Looking Downstream

FINAL 2015 Update

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

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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 water-dependent ecosystems downstream of the dam.

The 2014-2015 water year was dry, with water year precipitation at approximately 58% of average. April 1st and May 1st snow water equivalent, however, were at record lows measured at 9% and 2% of the April 1st average respectively. The water year of 2014-2015 also followed dry years in 2011-2012, 2012-2013, and 2013-2014, continuing a historically unprecedented drought in central California. Thus, hydrology studies in spring 2015 focused on monitoring low flow conditions; these low flows precluded any experimental flows, as well as filling the seasonal pond on the north side of Poopenaut Valley.

Vegetation-related fieldwork in Poopenaut Valley documented the rapid spread of non-native common mullein (*Verbascum thapsus*) within and adjacent to the seasonal pond on the north side of the river. Although the 2013 Rim Fire may have contributed to the spread of common mullein in this area, it is most likely related to the nearly continuously dry conditions in the pond over the past few years. Thus, maintaining at least some water in the Poopenaut Pond during the spring and summer months may be important in controlling the spread of non-native and invasive plants.

We continued bird surveys in Poopenaut Valley in the spring of 2015 using area searches, point counts, spot mapping, nest searches, and color banding. With area searches we observed a cumulative total of 240 individual birds of 38 species. We used spot mapping to determine the breeding territories of the four target Riparian Focal Species (Warbling Vireo, Yellow Warbler, Song Sparrow, and Black-headed Grosbeak) to elucidate their habitat-use patterns. Data collected during spot mapping and nest searching in 2011–2015 were used to calculate arrival, initiation of breeding, and fledging dates for the target Riparian Focal Species. We collected nest data to better understand nest-site selection, reproductive success, and phenology of the bird species in Poopenaut Valley. In 2015, we found 68 nests, which is substantially more than in previous year. The rate failure in Poopenaut Valley seemed unusually high; of the 68 nests found, 60% failed and 25% had unknown fates. Based on Riparian Focal Species fledging dates, we hypothesize that summer flooding events during dry and extremely dry years may cause more nest failure than spring flooding events. Several unusual bird species visited Poopenaut Valley during their spring migration, including Yellow-breasted Chat, Gray Flycatcher, Indigo Bunting, Swainson's Thrush, and Ovenbird.

Bat studies have identified an impressive biodiversity of bat species inhabiting Poopenaut Valley from spring 2011 through late summer 2015. Over this 4.5 year monitoring period, we have detected all 17 bat species known to occur within Yosemite National Park in

Poopenaut Valley; thus, Poopenaut Valley alone is as diverse as the entirety of Yosemite National Park. At least one species, the Mexican free-tailed bat, is present in Poopenaut Valley year-round. We documented five special status bat species, two of which were the first (spotted bat) and second (western mastiff bat) most frequently detected species during 2015.

Overall, bat detection frequencies decreased in 2015 to levels comparable to pre-2014 levels. The only species with marked increases were western mastiff bat and big brown bat at the south site. Species richness decreased slightly in 2015 at both sites and was fairly consistent with pre-2014 numbers. Seasonal patterns in species richness were also consistent with previous years at both sites. Summer has the highest level of species diversity while winter has the lowest. Averaged over the length of the study, the north site had slightly higher species richness than the south site in every season other than winter. The considerable jump in spotted bat and western mastiff bat detections at the south site in summer 2014 and 2015 requires further study; however, habitat effects from the Rim Fire in 2013, water levels in the river and seasonal pond, and prey availability and abundance are all likely factors.

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 western boundary of Yosemite National Park. 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 (National Park Service, 2009, 2010, 2011, 2012a, 2012b, 2014).

As in prior years, our 2015 research in Poopenaut Valley consisted of five main subject areas: (1) surface and ground water hydrology, (2) upland, meadow, wetland, and riparian vegetation, (3) riparian-dependent bird species, (4) bats, and (5) benthic macroinvertebrate assemblages. Results from benthic macroinvertebrate research are reported separately by researcher Jeff Holmquist of the University of California, Los Angeles, White Mountain Research Center (Holmquist and Schmidt-Gengenbach, 2015). This status report presents the other subjects in Chapters 2 through 5. This report details findings from the 2015 field season in Poopenaut Valley.

Chapter 2. 2015 Hydrology Studies in Poopenaut Valley

2.1 Introduction

This hydrology update covers the period between 4 May 2014 and 3 August 2015. Hydrology studies in 2015 primarily consisted of continued monitoring of water levels in the Tuolumne River in Poopenaut Valley, tributary streams, the Poopenaut Valley seasonal pond, and groundwater within the meadows adjacent to the river (Figure 2-1). Due to low water conditions, there was no flow experiment or any substantial water releases from O'Shaughnessy Dam in 2015.

2.2 Overview of the 2014-2015 water year

The 2014-2015 water year was dry, with water year precipitation at approximately 58% of average. April 1st and May 1st snow water equivalent, however, were at record lows measured at 9% and 2% of the April 1st average respectively (Table 1). Precipitation at O'Shaughnessy Dam for Water Year 2015 (California Data Exchange Commission site HEM) was 52.1 cm (20.5 inches).

Spring runoff on the Tuolumne River immediately upstream of Hetch Hetchy reservoir at USGS Gage 11274790 began on 14 March 2015 and peaked on 28 May 2015 at 25.2 cubic meters per second (cms) (890 cubic feet per second; cfs). Peak flow on the Tuolumne River below the reservoir occurred on 9 February 2015 at 27.9 cms (986 cfs), the result of a rain event the previous day (Figure 2-2).

The seasonal pond in Poopenaut Valley contained water for only a brief period in early February 2015, which was associated with the same rain event on 8 February; the pond was otherwise dry throughout the winter, spring, and summer of 2015 (Figure 2-2).

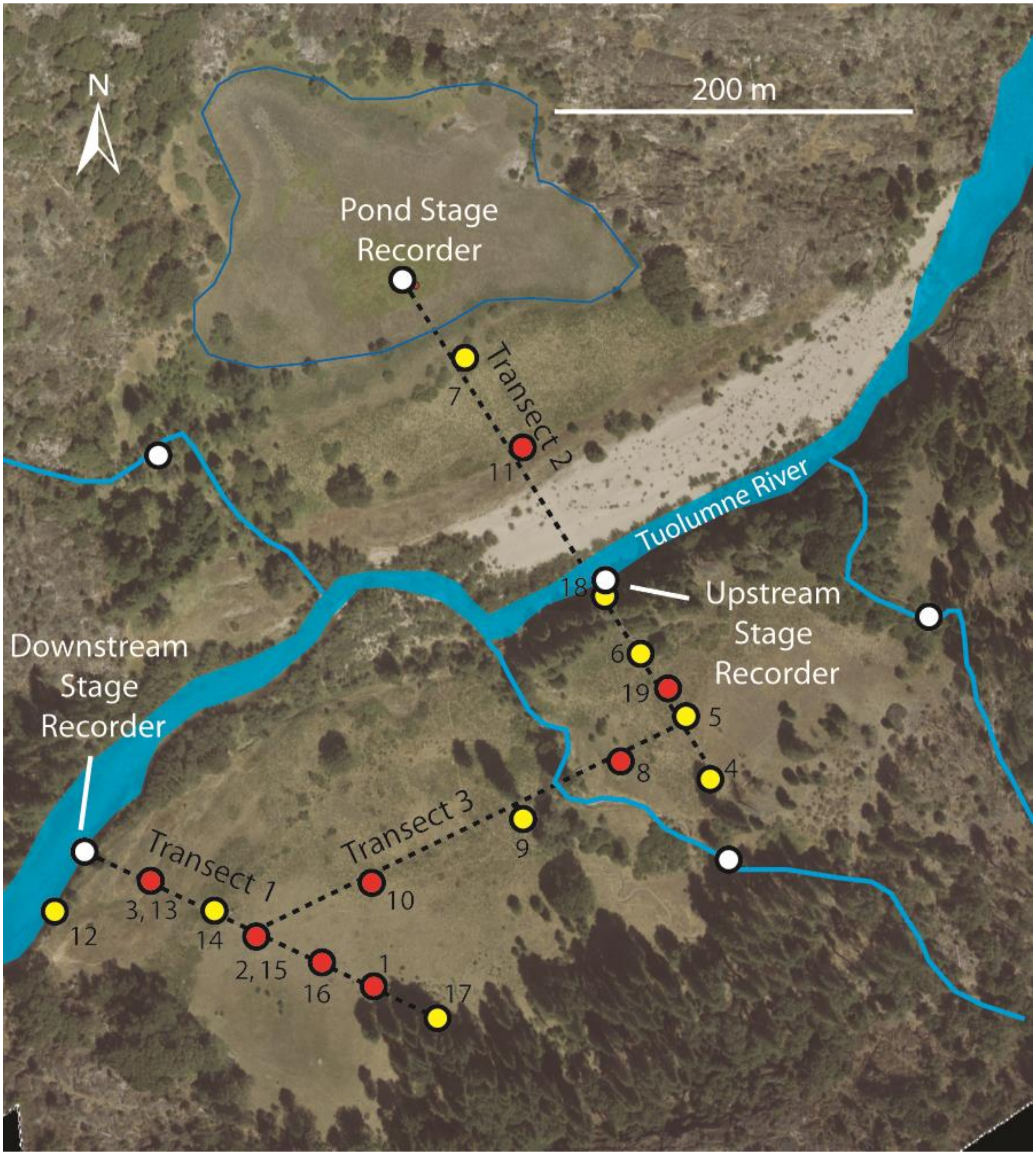


Figure 2-1. Poopenaut Valley water level monitoring locations. White dots indicate stage recorders in surface waters (Tuolumne River, tributaries, and seasonal pond). Red dots indicate existing groundwater monitoring wells. Yellow dots indicate former groundwater monitoring wells removed in October 2011.

Table 2-1. Summary snow water content for snow courses in the Tuolumne River watershed upstream in Yosemite National Park, 2015.

Snow Course	Course #	Elevation (m)	Apr 1st Average (cm)	April 1 2015 (cm)	May 1 2015 (cm)
Dana	157	2987	79	10.2	0
Rafferty	158	2865	83.3	14.0	--
New Grace	368	2713	121.9	31.8	11.4
Tuolumne	161	2621	57.7	0	0
Wilma	163	2438	109.7	8.9	0
Paradise	167	2332	101.3	3.8	0
Vernon	169	2042	56.9	0	0
Beehive	171	1981	59.7	0	0
Lower Kibbie	173	2042	66	0	0
			% April 1st Average	9%	2%

In terms of hydrological instrumentation, we have replaced most loggers with the newer Solinst Levellogger Edge model, as many original study loggers are beginning to fail. We seek to replace the remaining older loggers in fall of 2015. The tributary loggers should be replaced within the next year but are a lower priority.

Figure 2-2. Tuolumne River (red) and seasonal pond (blue) stage data for Transect 2 (upstream transect; see Figure 2-1 for location) in 2014-2015. The flat blue line for most of the period of record indicates that the seasonal pond was dry. The brief rain event on 8 February 2015 resulted in approximately 7 cm of water at the seasonal pond water level sensor (blue arrow), the only time during water year 2014-2015 that the pond contained any standing water.

Chapter 3. 2015 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. The maintenance and enhancement of the ecological integrity of these communities requires flow magnitude, timing, frequency and duration sufficient to inundate wetlands and maintain the water table and soil moisture required for plants to establish and persist. The minimum hydrologic requirements for a jurisdictional wetland in the western mountain region is defined by the US Army Corps of Engineers to have 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 (U.S. Army Corps of Engineers 2012). Through hydrologic assessments and modeling, hydrologists have recommended flow models and have a good sense of the physical response (e.g. soil saturation, water table level, soil moisture retention) to different flow magnitudes and durations. For example, Russo et al. (2012) suggested that surface soil inundation was the most effective method, in terms of minimizing the volume of flow releases, for saturating soils and supporting wetland hydrology. While soil physical and chemical properties may have changed quickly under an altered flow regime, measurable vegetation responses may take much longer before they reflect the effects of such restored hydrology. Therefore, assessment of the biological response through monitoring requires a longer time period. The NPS monitoring strategy calls for resampling the vegetation transects every other year, so the next sampling event will occur in 2016.

3.2 Non-native and invasive plants

2015 field work in Poopenaut Valley highlighted an increase in non-native plants. Among these, most notable was the rapid spread of common mullein (*Verbascum thapsus*) within and adjacent to the Poopenaut Valley seasonal pond on the north side of the river. Common mullein is a non-native species that has a seedbank known to last more than 50 years. Comparison of photographs between fall of 2012 and fall of 2015 (Figure 3-1) clearly show an increase in common mullein in the vicinity of the seasonal pond; as of 2015, this is the densest known population in Yosemite National Park. Although the 2013 Rim Fire may have contributed to the spread of common mullein in this area, mullein has not been observed in such high densities elsewhere within the Rim Fire perimeter. Thus, the spread of common mullein here is likely due to the very dry conditions in the pond over the past few years (e.g., National Park Service, 2014a, 2014b). If correct, then maintaining at least some water in the seasonal pond during the spring and summer months may be important in controlling the spread of non-native and invasive plants in Poopenaut Valley. Close monitoring of common mullein and other non-native plants in the vicinity of the seasonal pond in future water years will help to evaluate this relationship.

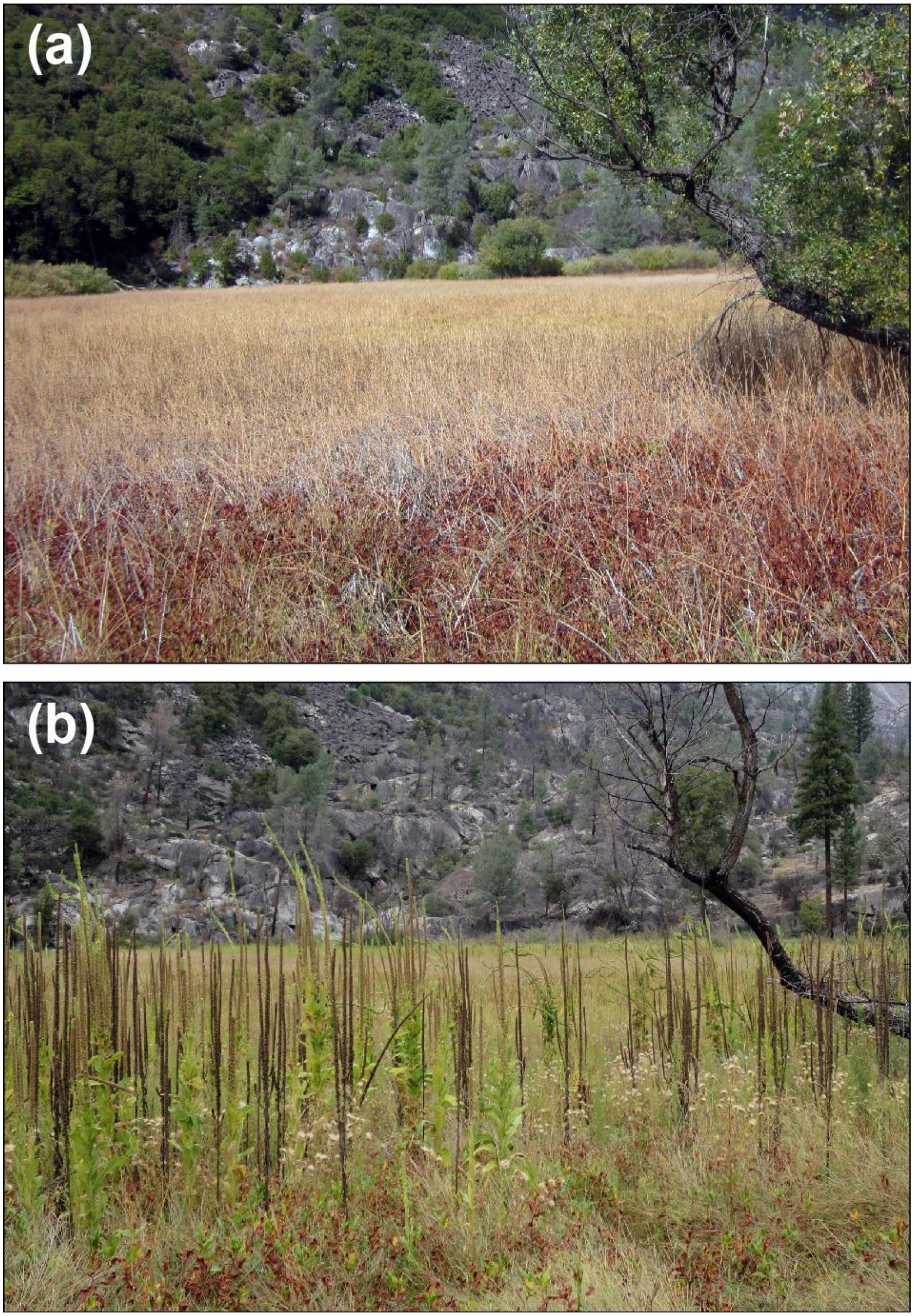


Figure 3-1. Repeat photographs showing spread of non-native and invasive common mullein (*Verbascum thapsus*) in the vicinity of the Poopenaut Valley pond between 2012 and 2015. (a) Photograph from the south side of the pond looking north in October of 2012 showing dominantly reeds and grasses; (b) same view in September of 2015, showing spread of common mullein.

Chapter 4. 2015 Bird 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 incurred from restoration efforts, river diversion and channelization projects, water impoundment, and flooding events.

One of the main objectives of studying birds in Poopenaut Valley is to gain a better understanding of how altered hydrology below O'Shaughnessy Dam affects breeding birds. We began investigations in 2007 by completing a California Wildlife Habitat Relationships model that predicts occurrence of vertebrate species (amphibians, reptiles, birds, and mammals) between O'Shaughnessy Dam and the park boundary and in Poopenaut Valley (National Park Service, 2009). Also in 2007, we began ground-truthing the model by conducting area search surveys with the goal of characterizing the breeding bird community in Poopenaut Valley (National Park Service, 2009, 2010, 2012a, 2012b, 2014, 2015). Since 2007, we have continued to augment our survey methods in order to delve deeper into the breeding ecology of the bird community in Poopenaut Valley. We have focused our studies on four species that commonly breed in Poopenaut Valley which were identified as Riparian Focal Species by The Riparian Bird Conservation Plan (RHJV, 2004): Warbling Vireo (*Vireo gilvus*), Yellow Warbler (*Setophaga petechia*), Song Sparrow (*Melospiza melodia*), and Black-headed Grosbeak (*Pheucticus melanocephalus*). These species play a central role in our goal to relate seasonal population trends of breeding birds in Poopenaut Valley to water availability.

We initiated bird studies in 2007 with search area surveys; beginning in 2008 we conducted point counts surveys; beginning in 2010 we conducted spot mapping surveys, nest searching, and territory mapping; beginning in 2012 we captured and banded birds; beginning in 2013 we color-banded Song Sparrows and Yellow Warblers and kept daily species lists of incidental observations (observations occurring outside of surveys); and beginning in 2014 we color-banded Warbling Vireos, Black-headed Grosbeaks, and Western Wood-Pewees. We continue to more closely monitor Song Sparrows and Yellow Warblers because they have special sensitivity to different aspects of the riparian system: Yellow Warblers are listed as a California Species of Special Concern, and Song Sparrows typically nest in the lowest vegetation strata, so their nests may be more vulnerable to flooding.

Color-banding serves two primary functions in our survey efforts. First, it increases the accuracy of territory mapping because color-banded birds can be more easily identified as individuals. More accurate and reliable knowledge of territories enables us to better correlate territory size with quality of available habitat. Second, color-banding provides an opportunity to measure various indices of avian population health, e.g., adult survival and recruitment. Color-banding can also help with determining an individual's breeding status (Anders and Marshall 2005). Incorporating color-banding into the suite of avian survey techniques utilized in Poopenaut Valley results in a more thorough and comprehensive assessment of ways in which the altered flow regime might be influencing avian population dynamics. This information on breeding bird populations will feed into recommendations to the San Francisco Public Utilities Commission on timing water releases from O'Shaughnessy Dam in order to benefit breeding birds.

4.2 Methods

4.2.1 Bird Area Search and Point Count Surveys

We conducted the ninth year of standardized area search surveys (2007–2015) and the eighth year of point count surveys (2008–2015) 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 0.03 km^2 (3 hectares) (Figure 4-1); see the 2007 Looking Downstream Report (National Park Service, 2009) for a more detailed description of protocols and search areas.

The area searches were conducted for 20 minutes each during which we recorded birds inside each area, and within 10 meters outside the area boundary, unless that boundary was the dividing line between areas. In 2008, we established two point count locations, one on either side of the river in Poopenaut Valley (see Figure 4-1): the north point count at the intersection of Area 1 and 2 (UTM 11S: 0252076 4200794); and the south point count at the intersection of Area 3 and 4 (UTM 11S 0252165 4200535). 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. We conducted point counts during 3 visits for 5 minutes each, coinciding with the same morning when we conducted area searches. Use of standardized survey methods allows data to be compared among years, and compared with locations outside of Poopenaut Valley. Each set of point counts and area searches was completed by 10 a.m. and was separated by 10 days or more. 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 presence of 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 description of data analysis methods and examples of standardized datasheets). Through 2013, species dissimilarity was calculated using the program SYSTAT. Beginning 2014, the program R (R Statistical Computing Software, Vienna, Austria) was used instead, since it is becoming a more widely used tool. We used R's the *vegdist* function with the *vegan* package to complete the Bray-Curtis dissimilarity measure.

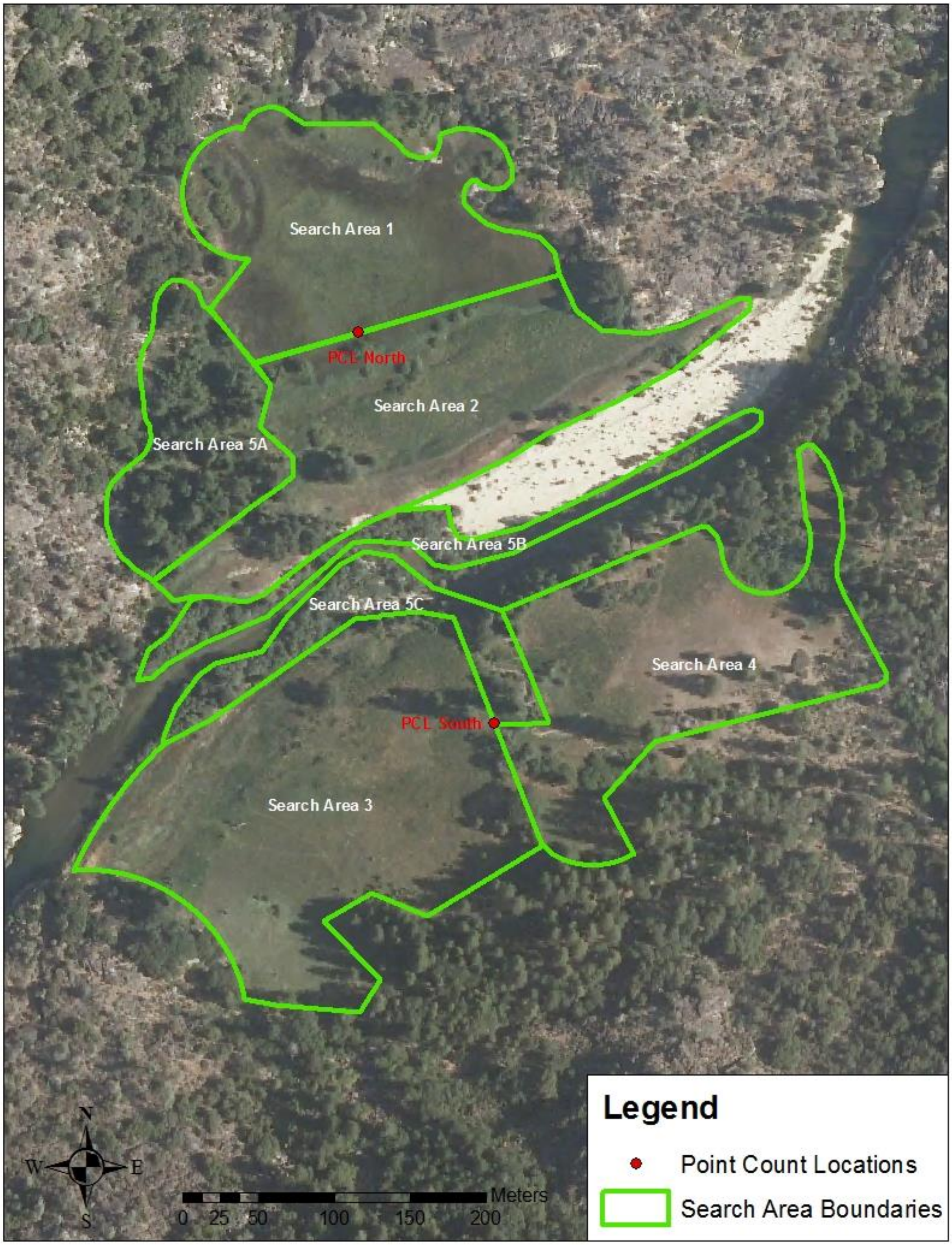


Figure 4-1. Bird search areas (same as spot map and nest search areas) and point count locations in Poopenaut Valley.

4.2.2 Bird Spot Map Surveys

In 2010, we began conducting spot map surveys in the same avian search areas (Areas 1–5) as the area searches (Figure 4-1). We completed 6 spot mapping visits of each area in 2015 with the exception of Area 3 which was visited 5 times. Because of comparatively low water flows in 2015, the river was easy to cross, so we were able to conduct a comprehensive survey of all five areas. During a single visit, we spent 40 to 90 minutes spot mapping each area, and finished by noon. We adapted spot mapping methods from the standardized spot mapping protocol described by Bibby et al. (1992), and Ralph et al. (1993). The observer walked the area slowly, stopping for as long as necessary to mark every target species detected in its exact location on a map of the area. The observer distinguished males from females if possible, and marked their locations on the map using a different symbol. The observer 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. During each visit, the observer recorded data on a new map.

At the end of the season, we prepared cumulative maps for the four focal species (Warbling Vireo, Yellow Warbler, Song Sparrow, and Black-headed Grosbeak) in order to determine the number of breeding pairs, territory sizes, and distribution. We digitized these maps and analyzed the detection data using ArcGIS. We mapped locations of individuals, pairs, and territorial behavior (such as counter-singing and chasing). Measuring the size of bird territories has been done using various methods in the past (Hayne, 1949; Odun and Kuenzler, 1955; Suthers, 1960; Wiens et al., 1985). Traditionally, bird detections were marked on a map, and then clusters of detections were grouped into the smallest polygon in which no internal angle exceeded 180 degrees (Burgman and Fox, 2003). This method is known as minimum convex polygons (Mohr, 1947). Although this method provides useful insight into potential territories, it is also susceptible to potentially significant observer bias (Laver and Kelly, 2008; Nilsen et al., 2008; Worton, 1995). For each species, we plotted each pair's territory location and size using kernel density estimation which has been claimed to be a more rigorous method of mapping home ranges (Borger et al., 2006; Naef-Daenzer, 1993; Seaman and Powell, 1996) than the minimum convex polygon method (Mohr, 1947; Silverman, 1986). The kernel density estimation produced a raster layer depicting detection densities. This layer estimated a probability density for the entire study area. To identify each territory belonging to a pair of birds, we used the kernel raster layer as a visual guide for creating a convex hull around groups of points. We used minimum registration number guidelines from I.B.C.C. (1970) to avoid selecting clusters with not enough detections. Each resulting convex hull represented an independent territory.

4.2.3 Bird Nest Search Surveys

Since 2010, we have conducted nest search surveys simultaneously with spot map surveys, and have used a standardized nest searching protocol (PRBO, 2001) as a general guide. 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 their nests. For each nest, we recorded the nest location using a Global Positioning System (GPS) unit and recorded information about the status and location of the nest onto a nest card. During every subsequent site visit, we checked nests and recorded the observed nesting activity onto the nest card. At the end of the season, we transferred nest card information onto a nest record sheet and coded nest results.

4.2.4 Bird Mist-netting and Color-banding

Beginning in 2012, we began capturing birds using mist-nets. In 2013, we began color-banding captured Song Sparrows and Yellow Warblers, and in 2014, we began color-banding Warbling Vireos, Black-headed Grosbeaks, and Western Wood-Pewees. With few exceptions, we identified all captured birds to species, age, and sex; and banded them with USGS-BRD (United States Geological Survey, Biological Resources Division) numbered aluminum bands. We collected the following data from all birds captured, including recaptures:

- capture code (newly banded, recaptured, band changed, unbanded)
- band number
- species
- age and how aged
- sex (if possible) and how sexed (if applicable)
- extent of skull pneumaticization
- breeding condition of adults (i.e., extent of cloacal protuberance or brood patch)
- extent of juvenal plumage in young birds
- extent of body and flight-feather molt
- extent of primary-feather wear
- presence of molt limits and plumage characteristics
- wing chord
- fat class and body mass
- date and time of capture
- station and net site where captured
- any pertinent notes

Our efforts were restricted to early morning hours, from local sunrise to approximately 0930. To capture the birds, we identified important movement corridors in each of the birds' territories and erected a 6-meter, 32 mm mesh mist net. Beneath the net, we hid an iPod equipped with a portable speaker and played a recording of the male song for up to approximately 20 minutes in order to attract the target species. We actively watched the mist-nets, and extracted any birds immediately after capture. We banded each individual with a USGS-BRD numbered aluminum bands with a unique 9-digit identification number and a unique combination of color bands to allow individual identification during subsequent field observations. We also collected data following the Institute for Bird Populations' MAPS (Monitoring Avian Productivity and Survivorship) protocol, including age, sex, breeding status, extent of body and flight feather molt, fat, wing chord length, and weight. Birds were released early with minimal data taken if they exhibited signs of stress.

