



AVIAN DEMOGRAPHY MONITORING AND VISITOR EDUCATION AT DEVILS POSTPILE NATIONAL MONUMENT 2002 - 2006



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TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
BACKGROUND AND INTRODUCTION	2
METHODS	3
RESULTS AND DISCUSSION	7
ACKNOWLEDGEMENTS	18
LITERATURE CITED	18

LIST OF TABLES

Table 1. Mist netting census dates	4
Table 2. Listed species detected	7
Table 3. California Partners in Flight riparian and coniferous forest Bird Conservation Plan focal	10
Table 4. Summary of mist net captures	11
Table 5. Hatch Year : After Hatch Year ratios	12
Table 6. Objectives, outcomes and recommendations	15

LIST OF FIGURES

Figure 1. PRBO study sites	3
Figure 2. Mist net locations	4
Figure 3. Rufous Hummingbird at Devils Postpile.	8
Figure 4. Yellow Warbler nest at DEPO, June 28, 2006.	9
Figure 5. Captures / net hour for each net in each year	11
Figure 6. Summary of adult and young birds captured	13
Figure 7. Number of visitors attending PRBO's mist netting	14
APPENDIX 1: PROJECT RECOMMENDATIONS (FROM HEATH 2005).	20
APPENDIX 2. MIST NETTING AND POINT COUNT CENSUS DATES	23
APPENDIX 3: BIRD LIST AND BREEDING STATUS	24
APPENDIX 4: ALL BIRDS CAPTURED DURING CONSTANT EFFORT MIST NETTING	26
APPENDIX 5: INVESTIGATIONS OF APPARENT ANNUAL ADULT SURVIVAL... ..	28

EXECUTIVE SUMMARY

In 2006, PRBO Conservation Science (PRBO) completed the fifth year of a bird monitoring and visitor education program in montane meadow and riparian habitats of Devils Postpile National Monument (referred to hereafter as DEPO or the Monument). With the goal of enhancing and protecting riparian and meadow breeding bird populations and their habitat, we have provided 13 habitat, management, and monitoring recommendations to National Park Service staff. These were presented in a previous report (Heath 2005) and are also presented in Appendix 1 of this report. We also provide an evaluation of PRBO's bird monitoring program and suggestions for future work.

In total, ninety-nine species have been documented within and in close vicinity to DEPO since 2001; 16 of these species occur on one or more sensitive species list. We detected 9 riparian and 11 coniferous forest California Partners In Flight (CalPIF) Bird Conservation Plan focal species within the study area; breeding status of the focal species was submitted for inclusion into the CalPIF statewide database to assist in documenting the most current California breeding distribution for these species.

Individuals and total captures per 100 net hours increased each year of the study, while number of species captured was variable. Capture numbers at DEPO were considered intermediate when compared to Kings Canyon and Yosemite National Park banding stations (DeSante et al. 2005).

Most of our individuals captured, in all years and in total, were from nets 4 – 7. It should be noted that it is this area where DEPO implemented the strictest control of visitor access as a part of their meadow rehabilitation efforts. Through these control efforts, which began in spring of 2002, all users were channeled to one trail, whereas previously multiple trails were forged and maintained. It is likely that limiting visitor use in this area benefited the birds that occupied the willows for nesting; whereas previously they were likely flushed from and kept off nests during times of human traffic.

The breeding species with highest captures of aged individuals were American Robin, Audubon's Warbler, Wilson's Warbler, Song Sparrow and Oregon Junco. American Robins, Audubon's Warblers and Oregon Juncos had stunningly low productivity in 2002-2004, 2004-2005 and 2005 respectively. Examples of high hatch-year biased age ratios were Wilson's Warblers in 2003 and Song Sparrows in 2005 and 2006. The pooled-species ratio in 2004 was the lowest of all years. Given that we had so few census days in 2006, it is interesting to note that captures of young birds for all species we investigated were intermediate to high relative to most other years and relative to adults in that year, indicating a relatively successful reproductive year.

