

Bird Monitoring as an Aid to Riparian Restoration

Findings from the Trinity River in northwestern California



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Program Area

The Trinity River Restoration Program works in a 40-mile program area, defined as the mainstem Trinity River from the Lewiston Dam to its confluence with the North Fork Trinity River.

Trinity River Restoration Program

The Trinity River Restoration Program began in 2000 with the goal of restoring the Trinity River's salmon and steelhead fisheries, which were severely degraded during the last half-century as a result of dams, water diversions under the Central Valley Project, and land-use practices such as gold mining. The restoration program, as outlined in the U.S. Department of the Interior's Record of Decision (2000), was founded to restore the fisheries by restoring features of a healthy alluvial river system, such as spring floods, river channel complexity, and gravel spawning habitat.

An additional program goal was to maintain or enhance riparian habitat. While some riparian habitat was lost as an expected consequence of channel rehabilitation activities, new riparian habitat has started to form due to strategic plantings and natural regeneration. This restored riparian habitat is being adaptively managed to increase plant species diversity and structural complexity and provide benefits for wildlife. Bird monitoring evaluates and informs riparian restoration by demonstrating wildlife benefits and identifying habitat features still needed for a functional riparian ecosystem.

Birds as Ecological Indicators

In order to understand the health of the environment it is necessary to use indicators because ecological systems are too complex to measure fully. While no single group of organisms can exactly represent the health of another, birds are among the best indicators to use (Hutto 1998, Altman 2000, Carignan and Villard 2002). Birds are **diverse** and they represent a large number of specific ecological conditions. Importantly, birds are **well-studied** so their habitat associations are generally well-known. Birds are also **cost-effective** to survey; a simple standardized methodology can detect over 200 species, providing information about associated ecological conditions. Additionally, birds tend to be **high on the food chain** so their persistence on the landscape depends on the presence of multiple other species. Finally, birds are effective indicators because they **respond to habitat changes at various scales**, due to their links to taxa that respond to small- and large-scale disturbance (e.g., insects and some mammals, respectively). When these factors are considered together, it is apparent that bird monitoring programs provide useful information about the integrity and functioning of the environment as a whole.

The Focal Birds

Five bird species – one resident and four migrants – were selected as riparian focal species for the Trinity River Restoration Program. In combination, these species represent key structural components of a riparian ecosystem capable of supporting numerous other species.



SONG SPARROW (*resident*)

This heavily-streaked russet, gray, and white bird is perhaps the most familiar sparrow in the United States. They are also our most common focal species. Song Sparrows keep relatively low to the ground as they utilize grasses and shrubs for nesting and foraging. They feed on seeds, berries, and a variety of invertebrates. As habitat generalists, Song Sparrows will inhabit numerous habitats containing **low, dense thickets** near wet or marshy areas. They are our first focal species expected to inhabit restored riparian and our first indication that young habitat is on a successful trajectory.



BLACK-HEADED GROSBEAK (*migrant*)

A large bill combined with a black, white, and cinnamon pattern helps identify males of this species. Black-headed Grosbeaks are often most abundant in riparian zones, young mixed conifer and hardwood forests, and at the interface between these two habitat types. They conceal their nests in the midstory and feed mainly on insects, seeds, and berries. On the Trinity, grosbeak abundance in the riparian zone is associated with **semi-open canopy, moderate shrub cover, and vertical stratification of vegetation layers, with a deciduous component**. These birds indicate the presence of young forest stands.



YELLOW-BREASTED CHAT (*migrant*)

White “spectacles” adorn the grayish head of this vocal bird with a bright yellow chest. Yellow-breasted Chats nest in the understory, often fewer than five feet off the ground. Their diet includes both insects and berries. This focal species prefers the **edges of large, dense thickets** in riparian or floodplain areas, often where there is an **open canopy overstory**. Yellow-breasted Chats indicate restored riparian areas where significant stands of shrub vegetation have established and canopy vegetation is present.



YELLOW WARBLER (*migrant*)

This bird with rich yellow plumage sports a prominent black eye. Yellow Warblers nest in midstory vegetation, typically between 1 and 14 feet off the ground. They feed almost exclusively on insects. Yellow Warblers are indicators of wet areas and **riparian thickets and woodlands**, particularly those dominated by willows and cottonwoods. Yellow Warblers, like Yellow-breasted Chats, indicate restored riparian areas with dense shrub vegetation and a canopy layer present.



TREE SWALLOW (*migrant*)

Iridescent blue-green above and snow-white below, the Tree Swallow is often seen in flight. Tree Swallows require **open areas** for foraging, preferably near water. The bulk of their diet is formed from insects taken on the wing, but berries and seeds may be eaten too. This focal species also indicates the presence of **large trees or standing dead trees (i.e., snags)**—features of mature forests—where they place their grass-lined nests in the absence of nest boxes.