In the event that birds other than targeted focal species flew into the net, we extracted and processed them as above, and banded them with a USGS-BRD numbered aluminum band (if we had the proper size), but did not apply color-bands. All banding data were collected under Permit Number 22423, administered by The Institute for Bird Populations (IBP). In accordance with the permitting requirements, IBP will send all electronically entered and proofed banding data to the USGS Bird Banding Laboratory at the Patuxent Wildlife Research Center, thereby contributing to a national long-term monitoring effort of birds.

4.3 Results

4.3.1 2015 Bird Area Searches

The ninth consecutive year of area search surveys in Poopenaut Valley took place on 16 May, 11 June, and 23 June 2015. Due to low water flow, all five search areas were accessible on each survey date. During the three visits, flow rates just below the O'Shaughnessy Dam (USGS Site Number: 11276500) were 1.5, 2.1, and 2.1 cms (52, 75, and 74 cfs), respectively (http://waterdata.usgs.gov). These flows are representative of flows experienced throughout the 2015 field season, thus are not reported for the other survey results.

During area searches, we observed a cumulative total of 240 individual birds of 38 species in Poopenaut Valley in 2015. To account for the likelihood of duplicate observations of individual birds among visits, we estimated relative abundance to be 176 individual birds using the highest count from the three visits for each species (Table 4-1). The five most frequently detected bird species based on high counts were:

- American Robin (*Turdus migratorius*)—17 individuals,
- Western Wood-Pewee (*Contopus sordidulus*)—15 individuals,
- Black-headed Grosbeak—11 individuals,
- Lazuli Bunting (*Passerina amoena*)—9 individuals, and
- Steller's Jay (*Cyanocitta stelleri*)—9 individuals (Table 4-1).

The six most frequently encountered species based on gross totals were:

- Western Wood-Pewee—24 detections,
- American Robin—19 detections,
- Black-headed Grosbeak—14 detections,
- Steller's Jay—14 detections,
- Lazuli Bunting—13 detections, and
- Spotted Towhee (*Pipilo maculatus*)—13 detections.

Table 4-1. Relative abundance of bird species detected during area searches in Poopenaut Valley, Yosemite National Park, in May–June 2015. Values reported are high counts for each species in each area across all three visits.

Species	Status	**1**	**2**	**3**	**4**	**5**	**Relative Abundance**
Acorn Woodpecker					1	2	**3**
American Robin		2	4	2	5	4	**17**
Anna's Hummingbird		2	2	1		1	**6**
Bewick's Wren		2				1	**3**
Blue-gray Gnatcatcher		2	1	1			**4**
Brown-headed Cowbird		1	1	1		2	**5**
Black-headed Grosbeak	RFS	1	1	3	3	3	**11**
Black Phoebe			1			1	**2**
Brown Creeper					1		**1**
Black-throated Gray Warbler		1		1	1	1	**4**
Bullock's Oriole		1				1	**2**
Bushtit		5	2			1	**8**
California Towhee		1					**1**
Cassin's Vireo			1		1		**2**
Downy Woodpecker						1	**1**
Hairy Woodpecker			1	1			**2**
House Wren		1	2		1	1	**5**
Hutton's Vireo					1		**1**
Lawrence's Goldfinch				2		3	**5**
Lazuli Bunting		5	1		1	2	**9**
Lincoln's Sparrow						1	**1**
MacGillivray's Warbler					2		**2**
Mourning Dove		2	2			2	**6**
Nashville Warbler					1		**1**
Northern Flicker			2	1		1	**4**
Northern Rough-winged Swallow						3	**3**
Nuttall's Woodpecker					1	3	**4**
Song Sparrow	RFS	1	1		1	3	**6**
Spotted Towhee		1	1	2	2	2	**8**
Steller's Jay		3	2	1		3	**9**
Warbling Vireo	RFS			1	2	2	**5**
White-breasted Nuthatch						1	**1**
White-crowned Sparrow						1	**1**
Western Scrub-Jay			2			1	**3**
Western Tanager			2		1	2	**5**
Western Wood-Pewee		1	5	3	1	5	**15**

Wilson's Warbler	RFS		1			1	**2**
Yellow Warbler	SSC, RFS	1	2	3		2	**8**
Combined Species Totals		**33**	**37**	**23**	**26**	**57**	**176**

RFS—Riparian Focal Species (see RHJV, 2004)
SSC— California Department of Fish & Wildlife Species of Special Concern (see California Department of Fish and Wildlife, 2015)

The montane riparian habitat in Area 5 had the highest species richness (30 species), abundance estimate (57 detections), Shannon's diversity index (*H* = 3.263), and evenness (*J* = 0.959). Area 3 exhibited the lowest species richness (14 species) and diversity index (*H* = 2.525). Area 1 had the lowest evenness (*J* = 0.934). Wet meadow habitat averaged 29.75 detections of an average of 17.5 species, which was much lower compared with 57 detections of 30 species in the montane riparian habitat (see Table 4-2).

Table 4-2. Species richness, relative abundance, bird diversity, and evenness from area searches, by study area in Poopenaut Valley, Yosemite National Park, May–June 2015.

	Species Richness+	Abundance Estimate*	Species Diversity Index*	Evenness*
Area 1 Wet Meadow	18	33	2.699	0.934
Area 2 Wet Meadow	21	37	2.906	0.955
Area 3 Wet Meadow	14	23	2.525	0.957
Area 4 Wet Meadow	17	26	2.662	0.940
Area 5 Montane Riparian	30	57	3.263	0.959

+Total number of species seen in each area over all 3 visits
*The highest count of the individuals of a species out of the 3 visits is used in calculations.

Analysis of area search data from Areas 1–5 using the Bray-Curtis Dissimilarity Measure revealed that Areas 1 and 4 differed the most in community assemblage (I_{BC} = 0.394, Table 4-3), meaning they shared the least number of species in common. Areas 2 and 5 shared the highest degree of community similarity (I_{BC} = 0.205, Table 4-3), meaning they shared the most similar species composition.

Table 4-3. Bray-Curtis Dissimilarity Matrix for bird assemblages by search area in Poopenaut Valley, Yosemite National Park, May–June 2015. Numbers enclosed in boxes indicate the least and most similar sites.

	Area 1	Area 2	Area 3	Area 4	Area 5
Area 1	0.000000				
Area 2	0.310345	0.000000			
Area 3	0.351351	0.260870	0.000000		
Area 4	0.393939	0.300000	0.212121	0.000000	
Area 5	0.371429	0.205128	0.206897	0.220339	0.000000

4.3.2 2015 Bird Point Counts

The eighth year of point count surveys in Poopenaut Valley took place during 2015 on 16 May, 11 June, and 23 June. On each visit, point counts were conducted at two sites: North Poopenaut and South Poopenaut. At North Poopenaut, we detected an average of 19.67 individuals of 25 species; at South Poopenaut we detected an average of 19.33 individuals of 25 species (Table 4-4). In total, we detected 32 species during all of the point counts.

Table 4-4. Raw abundance (total number of detections), relative abundance (mean individual detections), and species richness from point counts in Poopenaut Valley, Yosemite National Park, May–June 2015. Data include all detections of adult birds, excluding flyovers.

	North Poopenaut		South Poopenaut	
Species	**Total Individuals Detected**	**Relative Abundance**	**Total Individuals Detected**	**Relative Abundance**
Acorn Woodpecker	4	1.33	7	2.33
American Robin	2	0.67	1	0.33
Anna's Hummingbird	1	0.33	2	0.67
Ash-throated Flycatcher	1	0.33	0	0.00
Bewick's Wren	1	0.33	0	0.00
Blue-gray Gnatcatcher	1	0.33	1	0.33
Brown-headed Cowbird	0	0.00	1	0.33
Black-headed Grosbeak	4	1.33	5	1.67
Brown Creeper	0	0.00	1	0.33
Black-throated Gray Warbler	1	0.33	1	0.33
Bushtit	0	0.00	1	0.33
California Towhee	1	0.33	0	0.00
Cassin's Vireo	3	1.00	1	0.33
Downy Woodpecker	0	0.00	2	0.67

House Wren	2	0.67	1	0.33
Hutton's Vireo	0	0.00	1	0.33
Lazuli Bunting	5	1.67	2	0.67
Lesser Goldfinch	5	1.67	2	0.67
MacGillivray's Warbler	0	0.00	1	0.33
Mourning Dove	3	1.00	2	0.67
Mountain Quail	0	0.00	3	1.00
Northern Flicker	1	0.33	0	0.00
Song Sparrow	3	1.00	4	1.33
Spotted Towhee	2	0.67	3	1.00
Steller's Jay	4	1.33	6	2.00
Unidentified Blackbird	1	0.33	0	0.00
Warbling Vireo	6	2.00	3	1.00
Western Tanager	2	0.67	2	0.67
Western Wood-Pewee	3	1.00	4	1.33
Wilson's Warbler	1	0.33	0	0.00
Wrentit	1	0.33	0	0.00
Yellow Warbler	1	0.33	1	0.33
Abundance	59	19.67	58	19.33
Species Richness	25		25	
Total Species	32			

4.3.3 2015 Bird Spot Mapping

We used spot mapping to determine the breeding territories of the four target Riparian Focal Species: Warbling Vireo, Yellow Warbler, Song Sparrow, and Black-headed Grosbeak (Figure 4-2) to elucidate their habitat-use patterns in Poopenaut Valley. This year (2015) marked the sixth consecutive year of spot mapping. Each area was spot mapped 6 times, with the exception of Area 3 which was spot mapped 5 times. The areas were spot mapped on: 28–29 April, 6–7 May, 17 May, 20–21 May, 28 May, 4 June, 23–24 June. We compiled the spot mapping surveys into a cumulative map of detections and associated behaviors. We then plotted the breeding territories of the target species by analyzing the mapped data (Figure 4-2). Most of the territories were located along meadow edges, especially where willows were present.

Warbling Vireo: This species was present on the first spring visit to Poopenaut Valley on 24 April. We identified a total of seven territories in Poopenaut Valley during the 2015 field season (Figure 4-3). All territories had at least one portion adjacent to the riparian corridor of the Tuolumne River. We found five nests (Nest Numbers: 2, 10, 16, 46, 51): three failed (Nests 2, 10, and 16) and two had unknown fates (Nests 46 and 51).

Yellow Warbler: This species arrived later in Poopenaut Valley than the other three focal species, consistent with observations from previous years. The first male was detected on 29

April, the first female on 6 May. We identified six territories in Poopenaut Valley (Figure 4-4). All territories were along riparian corridors. We found seven nests (Nest 11, 23, 24, 32, 33, 48, and 58) (Figure 4-4). Nest 33 was a re-nest of Nest 11. Nest 24 had a color-banded female. All nests failed and no juveniles were seen in Poopenaut Valley. Yellow Warblers appeared to be absent in Poopenaut Valley after approximately 23 June. This could have been an earlier than normal departure following the failed nesting attempts.

Song Sparrow: Both males and females were observed during the first spring visit to Poopenaut Valley on 24 April. Additionally, both must have been present for the initiation of Nest 18, estimated to be 19 April (see Table 4-8). We detected four Song Sparrow territories. We found nests in two territories (Nests 18 and 20); both nests successfully fledged young. The other two territories had pairs of Song Sparrows which we saw frequently, but did not observe evidence of nesting (see Figure 4-5). The territory with Nest 18 was occupied by the male Song Sparrow YY/YS which was banded 24 April 2015. Winter observations are needed to confirm whether or not Song Sparrows are present year-round in Poopenaut Valley.

Black-headed Grosbeak: This species was present during the first spring visit to Poopenaut Valley on 24 April. We detected six Black-headed Grosbeak territories (Figure 4-6). Territories for this species were difficult to plot for three reasons. First, the birds often engaged in long flights. Second, detections were more spread out than other species. And third, because both male and female Black-headed Grosbeaks sing, counter-singing cannot easily be used as a criterion to delineate the boundaries between territories. In order to correctly distinguish counter-singing from intraparietal singing, simultaneously singing individuals must be simultaneously observed. The fact that both males and females sing may not have been considered in previous years of the study. The female song is “generally a simplified version of male song” (Ortega et al., 2010), so it may be possible for the surveyor to learn to distinguish the songs of the sexes in future years of the study, and thereby accurately record counter-singing. This year, we found four definite nests (Nest 19, 26, 28, and 41) and one possible nest (Nest 50) of this species. Of the definite nests, one fledged (Nest 19), two failed (Nest 26 and 41), and one had an unknown fate (Nest 28). The territory with Nest 41 may have belonged to the male Black-headed Grosbeak RW/YS. Interestingly, the two territories containing Nest 19 and Nest 28 were so close together (approximately 25 m), that they might have looked like one territory if the nests had not been active simultaneously. Thus, nest searching can be an important aid in spot mapping. Of all the nests, only one (Nest 41) was in the riparian corridor.

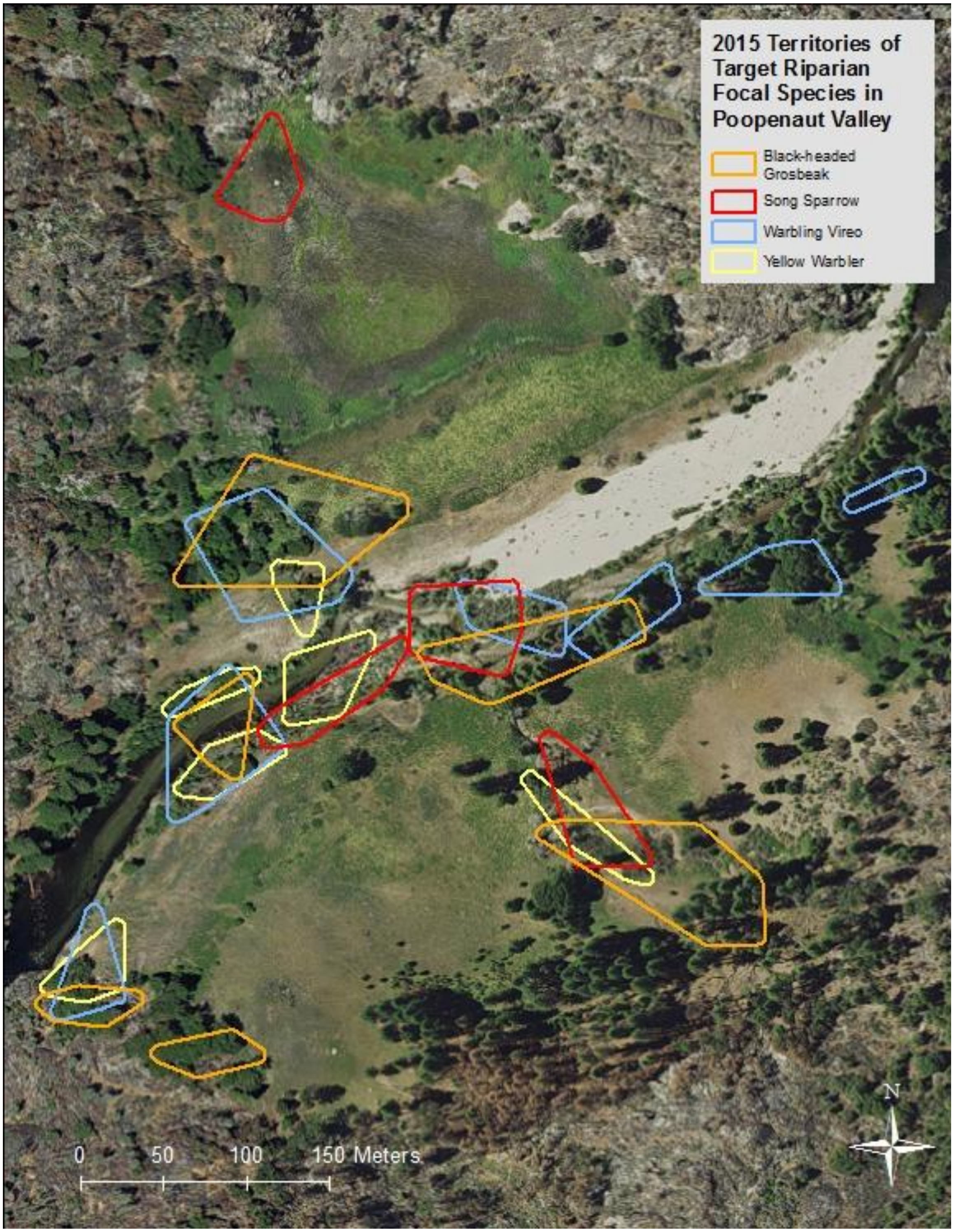


Figure 4-2. Warbling Vireo, Yellow Warbler, Song Sparrow, and Black-headed Grosbeak breeding territories in Poopenaut Valley, Yosemite National Park, 2015.

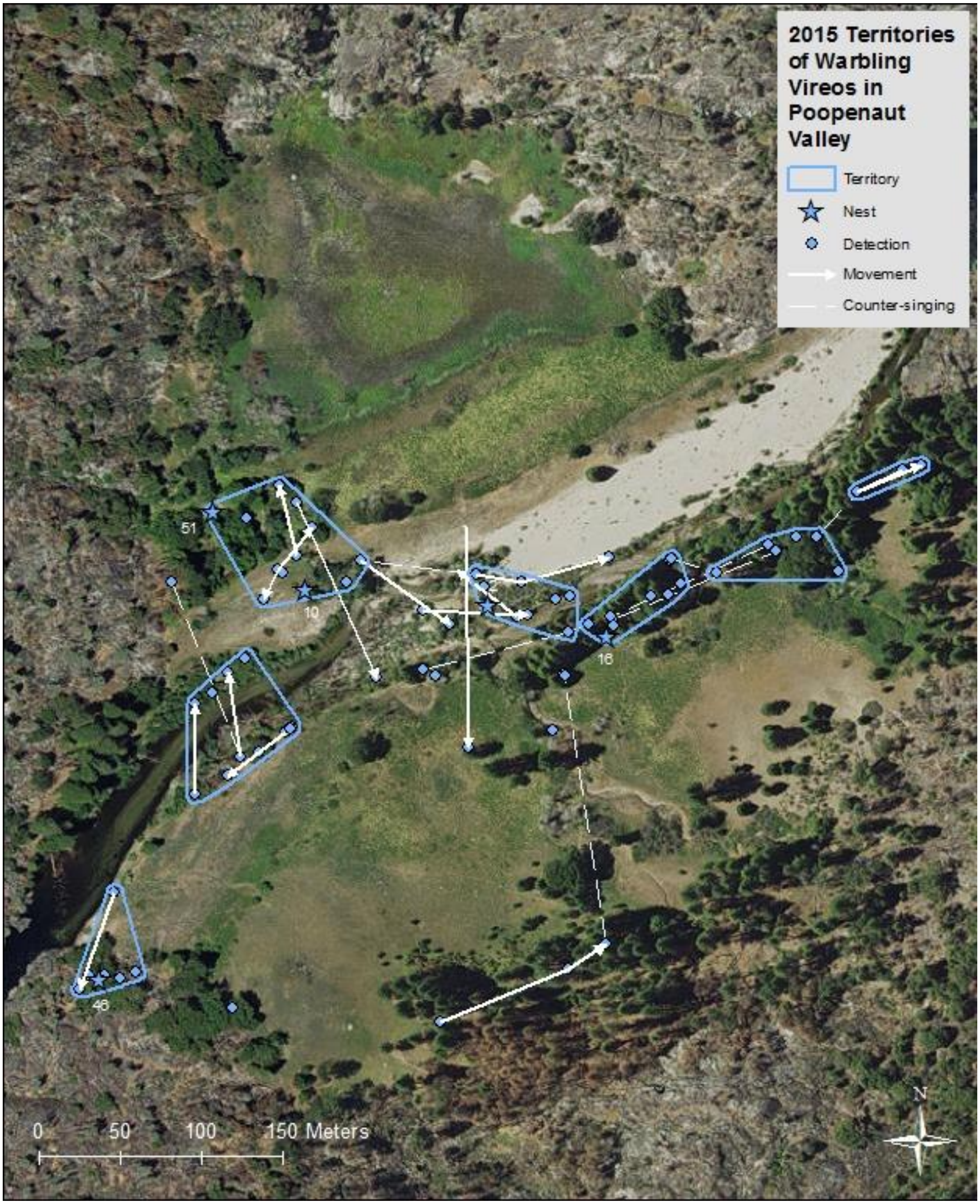


Figure 4-3. Warbling Vireo detections, territories, counter-singing between males, and individual movement within Poopenaut Valley, Yosemite National Park, 2015. Nest numbers are shown next to nests.

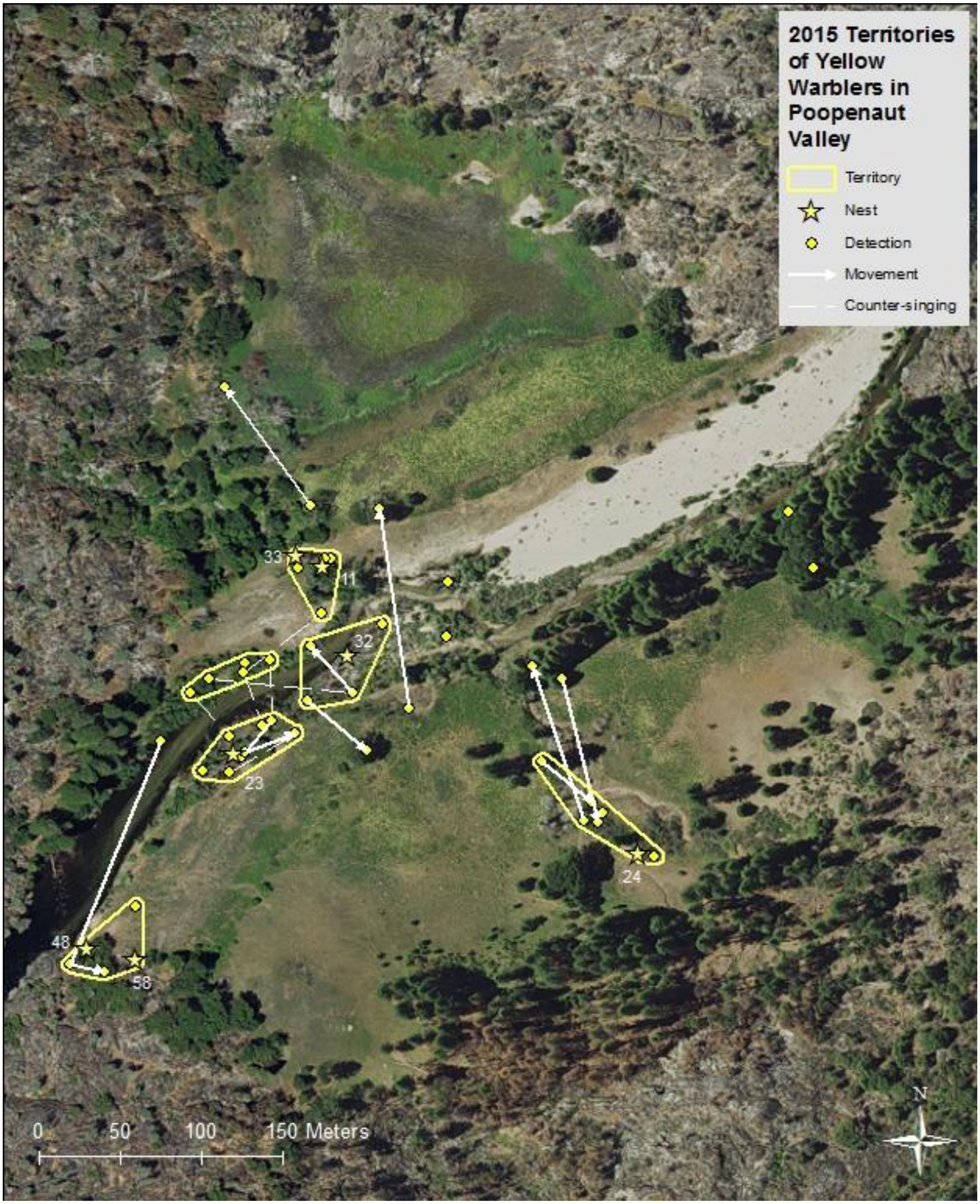


Figure 4-4. Yellow Warbler detections, territories, and individual movement within Poopenaut Valley, Yosemite National Park, 2015. Nest numbers are shown next to nests.

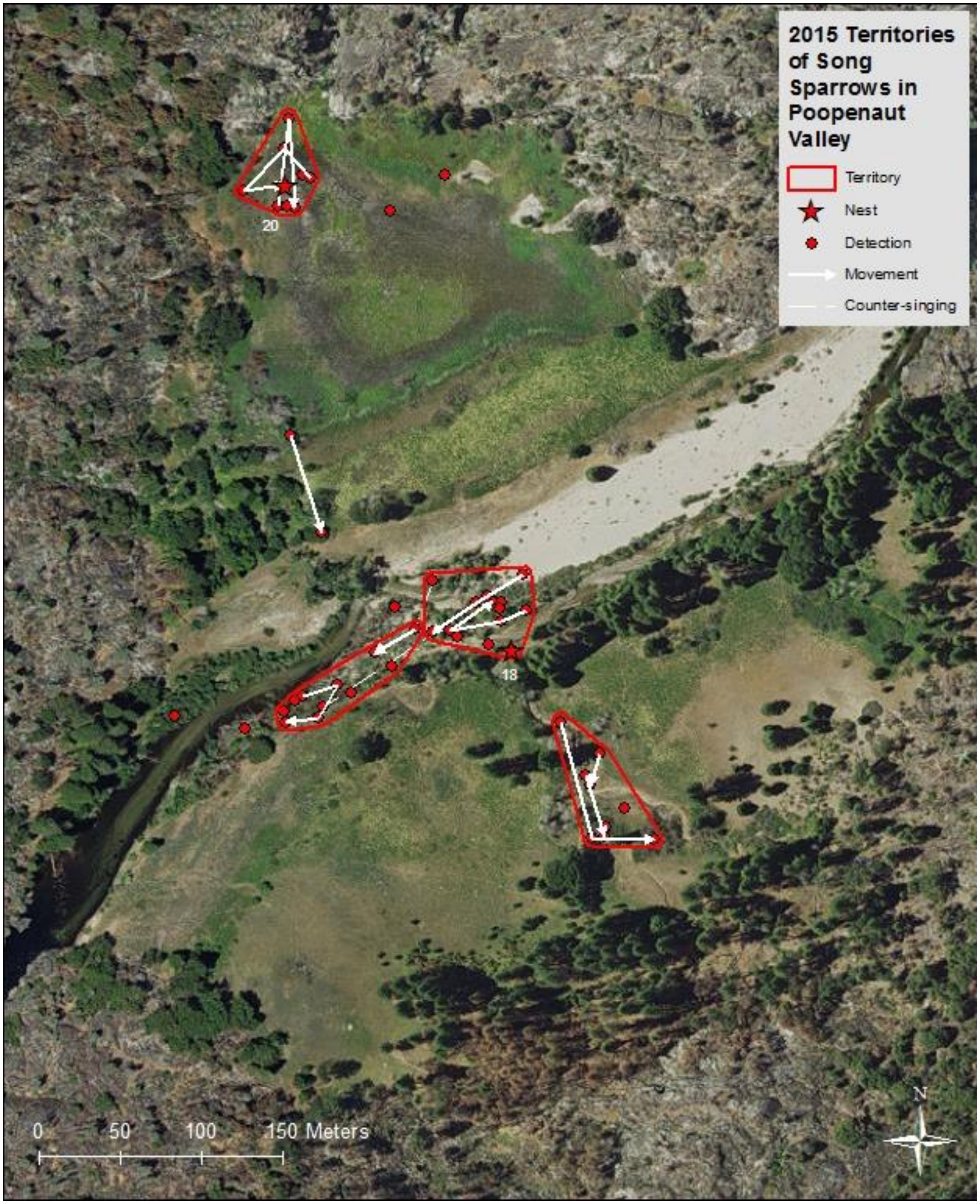


Figure 4-5. Song Sparrow detections, territories, counter-singing between males, and individual movement within Poopenaut Valley, Yosemite National Park, 2015. Nest numbers are shown next to nests.

