Yosemite National Park

Division of Resources
Management and Science

Looking Downstream

2010 Update

Physical and Ecological Responses to River Flow Downstream of Hetch Hetchy Reservoir, Yosemite National Park

March 8, 2012

By Greg Stock, Ph.D., James Roche, Monica Buhler, and Sarah Stock

National Park Service, Resources Management and Science, Yosemite National Park

Acknowledgements

We appreciate valuable discussions with, field assistance from, and data sharing with scientists from McBain & Trush, Inc., in particular Scott McBain, Bill Trush, and John Bair. We also thank Bill Sears, Jennifer Vick, Bruce McGurk, Tim Ramirez, Jim Salerno, Brian Sak, and Mike Horvath of the San Francisco Public Utilities Commission (SFPUC) for discussions, data, and support of this project. We thank Jessica Griffiths for assisting with protocol design and field work for passerine spot mapping and nest searching efforts. We appreciate Dr. Joe Szewczak for traveling from Arcata in summer 2010 to provide instruction to National Park Service biologists on how to effectively survey for bats in Poopenaut Valley. This work was funded by the SFPUC.

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Summary

The Looking Downstream project is an interdisciplinary study designed to better understand the physical processes and ecology of the mainstem Tuolumne River corridor between O'Shaughnessy Dam and the western boundary of Yosemite National Park. The project consists of hydrology, vegetation, and wildlife (bird, bat, and benthic macroinvertebrate) study components. An overarching goal of the Looking Downstream project is to provide information that water managers can use to manage environmental water releases from O'Shaughnessy Dam in ways that will more closely replicate natural physical processes and benefit dependent ecosystems downstream of the dam.

This status report details findings from the 2010 field season in Poopenaut Valley. Experimental water release objectives centered on hydrograph drawdown rates and the potential for destabilizing river and tributary banks. National Park Service work relative to hydrology focused on maintaining continuous records of stage and groundwater levels throughout the study area. Precipitation for 2010 was above average, resulting in relatively high river flows during the snowmelt period and sustained water in the seasonal pond in Poopenaut Valley.

Timing of willow seed production correlates well with peak flows and recession of a river with an unimpaired snowmelt hydrograph. It appears that duration and timing of red, shiny and arroyo willows, which occur on the banks of the river, seed dispersal correlate more to temperature and growing conditions (i.e. cool, wet springs delayed reproductive cycle) while dusky willow and narrow-leaf willow seed dispersal is directly related to flow (largely because they are under water at high flows). Dusky and narrow-leaf willows come out of dormancy in May but do not produce catkins or seeds until flows recede and they are no longer inundated.

Black cottonwoods are typically prolific seed producers on an annual basis but have produced minimal seed in Poopenaut Valley over the last three seasons (2008-2010), whereas black cottonwood on the Merced River produced many seeds. The reason for catkin drop observed on trees in Poopenaut Valley is still unknown but could be attributed to freezing temperatures or water availability, but may also be caused by fungus, insects or other pathogens; this issue needs additional investigation.

Bird survey results indicate that Poopenaut Valley provides important breeding and foraging areas for a diverse group of birds representing a variety of breeding niches and differing seasonal strategies (resident species, short-distance, and long-distance migrants). Birds observed in riparian-associated habitats occupy breeding niches of differing heights in the vertical strata, including understory, mid-story, and canopy. This finding suggests that the available habitat in Poopenaut Valley provides structural integrity beneficial to a wide diversity of birds.

Of particular interest are the avian riparian focal species that are understory nesters, which all need dense, shrubby understory and herbaceous groundcover for successful nesting. Whereas Yellow-breasted Chat and Wilson's Warbler do not appear to be resident during the breeding season, Song Sparrow is a confirmed breeder and nests in the understory riparian vegetation at the river's edge. In 2010 we documented an active Song Sparrow nest that failed due to rising river levels the week following 8 May. During years of high snow pack, Song Sparrows that build their nests on or near the ground in the riparian vegetation growing along the river's edge will probably risk having their nest destroyed by rapidly rising river levels.

However, Song Sparrows typically attempt more than one clutch, thus they may build a second nest after flood waters subside and reproduce successfully.

Preliminary bat survey results suggest that bats are an appropriate indicator species for evaluating ecological effects of dam releases on Poopenaut Valley's seasonal pond. Bats are sensitive to the abundance of emergent aquatic insects that are directly linked to water availability. The seasonal pond has been identified as a rich ecosystem and valuable resource during the summer months if it is filled by water that is released from the dam at the appropriate time.

Chapter 1. Introduction

The primary goals of the Looking Downstream project are 1) to fill in first-order information gaps by collecting baseline information on the hydrology, vegetation, birds, and bats. and benthic macroinvertebrates tied to river flow downstream of O'Shaughnessy Dam, 2) provide a general characterization of the river reach, and 3) assess its overall hydrological and ecological condition. An important overarching goal of these studies is to work collaboratively to produce science-based information and recommendations that the San Francisco Public Utilities Commission (SFPUC) can use to design environmental water releases that will be most beneficial to maintaining and enhancing ecosystems downstream of the dam.

Poopenaut Valley, a broad, low gradient valley located approximately 5.5 km (3.5 miles) downstream of O'Shaughnessy Dam, is one of the most ecologically diverse and productive areas in the river reach between the dam and the Yosemite National Park boundary. As a result, we consider Poopenaut Valley to be the location most sensitive to habitat disruption resulting from an altered hydrologic regime (National Park Service, 2009). For these reasons, we have focused our research efforts primarily in Poopenaut Valley, specifically on the meadow, wetland, and riparian ecosystems found there.

Precipitation during the spring of 2010 was above average (1930-present) for the Hetch Hetchy area, with rainfall of 35.6 cm (14.0 inches) from March through May. Snow pack within the Tuolumne River watershed on 1 May 2010 exceeded that of 1 April 2010 (113% and 101% of 1 April average, respectively). The onset of spring runoff was 16 April 2010, as determined using the maximum negative cumulative deviation from annual average flows at the USGS gage in the Grand Canyon of the Tuolumne River upstream of Hetch Hetchy Reservoir. The spring runoff peak upstream of Hetch Hetchy reservoir was substantially delayed by the late snows and occurred on 8 June 8 2010. Average dates for onset and peak spring runoff at Happy Isles gage on the Merced River are 14 April and 13 May 13, respectively (Andrews, in press), and are likely similar for the Tuolumne River above Hetch Hetchy.

As in earlier years, our 2010 research in Poopenaut Valley consisted of four main subject areas: 1) surface and ground water hydrology, 2) upland, meadow, wetland, and riparian vegetation, 3) riparian-dependent bird species, and 4) benthic macroinvertebrate assemblages. This report presents each subject area in a separate chapter. New for 2010 were preliminary surveys for bats in Poopenaut Valley, which will be expanded in 2011. Results from benthic macroinverterbrate research in 2010, previously included in the Looking Downstream reports, were reported separately by researcher Jeff Holmquist of the University of California White Mountain Research Station (Holmquist and Schmidt-Gengenbach, 2011).

Chapter 2. 2010 Hydrology Studies in Poopenaut Valley

2.1 Introduction

Monitoring of groundwater and surface water levels in Poopenaut Valley, initiated in 2007 (National Park Service, 2008, 2009), continued for a fourth season in 2010. This monitoring included stage records of the Tuolumne River, Poopenaut Valley tributaries, and the seasonal pond in Poopenaut Valley, as well as groundwater levels beneath Poopenaut Valley meadows.

Experimental water release objectives in 2010 centered on hydrograph drawdown rates and the potential for destabilizing river and tributary banks with rapid drawdowns. Stillwater Sciences conducted this work with support from National Park Service (NPS) staff (Stillwater Sciences, 2010).

NPS-specific work in 2010 relative to hydrology focused on maintaining continuous records of stage and groundwater levels throughout the study area. McBain & Trush, The San Francisco Public Utilities Commission (SFPUC), Darnell Shaw Environmental, and NPS personnel assembled and archived full records for all groundwater monitoring wells and stage recorders in Poopenaut Valley through 2010. This chapter summarizes instrumental records for the 2010 experimental high water event.

2.2 Methods

Monitoring of groundwater and surface water conditions continued in 2010 using the monitoring array initially installed in 2007 (Figure 2-1; wells 1-11) and augmented in 2009 (Figure 2-1; wells 12-19). Installation specifications are summarized in earlier Looking Downstream reports (National Park Service, 2008, 2009). An updated summary of groundwater monitoring wells and their installation elevations is shown in Table 2-1.

We used Solinst and Hobo pressure transducer dataloggers in the groundwater wells to collect hourly water level and temperature data throughout the winter and spring of 2008-2009 at 10 wells, 2 river stage recorders, 1 pond stage recorder, and 4 tributary stage recorders. Additionally, we collected air temperature, relative humidity, and barometric pressure in Poopenaut Valley. The eight additional piezometers were installed and instrumented in late April 2009. Prior to the experimental flood in 2010, all dataloggers were downloaded and reset to 15 minute logging intervals, and water levels measured manually.

2.3 Results and Discussion

Figure 2-2 depicts the overall spring flood hydrograph as recorded at the USGS gage below Hetch Hetchy Reservoir (USGS Gage 11-276500) 1 April – 27 July, 2010. The actual experimental water release period extended from May 10 to approximately 14 June 2010, as seen in the steep rises and more gradual declines in the hydrograph during this period. High flows after this period reflect some diurnal fluctuations resulting from passing excess flows over the drum gates at O’Shaughnessy Dam.

Water levels along the downstream and upstream well transects in Poopenaut Valley (Figures 2-3 and 2-4, respectively) demonstrate similar relationships to those observed in prior years. Deeper piezometers 15 and 19 contain water year-round and as a result give a more consistent picture of groundwater levels than shallower nearby wells (wells 2 and 5 respectively) which are dry much of the year. While piezometers are only screened near the bottom of their respective casings, they may prove to be better long-term monitoring instruments than the wells (which are screened to the surface) because they adequately represent the water table except during periods of rapid fluctuations in groundwater level. . Delayed response between river stage and groundwater levels in well 15 reflect the position of that well in an area that ponds following flooding, as well as the finer-grained soils at well 15 relative to those at well 1.

Figure 2-1. Poopenaut Valley study area with well locations (red dots) and stage recorders (white dots). Wells 3 and 13 are collocated as are wells 2 and 15.