Five years of capture / recapture data at DEPO was insufficient to confidently estimate adult annual survival. Due to low sample sizes even for species that we captured most frequently at DEPO, adult survival rate ranges at 95% confidence intervals far exceeded what we consider appropriate for estimating accurate survival.

We documented annual variation in breeding phenology; our first-of-the-year hatch year captures were as early as 2nd week of June (2004) to as late as last week of June (2002 & 2005). Hatch year birds could have been captured earlier in 2006, but we were not able to operate nets until 3rd week of June.

We interpreted bird monitoring, Monument restoration efforts and general avian ecology to over 1,500 visitors (2002 – 2006).

INTRODUCTION

PRBO Conservation Science (PRBO) began a bird monitoring and visitor education program in Devils Postpile National Monument in 2002. 2006 marked our fifth consecutive year for this proposed long-term program. With the goal of enhancing and protecting riparian and meadow breeding bird populations and their habitat, we have provided 13 habitat, management, and monitoring recommendations to National Park Service staff. These were presented in a previous report (Heath 2005) and are also presented in Appendix 1 of this report.

2006 project objectives for bird monitoring in riparian and meadow habitats of DEPO were to:

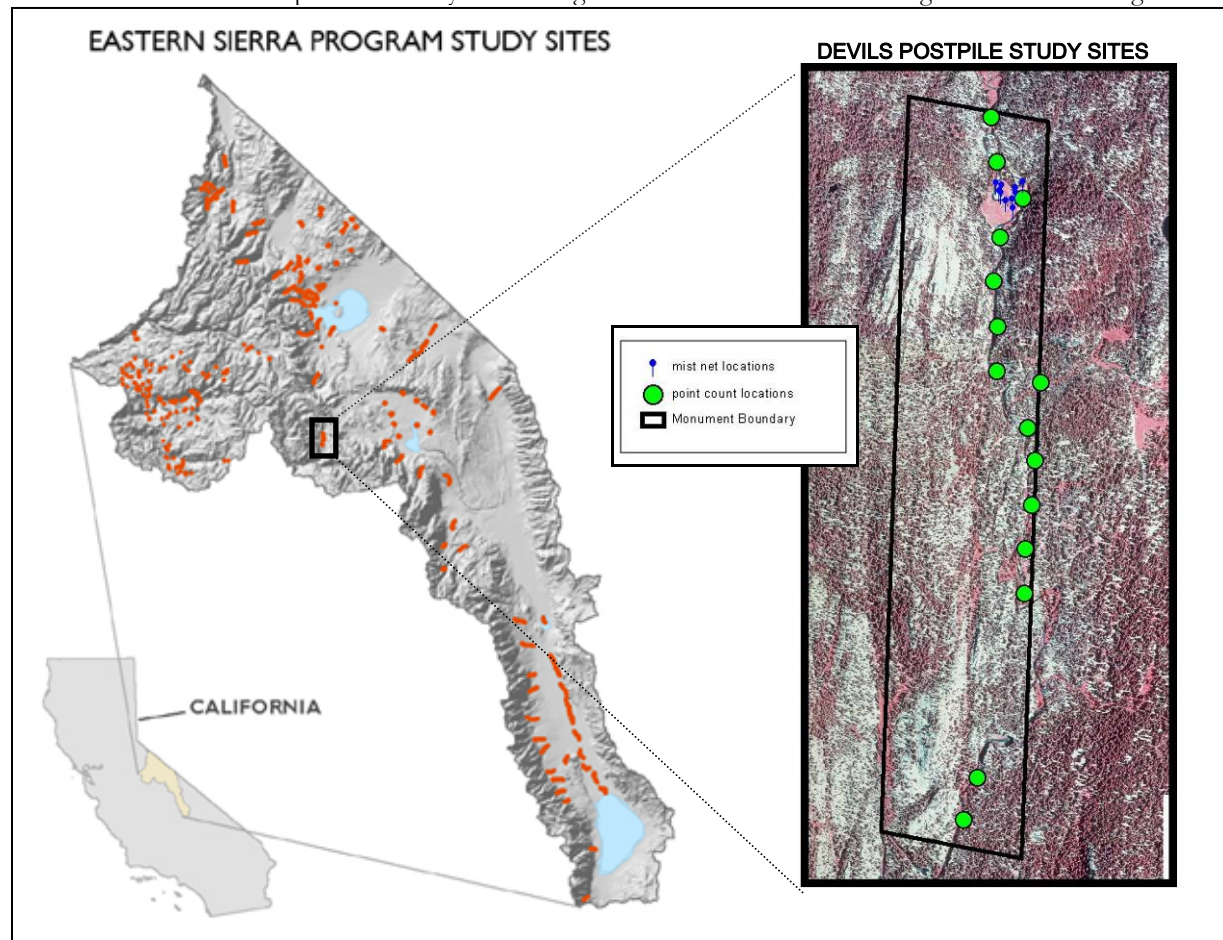
1. Determine over-winter survivorship rates for select short and long distance migrants that breed at DEPO.
2. Determine annual productivity for select species that breed at DEPO.
3. Document post-fledgling and migration timing and movement of select species.
4. Determine bird species diversity, richness and abundance of birds utilizing meadow and riparian habitats at DEPO.
5. Monitor long-term trends in 1, 2, 3 and 4.
6. Provide a baseline with which to measure bird responses to stochastic events.
7. Educate up to 500 visitors per year on bird monitoring techniques, bird and habitat conservation issues and ecology, and the importance of National Park Service lands for the protection of healthy bird populations.
8. Contribute to regional and national bird monitoring and conservation efforts such as PRBO's eastern Sierra bird monitoring program, MAPS (DeSante et al. 2005), CalPIF Bird Conservation Plans, and CDFG Natural Diversity Database.