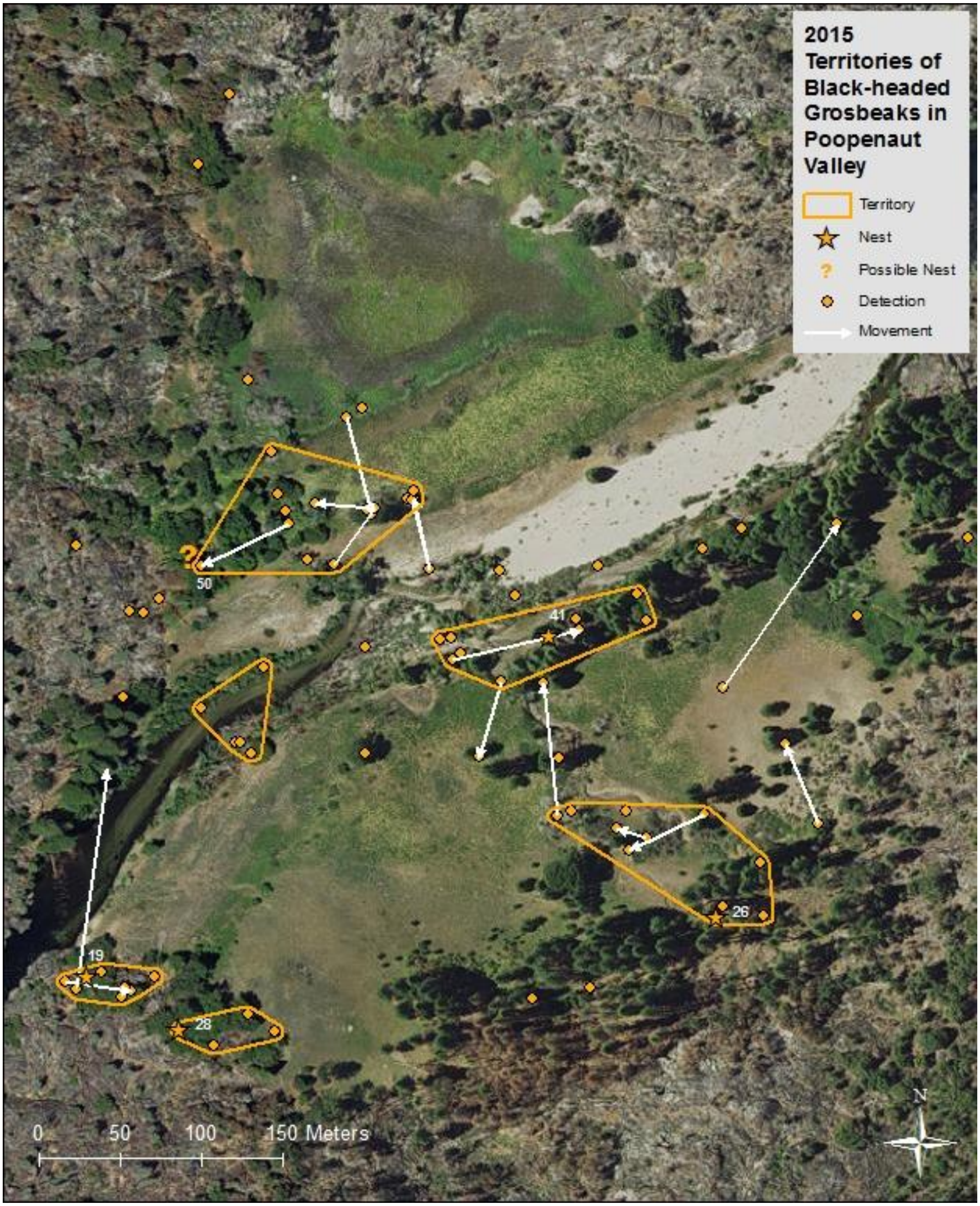


Figure 4-6. Black-headed Grosbeak territories, detections, and individual movement within Poopenaut Valley, Yosemite National Park, 2015. Counter-singing data was not used (see text). Nest numbers are shown next to nests.

4.3.4 2015 Bird Nest Searching

In 2015, we conducted the sixth consecutive year of nest searching in Poopenaut Valley. Concerted nest searching visits were made to Poopenaut on 28 and 29 April; 6, 7, 16, 17, 20, 21, 27, and 28 May; and 3, 4, 10, 11, 16, 23, and 24 June. We searched for nests most often in the morning or evening, when birds were generally the most active.

We found 68 certain nests of 23 species in and around Poopenaut Valley (Table 4-5). We plotted the nest locations using ArcGIS (see Figures 4-3, 4-4, 4-5, 4-6, 4-8, and 4-9). Four of the nests were located outside of Poopenaut Valley, proper: 3 on the Poopenaut Valley Trail between Hetch Hetchy Road and Poopenaut Valley (1 Brown Creeper, 1 House Wren, and 1 Mourning Dove), and 1 just downstream from Area 3 (Black Phoebe). Of the 64 nests, 18 were nests of target Riparian Focal Species: 4 Black-headed Grosbeak, 2 Song Sparrow, 7 Yellow Warbler, and 5 Warbling Vireo. Additionally, 4 possible nests were located but never confirmed: 1 Black-headed Grosbeak, 1 Cassin's Vireo, 1 Lawrence's Goldfinch, and 1 Northern Flicker. We observed nesting behavior (nest-material carries or parental visits to fledglings) but did not locate nests of Anna's Hummingbird, Brown-headed Cowbird, Canyon Wren, Nashville Warbler, Northern Pygmy-Owl, Spotted Owl, Steller's Jay, and Western Scrub-Jay.

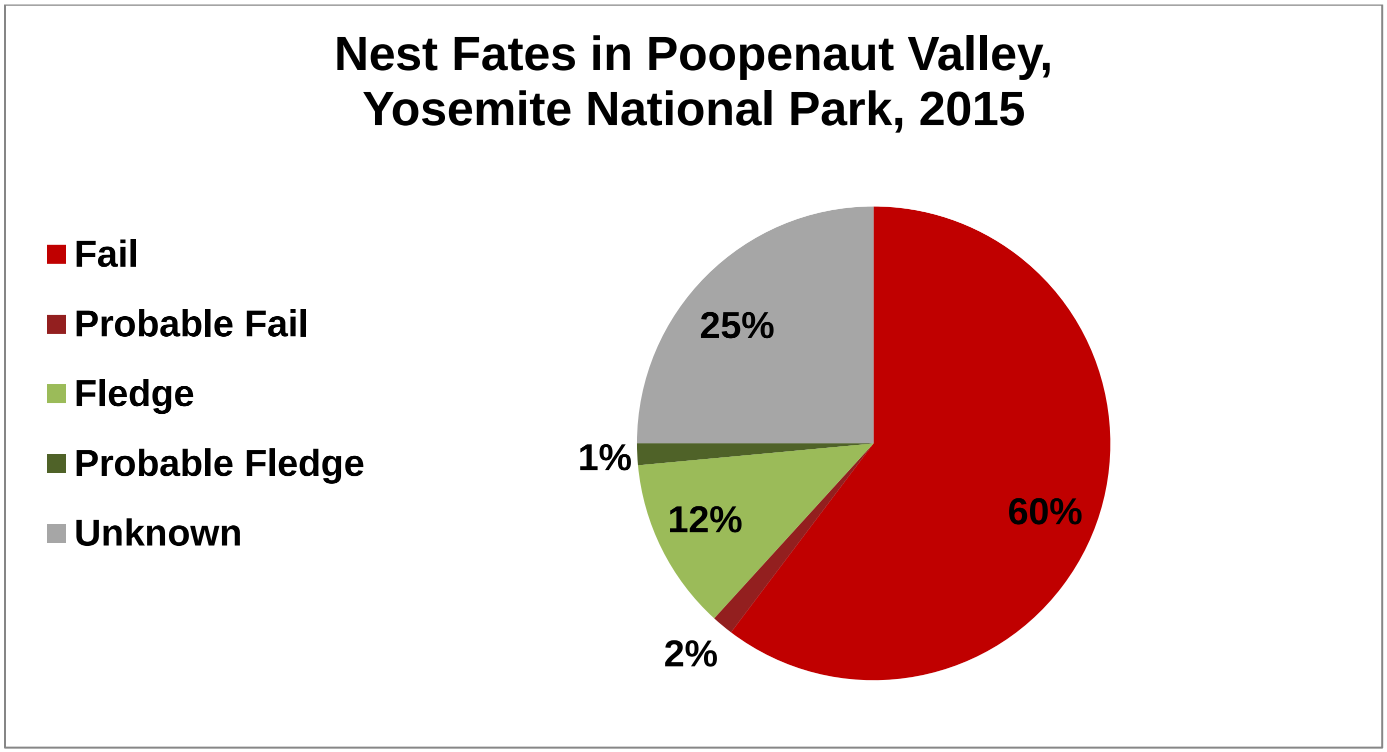
Table 4-5. Nests, nest fates, and confirmed breeding during 2015 nest searching in and near Poopenaut Valley, Yosemite National Park.

Species	Fate						Nesting Behavior Observed
	Fledge	Probable Fledge	Fail	Probable Fail	Unknown	**Total**	
Acorn Woodpecker					1	1	
American Robin	1		3		1	5	
Anna's Hummingbird							Yes
Belted Kingfisher					1	1	
Blue-gray Gnatcatcher					1	1	
Black-headed Grosbeak[1]	1		2		1	4	
Black Phoebe					1	1	
Brown Creeper	1				1	2	
Brown-headed Cowbird							Yes
Bullock's Oriole					1		
Bushtit	1		3		1	5	
Canyon Wren							Yes
Cassin's Vireo			3		1	4	
Downy Woodpecker			1			1	
Hairy Woodpecker					1	1	
House Wren	2	1			1	4	
Lawrence's Goldfinch			1			1	
Lazuli Bunting			1			1	
Lesser Goldfinch			1			1	
Mourning Dove			3			3	
Nashville Warbler							Yes
Northern Flicker			1			1	
Northern Pygmy-Owl							Yes
Northern Rough-winged Swallow					1	1	
Song Sparrow[1]	2					2	

Spotted Owl							Yes
Steller's Jay							Yes
Warbling Vireo[1]			3		2	5	
Western Scrub-Jay							Yes
Western Tanager			1	1		2	
Western Wood-Pewee			11		2	13	
Yellow Warbler[1]			7			7	
32 species	8	1	41	1	17	68	8

[1]Target Riparian Focal Species

Figure 4-7. Bird nest fates in Poopenaut Valley, Yosemite National Park, 2015.



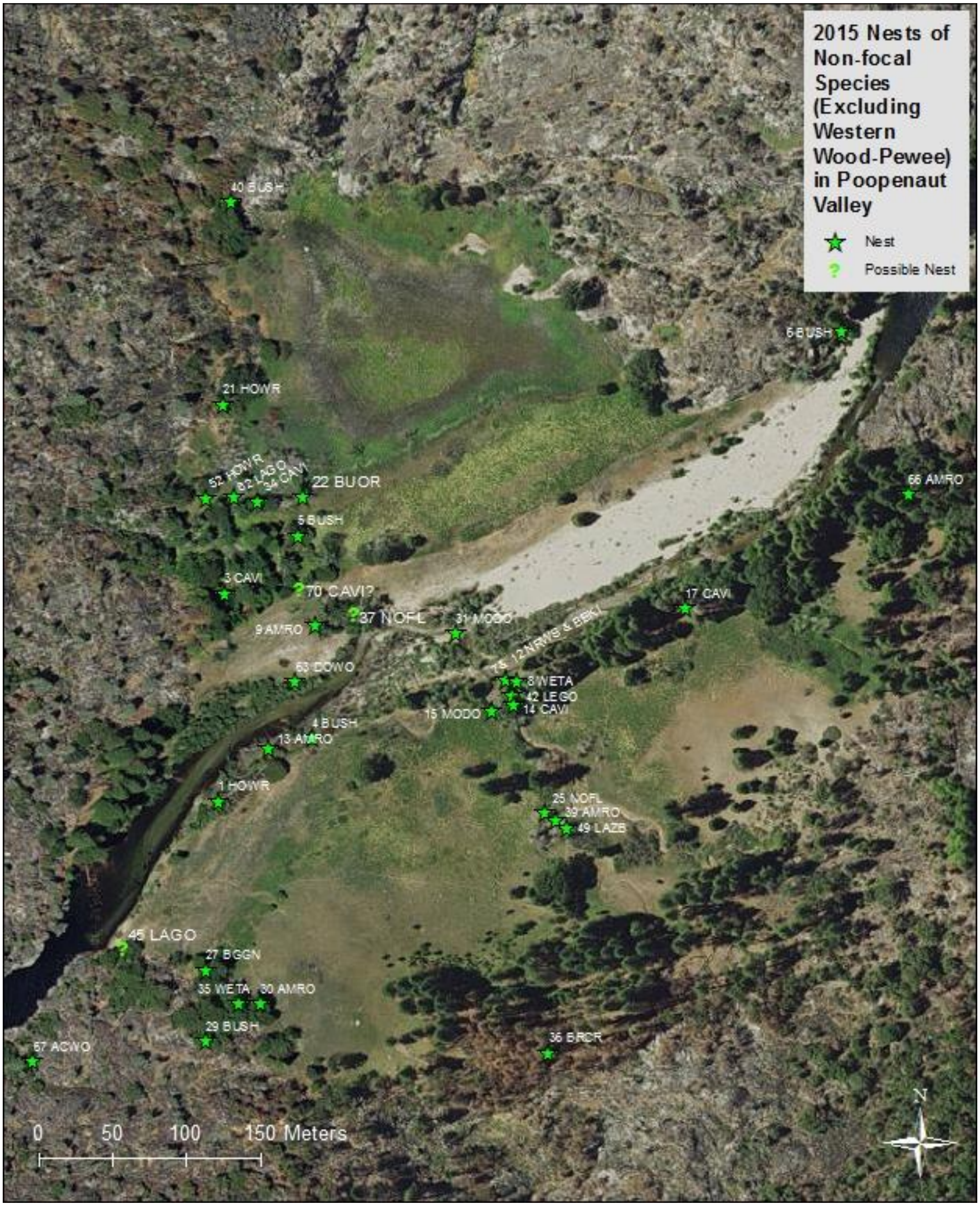


Figure 4-8. Locations of 43 non–Riparian Focal Species bird nests and three unconfirmed nests (Nests 37, 45, and 70) found in Poopenaut Valley, Yosemite National Park, May–

June 2015. Nests 55, 64, 69, and 71 (Brown Creeper, Hairy Woodpecker, Mourning Dove, and Black Phoebe, respectively) are not shown, since they were either found on the Poopenaut Valley Trail, or downstream from Poopenaut Valley. Nest numbers are shown next to nests followed by the alpha code for that species. Alpha codes represent the following species common names: ACWO = Acorn Woodpecker, AMRO = American Robin, BEKI = Belted Kingfisher, BGGN = Blue-gray Gnatcatcher, BHGR = Black-headed Grosbeak, BRCR = Brown Creeper, BUOR = Bullock's Oriole, BUSH = Bushtit, CANW = Canyon Wren, CAVI = Cassin's Vireo, DOWO = Downy Woodpecker, HOWR = House Wren, LAGO = Lawrence's Goldfinch, LAZB = Lazuli Bunting, LEGO = Lesser Goldfinch, MODO = Mourning Dove, NOFL = Northern Flicker, NRWS = Northern Rough-winged Swallow, SOSP = Song Sparrow, WAVI = Warbling Vireo, WETA = Western Tanager, YEWA = Yellow Warbler.

Figure 4-9. Locations of Western Wood-Pewee nests found in Poopenaut Valley, Yosemite National Park in 2015. Nest numbers are shown next to nests.

In 2015, all nests were discovered between 28 April and 24 June, with the second half of May being the most active nest-building period.

Nest 1; House Wren: On 28 April, the female entered the nest cavity carrying nest lining. On 20 May the female entered the nest cavity three times with unidentified objects. On 4 June, both parents entered the nest; one had a large green grub. On 16 June, one adult exited the cavity with a fecal sac indicating that the nestlings were at least 11 days old. No activity was seen at or around the nest over 20 minutes on 24 June, indicating that the nest was no longer active. Because the nestlings leave the nest at age 12–18 (Baicich and Harrison, 2005), it is likely that the young fledged. **Fate: Probable Fledge**. UTM 11S: 0252132 4200644.

Nest 2; Warbling Vireo: On 28 April, both adults were observed building the nest. On 29 April, an adult was still nest-building. On 6 May, the female was on the nest for more than 10 minutes, likely incubating. On 16 May, the male visited the nest. On 21 May, an adult again visited the nest. On 27 May, the nest was visibly torn apart. **Fate: Fail**. UTM 11S: 0252132 4200644.

Nest 3; Cassin's Vireo: On 28 April, both adults were beginning to build the nest using pieces of a paper wasp nest hanging from a Ponderosa Pine. It appeared to be the first day of nest building. On 29 April and on 6 May, there had been no progress on the nest since 28 April. On 11 June, another failed vireo nest was found 12 m SSE of this nest, possibly from the same pair. **Fate: Fail**. UTM 11s: 0251957 4200675.

Nest 4; Bushtit: On 28 April, one adult entered the nest with an object and the other adult exited the nest. On 6 May, the nest entrance had been enlarged to ~3 inches in diameter indicating predation. **Fate: Fail.** UTM 11S: 0252016 4200577.

Nest 5; Bushtit: On 29 April, both parents entered the nest carrying white fluffy material. On 7 May, one adult was near the nest. On 17 May, one adult was near the nest which had been torn open. **Fate: Fail**. UTM 11S: 0252007 4200714.

Nest 6; Bushtit: On 29 April, both parents were seen entering the nest with material gathered from willow catkins every ~5 minutes. On 16 May, we observed the male entering the nest carrying a large feather, and the female later entering the nest carrying white fuzz. The nest trembled for the next 4 minutes, presumably as the female worked on the nest construction. Another (inactive) Bushtit nest from this year was noticed a few meters away in the same tree. On 27 May, both nests had been torn open. Both adults called from ~20 m away. **Fate: Fail**. UTM 11S: 0252375 4200852.

Nest 7; Northern Rough-Winged Swallow: On 29 April, one adult was seen approaching the sandbank cavity carrying material. On 20 May, an adult entered this cavity (or possibly a neighboring one) with grass. On 4 June, an adult was seen exiting the cavity. On 10 June, an adult exited the cavity after at least 5 minutes inside, then reentered 10 minutes later. On 23 June, an adult entered the cavity for a few seconds. **Fate**: **Unknown**. UTM 11S: 0252147 4200616.

Nest 8; Western Tanager: On 6 May, the female was seen building the nest using small sticks. On 17 May, the nest was on the ground below where it had been constructed. **Fate: Fail**. UTM 11S: 0252152 4200606.

Nest 9; American Robin: On 6 May, the female made four trips to the nest with material. On 17 May, the female was flushed from the nest. On 21 May, the female was seen on the nest. On 28

May, the nest appeared to be tipped. On 4 June, there was no activity around the nest for over 35 minutes of observation. **Fate**: **Fail**. UTM 11S: 252018 4200654.

Nest 10; Warbling Vireo: On 6 May, an adult made five trips to the nest with material. On 17 May, an adult investigated the nest. On 21 May, the nest had been destroyed. **Fate: Fail**. UTM 11S: 252020 4200654.

Nest 11; Yellow Warbler: On 6 May, the female made three trips to the nest with material. On 16 May, the nest had been destroyed. **Fate: Fail**. UTM 11S: 252030 4200669.

Nest 12; Belted Kingfisher: Located on the riverbank approximately 1.9 m above the river (as measured on 19 August). On 6 May, an adult went to the cavity carrying food. On 16 May, an adult flew by carrying food every ~5 minutes for 30 minutes. On 17 May, an adult flew fast down the river by the nest, and then entered the nest for ~4 minutes. On 21 May, an adult made several passes by the nest with food. On 27 May, both adults made several trips up- and down-river, past the nest, steering strongly away from the nest when they saw the observer. On 4 June, the male flew by two times, once carrying a fish. **Fate: Unknown**. UTM 11S: 252147 4200616.

Nest 13; American Robin: On 7 May, the female was observed building the nest which was close to completion. On 17 May, no adult was present although there was strong wind and rain. On 4 June, the observer checked the nest and did not observe an adult. No activity was seen over the several subsequent weeks. **Fate: Fail**. UTM 11S: 251987 4200570.

Nest 14; Cassin's Vireo: On 16 May, the female made five trips to the nest with cottonwood bark and other material; the nest appeared two-thirds complete. One adult attacked a nearby Western Scrub-Jay along with the help of an American Robin. On 20 May, an adult attacked a nearby Northern Pygmy-Owl. On 27 May, the female incubated eggs. On 4 June, the female was on the nest for more than 10 minutes (brooding nestlings or incubating eggs). On 6 June, there was no activity at the nest for over 20 minutes. On 16 June, there was, again, no activity at the nest over 20 minutes. **Fate: Fail**. UTM 11S: 252153 4200600.

Nest 15; Mourning Dove: Ground nest. On 16 May, the nest was found on the ground with two eggs. On 21 May, the female was flushed from the nest, which still contained two eggs. On 28 May, the female was flushed from the nest which contained one egg and one nestling (Figure 4-10). On 4 June, the nest was empty with the exception of 2 feathers of this species. **Fate: Fail**. UTM 11S: 252138 4200595.

Figure 4-10. Mourning Dove nest observed on 28 May with one egg and one nestling.

Nest 16; Warbling Vireo: On 16 May, the female was observed building the nest while the male sang nearby. On 21 May, and again on 27 May, an adult incubated eggs. On 4 June, an adult was on the nest, presumably brooding nestlings. On 10 June, The nest had tipped and no adult was present—both adults were 80 m away. **Fate: Fail**. UTM 11S: 252205 4200625.

Nest 17; Cassin's Vireo: On 16 May, the female was seen building the nest which appeared to be two-thirds complete. On 17 May, both adults were near the nest mobbing a Brown-headed Cowbird. On 21 May, no adult was present. On 28 May, no adult was present and there was a Northern Pacific Rattlesnake on the ground below the nest. On 4 June, and again on 10 June, no adult was present. **Fate: Fail**. UTM: 252269 4200665.

Nest 18; Song Sparrow: On 16 May, the nest was found in a shrub 2.4 m up the side of the riverbank (above the water as measured on 19 August); both parents brought small dangly objects to the nest every ~5 minutes over 30 minutes (presumably to feed nestlings); the male was the individual that had been color-banded YY/YS on 24 April. On 20 May, an adult fed nestlings, which were making audible noises. On 21 May, an adult fed nestlings. On 28 May, both adults were 40 m away, no longer making trips to the nest, but no fledglings were audible over 10 minutes of observation. On 14 June, the male was seen with three other Song Sparrows (at least two of which were fledglings) 2 m from the nest. **Fate: Fledge**. UTM 11S: 252147 4200616.

Nest 19; Black-headed Grosbeak: On 17 May, the female was on the nest for ~20 minutes, presumably incubating eggs. On 20 May, an adult was near the nest. On 28 May, the male was singing on the nest for more than 5 minutes. On 4 June, both adults were making many trips to the nest area and the female fed a fledgling, which was begging (wing-fluttering) 5 m (horizontally) from the nest. **Fate: Fledge**. UTM 11S: 251885 4200416.

Nest 20; Song Sparrow: Found on 17 May, built among the Tule (*Schoenoplectus acutus*) in Area 1. During 20 minutes of observation, the female made four trips to the nest with green things (presumably food for the nestlings) while the male did not visit the nest. On 21 May, an adult brought a green grub to the nest. On 28 May, no activity was seen around the nest during

10 minutes of observation. On 4 June, both adults were seen ~25 m south of the nest with at least 2 fledglings. **Fate: Fledge**. UTM 11S: 252007 4200903.

Nest 21; House Wren: Found 17 May in Area 5A; both adults entered the nest cavity five times in total to feed nestlings. On 28 May, there was no activity near the nest during 5 minutes of observation. On 4 June, there was no activity near the nest for over 20 minutes of observation. **Fate: Unknown.** UTM 11S: 251956 4200803.

Nest 22; Bullock's Oriole: Identified on 17 May as a nest from this year, hanging near the top of a cottonwood at a height of 20 m. On 16 June, the nest lay on the ground below the tree. There were droppings in the nest. **Fate**: **Unknown**. UTM 11S: 252010 4200740.

Nest 23; Yellow Warbler: We located the nest 14 m above the ground in a 16 m high willow. On 20 May, the female made five trips to the nest with material. On 28 May, we observed the male near the nest. On 10 June, the nest was gone. **Fate: Fail**. UTM 11S: 251976 4200553.

Nest 24; Yellow Warbler: We found the nest 1.5 m above the ground in a 2 m – high willow bush. On 20 May, the female made four trips to the nest with white fuzz and willow bark for over 20 minutes. On 27 May, and again on 10 June, the female was flushed from the nest. On 16 June, the nest had been torn apart; the male sang 10 m away. The female had a red color-band; the only female Yellow Warbler banded with a red color band in Poopenaut Valley is RG/RS color-banded on 13 May 2014 and originally banded 10 July 2012 as a second-year female. **Fate: Fail**. UTM 11S: 252174 4200527.

Nest 25; Northern Flicker: This cavity was 15 m above the ground in a 23 m high cottonwood. On 20 May, the male exited the cavity carrying something white. On 27 May, the female visited the nest cavity. On 4 June, the tree had been torn apart where the nest had been; both adults flew around calling wildly. The snag was too robust to have been opened by a local bird species, so the nest was presumably predated by a mammal. **Fate: Fail**. UTM 11S: 252174 4200527.

Nest 26; Black-headed Grosbeak: On 20 May, the female was on the nest for at least 15 minutes. On 21 May, an adult was near the nest. On 28 May, the male was near the nest during over 25 minutes of observation; the nest appeared looser than before with parts hanging off of it. On 10 June, there was no activity near the nest. On 16 June, there was no activity near the nest during over 20 minutes of observation. **Fate: Fail**. UTM 11S: 252273 4200453.

Nest 27; Blue-gray Gnatcatcher: This nest was nearly impossible to see. On 20 May, the female made four trips to the nest with white fuzz. On 21 May, both adults were near the nest. On 10 June, both adults were very active near the nest, but we could not decipher what they were doing. On 16 June, there was no activity near the nest during 60 minutes of observation. **Fate**: **Unknown**. UTM 11S: 251944 4200420.

Nest 28; Black-headed Grosbeak: This nest was located 16 m above the ground in a 31 m high California Black Oak. Located 66 m from Nest 19 (Black-headed Grosbeak), these nests were active simultaneously. On 20 May, the female was seen putting her head down into the nest. On 21 May, an adult visited the nest for less than 1 minute. On 28 May, the nest was watched for 20 minutes, during which time an adult approached to within 40 m of the nest. On 10 June, no activity was seen around the nest for over 15 minutes. **Fate: Unknown**. UTM 11S: 251942 4200383.

Nest 29; Bushtit: On 20 May, the female brought a large green grub to the nest. On 21 May, a flock of six Bushtits (at least some of which were fledglings) was seen near the nest and there was no activity at the nest. On 28 May, there was no activity around the nest. **Fate: Fledge**. UTM 11S: 251944 4200372.

Nest 30; American Robin: On 20 May, the female was on the nest, presumably incubating eggs. On 27 May, the male was 40 m away from the nest carrying food. On 28 May, the female was sitting on the rim of the nest (Figure 4-11). On 4 June, an adult was 20 m away with food giving alarm calls and a nestling head was visible above the nest rim; the nestling appeared to be close to fledging-age. On 10 June, there was no activity at or near the nest and no nestlings were visible during over 10 minutes of observation. A fledgling called from 90 m away. **Fate: Fledge**. UTM 11S: 251981 4200397.

Figure 4-11. American Robin nest observed on 28 May 2015.

Nest 31; Mourning Dove: This nest was located approximately 1.5 m above the river. On 20 May, an adult was flushed from an empty but complete nest at a distance of 4 m. On 21 May, at 1500 hours, an adult was on the nest which was still lacking eggs. Neither adult nor egg was present on 27 May, 4 June, and 10 June. **Fate: Fail**. UTM 11S: 252114 4200648.

Nest 32; Yellow Warbler: On 21 May, the female was building the nest which was two-thirds complete. On 28 May, both adults were near the nest during two visits. On 4 June, and again on 10 June, no adult was present. On 16 June, there was still no activity around the nest during over 20 minutes of observation. **Fate: Fail**. UTM 11S: 252046 4200614.

Nest 33; Yellow Warbler: On 21 May, the female made five trips to the nest with material. On 28 May, no adult was present during over 5 minutes of observation. On 4 June, the female was on the nest for more than 15 minutes. On 11 June, the nest was on the ground below its original location. **Fate**: **Fail**. UTM 11S: 252014 4200675.

Nest 34; Cassin's Vireo: On 21 May, the male was on the nest which contained three eggs. On 27 May, an adult was on the nest incubating four eggs. On 4 June, both parents visited the nest to feed two nestlings. On 11 June, there was no activity near the nest and the nest was empty. **Fate: Unknown.** UTM 11S: 251979 4200737.

Nest 35; Western Tanager: This nest was very difficult to observe because it was 18 m above the ground in a 20 m high California Black Oak. On 21 May, the female went to the nest three times over 10 minutes (possibly building). On 28 May, there was no activity during over 10 minutes of observation. On 14 June, there was no activity over 40 minutes of observation, then both adults perched 20 m away from the nest, then displayed no activity for 50 minutes. **Fate: Probable Fail** UTM 11S: 251966 4200397.

Nest 36; Brown Creeper: On 21 May, both adults made six visits with food for over 10 minutes. On 28 May, the female entered the nest cavity with food and there was a begging (wing-fluttering) fledgling outside the nest. **Fate**: **Fledge**. UTM 11S: 252176 4200364.

Nest 37; Northern Flicker: On 21 May, an adult visited the cavity and a sound like begging nestlings was heard. There were no further observations at the nest. **Fate: Unknown**. UTM 11S: 252045 4200661.

Nest 38; Western Wood-Pewee: On 27 May, the female was early in the process of building the nest. On 4 June, the nest appeared to be two-thirds complete. On 10 June, the nest was on the ground below the tree, and there was dried egg yolk in the nest. The adults were observed building a new nest 20 m away (Nest 57). **Fate: Fail**. UTM 11S: 252127 4200654.

Nest 39; American Robin: On 27 May, the female brought something to the nest (probably material). On 28 May, neither adult visited the nest for over 40 minutes of observation, although they both came to within 40 m of the nest. Both adults defended their territory against a Western Scrub-Jay intrusion. On 4 June, there was no activity at the nest during 20 minutes of observation, although the male came to within 25 m of the nest. On 10 June, there was no activity at the nest for over 15 minutes of observation. On 16 June, there was no activity at the nest for over 25 minutes of observation. **Fate**: **Fail**. UTM 11S: 252181 4200521.

Nest 40; Bushtit: On 27 May, an adult brought something to the nest. On 28 May, an adult brought something yellow to the nest and then was inside for more than 3 minutes. On 4 June, while observing for more than 50 minutes the female arrived with white fuzz and then was inside the nest for more than 10 minutes. The male arrived with a grub, then later with a clump of white feathers. On 16 June, each adult entered the nest for approximately 15 seconds; one carried out a fecal sac. On 23 June, an adult visited the nest for 5 seconds. **Fate: Unknown**. UTM 11S: 251961 4200940.