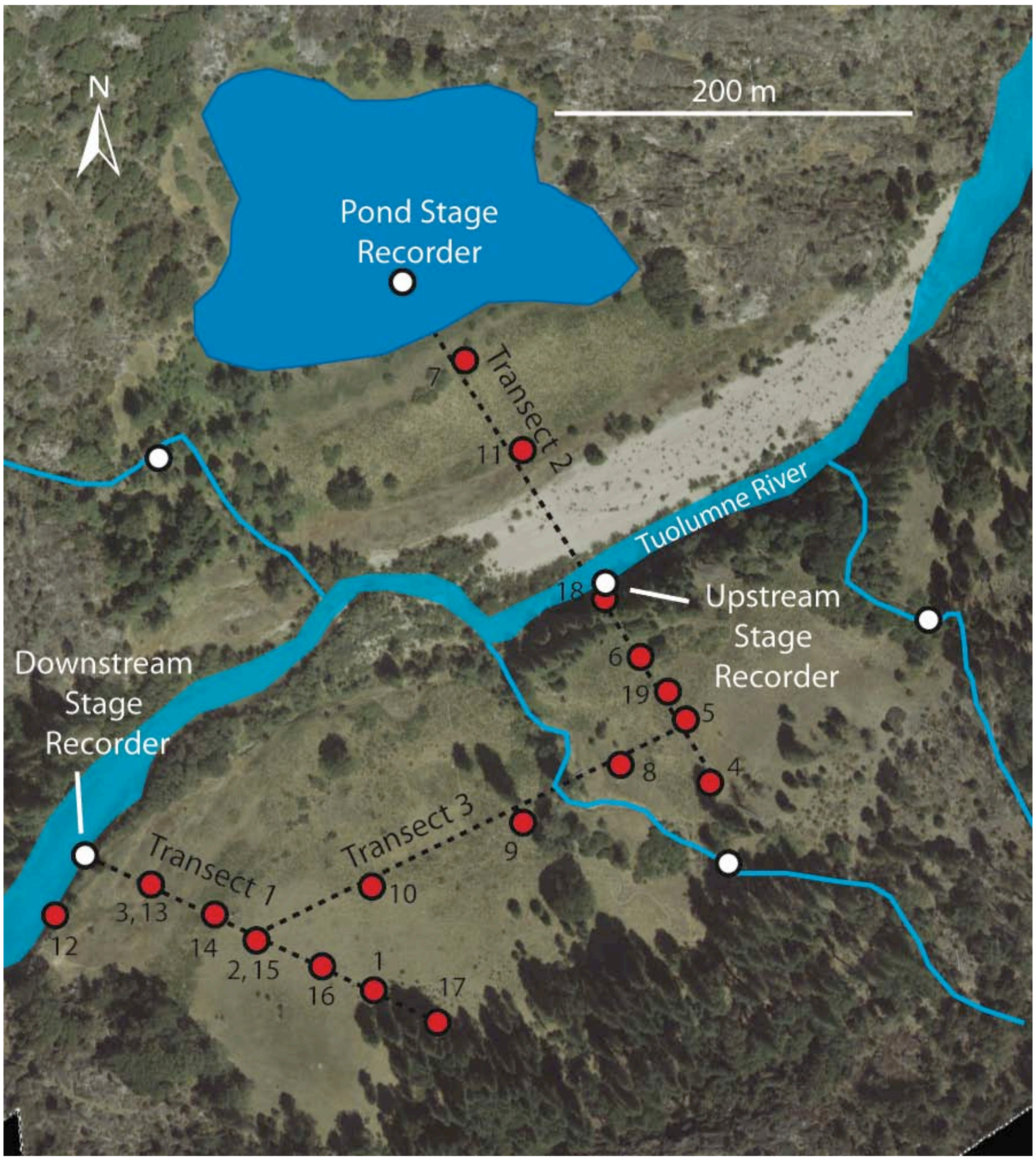


Table 2-1. Groundwater monitoring well depths and elevations (above sea level)

Well Number	Elevation TOC (m)	Stickup (m)	Ground Elevation (m)	Total well depth below ground surface (m)
1	1014.29	0.167	1014.124	3.730
2	1013.95	0.171	1013.783	3.960
3	1012.35	0.109	1012.241	3.540
4	1015.43	0.220	1015.210	2.930
5	1015.38	0.185	1015.191	3.970
6	1015.99	0.190	1015.798	3.800
7	1014.36	0.182	1014.173	3.510
8	1014.27	0.215	1014.057	2.720
9	1015.50	0.150	1015.344	3.800
10	1014.74	0.185	1014.554	3.770
11	1013.19	0.205	1012.985	3.650
12	1012.24	0.569	1011.671	2.833
13	1012.69	0.285	1012.399	3.099
14	1014.25	0.404	1013.850	4.396
15	1014.23	0.466	1013.768	4.863
16	1014.23	0.364	1013.859	4.898
17	1015.05	0.433	1014.618	4.828
18	1011.69	0.537	1011.147	1.609
19	1016.16	0.385	1015.780	5.789
Upstream recorder	1009.54	-	-	-
Downstream recorder	1009.60	-	-	-
Pond recorder	1012.48	-	-	-
SW Tributary	1013.46	-	-	-
SE Tributary	1012.99	-	-	-
North Tributary	1011.65	-	-	-

The seasonal pond on the north side of the river in Poopenaut Valley appeared to have filled by local precipitation and runoff during the winter of 2009-2010, and was more than 1 m (3.3 ft) deep prior to the spring snowmelt pulse on the Tuolumne River. It filled several times in response to multiple peak flows in the river hydrograph. Water depth in the pond was approximately 20-30 cm (8-12 inches) when the datalogger was retrieved on 27 July 2010, indicating that the pond contained standing water for more than six months in 2010. This long period of standing water provided important aquatic habitat for benthic macroinvertebrates and species such as bats that feed on them (see Chapter 4).

Despite the large O'Shaughnessy Dam spill volumes available in 2010, experimental water release objectives precluded the general wetland saturation duration objective of 14 consecutive days to within 30 cm of the ground surface (USAEC, 2008; National Park Service, 2009) for all but the lowest lying areas around well 3. However, that goal is obtainable for most wetland areas given similar spill volumes in future years.

Figure 2-2. Tuolumne River discharge at USGS gage 11-276500 below Hetch Hetchy Reservoir. The variable and stepped nature of the hydrograph primarily results from experimental water releases designed to explore the effects of variable drawdowns to river and tributary bank stability.

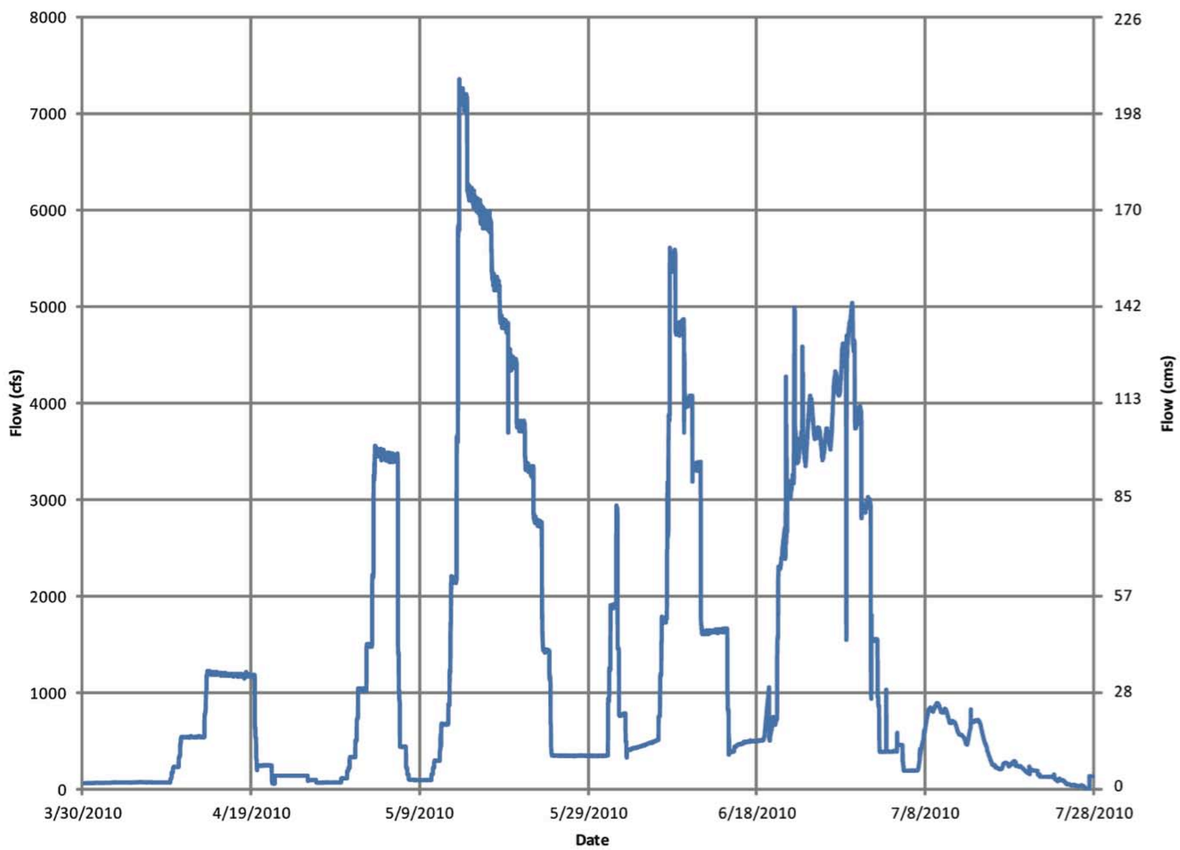


Figure 2-3. Groundwater well response to 2010 high flows along Transect 1 (downstream).