(Sources: Ehrlich et al. 1998, Marshall et al. 2003, RHJV 2004)

Population Trends

We detect **stable or increasing populations for our five focal species over the past ten years at two landscape scales**. At the **regional scale** of northwestern California, an analysis of Breeding Bird Survey data from the years 2002-2009 showed neither increasing nor decreasing trends for the five focal species (USGS 2012). In contrast, during the same time period at the **40-mile program area scale** (i.e., mainstem Trinity River from Lewiston Dam to its confluence with the North Fork Trinity River), populations increased for four of the five focal species (Song Sparrow, Black-headed Grosbeak, Yellow-breasted Chat, and Yellow Warbler); no trends were detected for the Tree Swallow (Miller et al. 2010).

At the **restoration site scale**, we had sufficient data for trend analysis at only one site—Hocker Flat—and even here results should be interpreted cautiously due to a small sample size. We analyzed population trends for the five focal species from 2005, the year channel rehabilitation occurred, through 2011. Song Sparrows showed reduced abundance immediately following channel rehabilitation activities, but then showed an increasing abundance trend such that their abundance reached pre-rehabilitation levels five years after restoration (Ausprey et al. 2012, Figure 1).

In a separate analysis using data from bird banding stations, we detected additional signals of reduced abundance following channel rehabilitation activities. During the first year post-restoration at the Hocker Flat site, abundance of Song Sparrow, Yellow Warbler, and Yellow-breasted Chat declined while abundance of these species increased, on average, across five untreated sites during the same time period (Alexander et al. In Review). Due to small sample sizes, these findings should be considered with caution.

Over 130 species of birds were detected during surveys in the program area, demonstrating the value of the Trinity River and its riparian habitat to avian diversity. This is consistent with the knowledge that riparian ecosystems support the most diverse bird communities in the arid and semi-arid parts of the western United States.

The five focal species were among the top ten most commonly detected birds during surveys. This abundance is needed for statistical analyses of bird population trends.

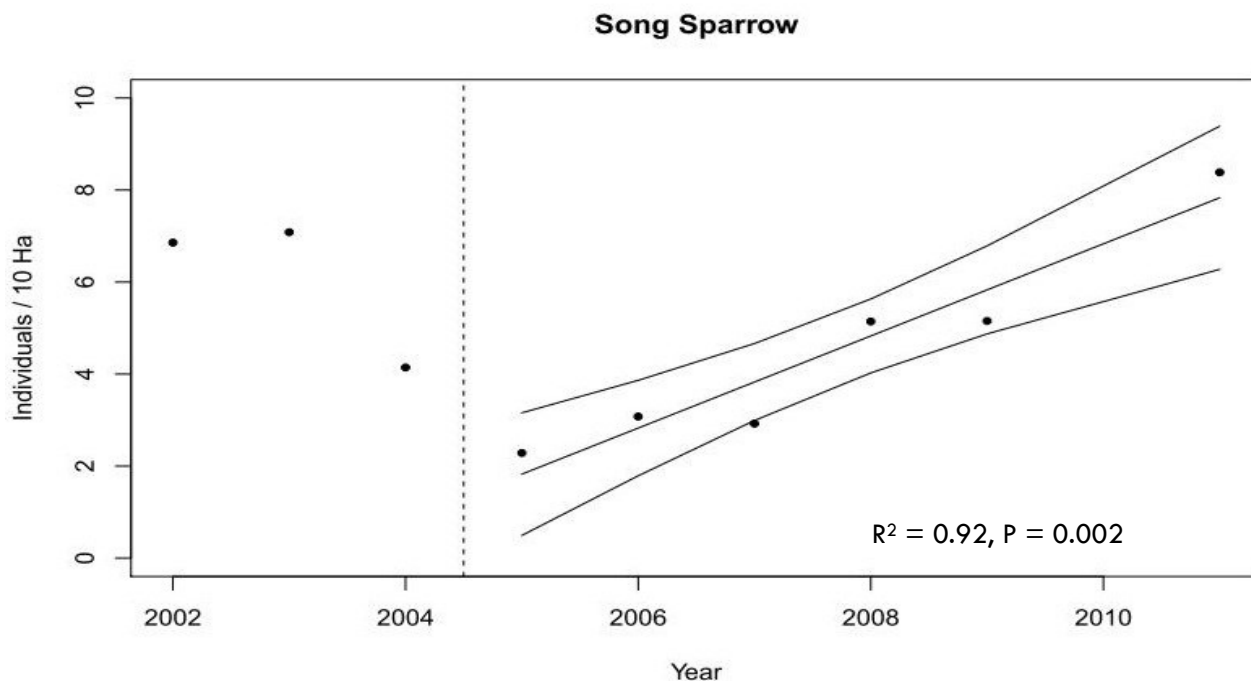


Figure 1. Abundance trend and 95% confidence bands for Song Sparrow at Hocker Flat, 2002 - 2011. The trend is estimated only for the years following site construction to investigate bird response to new vegetative growth. The vertical dashed line marks the year of construction. (Figure from Ausprey et al. 2012.)