Nest 41; Black-headed Grosbeak: On 27 May, the female was on the nest incubating eggs for at least 15 minutes. On 4 June, the nest was askew. On 10 June, there was no activity around the nest. We captured a male in this territory and identified him as a second-year and color-banded RW/YS. **Fate: Fail**. UTM 11S: 252170 4200626.

Nest 42; Lesser Goldfinch: On 20 May, the female made multiple trips to the nest area carrying material. On 27 May, the female was on the nest for more than 15 minutes, presumably incubating eggs. On 4 June, the male was 20 meters from the nest. On 10 June, the nest was on the ground and empty. **Fate: Fail**. UTM 11S: 252155 4200615.

Nest 43; Western Wood-Pewee: On 27 May, the female was early in the process of building the nest. On 4 June, no adult was present, but the nest appeared complete. On 10 June, the female was on the nest for at least 3 minutes, presumably incubating eggs. On 16 June, there was no activity at the nest for over 5 minutes of observation. **Fate: Unknown**. UTM 11S: 252207 4200652.

Nest 44; Western Wood-Pewee: On 27 May, the female was early in the process of building the nest. On 28 May, the female was again building the nest. On 4 June, the nest was gone, and the female was building a new nest 25 m away (Nest 47). **Fate: Fail**. UTM 11S: 251923 4200432.

Nest 45; Lawrence's Goldfinch: On 28 May, the pair came four times in 40 minutes to what appeared to be a nest of this species (a dainty ring of lichen built on a branch). On 4 June, there was no activity at the nest during over 30 minutes of observation, although both came to within 35 m. On 16 June, there was no activity at the nest during over 25 minutes of observation. **Fate: Unknown**. UTM 11S: 251888 4200434.

Nest 46; Warbling Vireo: On 28 May, both adults were at the nest. On 4 June, both adults came to the nest, one had something worm-looking; the visits to the nest lasted ~5 seconds. On 16 June, the female was on the nest. On 23 June, there was no activity at the nest during over 20 minutes of observation and the nest looked tipped. **Fate: Unknown**. UTM 11S: 251893 4200413.

Nest 47; Western Wood-Pewee: Re-nest of Nest 44. On 4 June, the female made four trips to the nest with material in 30 minutes. On 11 June, an adult was near the nest. On 16 June, the female incubated eggs. On 23 June, the nest was gone. **Fate: Fail**. UTM 11S: 251889 4200417.

Nest 48; Yellow Warbler: On 4 June, the female made four trips to the nest in 30 minutes with white fuzzy material, and a Warbling Vireo pair visited the nest. On 11 June, the male was near the nest; the female was building a new nest (Nest 58). On 16 June, there was no activity at the nest during 20 minutes of observation. **Fate: Fail**. UTM 11S: 251885 4200433.

Nest 49; Lazuli Bunting: On 4 June, the female made three trips to the nest with material (on one trip the material appeared to be fine bark). On 1 June (± 10 days), a female of this species appeared to bring material to a location 30 m to the north. On 16 June, the area the female was visiting on 4 June was searched thoroughly but the nest could not be located. No further activity was seen in the area during further visits. **Fate: Fail**. UTM 11S: 252189 4200516.

Nest 50; Black-headed Grosbeak: On 4 June, the male was observed next to a nest that appeared to belong to this species. On 10 June, there was no activity at the nest during over 20 minutes of observation. On 16 June, there was no activity at the nest during over 10 minutes of observation. **Fate: Unknown**. UTM 11S: 251956 4200670.

Nest 51; Warbling Vireo: On 4 June, both adults fed nestlings. On 11 June, there was no activity at the nest during over 20 minutes of observation. The male had a yellow band on its right leg. The only bird of this species that has been banded with a yellow band in Poopenaut Valley is YY/YS. This bird was banded on 14 May 2014 as an after hatch-year male. **Fate: Unknown**. UTM 11S: 251963 4200702.

Nest 52; House Wren: On 4 June, the female entered the nest cavity with food. On 11 June, there was no activity at the nest during over 20 minutes of observation. On 16 June, an adult was near the nest. On 24 June, there were fledglings 15 m from the nest. **Fate: Fledge**. UTM 11S: 251963 4200740.

Nest 53; Western Wood-Pewee: We located the nest 2.5 m over the river in a 7 m high willow. On 4 June, the female was building the nest using light and fluffy material; the nest appeared to be half complete. On 10 June, the female was building the nest. On 16 June, the female was incubating 3 eggs. On 23 June, the nest was gone. **Fate: Fail**. UTM 11S: 252033 4200605.

Nest 54; House Wren: On the Poopenaut Valley Trail. On 3 June, the female entered the nest cavity with food. On 4 June, an adult was at the nest with food. On 16 June, both adults were near the nest with a group of approximately five fledglings. **Fate: Fledge**. UTM 11S: 252638 4199922.

Nest 55; Brown Creeper: On the Poopenaut Valley Trail. On 21 May and 3 June, an adult entered the nest cavity with food. On 4 June and 15 June, an adult was near the nest. **Fate: Unknown**. UTM 11S: 252720 4199691.

Nest 56; Western Wood-Pewee: Nest was located approximately 1 m above the river in a 2 m high dead willow. On 10 June, the female was constructing the nest, which was close to completion. On 16 June, the female was incubating three eggs which had floating yolks (Figure 4-12). On 23 June, the female was on the nest. On 9 July, the nest was gone and the female appeared to be prospecting for a new nest site. **Fate: Fail**. UTM 11S: 251925 4200539.

Figure 4-12. Western Wood-Pewee nest above the river with three eggs on 16 June 2015.

Nest 57; Western Wood-Pewee: Re-nest of Nest 38. On 10 June, the female was building the nest, which appeared to be two thirds complete. On 16 June, the female was incubating eggs.

On 23 June, the nest was gone and the female was building a new nest 29 m away (Nest 72). **Fate: Fail**. UTM 11S: 252124 4200662.

Nest 58; Yellow Warbler: Re-nest of Nest 48. On 11 June, the female was building the nest. On 16 June, the female was on the nest incubating eggs for approximately 20 minutes. She left the nest for approximately 10 minutes before returning. On 23 June, there was no activity at the nest for over 20 minutes, and no individual of this species was seen in the area for over 1 hour. **Fate: Fail**. UTM 11S: 251915 4200426.

Nest 59; Western Wood-Pewee: On 11 June, the female was building the nest. On 16 June, the female was incubating eggs. On 24 June, the nest had been destroyed. **Fate: Fail**. UTM 11S: 251994 4200798.

Nest 60; Western Wood-Pewee: On 11 June, the female was building the nest, which appeared to be about half way completed. On 16 June, the female was on the nest, presumably incubating. On 24 June, the nest had been destroyed. **Fate: Fail**. UTM 11S: 252017 4200701.

Nest 61; Western Wood-Pewee: On 11 June, the female was starting to build the nest, collecting spider webs and rubbing them onto a branch. On 16 June, no progress had been made since 11 June. **Fate: Fail**. UTM 11S: 251958 4200675.

Nest 62; Lawrence's Goldfinch: On 11 June, the female was on the nest and the male visited her for approximately 30 seconds, possibly to feed her. They were flushed from the nest. Two minutes later, they returned. Seconds later, a Northern Pygmy-Owl streaked downwards at a 30º angle and grabbed the male off of the nest. The owl perched for approximately 20 seconds (Figure 4-13) and then flew off with the male in its talons. Approximately 80 m away, a juvenile Northern Pygmy-Owl was calling. Because Lawrence's Goldfinches rely on mate feeding, this nest probably failed. **Fate: Probable Fail.**

Figure 4-13. Northern Pygmy-Owl carrying male Lawrence's Goldfinch away from Nest 62 on 11 June 2015. The orange arrow points to the nest.

Nest 63; Downy Woodpecker: We located this nest 4 m above the river. On 16 June, an adult brought food to the nest and the nestlings vocalized in response. On 24 June, there was no activity at the nest for over 20 minutes. **Fate: Fail**. UTM 11S: 252005 4200615.

Nest 64; Hairy Woodpecker: This nest was located along the Poopenaut Valley Trail. On 16 June, both parents visited the nest with food. The nestlings were begging loudly. **Fate: Unknown**. UTM 11S: 252598 4200297.

Nest 65; Western Wood-Pewee: On 24 June, the female was building the nest. On 9 July, an adult was 20 m away, and the nest appeared slightly torn apart during over 20 minutes of observation. **Fate: Probable Fail**. UTM 11S: 251954 4200721.

Nest 66; American Robin: On 23 June, the female was building the nest using a piece of a fern. On 9 July, there was no activity at the nest during over 2 minutes of observation. **Fate: Unknown**. UTM 11S: 252420 4200742.

Nest 67; Acorn Woodpecker: On 23 June, an adult fed nestling(s) without entering the nest and a nestling could be seen at the cavity entrance. **Fate: Unknown**. UTM 11S: 251827 4200358.

Nest 68; Western Wood-Pewee: On 24 June, the female was building the nest. On 9 July, the nest was gone. **Fate: Fail**. UTM 11S: 252032 4200635.

Nest 69; Mourning Dove: We found this nest along the Poopenaut Valley Trail. On 17 May, an adult was flushed off of a completed nest. On 20, 21, 27, 28 May, there was neither activity at the nest nor eggs in the nest. **Fate: Fail**. UTM 11S: 252634 4199929.

Nest 70; Cassin's Vireo?: On 21 May, both adults were close to what appeared to be a nest of this species from this year. On 28 May, the nest was on the ground below its original location; the male was singing 12 m away. **Fate: Unknown**. UTM 11S: 252008 4200678.

Nest 71; Black Phoebe: On 20 May, this nest was located approximately 350 m downstream from Area 3. Although no longer active, the nest appeared to be a nest of this species from this year. We observed juveniles of this species in Poopenaut Valley. **Fate: Unknown**. UTM 11S: 251550 4200309.

Nest 72; Western Wood-Pewee: On 23 June, the female was building the nest. On 9 July, the female was on the nest, presumably incubating eggs. **Fate: Unknown**. UTM 11S: 252141 4200638.

4.3.5 2015 Riparian Focal Species (RFS) Color-banding

In 2015, we color-banded (Figure 4-14) on 24 April and 10 June and caught two Riparian Focal Species: a Black-headed Grosbeak and a Song Sparrow (Table 4-6). We located the mist-nets opportunistically where we had observed pairs of Song Sparrows and Black-headed Grosbeaks (Figure 4-2). Between 2012 to 2015, we color-banded 18 unique individual birds (Table 4-7).

Table 4-6. Target-netting locations in Poopenaut Valley during 2015 color-banding.

Date	Net	UTM Easting	UTM Northing	Net-hours
24 Apr	1	252093	4200640	0.5
10 June	2	252234	4200628	0.5

Figure 4-14. (A) Color-banded Warbling Vireo (Yellow-Yellow/Yellow-Silver); (B) Yellow Warbler captured in a mist-net; (C) Mist-net set up adjacent to river, with audio-lure on ground beneath net.

Both banded birds had cloacal protuberances indicating that they were in active breeding condition. The Song Sparrow was observed many times after banding. It successfully fledged young, and showed no signs of lasting stress.

Table 4-7. Banding summary of target-netting in Poopenaut Valley, 2012–2015.

Date	Capture Time	Net	New/ Recapture	Band Number	Species	Age	Sex	Color-bands
7/10/2012	0915	-	N	269082303	Black-throated Gray Warbler	AHY	F	-
7/10/2012	0630	-	N	269082295	House Wren	AHY	U	-
7/10/2012	0550	-	N	255126272	Song Sparrow	AHY	M	-
7/10/2012	0550	-	N	255126273	Song Sparrow	AHY	M	-
7/10/2012	0630	-	N	255126274	Song Sparrow	AHY	M	-
7/10/2012	0720	-	N	255126275	Song Sparrow	AHY	M	-
7/10/2012	0610	-	N	269082294	Western Wood-Pewee	AHY	M	-
7/10/2012	0730	-	N	269082300	Western Wood-Pewee	AHY	U	-
7/10/2012	0750	-	N	269082302	Western Wood-Pewee	AHY	F	-
7/10/2012	0630	-	N	269082296	Yellow Warbler	SY	F	-
7/10/2012	0630	-	N	269082297	Yellow Warbler	ASY	M	-

7/10/2012	0700	-	N	269082298	Yellow Warbler	ASY	M	-
7/10/2012	0720	-	N	269082299	Yellow Warbler	SY	F	-
7/10/2012	0740	-	N	269082301	Yellow Warbler	AHY	M	-
4/26/2013	0820	1	R	255126275	Song Sparrow	AHY	M	YY/SG
4/26/2013	0950	2	R	255126274	Song Sparrow	AHY	M	GG/YS
5/2/2013	0710	3	N	225130775	Song Sparrow	AHY	F	GR/TS
5/2/2013	0710	3	N	225130776	Song Sparrow	AHY	M	RY/ST
6/13/2013	0920	7	N	Unbanded	Black-headed Grosbeak	AHY	F	-
6/13/2013	0940	7	N	185128983	Lazuli Bunting	ASY	M	-
6/13/2013	0630	5	N	263019801	Yellow Warbler	AHY	F	TT/YS
6/13/2013	0820	6	R	269082298	Yellow Warbler	ASY	M	RR/GS
6/13/2013	0940	7	N	Unbanded	Black-headed Grosbeak	AHY	F	-
6/13/2013	0940	7	N	Unbanded	Black-headed Grosbeak	ASY	M	-
6/13/2013	0940	7	N	Unbanded	Black-headed Grosbeak	HY	U	-
6/18/2013	0640	8	R	269082301	Yellow Warbler	AHY	M	YY/GS
6/19/2013	0710	9	N	263019802	Yellow Warbler	AHY	M	YT/YS
5/13/2014	0630	1	N	254048301	Warbling Vireo	AHY	M	GR/GS
5/14/2014	0850	3	N	254048302	Warbling Vireo	AHY	M	YY/YS
4/30/2014	1820	1	N	263019803	Yellow Warbler	ASY	M	RS/RT
5/14/2014	0820	3	N	263019804	Yellow Warbler	ASY	M	GG/TS
5/1/2014	0700	1	N	225130777	Song Sparrow	AHY	M	RR/RS
5/13/2014	1910	1	N	225130778	Song Sparrow	AHY	F	RR/GS
5/14/2014	0630	1	N	225130779	Song Sparrow	AHY	M	TT/TS
4/30/2014	1800	1	R	255126274	Song Sparrow	AHY	M	GG/YS
5/13/2014	1820	1	R	255126274	Song Sparrow	AHY	M	GG/YS
5/13/2014	1850	1	R	269082299	Yellow Warbler	ASY	F	RG/RS
5/14/2014	0700	1	R	225130777	Song Sparrow	AHY	M	RR/RS
5/14/2014	0900	3	R	254048301	Warbling Vireo	AHY	M	GR/GS
5/13/2014	1840	1	N	Unbanded	Spotted Towhee	ASY	F	-
5/14/2014	0810	3	N	Unbanded	Bullock's Oriole	AHY	F	-
4/24/2015	1150	1	N	225130780	Song Sparrow	AHY	M	YY/YS
6/10/2015	1820	2	N	120296767	Black-headed Grosbeak	SY	M	RW/YS

***Age Code Key**: HY = Hatch Year, SY = Second Year, AHY = After Hatch Year, ASY = After Second Year*
***Color Band Key**: G = Green, R = Red, S = Silver (USGS-BRD numbered aluminum band), T = Turquoise, W = White, Y = Yellow*
***Sex Code Key**: F = Female, M = Male, U = Unsexed*
***New/Recapture Key**: N = New Band, R = Recapture*

We mapped 4 color-banded songbird territories in 2015 (Figure 4-15). The male Song Sparrow YY/YS was banded this year (24 April 2015) and successfully fledged young (Nest 18). The male Black-headed Grosbeak RW/YS was also banded this year but towards the end of fieldwork. Consequently, he was not re-sighted, but the territory in which he was banded may have belonged to him. That territory contained Nest 41 which had failed and a second nesting attempt was not documented. The Warbling Vireo YY/YS (initially banded 14 May 2014) was found with nestlings in Nest 51 on 4 June; the nest's fate is unknown. The Yellow Warbler RG/RS (initially banded 10 July 2012) was found building Nest 24. The nest reached incubation stage then failed sometime between 10 and 16 June. Yellow Warblers appeared to vacate Poopenaut Valley after 23 June, which would not provide enough time for this pair to successfully fledge a subsequent nest.

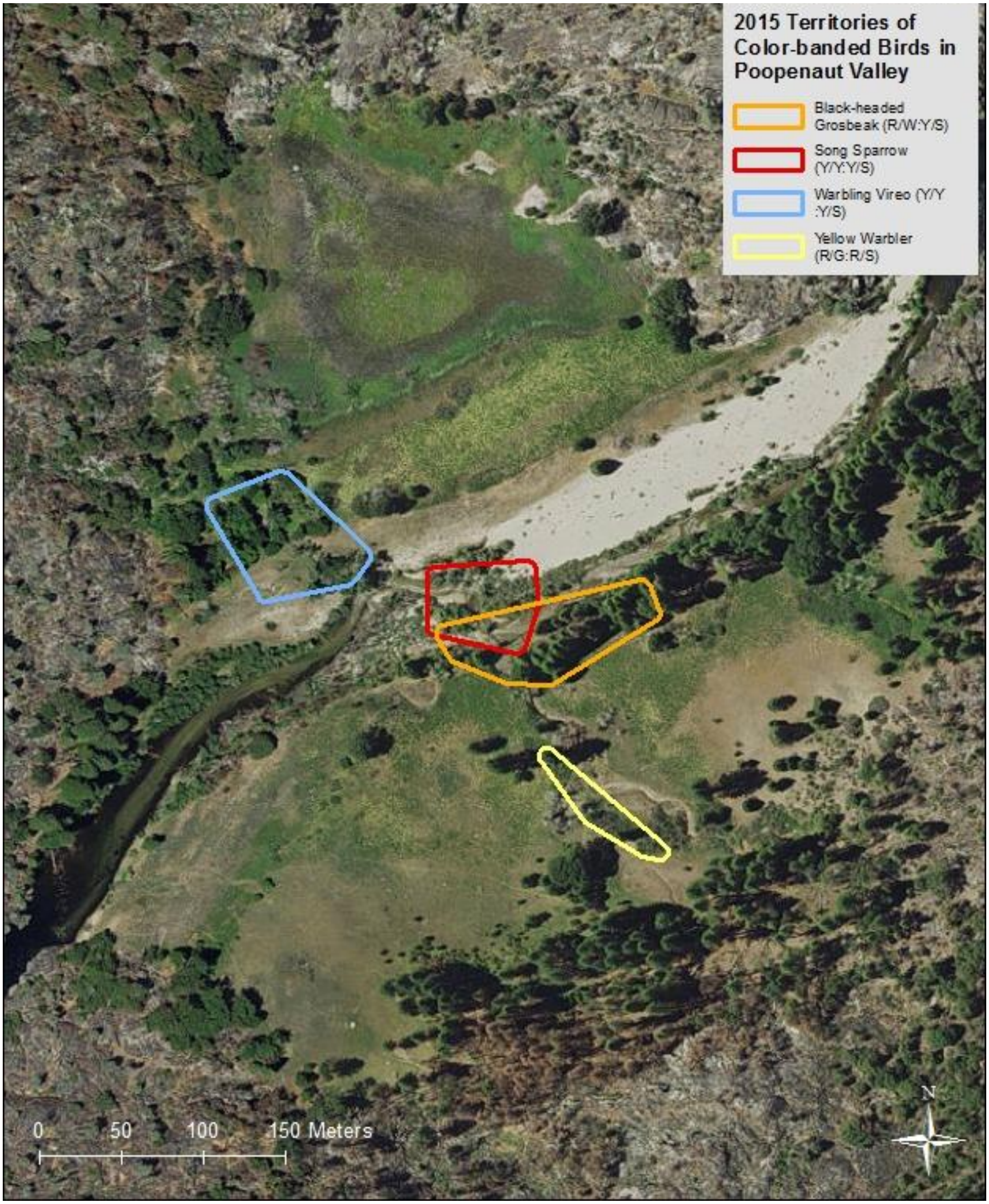


Figure 4-15. Territories of color-banded birds in Poopenaut Valley, 2015. Color band codes are as follows: G = Green, R = Red, S = Silver (USGS-BRD numbered aluminum band), T = Turquoise, W = White, Y = Yellow.

4.3.6 2015 Breeding Bird Summaries

Data collected during spot mapping and nest searching in 2011–2015 were used to calculate arrival, initiation of breeding, and fledging dates for the target Riparian Focal Species (Table 4-8). All species except for the Western Wood-Pewee began breeding in late April or early May (Table 4-9). In an average water year, late April and early May is a period of time when releases from O'Shaughnessy Dam create artificially low conditions. This year (2015), Tuolumne River levels remained low throughout the breeding season.

Table 4-8. Preliminary life history breeding schedules for the four target Riparian Focal Species plus Western Wood-Pewee in Poopenaut Valley, Yosemite National Park, 2011-2015. Dates reflect the earliest observed behavior pertaining to each activity, except where marked with an asterisk (*), indicating a hypothetical calculation based on known breeding observations and published life-history information. U = Unknown.

YELLOW WARBLER					
Resident/Migratory	Migratory				
Site Fidelity	High				
Feeding type/food source	Insects and other arthropods; gleaning, sallying, hovering				
Nesting strata	Often contains heavy understory brush 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 2+ clutches?	One brood (3-6 eggs) normally reared; second brood rarely attempted				
	2011	**2012**	**2013**	**2014**	**2015**
Males arrive	2 May	3 May	2 May	30 April	29 April
Females arrive	5 May	12 May	9 May	9 May*	6 May
Territory establishment	4 May	12 May	9 May	30 April	29 April[3]
Females begin nesting	12 May	—	17 May	4 May[1]	6 May
Fledglings leave nest	3-10 June	—	12 June* to 11 July	30 June	4 June*[2]

[1]Back-calculated from active nest 14 May 2014.
[2]Calulated from Baich and Harrison (2005) data, using mid-points of period lengths and clutch sizes, a 1-day pre-lay period, and that the assumption that nest was found halfway through building.
[3]From presence of singing males.

SONG SPARROW					
Resident/Migratory	Resident				
Site fidelity	High				
Feeding type/food source	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; wet meadows and margins of ponds, lake and slow-moving streams				
Nesting location	Ground cover, low in grass and shrubs				
Capable of two clutches?	Yes				
	2011	**2012**	**2013**	**2014**	**2015**

Males arrive[5]	28 April	27 April	26 April	24 April	24 April[3]
Females arrive[5]	28 April	27 April	26 April	24 April	19 April[4]
Territory establishment	28 April	27 April	26 April	24 April	19 April[4]
Females begin nesting	—	27 April	26 April	30 April[1]	19 April*[2]
Fledglings leave nest	—	20 May to 26 May	24 May	28 May	4 June

[1]Back-calculated from nest discovered with young on 13 May.
[2]Back-calculated from nest discovered with young on 16 May using mid-points of period lengths and clutch sizes from RHJV (2004), and mid-point of build time from Baich and Harrison (2005) and assuming one day pre-lay.
[3]Song Sparrow males were present on first spring visit.
[4]From "Females begin nesting".
[5]Song Sparrows may be year-round residents in Poopenaut Valley, winter observations are needed.

BLACK-HEADED GROSBEAK					
Resident/Migratory	Migratory				
Site fidelity	Unknown				
Feeding type/food source	Gleans animal matter, primarily insects and spiders, and vegetable matter, including cultivated fruit and weed seeds. Most forage on foliage, twigs, branches, and in the air				
Nesting strata	In outer branches of deciduous trees, cottonwoods, willows, and other hardwoods that margin rivers and streams, also in oak-conifer forest. Occupies diverse habitats				
Nesting location	Shrub, canopy, favors meadows, clearings, and extensive edge				
Capable of two clutches?	No; clutch 2-5 eggs				
	2011	**2012**	**2013**	**2014**	**2015**
Males Arrive	28 April	27 April	26 April	24 April	24 April[3]
Females Arrive	5 May	3 May	26 April	1 May	28 April
Territory establishment	28 April	3 May	26 April	24 April	28 April[4]
Females begin nesting	—	11 May[1]	2 May	13 May	4 May*[5]
Fledglings leave nest	—	4 June to 13 June	29 May to 13 June	—	4 June

[1]Active nest 11 May 2012
[2]Back-calculated from nest found 17 May, probably in incubation stage.
[3]Song Sparrow males were present on first spring visit.
[4]From presence of singing males.
[5]Back-calculated from nest found on 17 May (presumably in incubation stage) using mid-point of incubation time from RHJV (2004) and mid-point of building time from Baich and Harrison (2005) , and assuming 1 day of pre-lay.

WARBLING VIREO	
Resident/Migratory	Migratory
Site fidelity	Unknown

Feeding type/food source	Highly plastic, primarily glean from twigs in broad leaf tree-tops for insects throughout the year, some fruit in winter				
Nesting strata	In forked lateral limbs of tree periphery, prefer cottonwood, alders, and aspens that line streams				
Nesting location	Canopy, tall, primarily coniferous trees, 7m or higher				
Capable of two clutches?	Yes, two considered normal; clutch 3-5 eggs				
	2011	**2012**	**2013**	**2014**	**2015**
Males Arrive	28 April	27 April	26 April	24 April	24 April[3]
Females Arrive	28 April	27 April	2 May	7 May	28 April
Territory establishment	28 April	27 April	26 April	24 April	28 April[4]
Females begin nesting	-	11 May[1]	17 May[2], 25 May*	7 May	28 April
Fledglings leave nest	-	6 June to 18 June	30 June*	—	2 June*[5]

[1] Active nest 11 May 2012, two more on 21 May 2012

[2] Female begging behavior to male observed on 17 May 2013, 25 May 2013 back-calculated as likely nest initiation date for Warbling Vireo nest that fledged on 30 June.

[3] Warbling Vireo males were present on first spring visit.

[4] From presence of singing males & active nest

[5] Forward calculated from nest found in building stage on 28 April using building time from Baicich & Harrison (2005), and mode of number of eggs, average incubation time, and mid-point of range of nestling-time from RHJV (2004), and assuming nest was found mid-build.

Western Wood-Pewee	
Resident/Migratory	Migratory
Site fidelity	Unknown
Feeding type/ food source	Hawking, and gleaning while hovering (Ehrlich et al., 1988)
Nesting strata	Mainly in coniferous and sometimes deciduous woodlands, and in trees along watercourses (Baicich & Harrison, 2005).
Nesting location	In a tree, usually saddling a larger branch or in a near-horizontal fork, 15–30 ft up, or rarely up to 75 ft (Baicich & Harrison, 2005).
Capable of two clutches?	No (Bemis et al., 1999)
	2015
Males Arrive	24 April[1]
Females Arrive	U
Territory establishment	U
Females begin nesting	27 May
Fledglings leave nest	U

[1] Western Wood-Pewee males were present on first spring visit.

Table 4-9. Bird nest chronology of target Riparian Focal Species found in Poopenaut Valley, Yosemite National Park, 2015. Building and fledging dates are the first recorded observation of that nesting phase unless marked with an asterisk (*) indicating that they were extrapolated. Dates were extrapolated using the date found and the observed nesting phase along with the mid-points of the ranges of normal phase durations from RHJV (2004), if specified, or Baicich and Harrison (2005) if not. Calculations assume nests were found in the middle of the given nesting phase.

Nest Number	Species	UTM Easting	UTM Northing	Estimated Height (m)	Date Found	Nesting Phase	Start of Building	Fledging	Fate
2	Warbling Vireo	252132	4200644	5	28 April	Building	25 April*	2 June*	Fail
10	Warbling Vireo	252020	4200654	9	6 May	Building	3 May*	10 June*	Fail
11	Yellow Warbler	252030	4200669	9	6 May	Building	4 May*	4 June	Fail
16	Warbling Vireo	252205	4200625	5	16 May	Building	13 May*	20 June*	Fail
18	Song Sparrow	252147	4200616	2.4	16 May	Nestling	19 April*	14 June	Fledge
19	Black-headed Grosbeak	251885	4200416	15	17 May	Incubation?	4 May*	4 June	Fledge
20	Song Sparrow	252007	4200903	0	17 May	Nestling?	20 April*	4 June	Fledge
23	Yellow Warbler	251976	4200553	14	20 May	Building	18 May*	18 June*	Fail
24	Yellow Warbler	252225	4200492	1.5	20 May	Building	18 May*	18 June*	Fail
26	Black-headed Grosbeak	252273	4200453	12	20 May	Incubation	1 May*	9 June*	Fail
28	Black-headed Grosbeak	251942	4200383	16	20 May	Nestling	24 April*	27 May*	Unknown
32	Yellow Warbler	252046	4200614	3	21 May	Building	19 May*	19 June*	Fail
33	Yellow Warbler	252014	4200675	11	21 May	Building	19 May*	19 June*	Fail
41	Black-headed Grosbeak	252170	4200626	4	27 May	Incubation	14 May*	14 June*	Fail
46	Warbling Vireo	251893	4200413	17	28 May	Unknown	Unknown	Unknown	Unknown
48	Yellow Warbler	251885	4200433	13	4 June	Building	1 June*	3 July*	Fail
50	Black-headed Grosbeak?	251956	4200670	20	4 June	Unknown	Unknown	Unknown	Unknown
51	Warbling Vireo	251963	4200702	5	4 June	Nestling	4 May	12 June*	Unknown
58	Yellow Warbler	251915	4200426	6	11 June	Building	8 June*	10 July*	Fail

4.3.7 2007–2015 Cumulative Breeding Bird Summaries

Out of 113 species detected during 2007–2015 area searches, 2008–2015 point counts, 2010–2015 spot maps, 2013–15 nest searches, and 2013–15 incidental observations in Poopenaut Valley, we confirmed 37 breeding species, detected 25 probable breeding species, 12 possible breeding species, and 38 unlikely breeding species (Table 4-10). Of these, 8 are riparian focal species: Black-headed Grosbeak, Song Sparrow, Spotted Sandpiper, Swainson's Thrush, Warbling Vireo, Wilson's Warbler, Yellow-breasted Chat, and Yellow Warbler (RHJV, 2004); five are California Department of Fish and Wildlife Species of Special Concern: Olive-sided Flycatcher, Spotted Owl, Vaux's Swift, Yellow-breasted Chat, and Yellow Warbler (California Department of Fish and Wildlife, 2015).

