ecologically valuable restoration project.

Completing the Adaptive Feedback Loop

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

Conclusion

Incorporating songbird monitoring into salmonid-focused riparian restoration projects such as Clear Creek can transform a single-species focused restoration project into a multi-species community-based effort that will undoubtedly benefit more species. With the loss of over 95 percent of the riparian habitat in California, it is essential that restoration projects based in these habitats broaden their scope beyond the needs

of individual species and take an ecosystem-based approach. Without the use of multi-species monitoring programs it is impossible to determine whether the needs of an entire system are being met. Songbird monitoring is a practical means by which the necessary feedback can be obtained to assess the broadscale effectiveness of a restoration project.

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