Bird-Habitat Associations

Results from the Trinity River that quantify habitat associations of the focal species help to characterize the riparian habitat needed to support these, and other, wildlife species (Miller et al. 2005, 2010). Song Sparrows, Yellow Warblers, and Yellow-breasted Chats consistently show positive associations with willows (*Salix spp.*). To a lesser extent all focal species show positive associations with alders (*Alnus spp.*). Cottonwoods (some *Populus spp.*) are currently uncommon on the landscape and still Song Sparrows, Yellow Warblers, Yellow-breasted Chats, and Black-headed Grosbeaks show positive associations with these riparian trees. **Willows, alders, and cottonwoods** are all important components of the riparian habitat on the Trinity River.

Our findings highlight additional habitat features that should be present in a functional riparian system, based on their positive associations with focal species. These include areas with extensive **herbaceous cover** (Song Sparrow, Yellow Warbler), extensive **canopy cover** (Yellow Warbler), **numerous trees taller than 11m** (Black-headed Grosbeak), and **open areas near water** (Tree Swallow) (Miller et al. 2005, 2010).



Photo © Ian Ausprey

Restoration plantings at the Hocker Flat restoration site, 2011.

Noteworthy Findings from Broader Literature

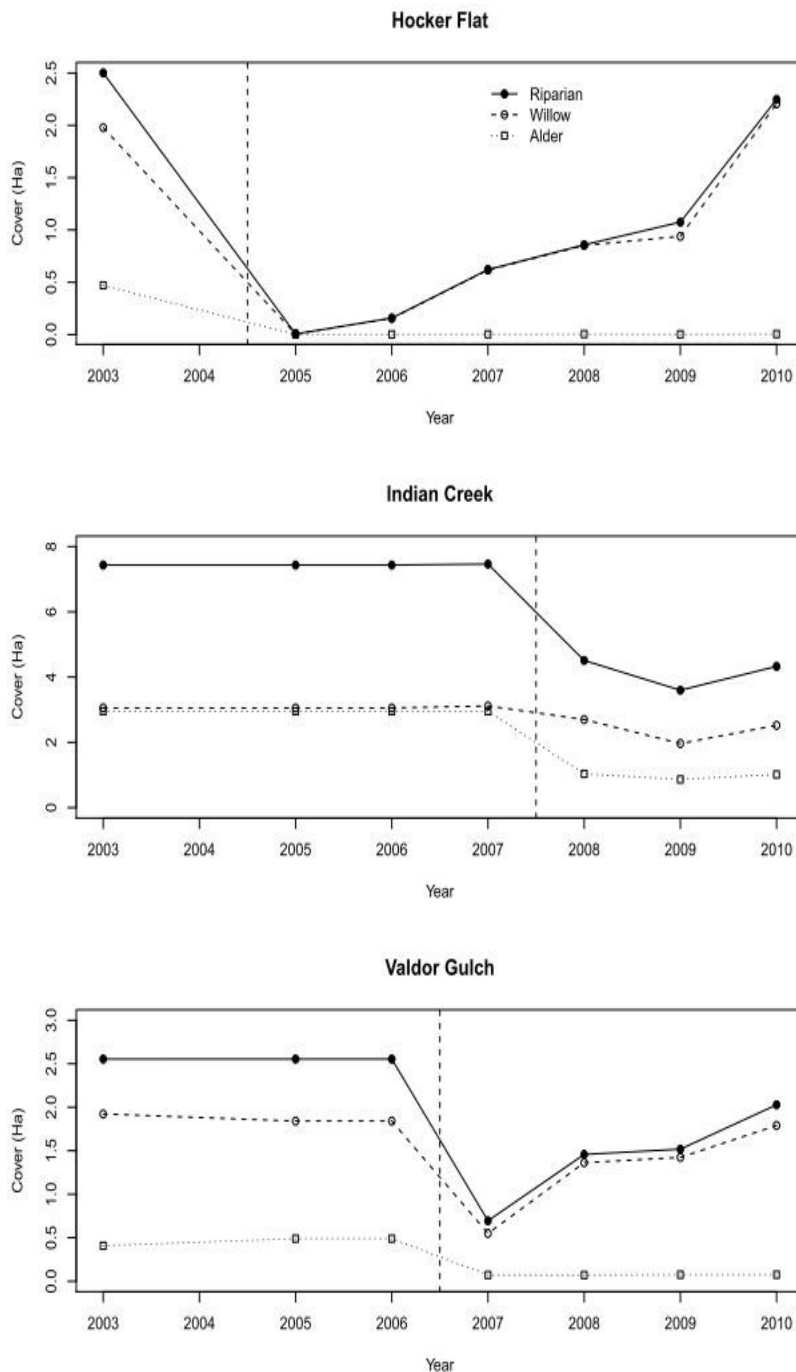
1. Song Sparrows, Yellow-breasted Chats, and Yellow Warblers are frequent hosts for Brown-headed Cowbirds (Erhlich et al. 1988, RHJV 2004). The number of young they produce each year will likely be **influenced by the size of the local cowbird population**.
2. A study by Gardali and Holmes in the Central Valley of California identified factors that explained how quickly bird abundance increased after restoration for seven species (2011). For six of the seven, the amount of riparian forest in the surrounding landscape was an explanatory factor: **the more riparian habitat on the nearby landscape, the faster bird abundance increased after restoration**. This finding serves as a guide to help prioritize future restoration projects.
3. The Lower Clear Creek Rehabilitation Project in Shasta County, California demonstrates the **value of maintaining large patches of riparian habitat** adjacent to restoration sites (Young and Burnett 2012). At one restoration site in particular, large patches of retained riparian vegetation appeared to aid the recovery of focal bird species. Three years post restoration, all focal bird species territories at this site incorporated portions of the adjacent, remnant vegetation. Yellow-breasted Chats occurred more densely here following restoration than at sites with smaller patches of remnant vegetation. At other restoration sites smaller patches of remnant vegetation also provided benefits, but to a lesser extent.