Table 4-10. List of 113 bird species detected and their breeding status from area search (AS), point count (PC), spot map (SM), and nest searching (NS) surveys, or incidental observations (I), in Poopenaut Valley, Yosemite National Park, April–July, 2007 to 2015. Species observed in 2015 are in bold.

Species (English Name)	Species (Standard Name)	Unlikely	Possible	Probable	Confirmed	Survey Type
Accipiter sp.		X				I
Acorn Woodpecker	***Melanerpes formicivorus***				T, ON	SM, AS, PC
American Coot	*Fulica americana*	X				SM
American Crow	*Corvus brachyrhynchos*	X				SM
American Dipper	***Cinclus mexicanus***				CF	SM
American Robin	***Turdus migratorius***				S, T, CN, CF, ON	SM, AS, PC
Anna's Hummingbird	***Calypte anna***				T, CN	SM, AS, PC
Ash-throated Flycatcher	***Myiarchus cinerascens***		X			SM, AS
Bald Eagle	*Haliaeetus leucocephalus*	X				SM
Band-tailed Pigeon	***Patagioenas fasciata***		X			SM, AS
Belted Kingfisher	***Megaceryle alcyon***				CN, CF	SM, AS
Bewick's Wren	***Thryomanes bewickii***			S		SM, AS
Black Phoebe	***Sayornis nigricans***				ON	SM, AS, PC

Species (English Name)	Species (Standard Name)	Unlikely	Possible	Probable	Confirmed	Survey Type
Black-headed Grosbeak	***Pheucticus melanocephalus***				T, P, CF, CN, F, ON	SM, AS, PC
Black-throated Gray Warbler	***Setophaga nigrescens***			S, T, P		SM, AS
Blue-gray Gnatcatcher	***Polioptila caerulea***				ON	SM, AS
Brewer's Blackbird	***Euphagus cyanocephalus***			S, P		SM, AS
Brown Creeper	***Certhia americana***				S, ON	SM, AS, PC
Brown-headed Cowbird	***Molothrus ater***				F	SM, AS, PC
Bufflehead	*Bucephala albeola*	X				SM
Bullock's Oriole	***Icterus bullockii***				CN, CF F, ON	SM, AS, PC
Bushtit	***Psaltriparus minimus***				S, ON	SM, AS
California Towhee	***Melozone crissalis***			S, P		SM, AS
Calliope Hummingbird	*Selasphorus calliope*			T, P		AS
Canada Goose	*Branta canadensis*			S, P		SM
Canyon Wren	***Catherpes mexicanus***				S, T, P, F	SM, AS, PC
Cassin's Finch	*Haemorhous cassinii*	X				SM
Cassin's Vireo	***Vireo cassinii***				S, T, P, ON	SM, AS, PC
Cedar Waxwing	***Bombycilla cedrorum***	X				AS
Chipping Sparrow	*Spizella passerina*				S, T, P, CN	SM, AS, PC
Cliff Swallow	***Petrochelidon pyrrhonota***	X				SM, I
Common Merganser	***Mergus merganser***				F	SM, AS, PC
Common Poorwill	***Phalaenoptilus nuttallii***		S			I
Common Raven	***Corvus corax***	X				I
Common Yellowthroat	*Geothlypis trichas*	X				SM

Species (English Name)	Species (Standard Name)	Unlikely	Possible	Probable	Confirmed	Survey Type
Dark-eyed Junco	***Junco hyemalis***			S, P		SM, AS
Downy Woodpecker	***Picoides pubescens***				ON	SM, AS
Dusky Flycatcher	***Empidonax oberholseri***			S, P		SM, AS, PC
Eagle sp.		X				I
Eared Grebe	*Podiceps nigricollis*	X				
Eurasian Collared-Dove	***Streptopelia decaocto***	X				I
European Starling	***Sturnus vulgaris***	X				I
Evening Grosbeak	***Coccothraustes vespertinus***	X				AS
Golden Eagle	*Aquila chrysaetos*	X				
Golden-crowned Sparrow	***Zonotrichia atricapilla***	X				I
Golden-crowned Kinglet	*Regulus satrapa*			S		SM
Gray Flycatcher	***Empidonax wrightii***	X				SM, AS, PC
Great Egret	*Ardea alba*	X				SM
Great Horned Owl	***Bubo virginianus***	X				I
Green-tailed Towhee	***Pipilo chlorurus***	X				I
Hairy Woodpecker	***Picoides villosus***				CF	SM, AS, PC
Hammond's Flycatcher	*Empidonax hammondii*			S		SM
Hermit Warbler	***Setophaga occidentalis***	X				SM
House Wren	***Troglodytes aedon***				S, T, P, ON	SM, AS, PC
Hutton's Vireo	***Vireo huttoni***			S		AS
Indigo Bunting	***Passerina cyanea***	X				NS
Lark Sparrow	***Chondestes grammacus***	X				SM
Lawrence’s Goldfinch	***Spinus lawrencei***				P, F, ON	NS, I
Lazuli Bunting	***Passerina amoena***				S, T, P, ON	SM, AS, PC

Species (English Name)	Species (Standard Name)	Unlikely	Possible	Probable	Confirmed	Survey Type
Lesser Goldfinch	***Spinus psaltria***				S, P, ON	SM, AS, PC
Lincoln's Sparrow	***Melospiza lincolnii***				CN	PC, AS
MacGillivray's Warbler	***Geothlypis tolmiei***			S, P		SM, PC, AS
Mallard	***Anas platyrhynchos***				P, F, ON	SM, AS, PC
Marsh Wren	*Cistothorus palustris*	X				SM
Mountain Chickadee	*Poecile gambeli*			S		SM
Mountain Quail	***Oreortyx pictus***			S		SM, AS, PC
Mourning Dove	***Zenaida macroura***				P, ON	SM, AS
Nashville Warbler	***Oreothlypis ruficapilla***				S, T, P, CF, F	SM, AS, PC
Northern Flicker	***Colaptes auratus***				ON	SM, AS, PC
Northern Pygmy-Owl	***Glaucidium gnoma***				F	NS
Northern Rough-winged Swallow	***Stelgidopteryx serripennis***				CN, ON	SM, AS, PC
Northern Saw-whet Owl	*Aegolius acadicus*		X			I
Nuttall's Woodpecker	***Picoides nuttallii***			D, S		SM, AS
Oak Titmouse	***Baeolophus inornatus***		X			SM, PC
Olive-sided Flycatcher	***Contopus cooperi***	X				I
Orange-crowned Warbler	***Oreothlypis celata***			S		SM, PC
Osprey	***Pandion haliaetus***		X			SM
Ovenbird	***Seiurus aurocapilla***	X				I
Pacific-slope Flycatcher	***Empidonax difficilis***			S		SM, AS
Painted Redstart	*Myioborus pictus*	X				I
Pine Siskin	***Spinus pinus***		X			SM, AS
Purple Finch	***Haemorhous purpureus***				S, P, CN	SM, AS, PC
Red-breasted Nuthatch	*Sitta canadensis*			S		SM, AS, PC
Red-tailed Hawk	***Buteo jamaicensis***	X				I

Species (English Name)	Species (Standard Name)	Unlikely	Possible	Probable	Confirmed	Survey Type
Red-winged Blackbird	***Agelaius phoeniceus***			S, T, P, C		SM, AS, PC
Ruby-crowned Kinglet	*Regulus calendula*	X				SM
Savannah Sparrow	*Passerculus sandwichensis*	X				SM, AS
Song Sparrow	***Melospiza melodia***				S, T, P, C, CN, CF, F, ON	SM, AS, PC
Spotted Owl	***Strix occidentalis***				S, P, F	I
Spotted Sandpiper	***Actitis macularius***			P		SM, AS
Spotted Towhee	***Pipilo maculatus***				S, P, CF, F, ON	SM, AS, PC
Steller's Jay	***Cyanocitta stelleri***			P, F		SM, AS, PC
Swainson's Thrush	***Catharus ustulatus***	X				I
Townsend's Warbler	*Setophaga townsendi*	X				SM
Tree Swallow	*Tachycineta bicolor*		X			SM
Vaux's Swift	***Chaetura vauxi***	X				I
Violet-green Swallow	***Tachycineta thalassina***				F	SM, AS, PC
Virginia Rail	***Rallus limicola***		X			SM
Warbling Vireo	***Vireo gilvus***				S, T, P, CN, CF, F, ON	SM, AS, PC
Western Bluebird	*Sialia mexicana*		X			SM
Western Kingbird	***Tyrannus verticalis***	X				SM
Western Meadowlark	*Sturnella neglecta*	X				I
Western Scrub-Jay	***Aphelocoma californica***				P, F	SM, AS, PC
Western Tanager	***Piranga ludoviciana***				CN	SM, AS, PC
Western Wood-Pewee	***Contopus sordidulus***				S, P, CN, ON,	SM, AS, PC
White-breasted Nuthatch	***Sitta carolinensis***	X				PC

Species (English Name)	Species (Standard Name)	Unlikely	Possible	Probable	Confirmed	Survey Type
White-crowned Sparrow	***Zonotrichia leucophrys***	X				AS
White-headed Woodpecker	***Picoides albolarvatus***	X				PC
White-throated Swift	***Aeronautes saxatalis***			P, C		SM, AS, PC
Wilson's Warbler	***Cardellina pusilla***		X			SM, AS
Wood Duck	*Aix sponsa*			P		SM
Wrentit	***Chamaea fasciata***			S		SM, AS, PC
Yellow Warbler	***Setophaga petechia***				S, T, P, C, CN, CF, F ON	SM, AS, PC
Yellow-breasted Chat	***Icteria virens***		S			SM, AS, PC
Yellow-rumped Warbler	***Setophaga coronata***			S		SM, AS, PC
113 species (including 2 unidentified)		**38**	**12**	**25**	**39**	

Breeding status for each species reported as unlikely, possible, probable, and confirmed (see National Park Service, 2007) in Poopenaut Valley for 2007-2015 Unlikely species represent those species considered transient in Poopenaut Valley. Codes indicating breeding status are: X = detected in study area during the breeding season; D = drumming woodpecker heard; S = more than one singing male in study area or male bird singing during at least 3 visits; T = territorial behavior; P = pair observed during the breeding season; C = courtship behavior or copulation observed; 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.

4.4 Discussion

2015 was the fourth consecutive dry year in Poopenaut Valley and the fourth summer in which no substantial release of water from O'Shaughnessy Dam occurred (National Park Service, 2013, 2014a, 2014b). It was also the second bird breeding season after Poopenaut Valley was burned in the Rim Fire during late summer 2013, which complicates our investigation of the effects of Tuolumne River flows on breeding bird ecology in Poopenaut Valley.

Poopenaut Valley provides stopover habitat for Neotropical migrants. Several unusual bird species visited Poopenaut Valley during their spring migration: Yellow-breasted Chat, Gray Flycatcher, Indigo Bunting, Swainson's Thrush, and Ovenbird. Similar to previous years of the study, Search Area 5 had the highest species richness, abundance, diversity, and evenness. Birds select habitat in Search Area 5 over other Areas because the riparian corridor likely contains more cover from predators and more prey (e.g., insects) associated with water availability from the Tuolumne River. We found that Search Area 3 had the lowest species richness and diversity, and that Search Area 1 had the lowest evenness. In order to analyze changes in bird populations over multiple years, a comprehensive analysis of the multi-year dataset would be needed.

The seasonal pond was already dry on our first visit to Poopenaut Valley this spring (24 April), and it was not inundated with water by a spring or summer water release from the dam. Typically, the ponds and wetlands dry up by late summer or early fall in Poopenaut Valley (RMS & McBain and Trush, 2007). Lack of water in the pond affects the type of vegetation and abundance of food, which may diminish the quantity and quality of breeding habitat for birds in Search Area 1. Additionally, the willows surrounding the pond were killed in the Rim Fire, making that area less suitable for riparian birds. The only target Riparian Focal Species using the seasonal pond was a pair of Song Sparrows which successfully fledged young from a nest in the dry pond (Nest 20).

The Rim Fire burned Poopenaut Valley north of the river on 23–24 August 2013 and south of the river on 10–11 September 2013. The fire caused dramatic short-term changes to the habitat of Poopenaut Valley: many willows and trees were killed, the structure of vegetation was changed, and the quantity of vegetation was reduced. In order to understand how these changes affected bird populations, we must compare survey data across multiple years before the Rim Fire to data collected after the Rim Fire. A large swath of willows was burned on the south side of the river. While the fire changed the habitat and made it no longer suitable for some birds (e.g., riparian focal species), it may have actually provided habitat for other, more fire-adapted species, such as Lawrence's Goldfinch and Lazuli Bunting. Western Wood-Pewee nests were the most abundant nests found during 2015 (13 of 68 nests) and burnt willow was their preferred nesting location.

We used spot mapping to closely examine territory size and distribution of target Riparian Focal Species in Poopenaut Valley. Bird territory size has been linked to other aspects of the biotic and abiotic community, including intraspecific competitive pressure and resource availability (Peters, 1983; Schoener, 1968; Tompa, 1962; Hixon, 1980). It may be possible to use territory size to develop metrics to study these variables as an evaluation of the health of bird communities and to gauge the relative habitat quality in Poopenaut Valley, but much more data on individual bird movement will be needed to make inferences pertaining to territory size. Most territories and nests of target Riparian Focal Species were located in close proximity to the Tuolumne River in 2015.

We collected nest data to better understand nest-site selection, reproductive success, and phenology of the bird species in Poopenaut Valley. This year, we found 68 nests, which is substantially more than in previous years (2012: 9 nests, 2013: 17 nests; and 2014: 14 nests). The increased nest finding success in 2015 was perhaps a result of greater observer effort and observer experience. The rate of nest failure in Poopenaut Valley seemed unusually high. Of the 68 nests found, 60% failed and 25% had unknown fates (Figure 4-7). Presumably, many of the nests of unknown fates also failed. As a rough rule, 50% nest failure is considered normal (Rodney Siegel, pers. comm., 2015). Whether the apparently high rate of nest failure during 2015 is normal in Poopenaut Valley or was unusual cannot be answered because there is not enough nest data from previous years. Nest failures in Poopenaut Valley were likely caused by predation by jays (a group of 15 Steller's Jays, an unusually large number, were observed crossing Search Area 3 together on 28 April), predation by mammals (e.g., Nest 25), unusual weather (spring and summer hailstorms), Brown-headed Cowbird parasitism, and in one case of a likely failure, an epic death of an adult male Lawrence's Goldfinch by a Northern Pygmy-Owl (Nest 45). In order to accurately examine the rates and causes of nest failure, we would need to check nests more frequently (recommendation: every 2–4 days) and employ a more sophisticated estimation of nest success (e.g., Mayfield, 1975). Additionally, a few tools could aid in observation. Telescoping mirror poles could be used to check high nests, which were prevalent in 2015. Video cameras could be used to determine nest statuses for difficult to monitor nests (e.g., Belted Kingfisher, Nest 12 and Northern Rough-winged Swallow, Nest 7) and to identify causes of nest failure.

Of the target Riparian Focal Species, we found four Black-headed Grosbeak nests (two failed, one fledged, and one had an unknown fate), two Song Sparrow nests (both fledged), five Warbling Vireo nests (three failed and two had unknown fates), and seven Yellow Warbler nests (all failed). Additional color-banding of Riparian Focal Species will allow us to better understand the reproductive success and habitat use of individual birds in Poopenaut Valley. This year, with minimal color-banding effort, we were able to attribute nest success to a specific individual in one case.

Before the construction of the O'Shaughnessy Dam "most water year types had one or several [snowmelt] peaks occurring as early as late April and May, and later peaks occurring in July" (RMS & McBain and Trush, 2007). The four target Riparian Focal Species typically begin nesting in late-April through mid-May in Poopenaut Valley. These natural spring flooding events may have discouraged birds from nesting in locations vulnerable to additional flooding later in the season or caused their nests to fail earlier in the season, allowing the birds more time to nest again. The dam and subsequent diversions "eliminated drier year [snowmelt] peaks which typically occurred earlier in the season, so the timing of the peaks has become biased toward later in the summer season, with very few peaks now occurring in April or May" (RMS & McBain and Trush, 2007). Specifically, they calculated the median date of post-dam "peak" snowmelt floods during dry years to be 10 June and extremely dry years to be 14 July. We have observed and calculated the earliest-nesting target Riparian Focal Species fledging before those dates, however, it is normal for some birds to begin nesting (and thus fledge) later than others, and two of the four species regularly raise a second brood. Therefore, we hypothesize that summer flooding events during dry and extremely dry years cause more nest failure than spring flooding events. This year, Nests 7, 12, 18, 20, 31, 53, and 56 were less than ~2 m above the surface of the Tuolumne River. These nests may have failed during a flooding event had the river not been maintained at a low stage throughout the spring and summer. Because Western Wood-Pewees nest late in the season and often nested close to the river in 2015, they are particularly vulnerable to late-season flooding. Furthermore, they were abundant in Poopenaut Valley and their nests were relatively easy to find. Therefore, we recommend additional effort searching for and monitoring their nests in future years of the project.

Heath and Ballard (2003) looked at the relationship between bird communities and habitat characteristics of several riparian drainages in the Eastern Sierra, and found that riparian width had a strong positive correlation with the probability of occurrence of Yellow Warblers and Song Sparrows. The regeneration of cottonwood and willow trees is frequently compromised in riparian systems with altered hydrological peaks and timing of flows. Natural hydrological processes are integral to the establishment of willow/alder shrub habitats with dense understory cover, which is critical to many riparian focal species (RHJV, 2004). Based on our ongoing research, it remains our recommendation to mimic a natural hydrograph as closely as possible in order to fill the ephemeral pond and maximize available nesting habitat and prey availability.

Chapter 5. 2015 Bat Studies in Poopenaut Valley

5.1 Introduction

Bats are essential in maintaining ecosystem health by controlling insect populations through nighttime foraging. Most bat species forage either directly over water or within the adjacent riparian zone, where plant and insect productivity is higher than in seasonally dry upslope areas. The riparian zone of Poopenaut Valley represents important foraging habitat for bat populations. There are 17 bat species known to occur within Yosemite National Park (Pierson et al., 2001), five of which are special status species that have experienced state-wide declines (Table 5-1). While population declines are based largely on issues that affect these species outside park boundaries, they serve to highlight the importance of park land as potential refugia, and signal a potentially heightened sensitivity of these species to management activities within the park.

Table 5-1. Common and scientific names of the seventeen bat species known to occur in Yosemite National Park. Species in bold indicate California species of special concern.

Common Name	*Genus species*
Pallid bat	***Antrozous pallidus***
Townsend's big-eared bat	***Corynorhinus townsendii***
Big brown bat	*Eptesicus fuscus*
Spotted bat	***Euderma maculatum***
Western mastiff bat	***Eumops perotis***
Western red bat	***Lasiurus blossevillii***
Hoary bat	*Lasiurus cinereus*
Silver-haired bat	*Lasionycteris noctivagans*
California myotis	*Myotis californicus*
Small-footed myotis	*Myotis ciliolabrum*
Long-eared myotis	*Myotis evotis*
Little brown bat	*Myotis lucifugus*
Fringed myotis	*Myotis thysanodes*
Long-legged myotis	*Myotis volans*
Yuma myotis	*Myotis yumanensis*
Canyon bat	*Parastrellus hesperus*
Mexican free-tailed bat	*Tadarida brasiliensis*

Bat populations in Poopenaut Valley may also serve as an ecological indicator of habitat health by providing information for further refining flow recommendations for the Tuolumne River, particularly the timing of when water should be released from O'Shaughnessy Dam. Past studies suggest that the highest bat species diversity, detection rates, and degree of foraging activity occur in the park's lower elevations (Pierson et al., 2001, Pierson et al., 2006, Pierson and Rainey 2009, Rainey et al., 2009). Most bat species in Yosemite forage for insects over ponds, rivers, meadows, and among riparian vegetation, which are all affected either directly or indirectly by stream flow. Bat species richness and foraging activity can be linked to prey availability which appears to respond to fluctuations in stream flow. This study aims to (1) determine seasonal patterns of bat species present in Poopenaut Valley, (2) quantify bat foraging activity in relation to stream flow, (3) aid in understanding the ecology of the seasonal pond as related to insect availability and stream flow, and most importantly (4) provide recommendations to SFPUC on timing water releases from O'Shaughnessy Dam in order to benefit focal bat species.

A fifth study objective has been added due to wildfire in the study area during August and September 2013. The Rim Fire offers a unique opportunity to study the effects of wildfire on the bat assemblages inhabiting Poopenaut Valley, as described below.

5.2 Methods

We conducted acoustic bat surveys at two sites in Poopenaut Valley to determine species presence and activity level. We deployed one bat detector on the south side of the Tuolumne River and operated it on a year-round basis in order to determine seasonal bat patterns in relation to stream flow. We deployed a second bat detector on the north side of the Tuolumne River adjacent to the seasonal pond and, when accessible, operated it to determine the relationship between bat foraging activity and water levels and insect availability in the adjacent seasonal pond (Figure 5-1).

At each site, we secured one detector and external battery in a locked metal box at the base of a 20 foot tall metal pole (Figure 5-2). At the top of the metal pole, we mounted an external microphone in a weather-proof metal casing and positioned it horizontally to face the meadow opening (south site) and seasonal pond (north site) in order to increase the detection probability of foraging bats. We powered each detector with a 6-volt external battery, which was secured in the locked metal box. Each detector recorded sound in the high frequency range continuously during each night between 1900 and 0700 during the first month of survey. For the remaining time period, each detector recorded sound in the high frequency range each night at two different time periods: (1) 1800 - 2300 and (2) 0300 - 0800. Acoustic surveys at the south site occurred from 14 April 2011 to 19 August 2015. Acoustic surveys at the north site occurred from 19 April 2011 to 19 August 2015. Detectors were scheduled to be checked on a monthly basis.

Figure 5- 1. Acoustic monitoring sites targeting bat species in Poopenaut Valley, Yosemite National Park. Monitoring occurred between April 2011 and August 2015 at two sites: (A) north of the Tuolumne River adjacent to the seasonal pond and (B) south of the Tuolumne River.

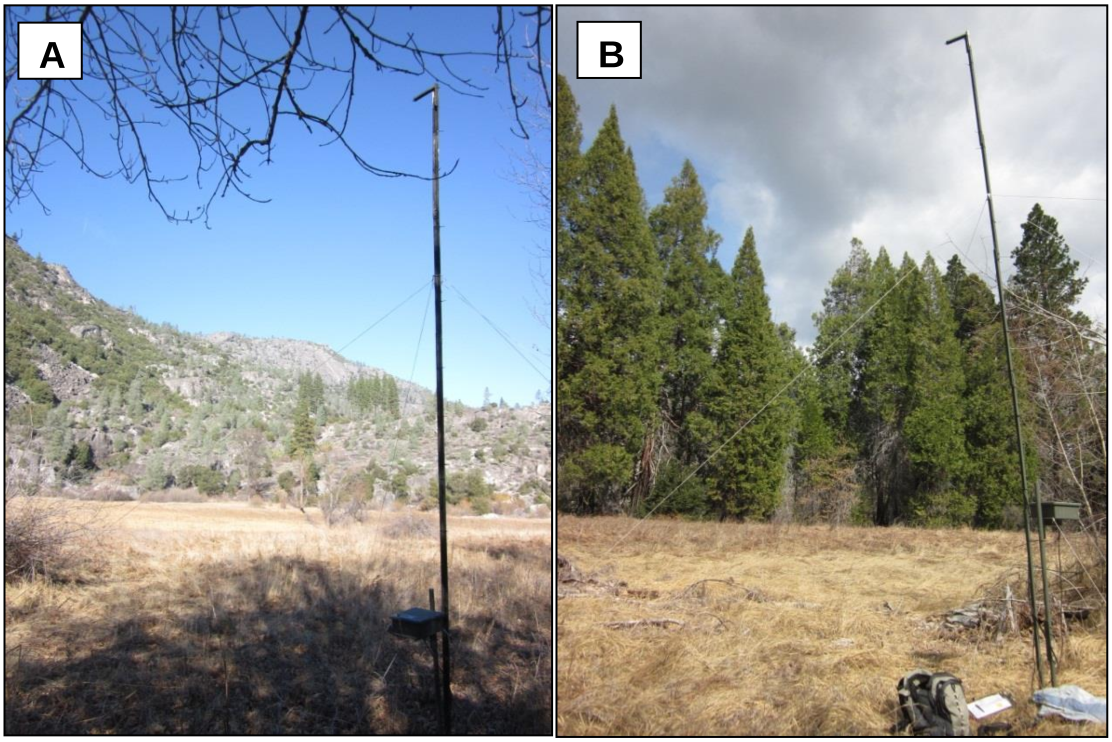


Figure 5-2. Acoustic bat detector set-ups in Poopenaut Valley (A) north of the Tuolumne River adjacent to the seasonal pond, and (B) south of the Tuolumne River.

We used Pettersson D500x ultrasound recording units coupled with SonoBat™ software for full-spectrum acoustic monitoring and bat echolocation call identification. The Pettersson D500x hardware is built specifically for long-term passive monitoring. SonoBat™ software provides a comprehensive tool for analyzing and comparing 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.

SonoBat's call trending algorithm recognizes the end of calls buried in echo and noise as well as establishes trends through noise and from low power signals. We analyzed echolocation call data from each site using the batch process option in SonoBat™. The discriminant probability threshold for each echolocation call was set at 0.90 and the acceptable call quality was set at 0.80. Species were identified by consensus only.

Due to erratic equipment failure (both sites), bear damage (north site only) and accessibility issues (north site only), continuous monitoring was not conducted during 2012 and 2014, with a large data gap during the summers. Additionally, during December 2012, human error resulted in incorrect recording times at the north site, with the detector recording at a less than optimal time period (i.e. during daylight) for one of the daily monitoring sessions during that month. From 7 December 2012 through 8 January 2013, the detector at the north site recorded from: (1) 0700 – 1300 and (2) 1700 – 2200, effectively reducing detection probability by half. Although no species were detected at the south site during this same period, the detector appeared to be functioning. Total seasonal monitoring effort for each site is shown in Table 5-2.

The Rim Fire burned the north side of Poopenaut Valley 23-34 August 2013 and the south side 10-11 September 2013 (Figures 5-3, 5-4). Both bat detectors were in burned areas but continued to record when fire swept through the valley. The detector at the south site suffered minimal damage (burnt external microphone cable) whereas the detector at the north side remained undamaged.

Figure 5-3. Aerial image of Poopenaut Valley taken 10 September 2013 showing active burn front of the Rim Fire on the south side of the valley, and the area on the north side of the valley that burned on 23-24 August 2013. The northern area includes the seasonal pond and site of the north bat detector (A). The active burn front eventually reached the bat detector at the south site (B).

Figure 5-4. Poopenaut Valley post-Rim Fire on 23 September 2013. Bat detectors at the north site (A) and the south site (B) were in burned areas. Both detectors were recording during the Rim Fire.

5.3 Results

We documented a high diversity of bat species in Poopenaut Valley from spring 2011 through late summer 2015. Over this 4.5 year monitoring period, we detected all 17 bat species known to occur within Yosemite National Park (Pierson et al. 2001) in Poopenaut Valley; thus, Poopenaut Valley alone is as diverse as the entirety of Yosemite National Park. Five of the 17 documented species are California species of special concern (pallid bat, spotted bat, western mastiff bat, Townsend's big-eared bat, and western red bat). Western red bat was detected for the first time at both the north and south sites in August–September 2013, during the period when the Rim Fire burned through the study area. They were again documented in August–September 2014 and July–August 2015. Similarly, the fringed myotis was detected for the first time at both sites during the Rim Fire and has been detected at both sites throughout 2014, but only once in 2015 in July. Although the pallid bat was detected at the south site in 2011 and at the north site in 2012, it was not detected at either site in 2013. In 2014, pallid bats were again detected at both sites throughout the summer, and then mostly disappeared in 2015.

Preliminary results show that bat assemblages in Poopenaut Valley varied by year, season (Figures 5-5 to 5-8), and site (Figures 5-9 to 5-12). Whereas the majority of species tended to arrive in late spring/early summer, peak in detection frequency during late summer, and depart sometime during the fall, two species stood out with considerably higher detection frequencies: spotted bat and Mexican free-tailed bat (Figures 5-5 and 5-6). The biggest difference in detection frequency occurred at the south site during spring 2014; the spotted bat had 14 times more detections as the next most frequently detected species, the Mexican free-tailed bat. Spotted bat detections dropped off slightly, but remained high throughout summer and fall 2014 at the south site. Through summer and fall 2014, detection rates for Mexican free-tailed bats at the north detector were the highest we've documented over the past 4.5 years (Figure 5-5). During this same time period, very high detection rates were also documented for California myotis, western mastiff bat, and canyon bat (Figures 5-5 and 5-6). Western mastiff bat detections spiked in the summer of 2015, although this is based on a small sampling period. Habitat requirements and arrival/departure dates of the eight most frequently detected bat species in Poopenaut Valley are described in Table 5-3.