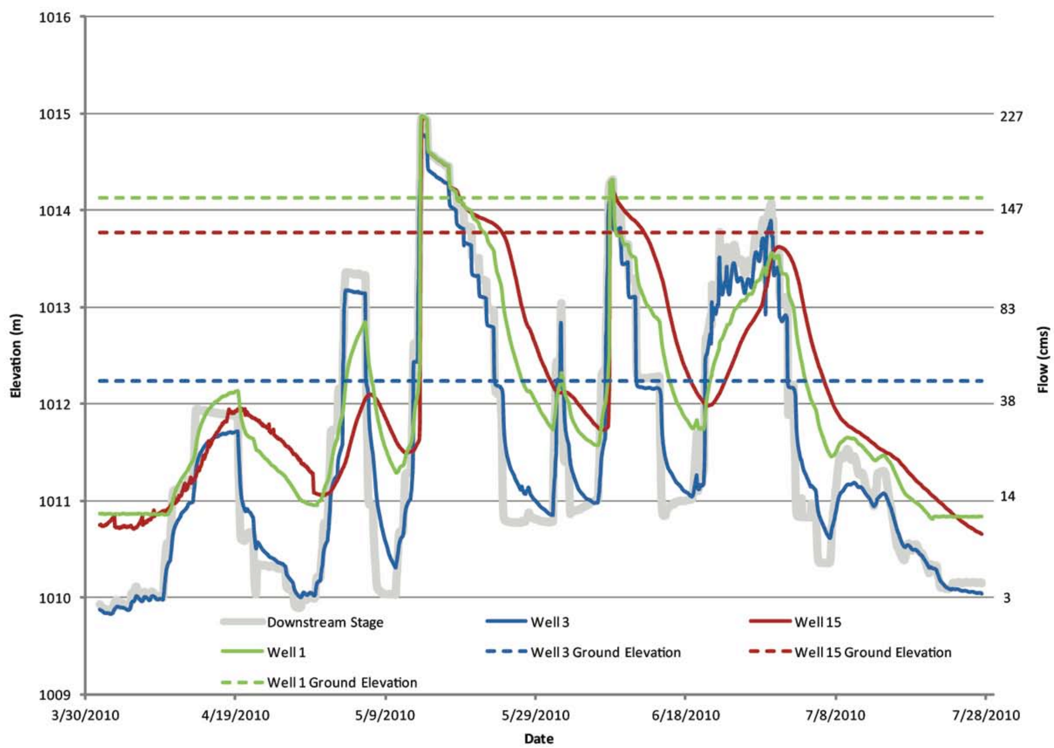
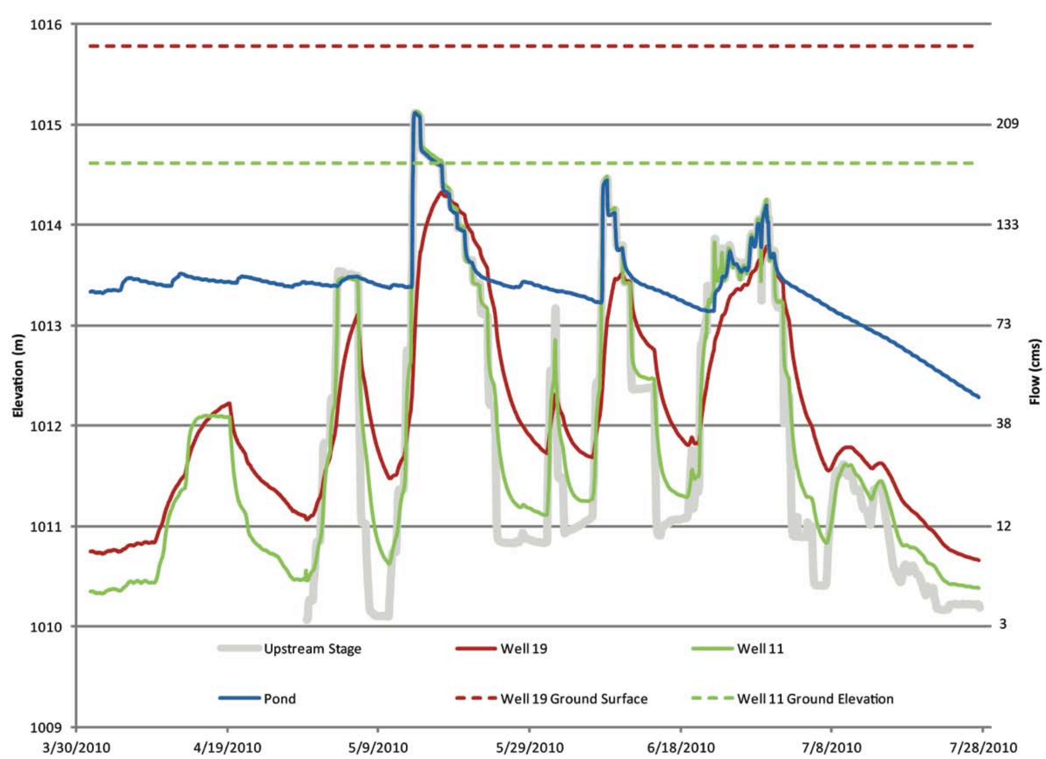


Figure 2-4. Groundwater well response to 2010 high flows along Transect 2 (upstream).



Chapter 3. 2010 Vegetation Studies in Poopenaut Valley

3. 1 Introduction

Herbaceous wetland and upland meadows intermixed with dense riparian trees and shrubs comprise the vegetation in Poopenaut Valley. Maintaining or improving the ecological integrity of these communities requires river flow magnitude, timing, frequency and duration sufficient to inundate wetlands and raise the water table for plants to establish and persist. The minimum hydrologic requirements for a wetland in the western mountains region of the continental United States is defined by the US Army Corps of Engineers to be soil saturation within 30 cm (12-inches) of the ground surface for a period of 14 consecutive days during the growing season 5 out of every 10 years (USACOE 2008). Through hydrologic assessments and modeling, we have recommended flow models and a good sense of the physical response (soil saturation, groundwater level). However, measuring the biological response requires a much longer time period.

The wetland delineation and description of existing vegetation types in Poopenaut Valley, completed in 2007 (National Park Service, 2009) and refined in 2008 and 2009, provide a baseline of the composition and spatial distribution of plant communities and wetlands. Vegetation dominance, frequency, abundance and distribution vary widely between years due to fluctuations in annual temperature and precipitation. Therefore, detection of a plant community response is likely to take many years of monitoring. In order to refine these assessments additional vegetation work continued in the 2010 season including vegetation monitoring, the woody riparian plant seed dispersal study and invasive plant species survey and removal and assisting McBain & Trush staff on data collection for woody riparian plant assessments. Each of these studies is discussed in detail below. In 2010, we identified additional plant species occurring in Poopenaut Valley, bringing the total number of observed plant species to 176, a very high number relative to other areas in Yosemite National Park.

3.2 Woody Riparian Plant Seed Dispersal Study

Riparian vegetation provides important habitat for wildlife, particularly birds, and requires further investigation to assess current conditions and to establish the relationship to the hydrologic regime of the Upper Tuolumne River. Reproduction for many riparian tree and shrub species (such as willows) depends on certain hydrologic (moist with a receding water table) and seedbed (bare mineral ground) conditions for successful germination. Understanding the timing of seed release and dispersal for riparian vegetation is thus essential to providing opportunities for recruitment under managed flow conditions.

3.2.1 Methods

Following the methodology described in 2009 (National Park Service) we continued assessments of the life cycle, including the timing and duration of seed dispersal, of five species of willow (*Salix ssp*.) and black cottonwood (*Populus balsamifera ssp. trichocarpa*) for the third year. One difference in methodology is the use of Tanglefoot rather than Vaseline in order to improve seed entrapment.

Access to riparian vegetation in Poopenaut Valley is limited when river flows are higher than 8.5 cms (300 cfs) because it is not possible to safely cross the river and many willows are inundated. During the main seed production period (May-July) in 2010, flows under 8.5 cms (300 cfs) occurred for only 4 days in May, but finally dropped below that level on July 16. Due to this restricted access, we focused seed collection on arroyo willow *(Salix lasiolepis)* and shiny willow *(Salix lucida),* as they occur on the south side of the river and recorded life cycle information for red willow *(Salix laegivata)*, narrow-leaf willow *(Salix exigua)* and dusky willow *(Salix melanopsis)*. Black cottonwood produced little seed in 2010 and like previous years, life cycle information was compromised because of limited access (all female trees occur on the north side of the river). Assessments of a population of black cottonwood along the Merced River at a similar elevation did provide some comparative phenological information for this species.

3.2.2 Results

3.2.2.1 Seed Production

Seed data are not presented because the number of seeds collected varies so widely between years and is likely not a result of actual seed production but trap placement, amount of Vaseline or Tanglefoot placed on the trap and data collection and counting errors. General summaries for each species monitored follows. Life cycle information and observation of seed dispersal provides more relevant information and is discussed in the following section.

Arroyo Willow

Arroyo willow occurs along the tributaries and these shrubby willows begin dispersing seeds earliest in the year as compared to other willow species.

Shiny Willow

Shiny willow grows along the intermediate bank terraces of the Tuolumne River and most established trees experience inundation at flows above 85 cms (3,000 cfs). High flows hampered access to these traps periodically, but enough traps were collected for consistent data.

Red Willow

Red willow grows in tree form along the tributaries, next to the pond and within the bed and banks of the Tuolumne River. Due to our inability to access red willow throughout the entire seed production period, seed data were not collected in 2010.

Dusky Willow and Narrowleaf Willow

These two willow species occupy the sandbars within the bed and banks of the Tuolumne River, experience some inundation at flows above 28 cms (1000 cfs), and complete inundation at 85 cms (3,000 cfs). Because of high flows during most of the seed production season seed data were not collected.

Black Cottonwood

Black cottonwoods are typically prolific seed producers on an annual basis. In 2008, 2009, and 2010 both male and female black cottonwood produced catkins in late April/early May but most trees dropped catkins before maturity in 2008 and 2010, and all trees dropped catkins in 2009 resulting in little or no seed production. Additionally, on nearly all male trees (whose catkins develop earlier than female trees) many leaves became blackened and stunted.

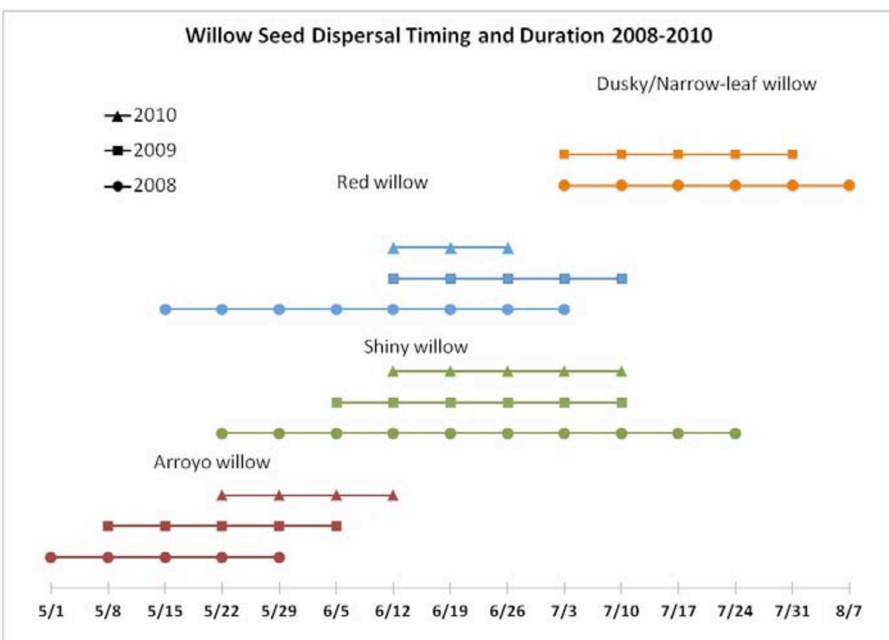
Black cottonwoods occurring at a similar elevation (1000m) on the Merced River at Cascade Creek provide some comparison. Seed traps collected weekly captured some seeds, but numbers were so small that data are not included in this report.