Summary

Ten years into the Trinity River Restoration Program we see that channel rehabilitation activities as implemented, including the removal of riparian berms and the construction of river channels and floodplains, did not lead to significant degradation of the riparian habitat, as indicated by increasing or stable populations of the five focal riparian bird species at the program area scale.

Riparian habitat at select restoration sites is showing increasing ecological value over time. The Song Sparrow, our focal species that uses early successional habitat, returned to pre-restoration levels of abundance within five years of channel rehabilitation activities at the Hocker Flat site (Ausprey et al. 2012), where the extent of riparian vegetation also recovered during the same time period (Figure 2). Riparian vegetation is still recovering at other sites, such as Indian Creek and Valdor Gulch, and ongoing monitoring will assess whether the ecological value of riparian habitat at restoration sites continues to increase until it can support healthy

populations of the full suite of focal species.



There are indications that channel rehabilitation activities have led to negative impacts on some focal species at the site scale immediately following channel rehabilitation (Ausprey et al. 2012, Alexander et al. In Review). This is not surprising due to the restoration-associated reduction in vegetation, and these impacts are not expected to persist if the riparian habitat is successfully replaced. That said, site-scale negative impacts can be minimized by retaining both substantial habitat at the program area scale and large patches of habitat adjacent to restoration sites (Gardali and Holmes 2011, Young and Burnett 2012).

The diverse habitat-associations we detected for the focal species lend support to the Trinity River Restoration Program's plan to create diverse and structurally and spatially complex stands of riparian habitat. Through adaptive management the Trinity River Restoration Program can use the resulting information about important habitat characteristics to better ensure functional riparian habitats are retained across the landscape and restored at project sites.

Figure 2. Recovery of riparian vegetation at three restoration sites. Construction year is indicated with dashed line. (Figure from Ausprey et al. 2012.)

Bird Monitoring Contributions Now and in the Future

Bird monitoring on the Trinity River has delivered baseline ecological data to inform restoration activities and assess its impacts and successes. Bird population data collected prior to restoration will help determine whether the program goal to maintain or enhance riparian habitat is achieved. Bird-habitat associations identify important habitat features that will guide management to ensure the recovery of focal species populations post-restoration. Bird monitoring has also demonstrated that ecological value is returning at the Hocker Flat restoration site after only a few years.

Ongoing monitoring includes methods that will provide more detailed information about the abundance of birds as well as their habitat choices and reproductive success (Stephens and Ausprey 2012). In 2012, we began implementing two additional intensive survey methodologies—spot mapping and nest monitoring—to determine whether focal species are establishing territories in restored habitat and if so, what riparian components are preferred. These new studies will also determine the reproductive success of these individuals to ensure abundance is not a misleading indicator of population health. These monitoring efforts will allow us to more precisely link bird health to restoration activities. Our findings will continue to inform the adaptive management of riparian restoration on the Trinity River, with expected benefits for wildlife and humans.

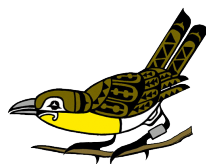
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