Seasonal bat use of Poopenaut Valley varied among species, with Mexican free-tailed bat being the only species that was detected year-round at both sites over the duration of the study period (Figures 5-5 to 5-8). During winter 2013/14, multiple species were detected at the south site, including western mastiff bat, spotted bat, hoary bat, silver-haired bat, and California myotis. North site detections in winter 2013/14 included hoary bat, silver-haired bat, California myotis, and Yuma myotis.

Interestingly, detection frequency increased for the majority of bat species at both sites during the Rim Fire in late summer 2013 (Figures 5-5 to 5-8). During the Rim Fire, the Mexican free-tailed bat had the highest detection frequency at the north site, followed closely by California myotis, and to a lesser extent, canyon bat, hoary bat, and Yuma myotis. At the time, the California myotis had the highest detection frequency ever recorded for this species at the north site during the Rim Fire. At the south site, there were noticeable increases in detection frequencies of the Mexican free-tailed bat, silver-haired bat, California myotis, big brown bat, Yuma myotis, and long-legged myotis during the Rim Fire. In past years at both sites during this time period, in the absence of fire, the majority of species detection frequencies decreased or remained stable.

While detection frequencies increased during the Rim Fire, the largest increases for many species occurred during spring-fall 2014. This increase was pronounced at both sites, though each site had different ratios of species. At the north site, Mexican free-tailed bat, California myotis, canyon bat, hoary bat, Yuma myotis, silver-haired bat, big brown bat, and fringed myotis all set record highs (Figures 5-5 and 5-7). Similarly, at the south site, spotted bat, California myotis, western mastiff bat, canyon bat, hoary bat, Yuma myotis, big brown bat, fringed myotis, and small-footed myotis saw substantial increases (Figures 5-6 and 5-8).

Overall, detection frequencies decreased in 2015 to levels comparable to pre-2014 levels. The only species with marked increases were western mastiff bat and big brown bat at the south site (Table 5-3; Figures 5-6 and 5-8).

Species richness decreased slightly in 2015 at both sites and was fairly consistent with pre-2014 numbers (Figures 5-14 and 5-15). Species richness is defined as number of species detected within seasonal time periods. Seasonal patterns in species richness were also consistent with previous years at both sites. Summer has the highest level of species diversity while winter has the lowest. Averaged over the length of the study, the north site had slightly higher species richness than the south site in every season other than winter (Figure 5-16).

Accessibility issues at the north site and equipment failure at both sites prevented continuous monitoring over the 4.5 year survey period, which lowered our ability to detect bats continuously. While the detection rates take effort into account, we collected much less data over certain periods of time. For example, at the north site during summer 2011, the detector operated only five days during June, July, and August (Table 5-2). As a result, seasonal comparisons between years and sites will become more meaningful when additional data are collected over the coming years.

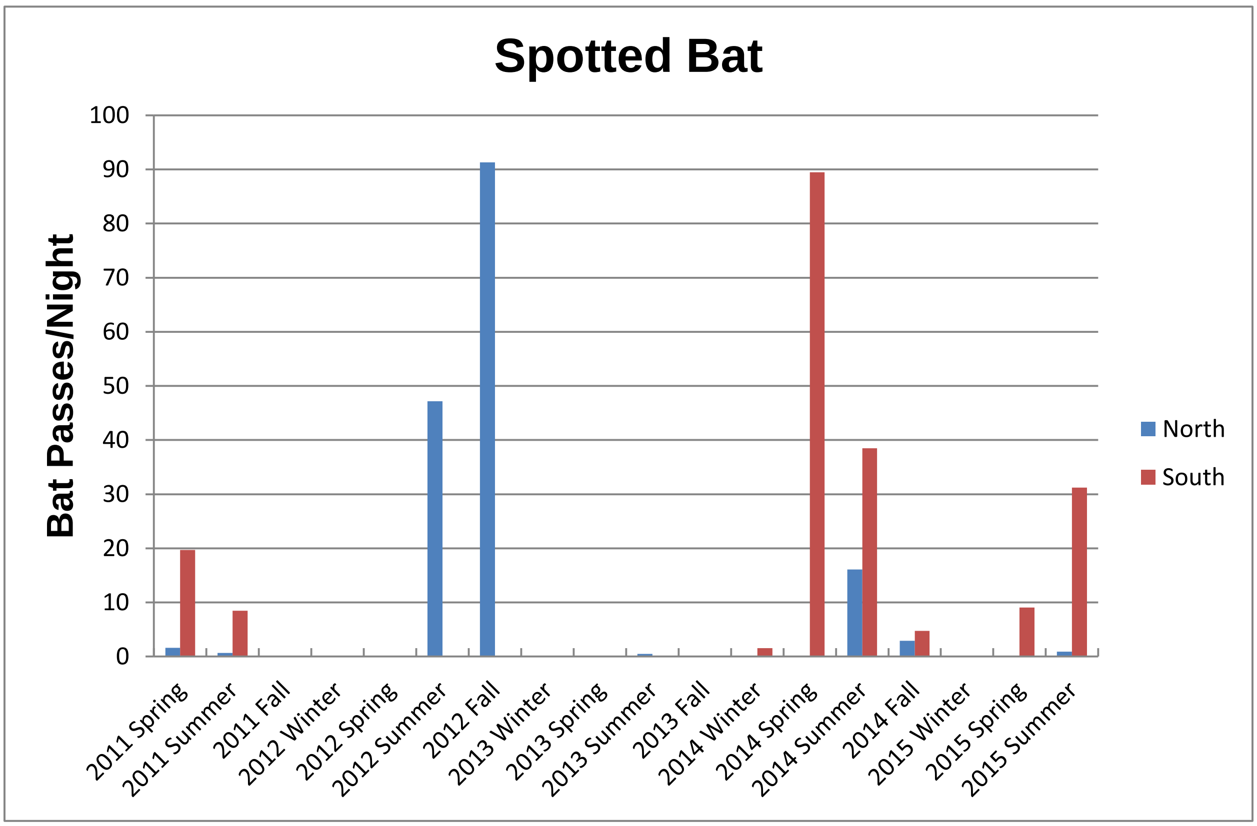
Table 5-2. Total seasonal monitoring effort from acoustic bat detectors at two sites in Poopenaut Valley, Yosemite National Park from 14 April 2011 to 19 August 2015. Spring is March-May, Summer is June-August, Fall is September-November, and Winter is December-February. The first number indicates total number of days that the detector was operational; the second number in parentheses indicates the percentage of operational days out of all days elapsed in that season.

	2011			2012				2013			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall
North	42 (46%)	5 (5%)	48 (53%)	70 (78%)	92 (100%)	88 (96%)	74 (81%)	57 (63%)	92 (100%)	92 (100%)	12 (13%)
South	14 (15%)	18 (20%)	82 (90%)	90 (100%)	90 (98%)	92 (100%)	88 (97%)	87 (95%)	90 (98%)	91 (99%)	22 (24%)

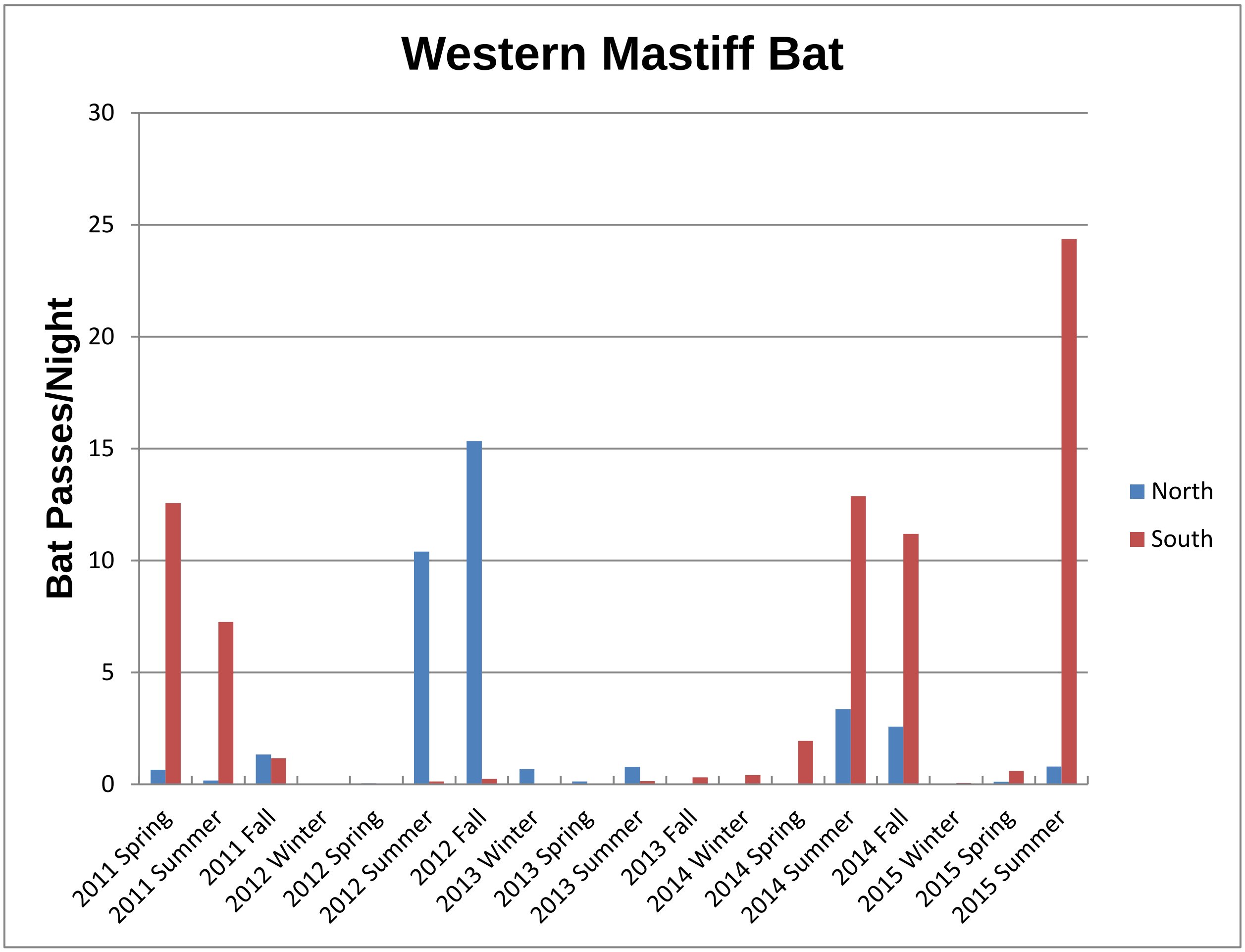
	2014				2015		
	Winter	Spring	Summer	Fall	Winter	Spring	Summer
North	53 (58%)	59 (68%)	36 (46%)	107 (100%)	78 (100%)	91 (100%)	70 (86%)
South	34 (37%)	55 (75%)	68 (76%)	107 (100%)	78 (100%)	34 (37%)	59 (24%)

Table 5-3. Occurrence, habitat requirements, arrival/departure dates, and bat detections by season of the eight most frequently detected bat species in Poopenaut Valley from 14 April 2011 to 19 August 2015. Arrival/departure dates represent when each species was first/last detected each year. Some species were present year-round. Note*Acoustic bat detectors were not operating continuously during the entire monitoring period. Refer to Table 5-2 for total seasonal monitoring effort. The vertical axis on graphs is the number of bat detections/number of recording nights.

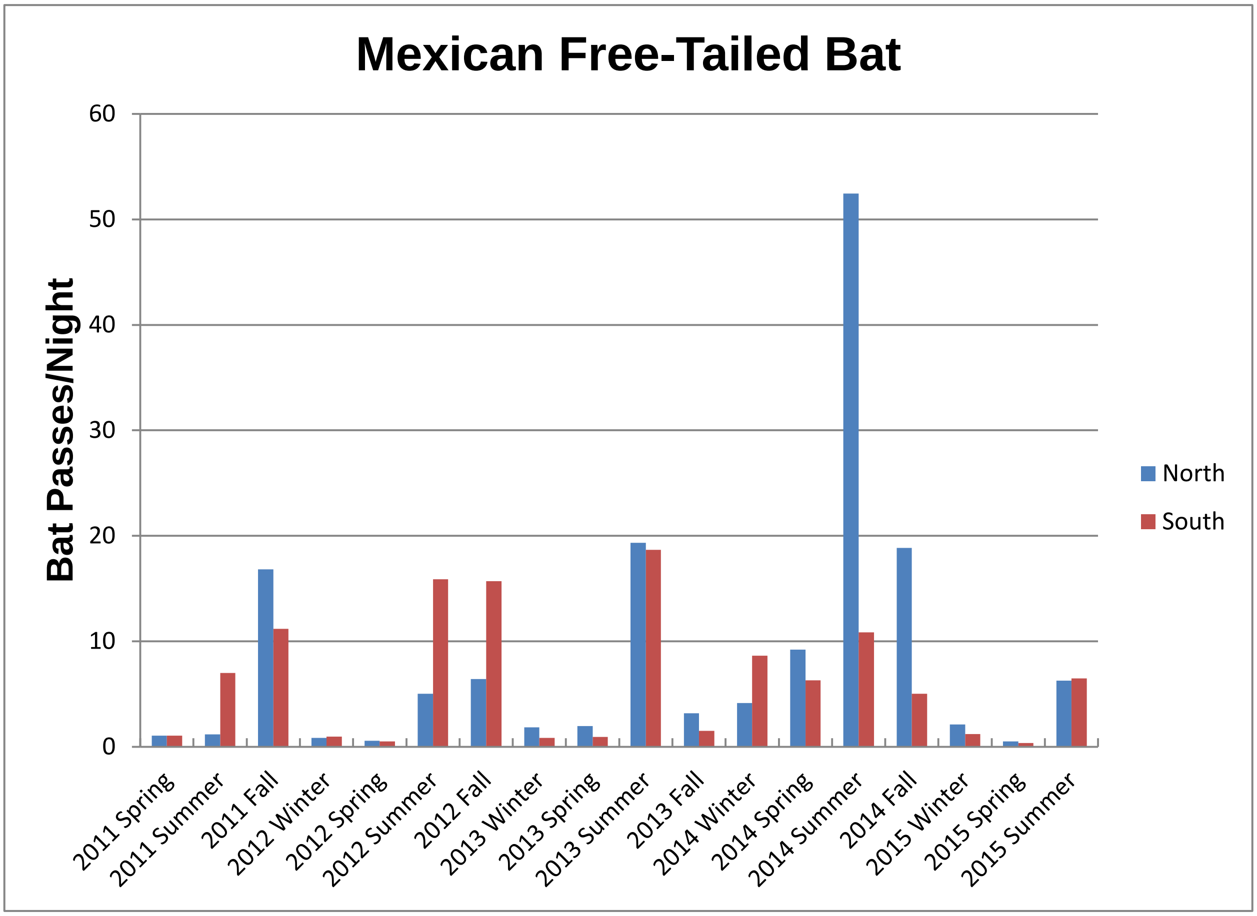
SPOTTED BAT		
Occurrence/habitat	Widely distributed throughout Sierra Nevada, with records > 3000 m. Occurs in habitats ranging from desert scrub to montane coniferous forests	
Feeding type/food source	Forages in a wide variety of habitats,5-15 m off the ground, primarily for moths	
Roosting structure	Uses crevices in rock faces for roosting and reproduction	
Seasonal movements	Makes local movements in some areas, from high elevations in summer to lower elevations in fall. Little is known about the California populations; may be yearlong residents, or migratory.	
2011-2015	**NORTH**	**SOUTH**
Average Arrival	April–May	April–May
Average Departure	September–November	August–September



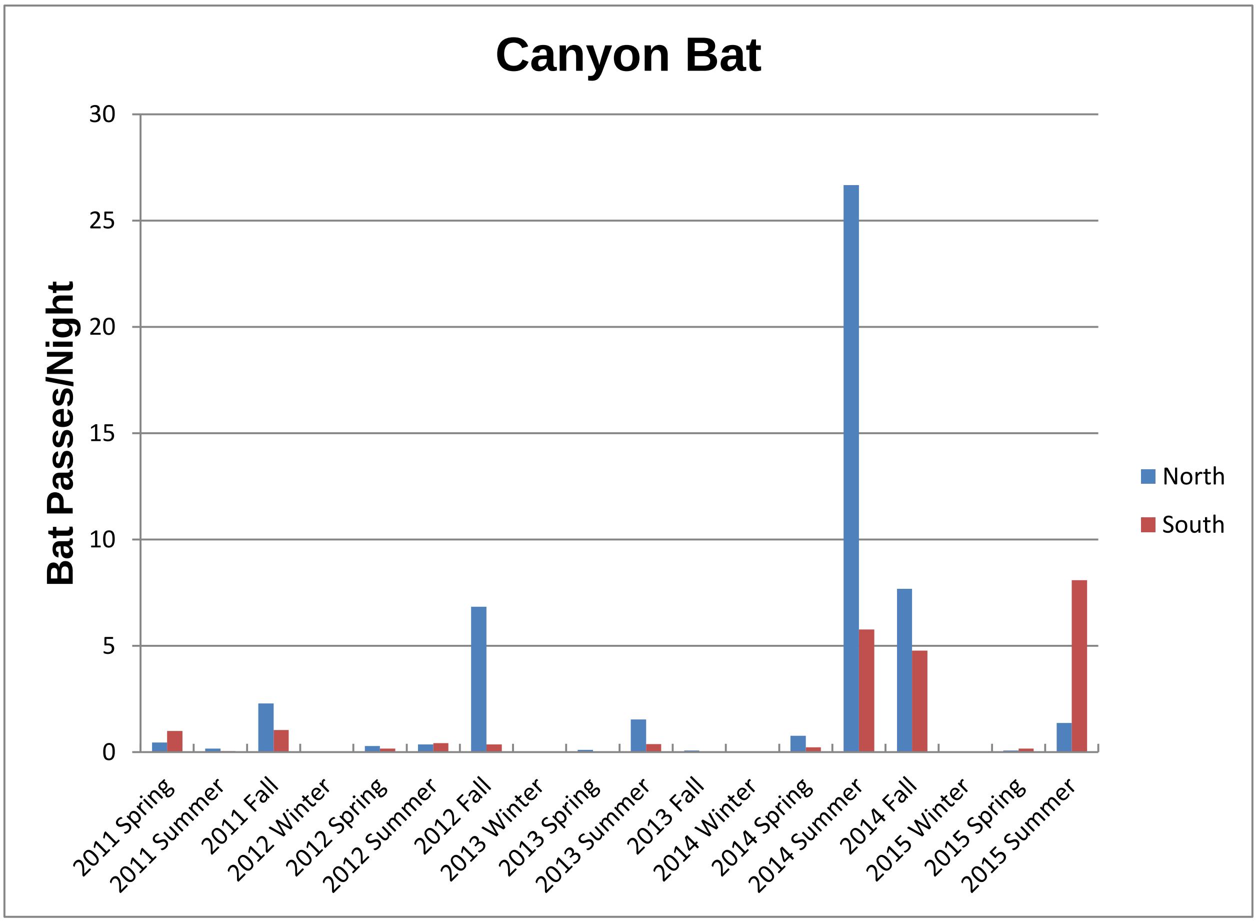
WESTERN MASTIFF BAT		
Occurrence/habitat	Found in a variety of habitats to > 3000 m in elevation. From desert scrub to chaparral to oak woodland and into the ponderosa pine belt.	
Feeding type/food source	Detected most often over meadows and other open areas, but will also feed above forest canopy; sometimes to high altitudes (1,000 feet)	
Roosting structure	Roosts primarily in crevices in cliff faces and occasionally trees	
Seasonal movements	Unknown	
2011–2015	**NORTH**	**SOUTH**
Average Arrival	January–April	April–May
Average Departure	October–December	September–October



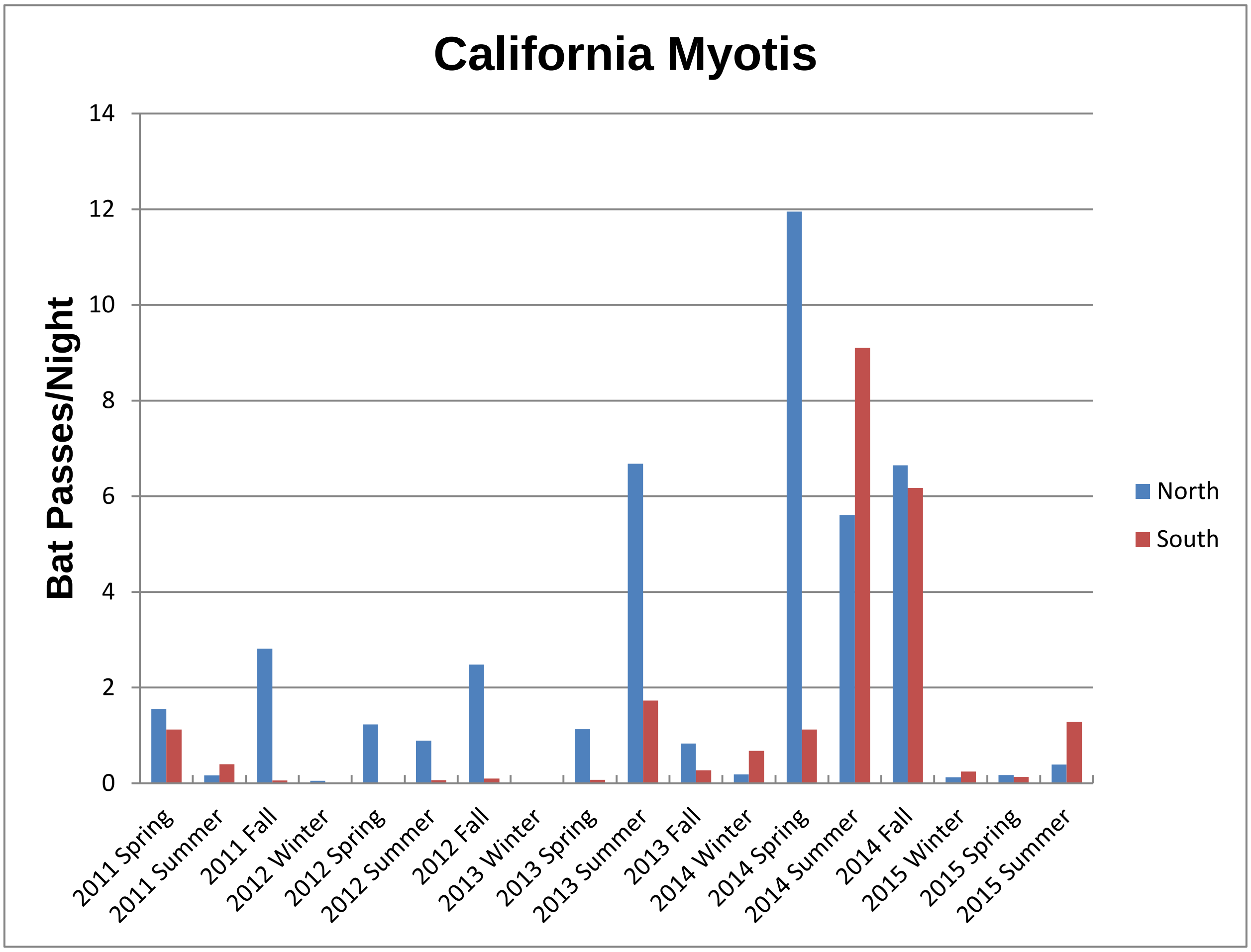
MEXICAN FREE-TAILED BAT		
Occurrence/habitat	Uncommon in high Sierra Nevada but found throughout California. Found in all habitats including mixed conifer forest, but open habitats such as woodlands, shrublands, and grasslands preferred.	
Feeding type/food source	Forages high, 100 feet above ground.	
Roosting structure	Roosts in caves, mine tunnels, crevices, and buildings.	
Seasonal movements	In California, makes local movements to and from hibernacula or short migrations attitudinally.	
2011–2015	**NORTH**	**SOUTH**
Average Arrival	Year-round	Year-round
Average Departure	Year-round	Year-round



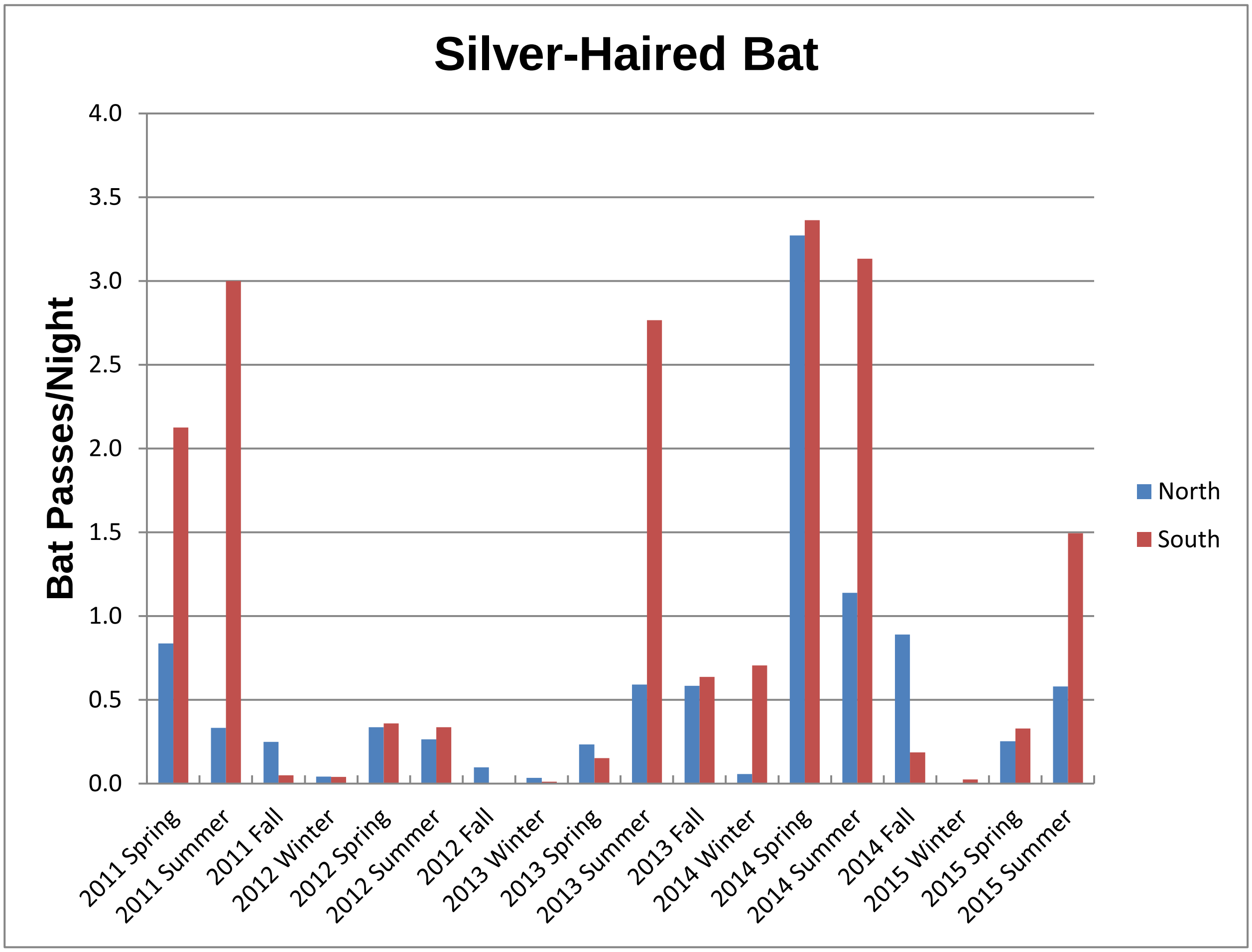
CANYON BAT		
Occurrence/habitat	Wide range including desert, grassland, woodland, and mixed conifer forests. Yearlong resident in California	
Feeding type/food source	Feeds at low to moderate heights over water, rocky canyons, and along cliff faces.	
Roosting structure	Roosts in rock crevices, mines, caves, and buildings.	
Seasonal movements	Yearlong resident in California. May make local movements.	
2011–2015	**NORTH**	**SOUTH**
Average Arrival	March	April
Average Departure	October-November	September-October