3.2.2.2 Timing and Duration of Seed Production

Willow seed dispersal begins in late April and persists well into August. Each week, we documented reproductive stage and recorded the beginning and end of seed production (Figure 3-1). Arroyo willow seed production peaks in May, red and shiny willow peak in June and dusky and narrow-leaf willow peak in July. Arroyo willow has the earliest and shortest seed production period, red willow the longest duration and dusky/narrow-leaf the latest. Dusky/narrow-leaf willow had a second wave of seed production (common for these species) beginning the second week of August (observed in all years), but seed collection ended at this time.

For dusky/narrow-leaf willow, timing and duration of seed production was similar between 2008 and 2009 (no data for 2010). For arroyo willow and shiny willow, seed production began and ended later in 2009 and even later in 2010 as compared to 2008. Red willow seed production occurred for a much longer duration in 2008 than in both 2009 and 2010 and began much later in the latter two years.

Figure 3-1.Timing and duration of willow seed production in Poopenaut Valley, 2008-2010



Black cottonwood in Poopenaut Valley and those along the Merced River broke bud and began catkin development at the same time (end of April). Black cottonwood in Poopenaut dropped most catkins by early June and no seed dispersal was observed while catkins on trees along the Merced River fully developed and prolific seed production continued from early June through mid-July. Similar to 2008 and 2009 (see National Park Service, 2009) three instances of below freezing temperatures occurred in Poopenaut between late April and early June in 2010. Temperature data for the Merced River are not available.

3.3 Vegetation Monitoring

One of the goals of recommending a managed flow regime for ecological benefits is to maintain the existing wetlands in Poopenaut Valley. There are measureable inter- and intra-annual variations in plant communities because of temperature, moisture availability and competition. Changes in vegetation at the community level typically do not occur quickly but may gradually shift when there are alterations in ecological processes (such as increased flows). We can remap wetland boundaries, but it is likely to take many years to detect a measurable expansion or shift. Focused vegetation monitoring may provide an opportunity to detect a more subtle shift if individual species are responding to changes in managed flow rather than to inter- and intra-annual variations in temperature and available water. For example, these data may detect a continued presence or expansion of a particular species that is unlikely to occur from short term changes in growing conditions but is in response to wetter conditions produced by the managed flow regime. This could be the first indication of a shift or expansion at the plant community level.

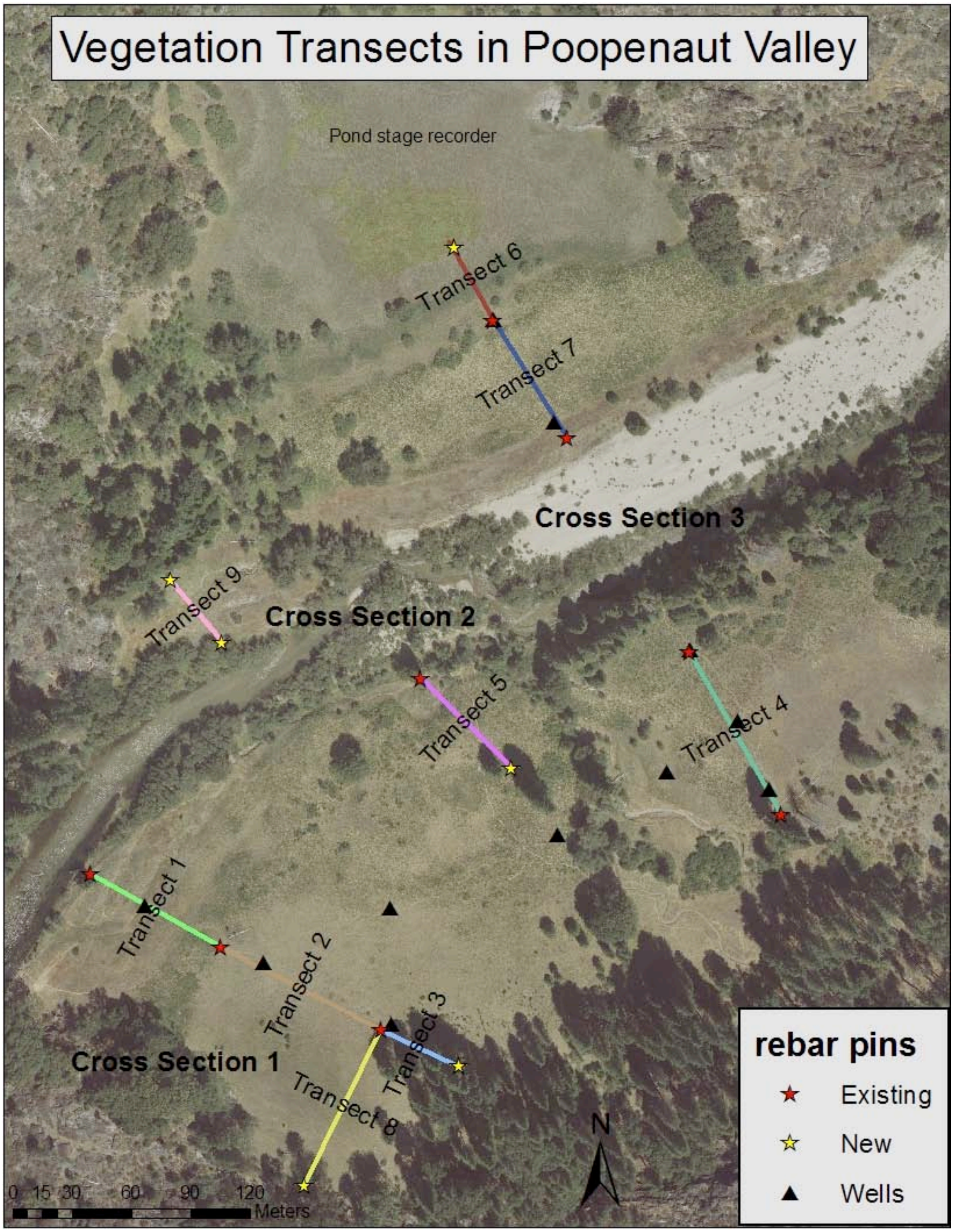
In an attempt to better assess changes in vegetation we established nine transects along and perpendicular to three established cross sections, recording 600 intercept data points and 59 nested frequency quadrats. Most cross sections are defined by semi-permanent surveyed rebar end points and vary in length.

Cross Section 1 is broken up into 3 transects (to improve the repeatability in subsequent surveys), Cross Section 2 has one transect and Cross Section 3 is broken up into 3 transects (1 on the south side of the river and 2 on the north side). We also installed one additional transect perpendicular to Cross Section 1 to better monitor Wetland 1 and a final transect north of the river at the west end (Figure 3-2).

Data collected on each transect includes a point intercept reading every meter (on the whole number) and a varying number of nested frequency plots randomly placed along the transects. The nest sizes include: 0.1 meters (read the corner closest to the beginning point), 0.25 meters. 0.5 meters (the half perpendicular to the transect) and the full meter. Beginning in the smallest quadrant we recorded all species observed. Each species is recorded only once in the smallest nest in which it occurs. Protocol is based on standards for measuring and monitoring vegetation (Elzinga et al. 1998) along with guidance from John Bair of McBain and Trush (J. Bair, pers. comm., 2009)

Analyses of these transect data are ongoing, and include establishing the relationship between plant communities and water table utilizing hydrologic models along the cross sections, as well as comparative analyses between years. We expect to report results from these analyses in the 2011 Looking Downstream report.

Figure 3-2. Vegetation monitoring transects in Poopenaut Valley



3.4 Invasive Plants

A comprehensive survey completed in 2009 for invasive plant species above and below Poopenaut Valley (presented in National Park Service, 2009) provides information on the frequency and spatial distribution of target invasive plant species, particularly Himalayan blackberry (*Rubus discolor*). After such extensive survey in 2009 and limits in staffing only limited survey occurred in 2010, although some removal of invasive plants including bull thistle *(Cirsium vulgare)*, common mullein *(Verbascum thapsis)* and Klamath weed *(Hypericum perfoliatum)* established in Poopenaut Valley, as well as along the trail to Poopenaut Valley, continued. These populations are scattered and typically small so treatment acreage is negligible. However, it is extremely important to treat these areas before populations spread or become denser. Treatment of Himalayan blackberry did not occur in 2010, as effective methods of treatment were not available.

3.5 Discussion

As expected, it appears that the timing of willow seed production correlates well with peak flows and recession of the Tuolumne River unimpaired snowmelt hydrograph. If timing, duration, frequency and magnitude of regulated floods mimic the unimpaired hydrograph in the future, riparian vegetation will possibly change in structure and spatial distribution. However, this requires assessments of the current woody riparian vegetation structure, condition (live to dead ratio), spatial distribution and location in terms of avian habitat and relationship to the hydrograph. Future monitoring should consider such assessments to document potential changes in riparian vegetation. Consultants to the SFPUC (McBain and Trush) have assessed the relationship between woody riparian tree age and historical hydrology; results will be available in a forthcoming flow recommendations report for O'Shaughnessy Dam. In 2010, NPS initiated an assessment of the relationship between riparian habitat and avian riparian focal species breeding (see Chapter 4).

It appears that duration and timing of seed dispersal for those willows occurring on the banks of the river correlate more to temperature and growing conditions (i.e. cool, wet springs delayed reproductive cycle) while dusky willow and narrow-leaf willow seed dispersal is directly related to flow (largely because they are under water at high flows). Spring conditions in 2009 and 2010 were unusually cool and wet, whereas conditions in 2008 were more typical. We observed that dusky and narrowleaf willows come out of dormancy in May but do not produce catkins or seeds until flows recede and they are no longer inundated.

Black cottonwoods are typically prolific seed producers on an annual basis but have produced minimal seed in Poopenaut Valley over the last three seasons. In contrast, black cottonwood on the Merced River produced many seeds. The reason for catkin drop observed on trees in Poopenaut Valley is still unknown but could be attributed to freezing temperatures or water availability, as discussed in the 2009 Looking Downstream report (National Park Service, 2009), but may also be caused by fungus, insects or other pathogens; these possibilities need further investigation. We do not have temperature data along the Merced River to compare to Poopenaut Valley, though temperature data collection may be included in the future to help determine if freezing temperatures when trees are just breaking bud contribute to the lack of seed development in Poopenaut Valley.