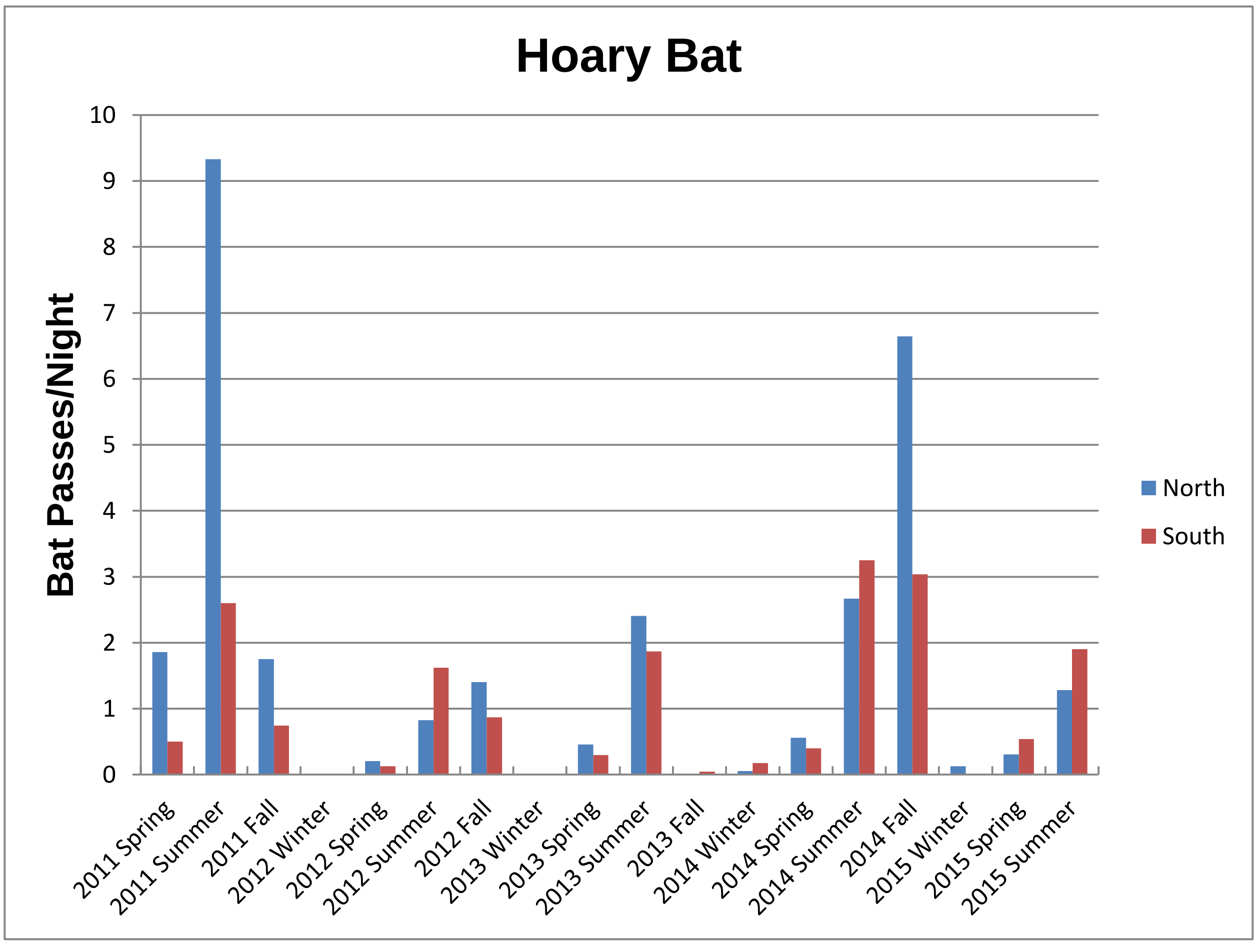
CALIFORNIA MYOTIS		
Occurrence/habitat	Broad distribution over western North America, most abundant at mid-elevations. Found in almost every habitat.	
Feeding type/food source	Forages in canopy and along riparian corridors on insects and moths.	
Roosting structure	Uses crevices in wide variety of natural and anthropogenic structures.	
Seasonal movements	Individuals can be active in winter, even in below freezing temperatures.	
2011–2015	**NORTH**	**SOUTH**
Average Arrival	January–March	January–April
Average Departure	September–October	September–November



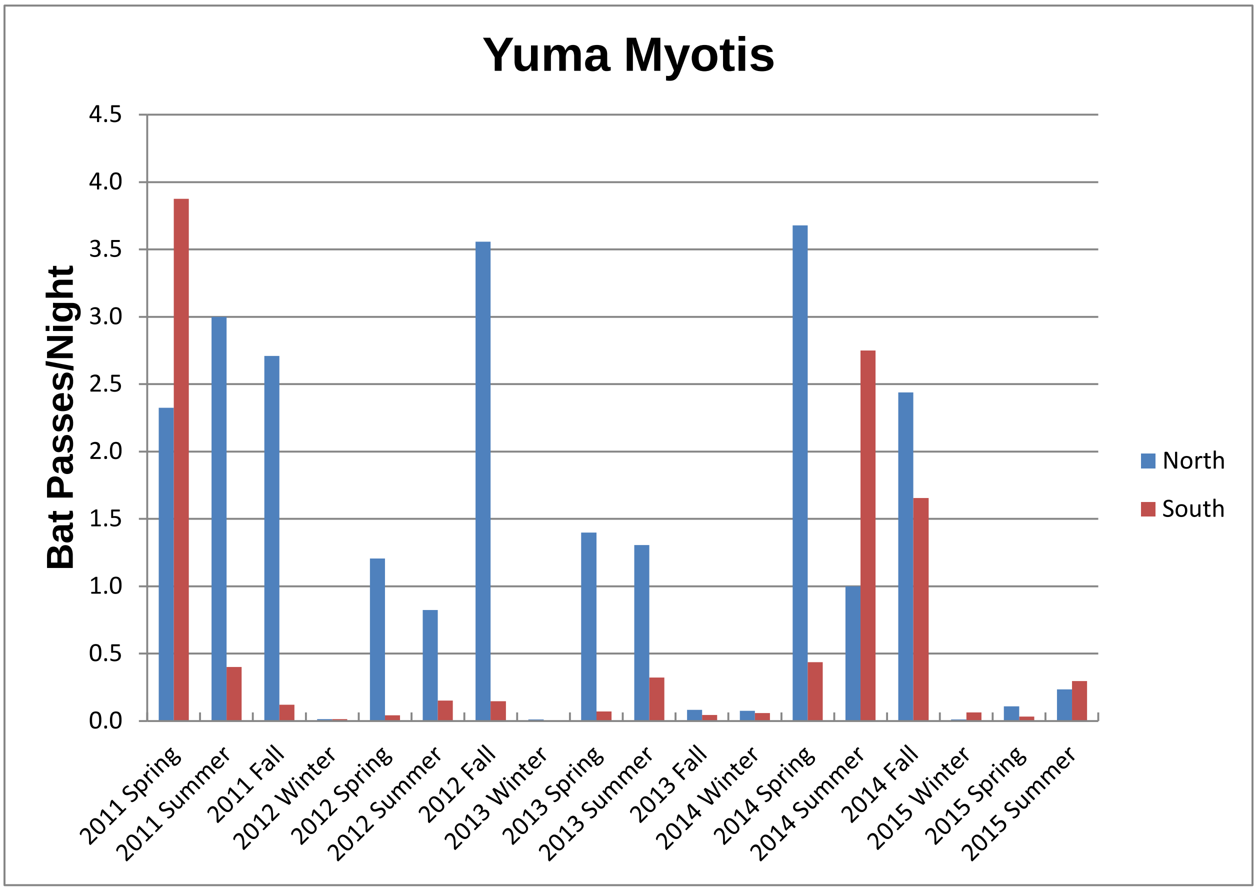
SILVER-HAIRED BAT		
Occurrence/habitat	Broad distribution concentrated in northern part of CA.	
Feeding type/food source	Forages above canopy, in forest clearings, and in riparian zone along water courses for wide variety of insects and moths	
Roosting structure	Roosts in trees	
Seasonal movements	Migratory	
2011–2015	**NORTH**	**SOUTH**
Average Arrival	January	January–February
Average Departure	September	September



HOARY BAT		
Occurrence/habitat	The hoary bat is the most widespread North American bat. Habitats include cottonwood riparian habitat, forested areas, and woodlands.	
Feeding type/food source	Feeds primarily on moths.	
Roosting structure	Roosts in dense foliage of medium to large-size trees	
Seasonal movements	Migrates between summer and winter ranges, probably over long distances. During spring and fall, large groups are encountered, occasionally in unusual locations. Females precede males in the northward spring migration, which occurs from Feb - May. Fall migration occurs Sep - Nov.	
2011–2015	**NORTH**	**SOUTH**
Average Arrival	February–April	January–April
Average Departure	September–October	September–October



YUMA MYOTIS		
Occurrence/habitat	Usually occurs below 8,000 feet in elevation. Optimal habitats are open forests and woodlands with sources of water over which to feed. More highly associated with water than any other species.	
Feeding type/food source	Forages over open, still, or slow-moving water and above low vegetation in meadows for emergent insects (midges, mayflies, caddis flies) and moths.	
Roosting structure	Roosts in buildings, caves, or crevices.	
Seasonal movements	Probably makes local or short migrations to suitable hibernacula. Individuals that spend summer at high elevations probably move downslope.	
2011–2015	**NORTH**	**SOUTH**
Arrival	February–March	March–April
Departure	September–October	September–November



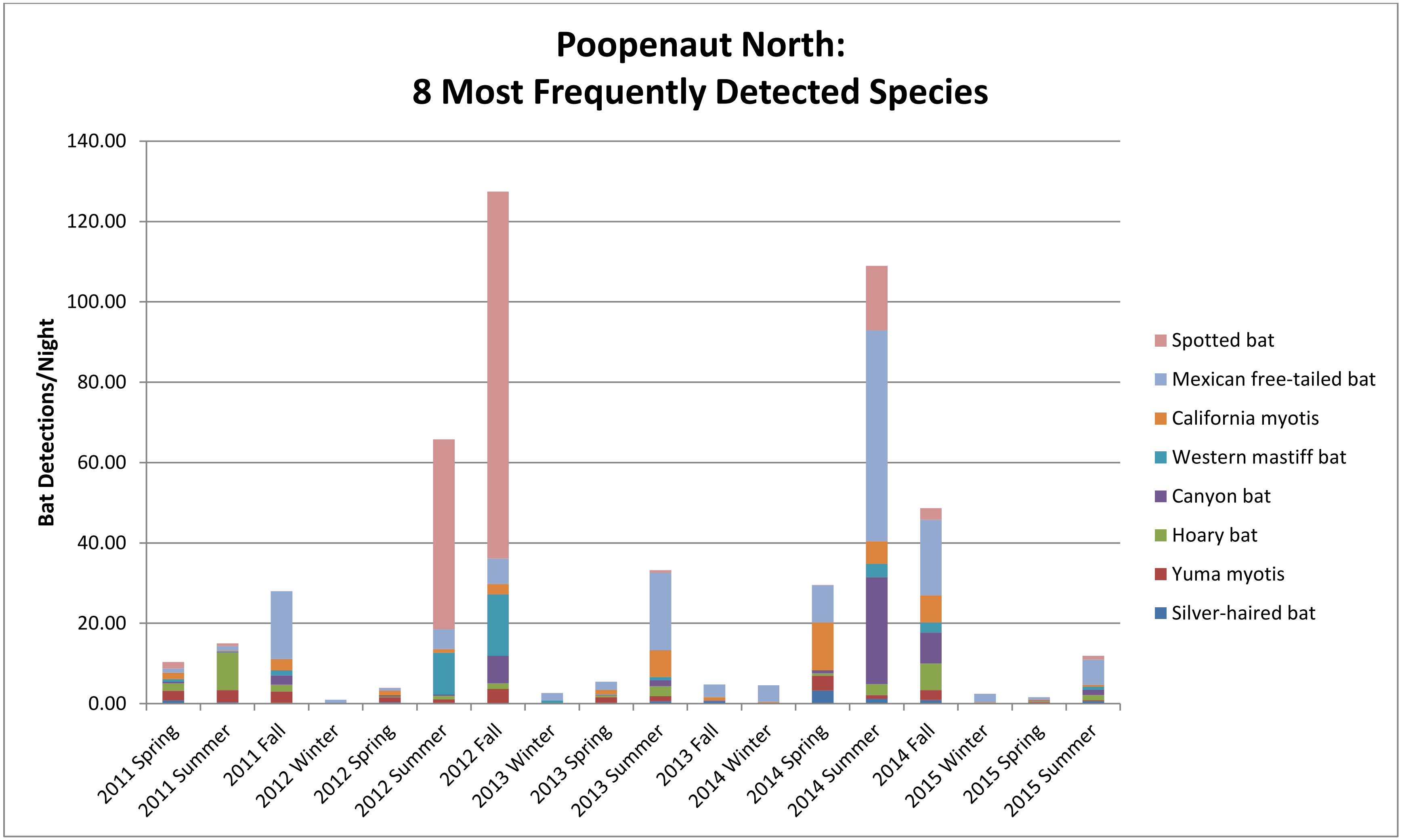


Figure 5-5. Bat detections by season of the 8 most frequently detected species at the north detector from 14 April 2011 to 19 August 2015. The vertical axis is number of bat detections/number of recording nights.

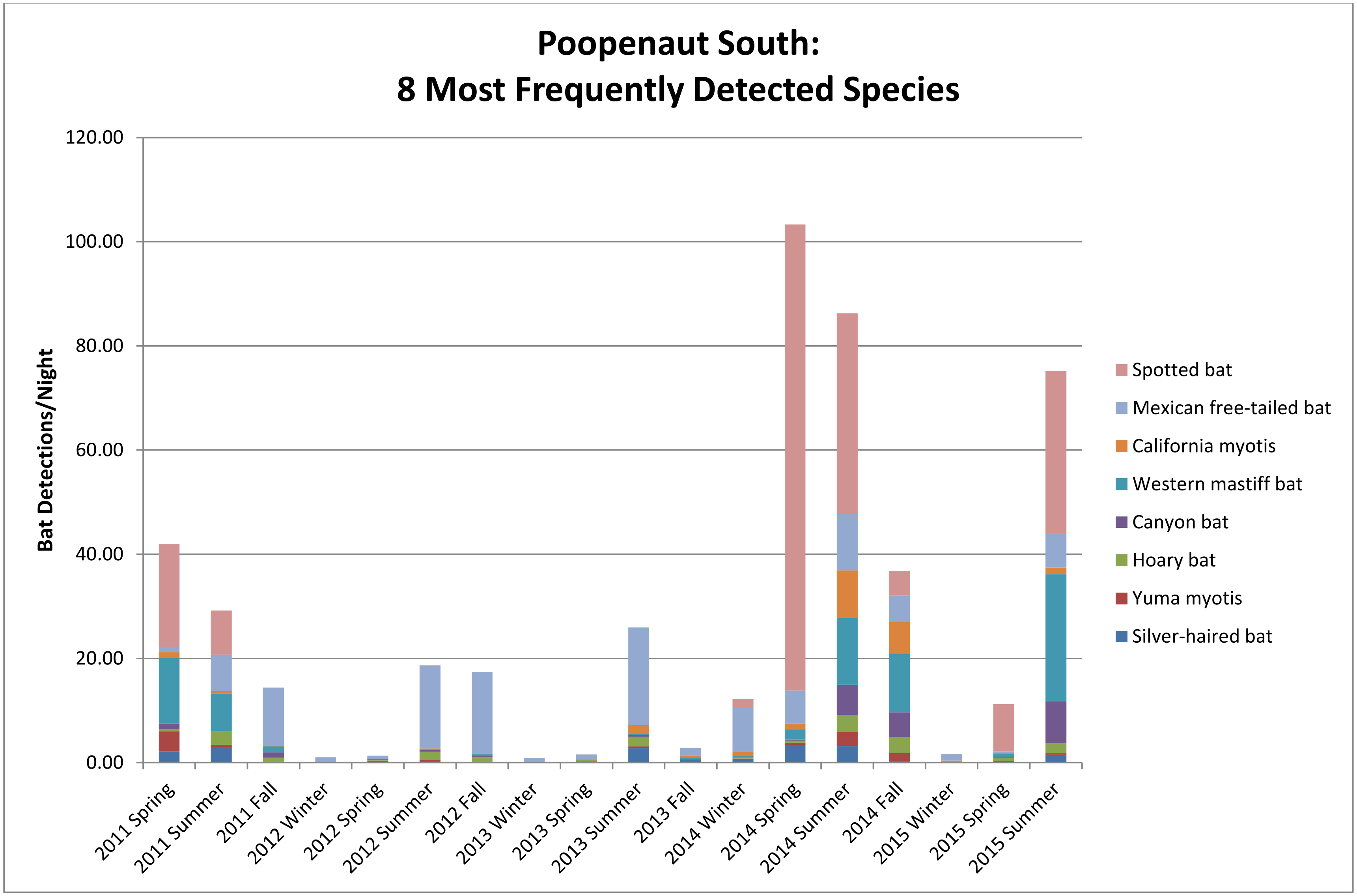


Figure 5-6. Bat detections by season of the 8 most frequently detected species at the south detector from 14 April 2011 to 19 August 2015. The vertical axis is number of bat detections/number of recording nights.

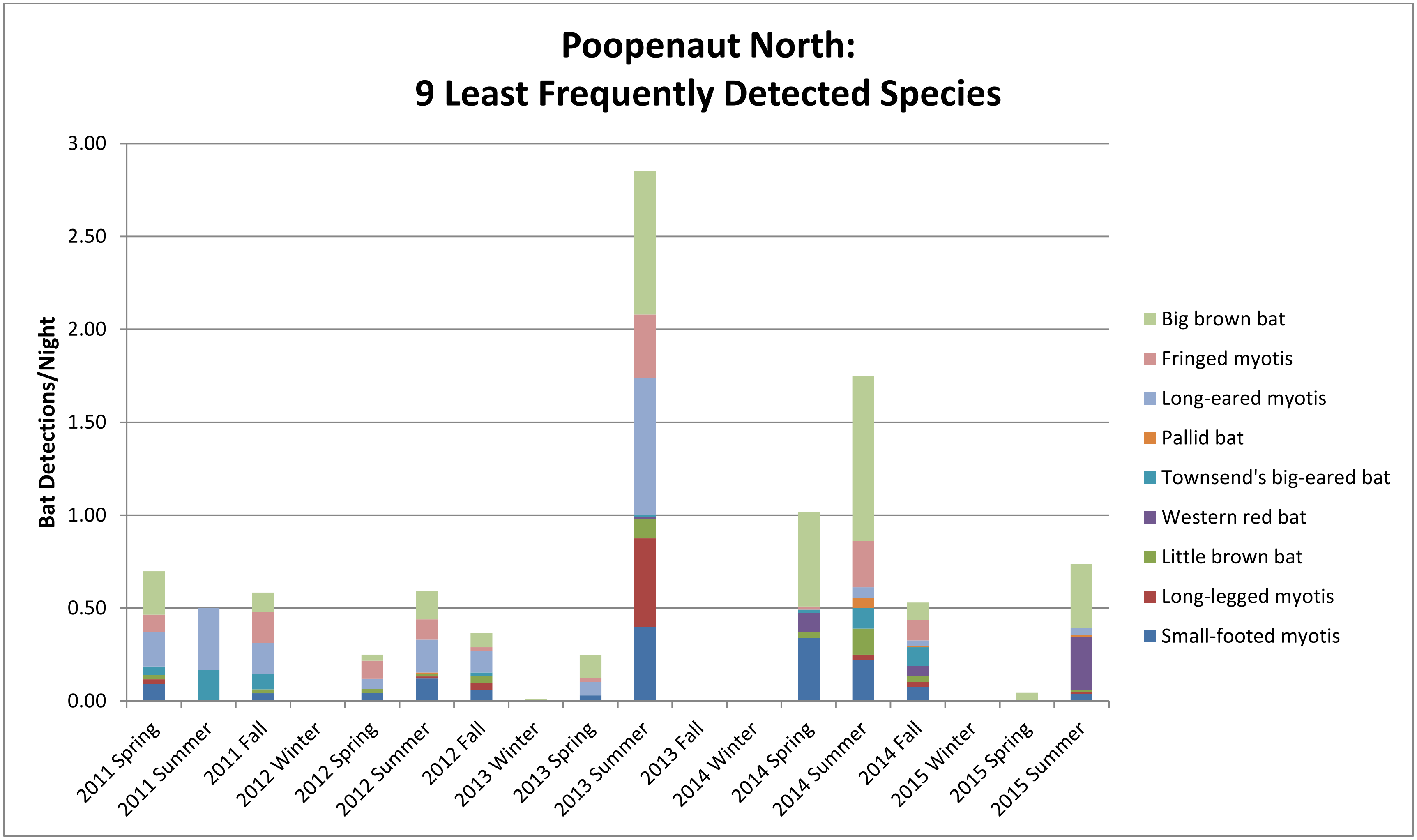


Figure 5-7. Bat detections by season of the 9 least frequently detected species at the north detector from 14 April 2011 to 19 August 2015. The vertical axis is number of bat detections/number of recording nights.

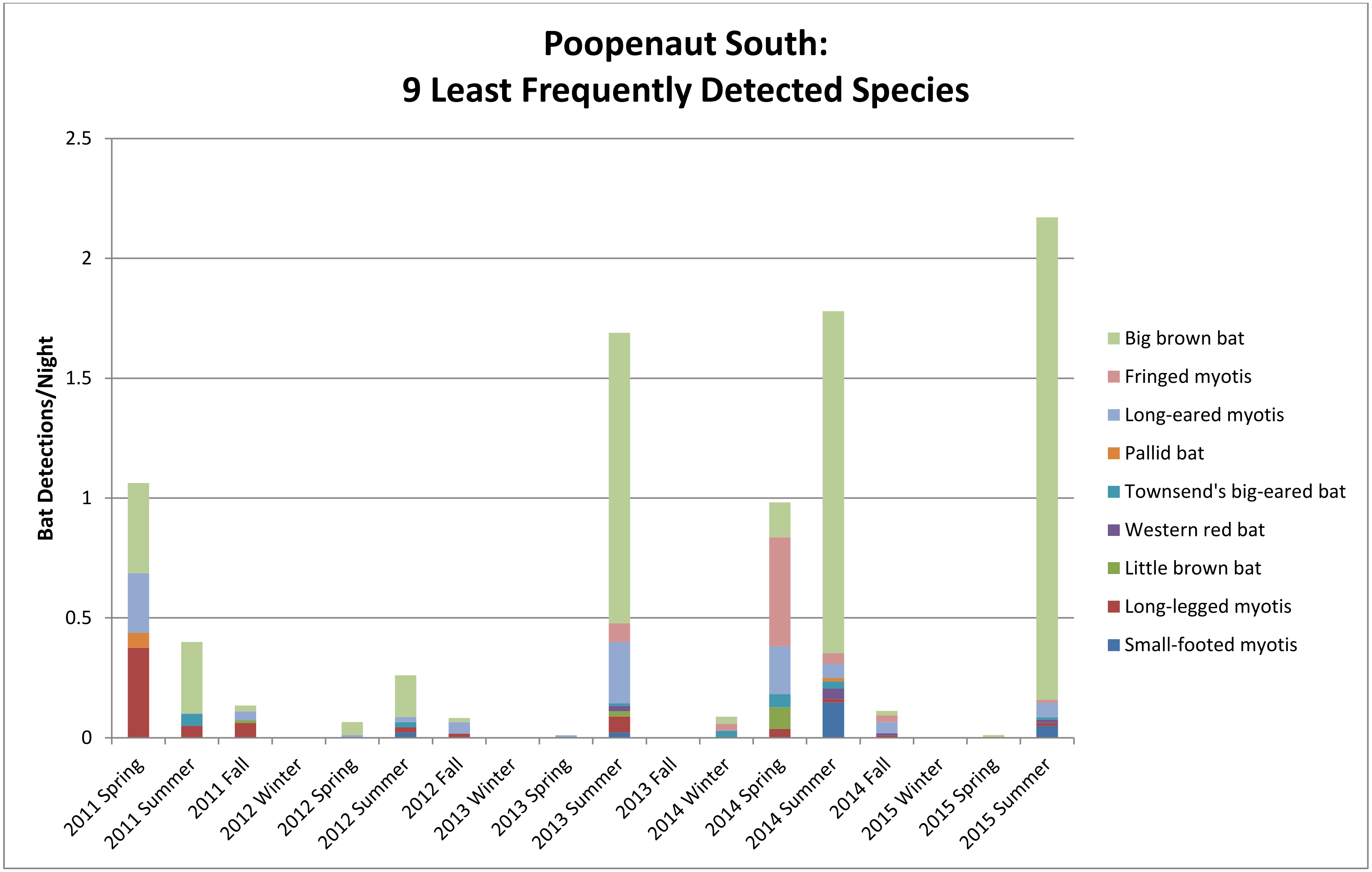


Figure 5-8. Bat detections by season of the 9 least frequently detected species at the south detector from 14 April 2011 to 19 August 2015. The vertical axis is number of bat detections/number of recording nights.

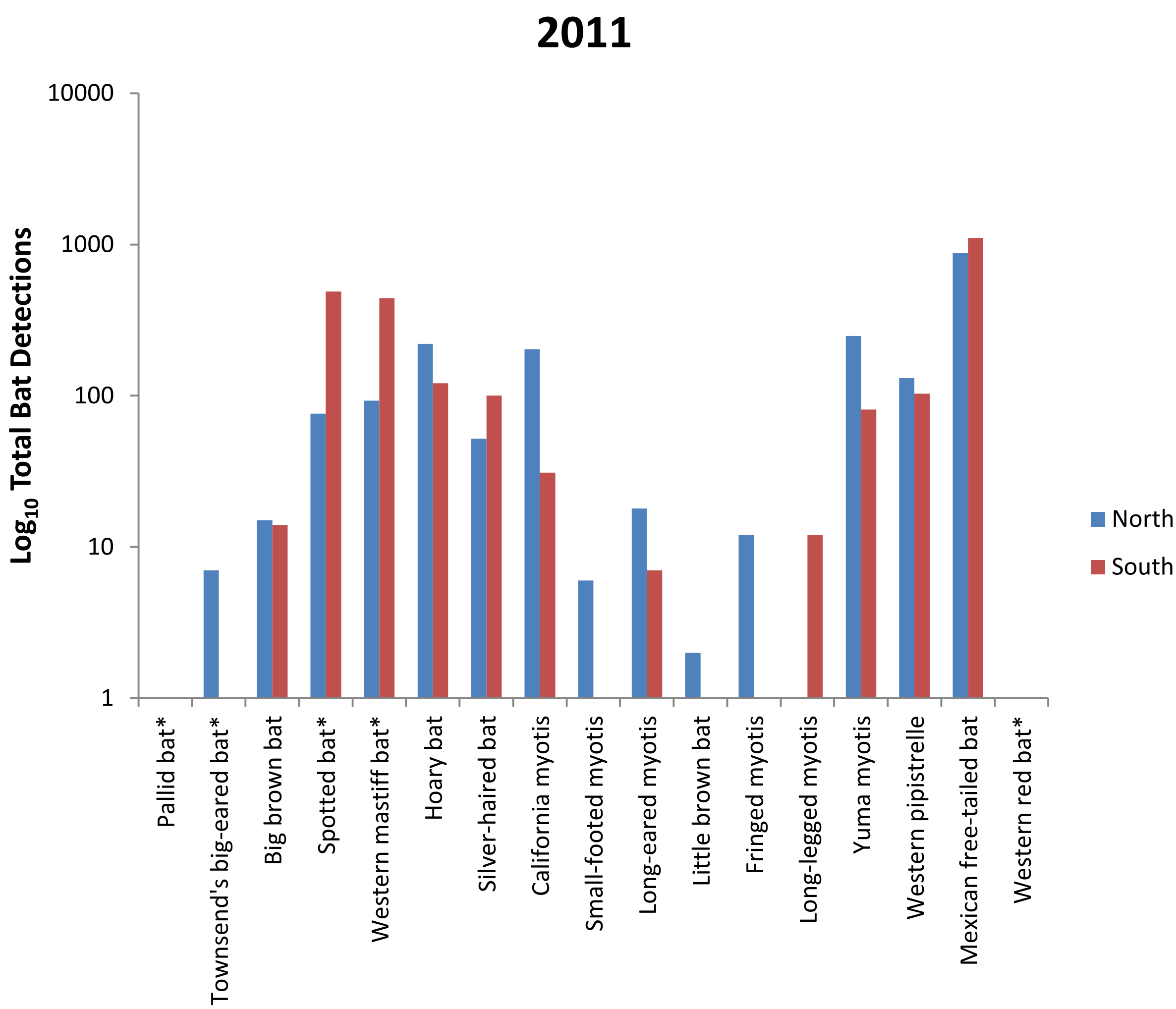


Figure 5-9. Total bat detections on a logarithmic scale (base 10) in Poopenaut Valley by site from April 2011 to December 2011 (Year 1). Total bat detections do not necessarily indicate abundance, as a single bat may produce many detections. A total of 16 bat species were detected. * indicates California species of special concern.

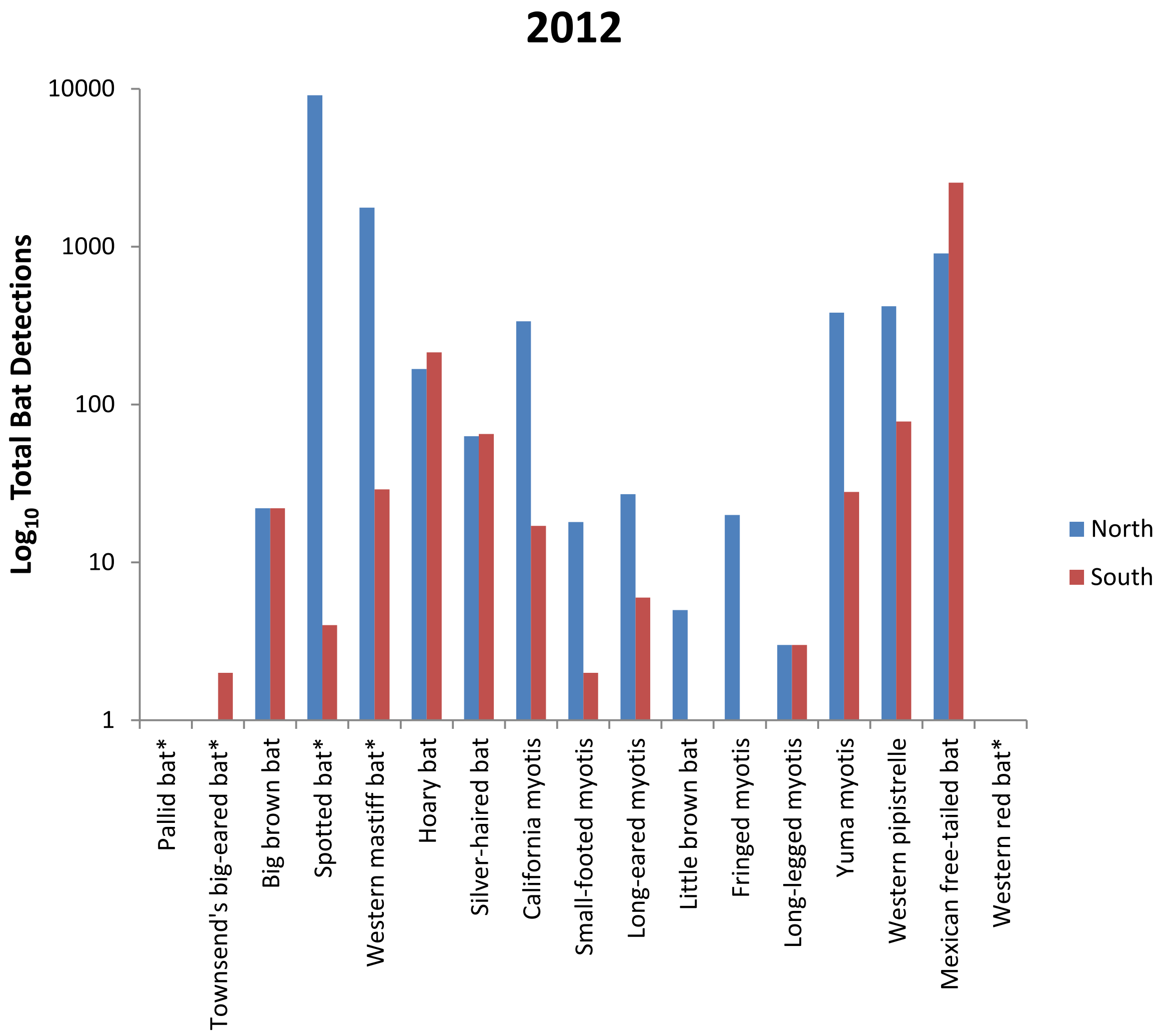


Figure 5-10. Total bat detections on a logarithmic scale (base 10) in Poopenaut Valley by site from January 2012 to December 2012 (Year 2). Total bat detections do not necessarily indicate abundance, as a single bat may produce many detections. A total of 16 bat species were detected. * indicates California species of special concern.

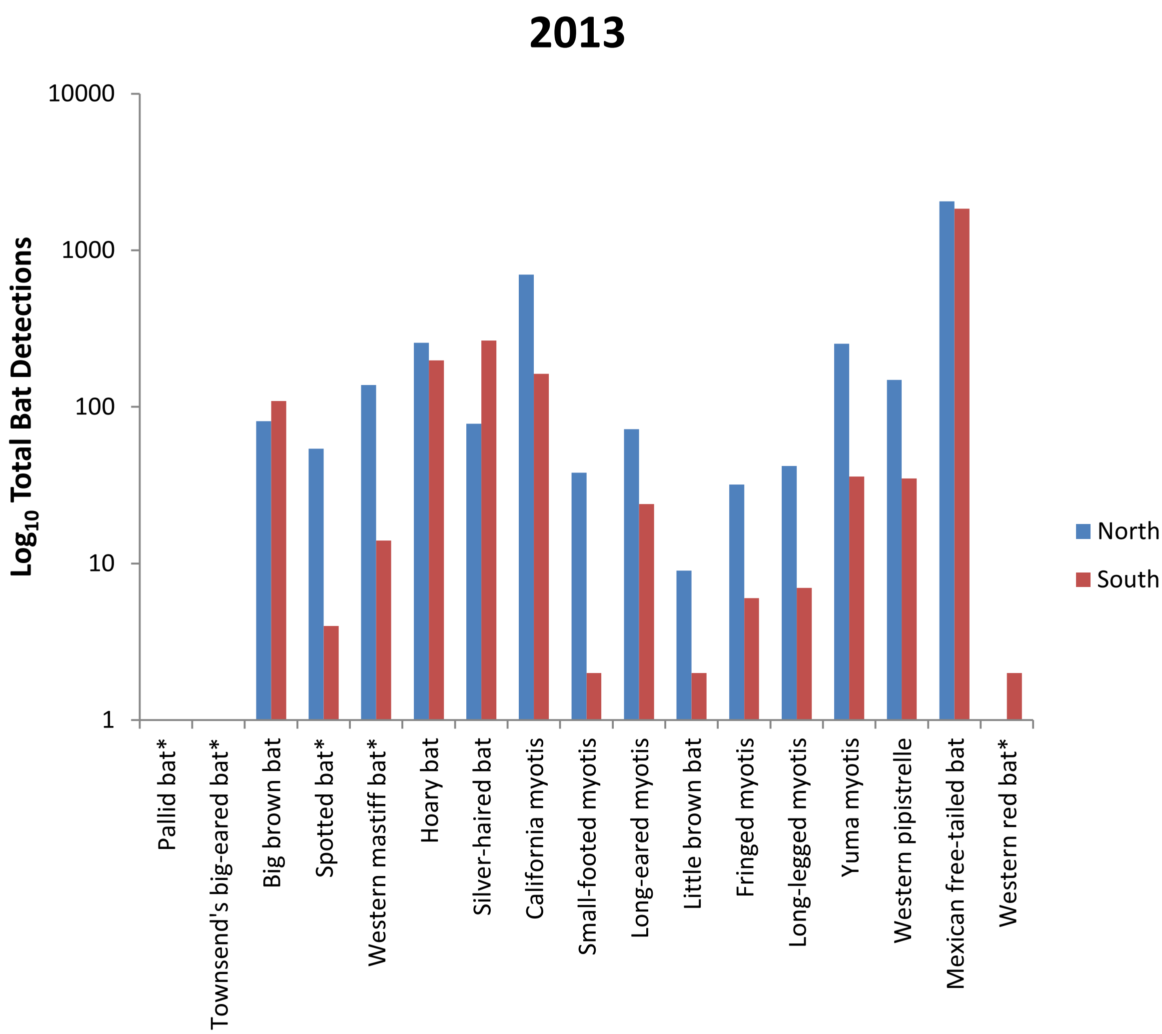


Figure 5-11. Total bat detections on a logarithmic scale (base 10) in Poopenaut Valley by site from January 2013 to September 2013 (Year 3). Total bat detections do not necessarily indicate abundance, as a single bat may produce many detections. A total of 16 bat species were detected. * indicates California species of special concern.

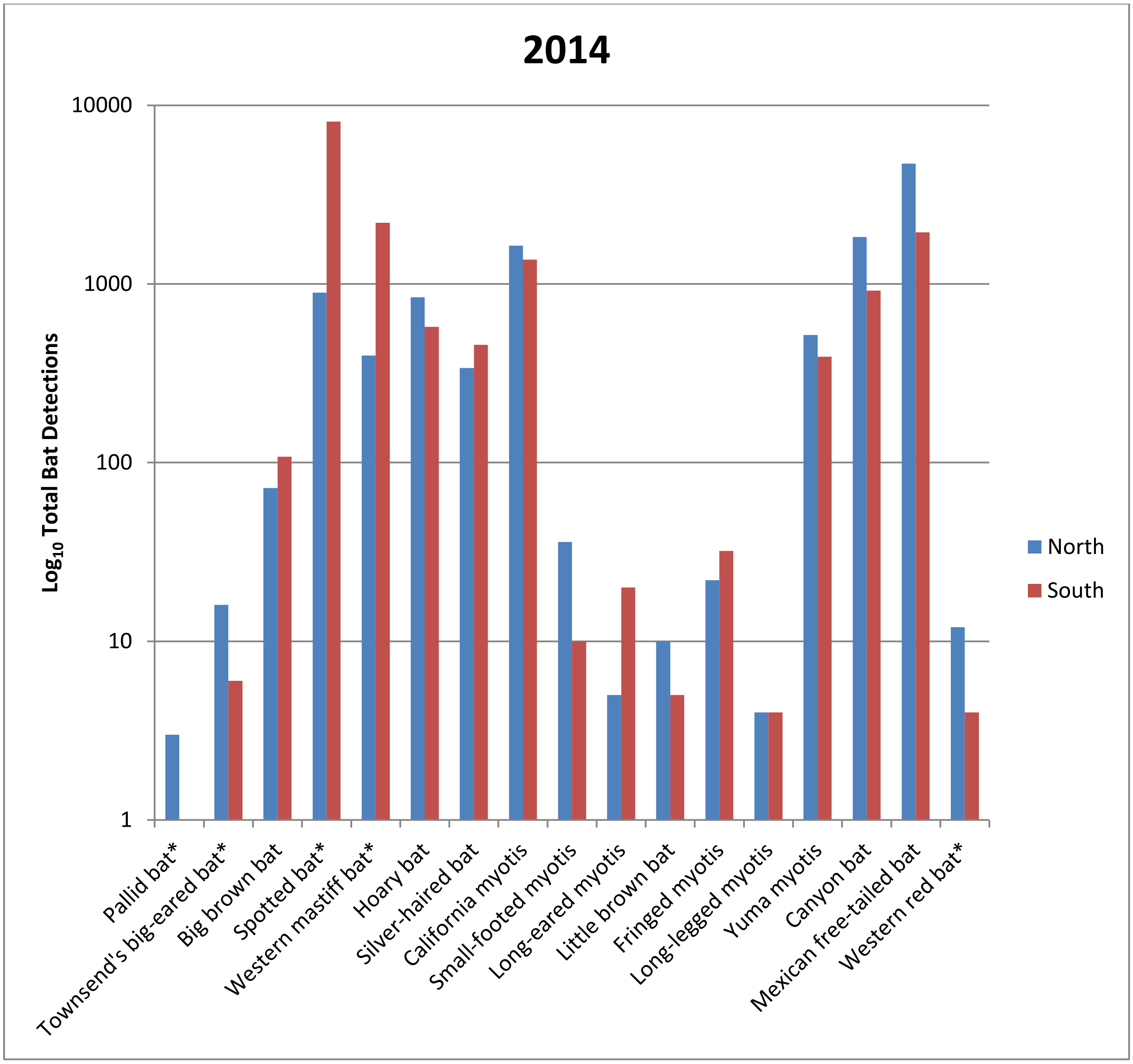


Figure 5-12. Total bat detections on a logarithmic scale (base 10) in Poopenaut Valley by site from January 2014 to December 2014 (Year 4). Total bat detections do not necessarily indicate abundance, as a single bat may produce many detections. A total of 17 bat species were detected. * indicates California species of special concern.

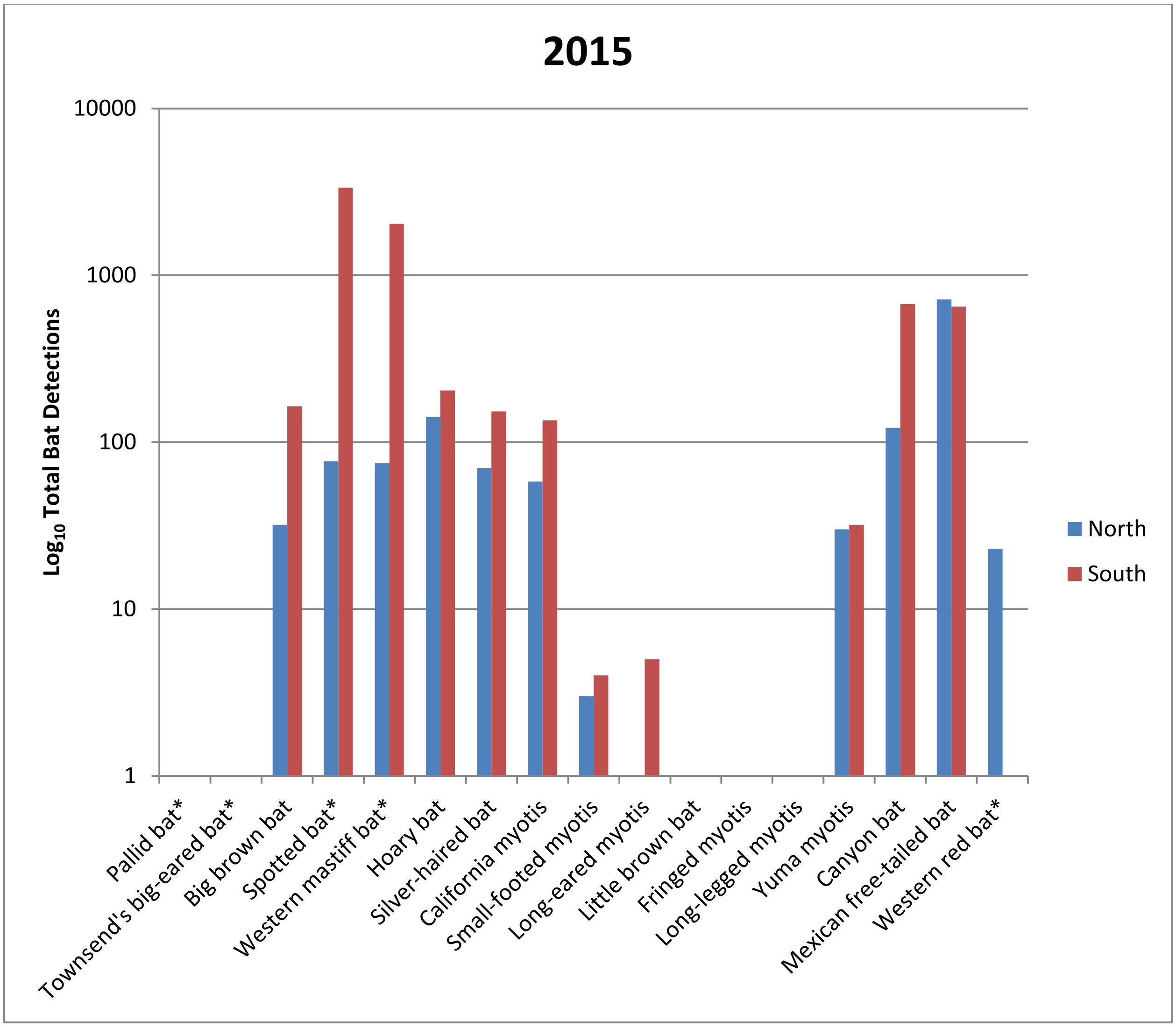


Figure 5-13. Total bat detections on a logarithmic scale (base 10) in Poopenaut Valley by site from January 2015 to August 2015 (Year 5). Total bat detections do not necessarily indicate abundance, as a single bat may produce many detections. A total of 17 bat species were detected. * indicates California species of special concern.

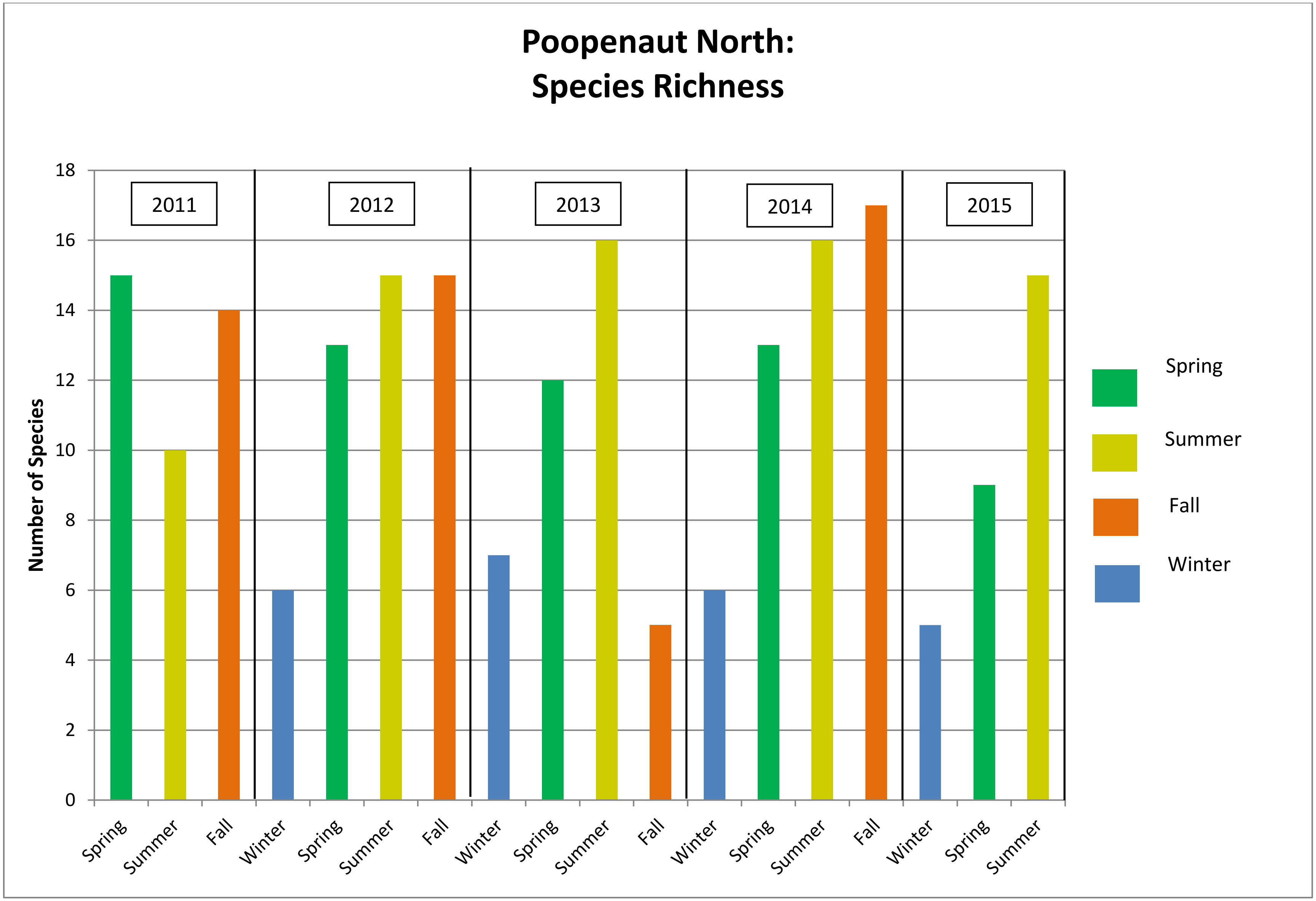


Figure 5-14. Bat species detected by season at the Poopenaut Valley north detector site.

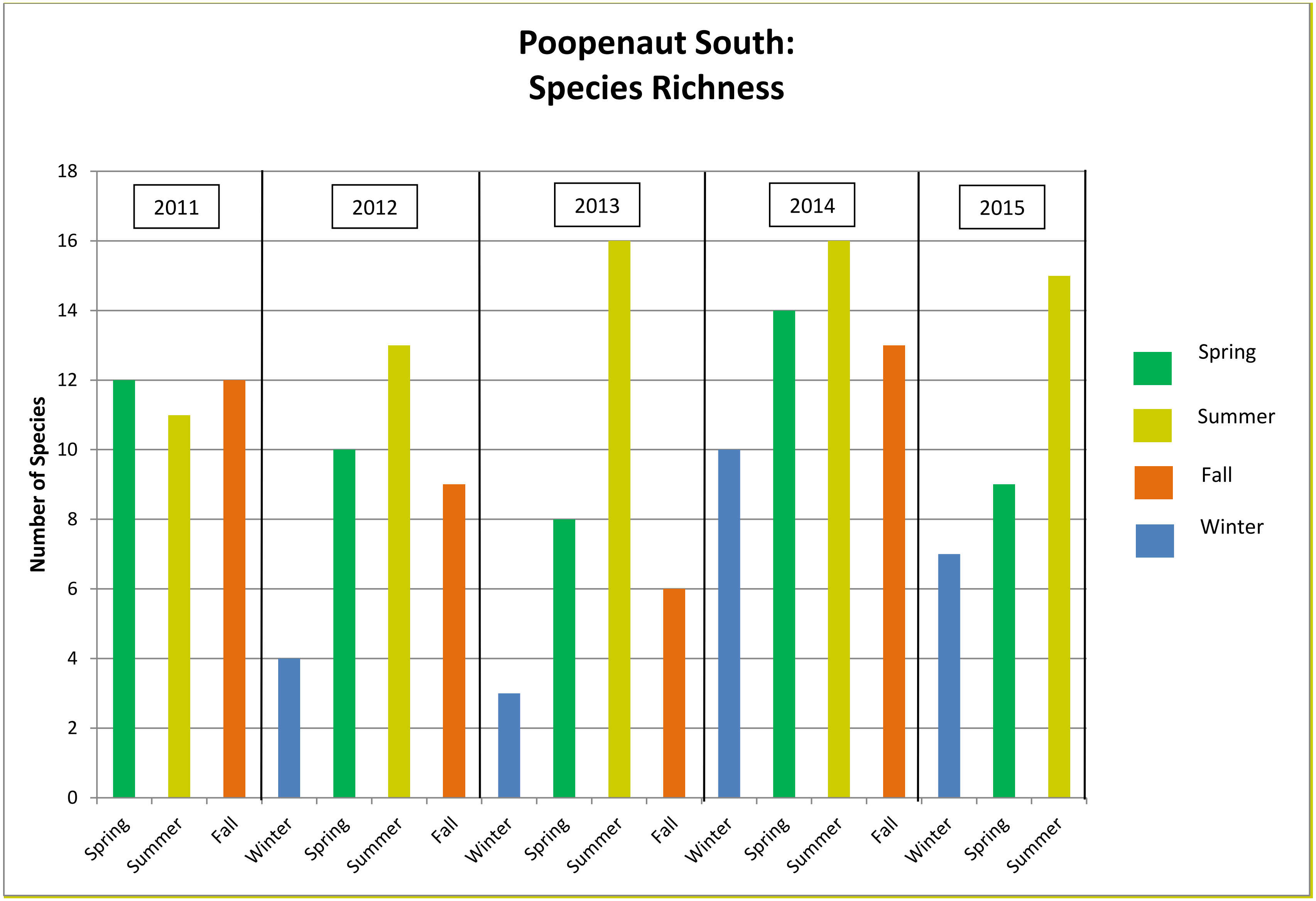


Figure 5-15. Bat species detected by season at the Poopenaut Valley south detector site.

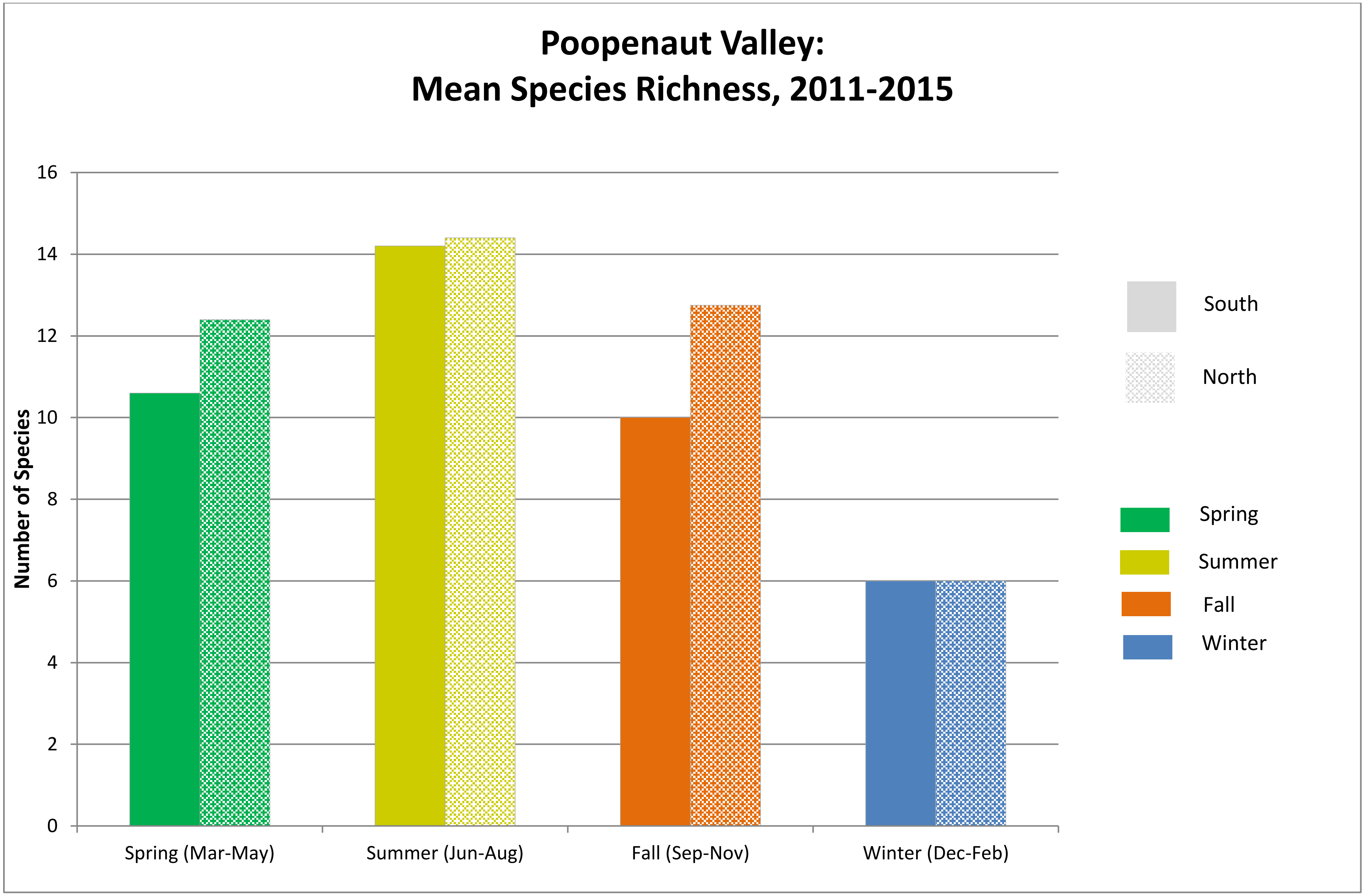


Figure 5-16. Bat species detected by season in Poopenaut Valley at both detector sites. Values are averaged from 2011-2015.

5.4 Discussion

Results of this study have identified an impressive biodiversity of bat species inhabiting Poopenaut Valley, with at least one species, the Mexican free-tailed bat, present year-round. We documented five special status species, two of which were the first (spotted bat) and second (western mastiff bat) most frequently detected species during 2015. The considerable jump in spotted bat and western mastiff bat detections at the south site in summer 2014 and 2015 requires further study; however, habitat effects from the Rim Fire in 2013, water level, and prey availability and abundance are likely factors.

Holmquist and Schmidt-Gengenbach (2012) found that benthic macro-invertebrate fauna in the seasonal pond north of the Tuolumne River adds considerably to the total biodiversity of the Poopenaut Valley ecosystem. The seasonal pond contributed an additional six orders and 28 families to those identified from the Tuolumne River benthic macro-invertebrates during 2007-2009; two orders and eight families were detected in 2011-12 (Holmquist and Schmidt-Gengenbach 2012).

Detection frequencies of numerous species decreased in 2015 compared to 2014. 2015 was an extreme drought year and the fourth in a row with below average precipitation, resulting in very low flows from Hetch Hetchy reservoir. Although flows were reduced, there were fairly constant water levels in the river throughout the year; these flows may provide a sort of refuge in an otherwise very dry landscape.

Due to the absence of bat data during summer 2011 when the seasonal pond had the most water for the longest duration, we cannot conclude at this time that water alone was the main factor driving bat activity levels in Poopenaut Valley. An experimental flow that would result in the filling of the seasonal pond during spring or summer 2016 would help address this discrepancy in the data. This would also help confirm if higher water levels for longer durations in the seasonal pond attract the impressive number of spotted bats that were detected in significantly higher frequency during the summer of 2012 and spring of 2014 when the pond had water. These elevated levels of detection for spotted bats continued into the summer and fall of 2015.

Interacting with water availability, prey abundance also affected bat assemblages in Poopenaut Valley in 2013. During 2013 sampling, Holmquist and Schmidt-Gengenbach (2013) found that a number of pond-associated benthic macro-invertebrate taxa were uncommon or absent in samples, including damselflies, mosquitos, water beetles, and some midges. The low diversity and abundance in pond riparian habitat were likely in part a result of lack of pond filling in 2013 (Holmquist and Schmidt-Gengenbach, 2013). The lack of invertebrate prey due to the pond remaining dry likely had a negative effect on the bat assemblages in Poopenaut Valley during spring and summer 2013, with spotted bat, western mastiff bat, and to a lesser extent, canyon bat, detected in significantly lower frequency.

The detection increases for a majority of the bat species inhabiting Poopenaut Valley during spring-fall of 2014 was unexpected, and will continue to be investigated. Whether the increase in detection frequency for the majority of bat species during August-September 2013 or the subsequent increase in 2014 can be attributed directly to the Rim Fire requires further investigation. Detection frequencies for numerous species decreased in 2015 to pre-Rim Fire levels, which points to some effect from the Rim Fire. It is likely that multiple factors are interacting to affect bat activity.

The Rim Fire also likely affected the invertebrate assemblage in Poopenaut Valley, directly through mortality of plant-associated taxa, indirectly via habitat loss or restructuring, and via emigration of mobile organisms from the area (Holmquist and Schmidt-Gengenbach, 2013). Adults, juveniles, and eggs that were already in overwintering stages in surface soils are likely to have suffered some mortality (Holmquist and Schmidt-Gengenbach, 2013). A reduction in invertebrate prey, whether from wildfire or lack of filling of the seasonal pond, may have direct consequences for bat assemblages that inhabit Poopenaut Valley. However, wildfire on the landscape can also have a positive effect on bat species. In their study of the 2002 McNally Fire in the Sierra Nevada, Buchalski et al. (2013) suggest that bats may exhibit some resiliency to landscape scale fire in mixed-conifer forests of California, and that some species preferentially select burned areas for foraging, perhaps facilitated by reduced clutter and increased post-fire availability of prey and roosts. This may explain the increase in detection frequency for the majority of bat species inhabiting Poopenaut Valley during and after the Rim Fire. Continued monitoring will help determine what long-term effects the Rim Fire had on bat assemblages inhabiting Poopenaut Valley.

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