Much of the invasive Himalayan blackberry in Poopenaut Valley is growing within the bed and banks of the Tuolumne River, making treatment with glyphosate difficult. Managers are working on developing an effective treatment strategy, to be available by 2011. Additionally, the very large patch of Himalayan blackberry established immediately downstream of O'Shaughnessy Dam provides a substantial seed source and full treatment cannot occur until this population is eradicated.

3.6 Future work

After three seasons of the woody riparian seed dispersal study, a range of timing and duration of willow seed dispersal is established. We will continue with some life cycle information but will no longer hang willow seed traps as the number of seeds collected varies so widely and the difficulties in access compromise our data. Coordination with the SFPUC and McBain and Trush on the riparian vegetation assessments will continue. These data may point to the time of establishment and the hydrologic conditions of that time. In particular, if riparian vegetation established under more static flows conditions (i.e. prior to the construction of the tunnel when flows were relatively constant).

We will continue analyses of vegetation monitoring transect data, incorporating data collected in 2011. This will include investigating ways to correlate soil moisture gradients and plant community spatial distribution.

Invasive plant removal efforts in Poopenaut Valley, particularly for Himalayan blackberry, will be more comprehensive in 2011 when effective treatment options are available with the completion of the Yosemite Invasive Plant Management Plan. Treatment will include the river corridor from Poopenaut Valley to O'Shaughnessy Dam. Possible options for treating cheat grass are also being explored by the National Park Service at this time.

Chapter 4. 2010 Bird and Bat Studies in Poopenaut Valley

4.1 Introduction

The sensitivity of bird populations to changes in the ecosystem makes them an important indicator of overall habitat quality (Marzluff and Sallabanks, 1998). Long-term monitoring of birds, particularly during the breeding season, can be used to effectively assess habitat health (Ralph et al., 1993). Bird population dynamics have been used as scientifically viable surrogates for evaluation of ecosystem condition because (1) birds are conspicuous, easily observable, and monitoring and analysis are cost effective; (2) as secondary consumers (i.e. insectivores), birds are sensitive indicators of environmental change; and (3) knowledge of the natural history of many bird species has a rich basis in literature. In human-altered riparian areas, bird monitoring can be a valuable tool for assessing changes in habitat quality due to restoration efforts, river diversion and channelization projects, water impoundment, and flooding events.

Similar to birds, bats are also recognized as important bioindicators (Jones et al., 2009). Bats play an important role in riparian ecosystems and reflect the productivity of insect communities. 2010 marked the first year bats have been surveyed in the Poopenaut Valley. Surveys will continue in the near future to establish potential linkages to insect productivity in riparian vegetation, wetlands, and the seasonal pond in Poopenaut Valley.

To understand potential effects of altered hydrology below O'Shaughnessy Dam on wildlife in Poopenaut Valley we have accomplished the following objectives: (1) modeled predicted occurrence of vertebrate species between O'Shaughnessy Dam and the park boundary and in Poopenaut Valley using California Wildlife Habitat Relationships (CWHR) system models and validation tools (National Park Service, 2007); and (2) characterized the breeding bird community in Poopenaut Valley (National Park Service, 2007, 2008, 2009). In 2010 we have begun to assess the Poopenaut Valley riparian habitat in relation to bird riparian focal species (RHJV 2004) breeding in Poopenaut Valley. Also in 2010, we initiated a pilot bat study to relate seasonal bat species richness and diversity to the seasonal pond (water depth, temperature, and seasonality) in Poopenaut Valley. This information will help further inform the timing of water releases from O'Shaughnessy Dam in order to improve the overall ecosystem function in Poopenaut Valley.

4.2 Methods

4.2.1 Area Search and Point Count Surveys

We conducted the fourth year of standardized area search surveys and the third year of point count surveys to estimate bird community species abundance, composition, and habitat use in Poopenaut Valley wet meadow and montane riparian habitats. We conducted area searches in five distinct areas, each comprising approximately 3 hectares (7.41 acres); see the 2007 Looking Downstream Report (National Park Service, 2009) for a thorough description of protocols and search areas. In 2008 we established two point count locations, one on each side of the river in Poopenaut Valley at locations intersecting Areas 1 and 2, and Areas 3 and 4 (Figure 4-1). We used the standardized point count protocol for monitoring landbirds (Ralph et al., 1993, Nur et al., 1999), including the use of a standardized datasheet. Use of standardized methods will allow data to be compared among point count survey results in subsequent years, as well as in areas outside of Poopenaut Valley. Each set of surveys were spaced at least 10 days apart and were completed by 10 am. Point counts were conducted for 5-minutes each, during each of the three visits, following the area searches. For both survey methods, the observer recorded observed species, method of detection (visual, song, or call), and indications of breeding status, such as copulation, courtship or territorial display, food carrying, and any observed fledglings. Data analysis of area searches and point counts included relative abundance, species richness, species diversity index, evenness, and dissimilarity (see National Park Service, 2009 for a description of data analysis methods and examples of standardized datasheets).

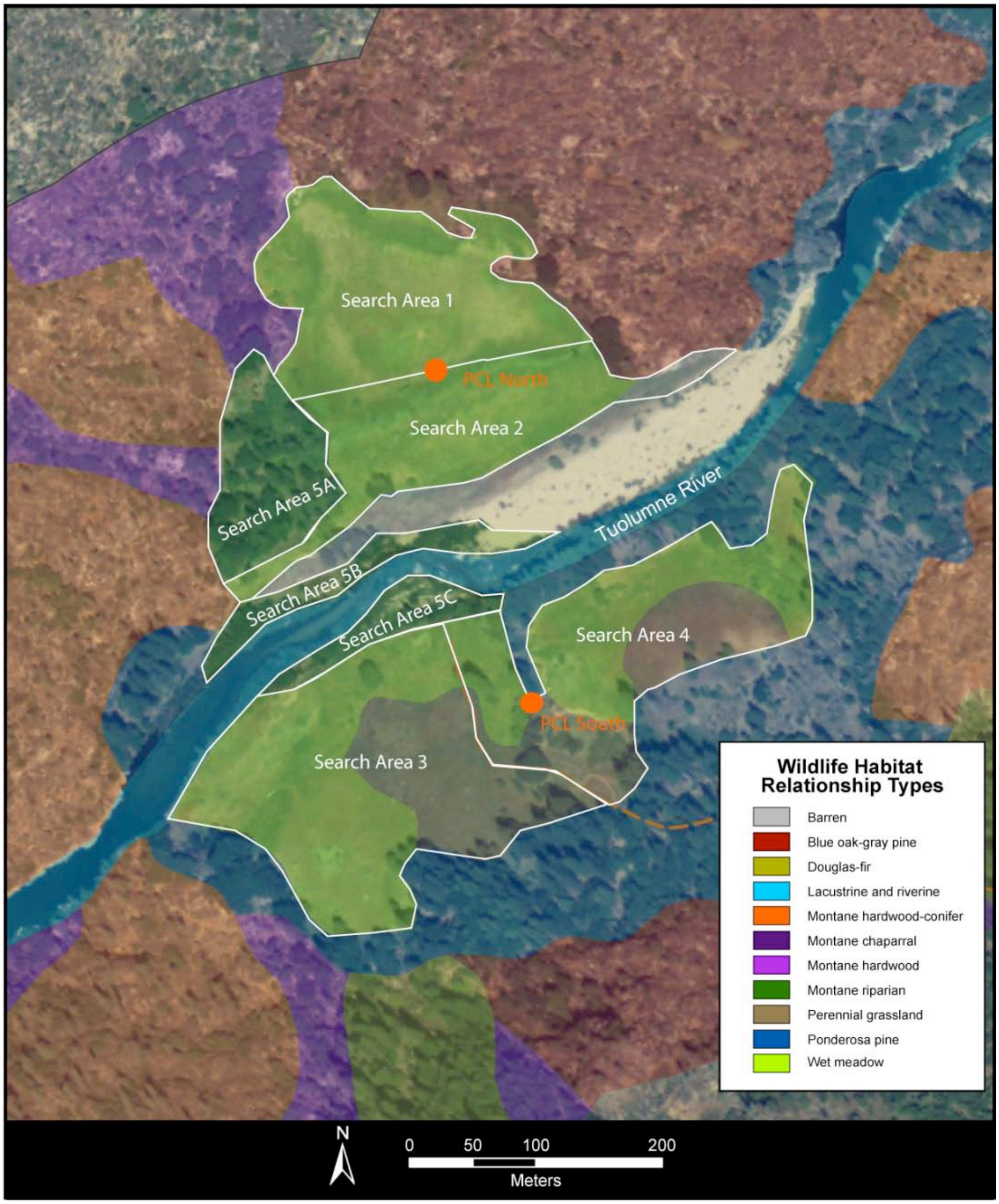
4.2.2 Spot Map Surveys

We conducted spot map surveys in the same avian search areas (Areas 1-5) as the area searches (Figure 4-1). This year (2010) was a pilot effort and was limited to six visits. If area searches and point counts were conducted during a given visit, spot mapping would commence afterwards. Mapping was conducted for 40 to 90 minutes and completed by 12 pm in each area. Methods were adapted from the standardized spot mapping protocol (Bibby et al., 1992, Ralph et al., 1993). The observer walked the area slowly, stopping for as long as necessary to mark every bird detected in its exact location on a map of the area. Males and females were distinguished if possible, and marked accordingly. Observers also noted if males were singing (denoted by circling the male), recorded any and all territorial behavior including chasing or counter-singing (denoted by drawing dotted lines between individuals), and noted the direction of movement of individuals using arrows. A new map was created for each visit. At the end of the season, cumulative maps were prepared for four breeding riparian focal species (Black-headed Grosbeak [*Pheucticus melanocephalus*], Song Sparrow [*Melospiza melodia*], Warbling Vireo [*Vireo gilvus*], and Yellow Warbler [*Setophaga petechia*]) in order to determine number of breeding pairs and territory sizes. A species cumulative map was created on paper using data from all five visits. Next, boundaries for each territory were estimated based on the maps, and drawn accordingly. Finally, the territory boundaries were digitized in GIS to investigate habitat use.

4.2.3 Nest Search Surveys

We conducted nest search surveys simultaneously with spot map surveys. Birds exhibiting probable or confirmed breeding activity such as foraging in pairs, carrying nesting material, or carrying food were followed as closely as possible in order to find nests, and their movements and behaviors were mapped onto the spot maps. If a nest was located, the location was recorded with GPS and a nest card was filled out. Every nest was checked on subsequent site visits and nest activity was recorded onto the nest card. At the end of the season, nest card information was transferred onto a nest record sheet where nest results could be coded.

Figure 4-1. Bird search areas (same as spot map areas) and point count locations (PCL) relative to Wildlife Habitat Relationship types in Poopenaut Valley.

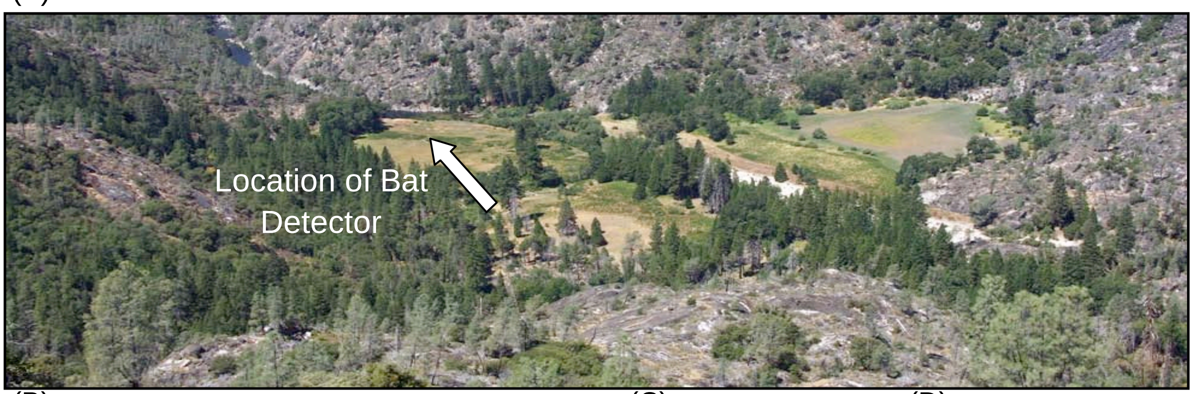


4.2.4 Bat Acoustic Surveys

During the 2010 field season, we conducted a pilot study to determine bat species presence/absence, composition, and activity. Dr. Joe Szewczak, creator of SonoBat™, provided hands-on training to Yosemite Wildlife Biologists the week of 28 June to (1) use bat detection and recording software and equipment and (2) analyze and interpret bat echolocation calls. We placed a Pettersson D500x ultrasound recording unit in Poopenaut Valley so that it would blend in with existing vegetation and would face the meadow opening. The Pettersson recording unit is built specifically for long-term passive monitoring and can be deployed for up to two weeks using AA batteries or for a longer period of time using an external power source. It has a single built-in microphone and has black, rugged aluminum housing with overall dimensions of 165 mm x 170 mm x 53 mm. We programmed the detector to record ultrasound continuously from one hour before dusk throughout the night to one hour post dawn (Figure 4-2 A through D).

Figure 4-2. (A) Bat detection setup in Poopenaut Valley. Bat detector located on the south side of the Tuolumne River in Poopenaut Valley; (B) Bat detector placed at edge of vegetation; (C) Detector attached to a stick and oriented with internal microphone pointing up into the air; (D) Pettersson recording unit being programmed to record.

(A)



(B) (C) (D)

We used SonoBat™ software to process the recordings from the Petterson recording unit. This software analyzes and compares high-resolution full-spectrum sonograms of bat echolocation calls. SonoBat™ uses a decision engine based on the quantitative analysis of approximately 10,000 species-known recordings from across North America. The software automatically recognizes and sorts calls, then processes the calls to extract six dozen parameters that describe the time-frequency and time-amplitude trends of a call. The software's call trending algorithm can also recognize the end of calls buried in echo and noise as well as establish trends through noise and from low power signals. SonoBat™ generates high resolution continuous trends of time-frequency and time-amplitude content that enable robust parameter extraction.

We first analyzed echolocation call data using the batch process option in SonoBat™ and then reanalyzed using the manual option in SonoBat™ for species confirmation. Within SonoBat™, we manipulated screen-positioned cursors to quantify low/high frequency, bandwidth, duration, heel, slopes, characteristic frequency, and harmonics to differentiate bat echolocation calls for species determination. We also compared our bat calls to known reference bat calls (from captured bats) in SonoBat™ for species identification.

4.3 Results

4.3.1 Area Searches

The fourth consecutive year of area search surveys in Poopenaut Valley took place during summer 2010 and comprised three separate visits (5/8/2010, 5/25/2010, and 6/28/2010). During the latter two visits, the north side of the river (Areas 1, 2, 5A, and 5B) was inaccessible due to high water, and those search areas and the point count locations were omitted from analyses accordingly. During the three visits, flow was approximately 3 cms (104 cfs), 10 cms (355 cfs) and 126 cms (4,440 cfs), respectively.

For area searches, a total of 253 individuals of 39 species was observed in Poopenaut Valley. Accounting for possible duplicate observations among visits, we estimated relative abundance to be 179 individuals (Table 4-1). The most frequently encountered species were: Black-headed Grosbeak (17 individuals), American Robin (*Turdus migratorius*) (15 individuals), Red-winged Blackbird (*Agelaius phoeniceus*) (14 individuals), and Song Sparrow (13 individuals).

Table 4-1. Bird species detected from area searches and their relative abundance in Poopenaut Valley, Yosemite National Park, in May – June 2010.

		Areas					
Common Name	**Status**	**1**	**2**	**3**	**4**	**5C**	**Total**
Acorn Woodpecker					2		2
American Robin		2	3	3	4	3	15
Anna's Hummingbird			1		1		2
Band-tailed Pigeon					4		4
Black Phoebe			1			1	2
Black-headed Grosbeak	RFS	2	1	4	5	5	17
Blue-gray Gnatcatcher		1					1
Brewer's Blackbird					1		1
Brown Creeper					1		1
Brown-headed Cowbird		2	1	1		2	6
Bullock's Oriole		1		4	2	3	10
California Towhee		1					1
Cassin's Vireo				2	1	1	4
Chipping Sparrow				1			1
Dark-eyed Junco				1			1
Hairy Woodpecker				1			1
House Wren		2		2		1	5
Lesser Goldfinch					2	3	5
Lincoln's Sparrow				1			1
MacGillivray's Warbler					1	1	2
Mallard						3	3
Nashville Warbler		4			3		7
Northern Flicker		1			2		3
Northern Rough-winged Swallow			1			2	3
Pine Siskin		2		1			3
Red-breasted Nuthatch					2		2
Red-winged Blackbird		6	4			4	14
Song Sparrow	RFS	3		4	2	4	13
Spotted Towhee		1		3	3		7
Steller's Jay		1	2	1	2	1	7
Warbling Vireo	RFS	1		3	4	3	11
Western Meadowlark				1			1
Western Scrub-Jay					1		1
Western Tanager				1	4		5
Western Wood-Pewee				4	1	2	7
Wilson's Warbler	RFS					1	1
Yellow Warbler	CSC,SSC,RFS		1		2	1	4
Yellow-breasted Chat	CSC,SSC,RFS			1	1		2
Yellow-rumped Warbler			1	1		1	3
Total		**30**	**16**	**40**	**51**	**42**	**179**

CSC = California species of special concern; SSC = CDFG Bird Species of Special Concern; RFS = California Partners in Flight Riparian Focal Species

The wet meadow habitat in Search Area 4 had the highest species richness (23 species), diversity index (*H* = 2.99), and relatively high evenness (*J* = 0.95). The wet meadow areas averaged 34 detections (relative abundance) of 17 species (Table 4-2), which were slightly lower than the indices for the montane riparian area (42 detections of 19 species). Of all five search areas, Search Area 4 had the most number of detections (51 individuals).

Table 4-2. Species richness (number of species), abundance, bird diversity, and evenness from area searches, by study area in Poopenaut Valley, Yosemite National Park, May – June 2010.

Search Area	**Species Richness**	**Abundance Estimate***	**Species Diversity Index***	**Evenness***
Search Area 1 Wet Meadow	15	30	2.517	0.929
Search Area 2 Wet Meadow	10	16	2.133	0.927
Search Area 3 Wet Meadow	20	40	2.818	0.941
Search Area 4 Wet Meadow	23	51	2.992	0.954
Search Area 5 Montane Riparian	19	42	2.791	0.948

*For each species in a given area, the highest number of individuals detected in the three visits is reported.

Analysis of area search survey data from Search Areas 1, 2, 3, 4, and 5C using the Bray-Curtis Dissimilarity Measure (Bray and Curtis 1957) revealed that Areas 1 and 4 differed the most in community assemblage (I_{BC} = 0.444, Table 4-3), meaning they shared the least number of species in common. Areas 3 and 5 shared the highest degree of community similarity (I_{BC} = 0.059, Table 4-3), meaning they had similar species composition.

Table 4-3. Bray-Curtis Dissimilarity Matrix for bird assemblages by search area in Poopenaut Valley, Yosemite National Park, May – June 2010. Numbers enclosed in boxes indicate the least and most similar sites.

	Area 1	*Area 2*	*Area 3*	*Area 4*	*Area 5*
Area 1	0				
Area 2	0.273	0			
Area 3	0.231	0.286	0		
Area 4	0.444	0.368	0.238	0	
Area 5	0.286	0.368	0.059	0.182	0

4.3.2 Point Counts

The third year of point count surveys in Poopenaut Valley took place during summer 2010 and comprised three separate visits (5/8/2010, 5/25/2010, and 6/28/2010). Because the river was too high to cross after the first visit, we were not able to conduct surveys on the north side during visits 2 and 3. Results from the south side were averaged per visit to account for differences in effort. At North Poopenaut, we detected 25 individuals of 13 species. At South Poopenaut, we detected an average of 25.33 individuals of 22 species. Both point count locations were similar in their abundance and species richness (Table 4-4). Point count surveys in 2010 did not detect any new species in Poopenaut Valley.

Table 4-4. Total number of individuals, species relative abundance, and species richness by point using 2010 point count data in Poopenaut Valley, Yosemite National Park. Data include all detections, excluding flyovers.

Point	**North Poopenaut 1 Visit[1]**		**South Poopenaut 3 Visits[1]**	
Species	**Number of Individuals**	**Relative Abundance[2]**	**Number of Individuals**	**Relative Abundance[2]**
Acorn Woodpecker	0	NA	4	1.33
American Robin	1	NA	3	1.00
Anna's Hummingbird	1	NA	0	0
Black-headed Grosbeak	2	NA	5	1.67
Black Phoebe	0	NA	0	0
Brown-headed Cowbird	2	NA	2	0.67
Bullock's Oriole	1	NA	8	2.67
Cassin's Vireo	1	NA	4	1.33
House Wren	0	NA	6	2.00
Lesser Goldfinch	0	NA	1	0.33
Mallard	1	NA	0	0
Mountain Quail	0	NA	1	0.33
Nashville Warbler	2	NA	0	0
Northern Flicker	0	NA	1	0.33
Orange-crowned Warbler	0	NA	2	0.67
Purple Finch	0	NA	1	0.33
Red-winged Blackbird	5	NA	5	1.67
Song Sparrow	1	NA	3	1.00
Spotted Towhee	0	NA	3	1.00
Steller's Jay	1	NA	3	1.00
Warbling Vireo	1	NA	8	2.67

Western Tanager	0	NA	3	1.00
Western Wood-Pewee	3	NA	8	2.67
Wrentit	0	NA	1	0.33
Yellow-breasted Chat	0	NA	1	0.33
Yellow Warbler	0	NA	3	1.00
Total Individuals	**25**	NA	**76**	**25.33**
Species Richness	**13**	NA	**22**	**13**

[1]North Poopenaut was visited only once due to high flows; South Poopenaut was visited all three times

[2]Average number of individuals per visit

NA = Not applicable because only one visit was conducted

4.3.3 Spot Mapping and Nest Searching

In 2010 we conducted a pilot effort for spot mapping and nest searching in Poopenaut Valley. We conducted six spot mapping visits: 4/29/2010, 5/7/2010, 5/12/2010, 5/25/2010, 6/11/2010, and 6/28/2010. Areas 1 & 2 were mapped only on 4/29/2010, and were inaccessible due to high water for the duration of the season. A cumulative total of 552 birds of 55 species were detected in all five areas over all six visits. To account for possible duplicate observations among visits, we estimated relative abundance to be 360 individuals (Table 4-5).

Table 4-5. Species richness and relative abundance by search area using 2010 spot mapping data in Poopenaut Valley, Yosemite National Park. Data include all detections, excluding flyovers.

	Area 1*	***Area 2****	***Area 3***	***Area 4***	***Area 5***	***Total***
Species Richness	23	16	32	34	32	55
Abundance	58	67	74	84	77	360

*Only one visit; other search areas had 6 visits.

We mapped breeding territories for the four confirmed breeding Riparian Focal Species (Black-headed Grosbeak, Song Sparrow, Warbling Vireo, and Yellow Warbler; Figure 4-3). Within the Poopenaut Valley study area we confirmed four Black-headed Grosbeak territories, four Warbling Vireo territories, seven Song Sparrow territories, and three Yellow Warbler territories. Black-headed Grosbeak territories were the largest on average, while Song Sparrow territories were the smallest. The cumulative maps show that meadow edges were most heavily used by these bird species, especially edges where willows were present (Figure 4-3).

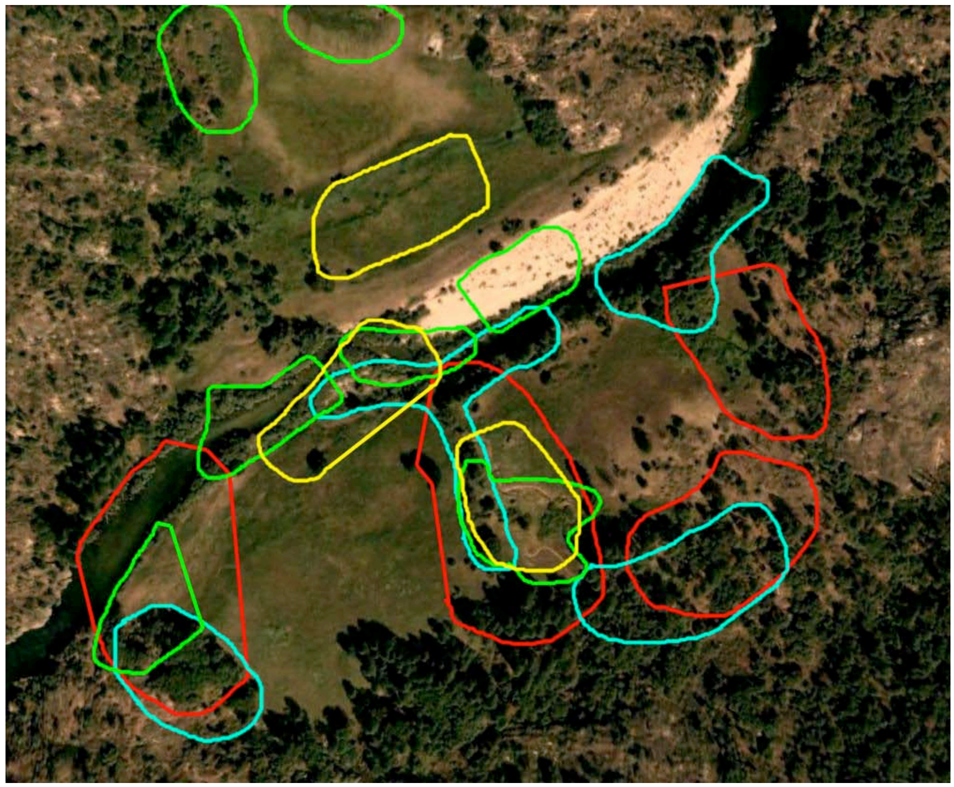
Figure 4-3. Breeding territories for four Riparian Focal Species based on spot map surveys in Poopenaut Valley, Yosemite National Park.

Black-headed Grosbeak

Warbling Vireo

Song Sparrow

Yellow Warbler



Cumulative map showing territories of all 4 Riparian Focal Species

4.3.4 Nest searching

In 2010, using nest searching methods (Ralph et al., 1993), we located eight nests of five species. Four other pairs of birds of three species were determined to be nesting in a particular area, though nests were not actually located (Table 4-6).

Table 4-6. Nests confirmed during 2010 nest searching in Poopenaut Valley, Yosemite National Park.

Species	Nests located	Nests confirmed but not located
Bullock's Oriole	4	
House Wren	1	
Lincoln's Sparrow		1
Purple Finch	1	
Song Sparrow[1]	1	2
Western Wood-pewee	1	
Yellow Warbler[1]		1

[1] Riparian focal specie (RHJV 2004)

We observed two species nesting in willows in the river channel in Area 5: Song Sparrow and Yellow Warbler. On 5/8/2010, we observed a pair of Song Sparrows building a nest approximately 1.5 m (5 ft) off the ground in willows located in area 5B. When we revisited the site on 12 May, the water level had risen above this height, destroying the nest. We observed a pair of Northern Rough-winged Swallows (*Stelgidopteryx serripennis*) investigating a series of cavities in the bank of the river in area 5B on 5/7/2010, but by late May the river had risen to cover these cavities, so any nests inside would have failed. On 5/25/2010, we observed a different pair of Song Sparrows in area 5C carrying food into a thicket of willow branches just above the water, which was estimated to be at least 1.8-2.1 m (6-7 ft) deep. On 6/28/2010, a female Yellow Warbler in area 5C carried food into a clump of willow branches above the water. Though the 2nd Song Sparrow nest and Yellow Warbler nest were not definitively located, it is clear that they survived the rising river waters.

Data collected during nest searches were used to calculate dates pertaining to arrival on the breeding ground, initiation of breeding, and fledging young for riparian focal species (Table 4-7). These data show that several species initiate breeding in late April or early May, when water levels have historically been artificially low due to flow regulation by O'Shaughnessy Dam.

Table 4-7. Preliminary life history information and breeding schedules for four riparian focal species in Poopenaut Valley, Yosemite National Park.

YELLOW WARBLER				
Resident/Migratory?	Migratory			
Site Fidelity	High			
Feeding type/food source	Insect and other arthropods, gleaning, sallying, hovering			
Nesting strata	Often contain heavy brush understory for nesting and tall trees for foraging and singing			
Nesting location	0.60 to 4.90 m above ground in shrub or deciduous sapling			
Capable of two clutches?	One brood (3-6 eggs) normally reared; second broods rarely attempted.			
	Earliest Date	**Average Date**	**Latest Date**	**Notes**
Males Arrive	By April 29	-	-	
Females Arrive	By May 25	-	-	
Males define territories	By April 29	-	-	
Females begin nesting	31-May	-	12-Jun	based on food carry of large caterpillar 6/28
Fledglings Leave nest	29-Jun	-	6-Jul	

SONG SPARROW				
Resident/Migratory?	Resident			
Site Fidelity	High			
Feeding type/food source	During nonbreeding, variable: seeds, fruits, and invertebrates. During breeding, primarily insects and other small invertebrates; some seeds and fruit.			
Nesting strata	Nests commonly 0–4 m, mostly on ground under grass tuft or shrub.			
Nesting location	Wet meadows and margins of ponds, lakes, and slow-moving streams.			
Capable of two clutches?	Yes			
	Earliest Date	**Average Date**	**Latest Date**	**Notes**
Males Arrive	by April 29	-	-	
Females Arrive	by April 29	-	-	
Males define territories	by April 29	-	-	
Females begin nesting	26-Apr	8-May	23-May	nest material obs on 5/8; food carry on 5/25
Fledglings Leave nest	26-May	-	22-Jun	food carry obs 5/25; fledglings 6/28

BLACK HEADED GROSBEAK				
Resident/Migratory?	Migratory			
Site Fidelity	Unknown			
Feeding type/food source	Gleans primarily insects and spiders, and feeds on fruit and weed seeds. Mostly forage in foliage, sometimes on twigs, branches, and in air.			
Nesting strata	In outer branches of deciduous trees: cottonwoods, willows, aspens, and other hardwoods that margin rivers and streams, also oak-conifer forest and old orchards. Occupies diverse habitat.			
Nesting location	Shrub, canopy, favor meadows, clearings, and edge habitats.			
Capable of two clutches?	No, 2-5 eggs.			
	Earliest Date	**Average Date**	**Latest Date**	**Notes**
Males Arrive	by April 29	-	-	

Females Arrive	by April 29	-	-	
Males define territories	by April 29	-	-	
Females begin nesting	11-May	-	20-May	
Fledglings Leave nest	by June 13	-	-	Fledglings obs. 6/28

WARBLING VIREO				
Resident/Migratory?	Migratory			
Site Fidelity	Unknown			
Feeding type/food source	Variable, primarily twig gleaning in broad leaf tree tops for insects throughout the year, some fruit in winter.			
Nesting strata	In forked limbs of tree periphery, prefer cottonwood, alder, and aspen that flank streams.			
Nesting location	Canopy, primarily coniferous trees, 7m or higher.			
Capable of two clutches?	Yes, two normal. Clutch 3-5 eggs.			
	Earliest Date	**Average Date**	**Latest Date**	**Notes**
Males Arrive	by April 29	-	-	
Females Arrive	by April 29	-	-	
Males define territories	by April 29	-	-	
Females begin nesting	8-May	-	29-May	carry material obs. 5/7
Fledglings Leave nest	4-Jun	-	24-Jun	fledglings obs. on 6/28

4.3.5 Breeding Birds

Out of 66 species detected during 2007-2010 area searches and 2008-2010 point counts, we confirmed 14 breeding species, detected 27 probable breeding species, 19 possible breeding species, and 7 unlikely breeding species in all study areas and points combined. In addition, we detected 7 riparian focal species (Black-headed Grosbeak, Song Sparrow, Spotted Sandpiper (*Actitis macularia*) Warbling Vireo, Wilson's Warbler (*Wilsonia pusilla)*, Yellow-breasted Chat (*Icteria virens)*, and Yellow Warbler (RHJV, 2004), 2 California Species of Concern (Yellow Warbler and Yellow-breasted Chat), 2 nest predators (Steller's Jay [*Cyanocitta stelleri*] and Western Scrub-Jay [*Aphelocoma californica*]), and 1 invasive nest-parasite species, (Brown-headed Cowbird [*Molothrus ater*]) (Table 4-8).

Table 4-8. List of 66 bird species detected and their breeding status from area search (AS), point count (PC), and spot map (SM) surveys in Poopenaut Valley, Yosemite National Park, in April – June 2007 to 2010.

Species	Unlikely	Possible	Probable	Confirmed	Survey
Acorn Woodpecker		X			AS, PC, SM
American Robin			S, P, T		AS, PC, SM
Anna's Hummingbird			T, P	CN	AS, PC, SM
Ash-throated Flycatcher		X			AS
Band-tailed Pigeon	X				AS
Belted Kingfisher	X				AS
Black-headed Grosbeak			**S, P**	**CN, F**	**AS, PC, SM**
Black-throated Gray Warbler			S		AS, PC
Black Phoebe			S		AS, PC, SM
Blue-gray Gnatcatcher		X			AS
Brewer's Blackbird		X			AS, SM
Brown-headed Cowbird			S, P		AS, PC, SM
Brown Creeper			S		AS, SM
Bullock's Oriole			S, P	CF, CN, F, ON	AS, PC, SM
Bushtit		X			AS, SM
California Towhee			S		AS
Calliope Hummingbird			T, P		AS
Cassin's Finch	X				SM
Cassin's Vireo			S, P		AS, PC
Chipping Sparrow			S		AS, PC, SM
Common Merganser		X			AS, SM
Dark-eyed Junco			S		AS, SM
Downy Woodpecker		X			AS, SM
Dusky Flycatcher			P		AS, PC
Evening Grosbeak	X				AS
Hairy Woodpecker		X			AS, SM
Hammond's Flycatcher			S		SM
House Wren			S, P	CF, CN, ON	AS, PC, SM
Hutton's Vireo		X			AS
Lark Sparrow		X			SM
Lazuli Bunting			P		AS
Lesser Goldfinch			S, P	FS*	AS, PC, SM
Lincoln's Sparrow			S, P	CN	AS
MacGillivray's Warbler			S		AS, PC, SM
Mallard			P		AS, PC, SM
Mountain Quail		X			PC
Mourning Dove		X			AS
Nashville Warbler			S, P		AS, PC, SM
Northern Flicker		X			AS, PC, SM
Northern Rough-winged Swallow			S, P		AS, SM
Nuttall's Woodpecker		X			AS
Orange-crowned Warbler		X			PC, SM

Oak Titmouse		X			PC
Pacific-slope Flycatcher			S		AS, SM
Pine Siskin		X			AS, SM
Purple Finch			S, P	CN	PC, SM
Red-breasted Nuthatch		X			PC, SM
Red-winged Blackbird			S, T, P		AS, PC, SM
Savannah Sparrow	X				AS
Song Sparrow			**S, P**	**CN, CF, F**	**AS, PC, SM**
Spotted Sandpiper			P		SM
Spotted Towhee			S, P	CF, F	AS, PC, SM
Steller's Jay				F	AS, PC, SM
Violet-green Swallow			C	F	AS, PC, SM
Warbling Vireo			**S, P**	**CN, F**	**AS, PC, SM**
Western Meadowlark	X				AS
Western Scrub-Jay		X			AS, PC, SM
Western Tanager			S, P, T		AS, PC, SM
Western Wood-Pewee			S, T, P	CN, ON	AS, PC, SM
White-breasted Nuthatch	X				PC
White-throated Swift			C		AS
Wilson's Warbler			**S**		**AS, SM**
Wrentit			S		PC
Yellow-breasted Chat			**S**		**AS, PC, SM**
Yellow-rumped Warbler			S		AS, PC, SM
Yellow Warbler			**P, S, T**	**CF**	**AS, PC, SM**

*observed by Institute for Bird Populations intern, making it less reliable

Breeding status for each species is reported as unlikely, possible, probable, and confirmed breeders (see text from National Park Service, 2007 for description) at Poopenaut Valley, summers 2007-2010. Codes indicating breeding status are: X = detected in study area during the breeding season; P = pair observed during the breeding season; S = more than one singing male in study area or male bird singing during at least 3 visits; D = drumming woodpecker heard; C = courtship behavior or copulation observed; T = Territorial behavior; CN = bird observed carrying nest material or nest building; CF = bird observed carrying food for young; F = recently fledged or downy young observed; ON = occupied nest observed. Partners in Flight riparian focal species (RHJV, 2004) are indicated by **bold** print.

4.3.6 Bat Surveys

We placed one bat detector in Poopenaut Valley for two nights, 13-15 July 2010. We retrieved the detector on 15 July 2010. Preliminary results from this 2010 pilot study detected nine species, including three species (out of five identified in Yosemite) classified as California Species of Special Concern: spotted bat, western mastiff bat, and Townsend's big-eared bat (Table 4-9). Of particular interest is the detection of Townsend's big-eared bat, as Poopenaut Valley is one of only two locations in the park where the species was detected during 2010 bat surveys. Another exciting result is the very high number of western mastiff bat detections, much more than at any other site in the park surveyed this year. Poopenaut Valley appears to support a great diversity of bat species, including species that are dwindling in other areas of California.

Table 4-9. Bat species and number of detections from surveys conducted in Poopenaut Valley, Yosemite National Park, 13-15 July 2010.

Common Name	Latin Name	# detections	Dates detected
California myotis	Myotis californicus	2	7/13/10
Canyon bat	Parastrellus hesperus	8	7/13/10
Hoary bat	Lasiurus cinereus	29	7/13/10, 7/14/10
Mexican free-tailed bat	Tadarida brasiliensis	227	7/13/10, 7/14/10
Silver-haired bat	Lasionycteris noctivagans	5	77/13/10, 7/14/10
Spotted bat	**Euderma maculatum**	**37**	**7/13/10, 7/14/10**
Townsend’s big-eared bat	**Corynorhinus townsendii**	**1**	**7/13/10**
Western mastiff bat	**Eumops perotis**	**120**	**7/13/10, 7/14/10**
Yuma myotis	Myotis yumanensis	4	7/14/2010

Bold Font = California Species of Special Concern

4.4 Discussion

Results from bird surveys indicate that Poopenaut Valley provides important breeding and foraging areas for a diverse group of birds representing a variety of breeding niches and differing seasonal strategies (resident species, short-distance, and long-distance migrants). Birds observed in riparian-associated habitats occupy breeding niches of differing heights in the vertical strata, including understory, mid-story, and canopy. This finding suggests that the available habitat in Poopenaut Valley provides structural integrity beneficial to a wide diversity of birds (MacArthur and MacArthur, 1961; Karr and Roth, 1971).

Of particular interest are the riparian focal species (RHJV, 2004) detected in Poopenaut Valley that are understory nesters. These include Song Sparrow, Yellow-breasted Chat, and Wilson’s Warbler, which all need dense, shrubby understory and herbaceous groundcover for successful nesting. Whereas Yellow-breasted Chat and Wilson’s Warbler do not appear to be resident during the breeding season, Song Sparrow is a confirmed breeder and nests in the understory riparian vegetation at the river’s edge. In 2010 we documented an active Song Sparrow nest that failed due to rising river levels the week following 8 May. During years of high snow pack, Song Sparrows that build their nests on or near the ground in the riparian vegetation growing along the river’s edge will probably risk having their nest destroyed by rapidly rising river levels. However, Song Sparrows typically attempt more than one clutch, thus they may build a second nest after flood waters subside and reproduce successfully. It would be worthwhile to monitor later in the season to document if this is occurring in Poopenaut Valley. Finding and monitoring nests provides important information on how timing and duration of water releases has a direct effect on species nesting success.

Preliminary results from the pilot study on bats appear to suggest that bats are an appropriate indicator species for managing Poopenaut Valley’s seasonal pond. Bats are sensitive to the abundance of emergent aquatic insects that are directly linked to water availability. The seasonal pond has been identified as a rich ecosystem and valuable resource during the summer months if it is filled by water that is released from the dam at the appropriate time. Future bat monitoring will investigate how bat species presence/absence and species richness fluctuate throughout the year in response to seasonality of the pond and varying degrees of ponded water.

4.5 Future work

The pilot studies this year on nesting birds and foraging bats were initiated to investigate how timing of water releases affect productivity of birds and seasonal assemblages of bats. Preliminary results show great promise toward informing timing of water releases from O'Shaughnessy Dam, both in terms of the river discharge and stage and the filling of the seasonal pond.

Full implementation of the bird nesting and bat population studies would further fulfill our overarching goal of informing water releases from O'Shaughnessy Dam for ecological benefit. We now have evidence that the timing and duration of flood events impact certain bird species' nesting success. Additional years of study are needed to determine approximate arrival and nest initiation dates and specific nesting locations for focal species during years of varying snow pack and flow regimes. Determining the timing for when birds begin nesting and the locations for where they build their nests will enable a more accurate assessment for objective recommendations related to river discharge and stage in Poopenaut Valley.

Implementing bat monitoring year-round will allow us to characterize seasonal bat population dynamics and help inform when and how long the seasonal pond needs to be full. From our pilot investigation, we have learned that there is a high diversity of bats in Poopenaut Valley, all of them insectivorous, and most of them dependent on insects associated with the riparian ecosystem. Working closely with Jeff Holmquist (UC White Mountain Research Station) and his investigations of aquatic invertebrate species richness and diversity associated with the pond will provide a key linkage to bat population dynamics and determining how population dynamics are tied to the seasonal pond. Integrating the aquatic invertebrate and bat species richness information with pond stage and temperature will further develop a picture of ecosystem health for informing spring and summer water releases.

As a separate study in 2011 we plan to complete a third year of point count surveys in the Merced River Corridor in Yosemite Valley. By the end of 2012, we should be able to compare bird survey results from Poopenaut Valley to results from these Merced River Corridor results, which may be useful for providing insight into how Poopenaut Valley differs or is similar in bird assemblage to a nearby watershed that is not impounded.

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