METHODS

Study area description

At 2,300 m in elevation, Devils Postpile National Monument is located along the San Joaquin River, Madera County on the western slope of the Sierra Nevada, near the town of Mammoth Lakes, California. The study area comprises Soda Springs meadow adjacent to the monument Ranger Station and the riparian habitat associated with the San Joaquin River and Red's Meadow Creek within monument boundaries (Figure 1; 37° 37' N, 119° 05' W to 37° 52' N, 119° 05' W).

Figure 1. PRBO study sites at Devils Postpile National Monument, 2002 – 2006. Methods employed at Devils Postpile were standardized and comparable to study sites throughout PRBO's Eastern Sierra Program bird monitoring network.



Research permit

All bird monitoring and education work in 2002 - 2006 was performed under National Park Service Scientific and Collecting Research Permit (DEPO-2002-SCI-0001, DEPO-2003-SCI-0001, DEPO-2002-SCI-0003, DEPO-2005-SCI-0004, and DEPO-2002-SCI-0006).

Data Collection

Mist Netting and Banding

The Soda Springs Meadow mist netting station location (Figure 2) was chosen primarily for the purpose of documenting bird use of the meadow and for monitoring the response of birds to meadow rehabilitation and visitor management that occurred there. Nets 1 and 2 were located on the lodgepole forest / meadow edge; 3 was located on the willow / meadow edge; 4 – 7 were located within the thick willow patch on the east side of the River and 8 – 10 were located in the west meadow among smaller patches of willow stringers. The site was also chosen for its proximity to the Monument Ranger Station for the purpose of conducting visitor outreach and education. Visitor use was excluded from the meadow entirely during our banding sessions.

Netting procedures conformed to the guidelines described in Ralph et al. (1993). In summary, 10 mist nets were operated once every ten-day period (Table 1). Nets were unfurled 15 minutes after local sunrise, checked every 20 minutes (more often in cold weather) and were operated for five hours during each census period. Captured birds were carefully removed from the net and processed nearby. Each bird (except game birds) received a United States Fish and Wildlife Service (USFWS) band for permanent identification to enable estimates of survival from subsequent recaptures. Age, sex, wing length, breeding condition, weight, skull ossification, flight feather wear, molt and fat score of each bird were recorded as described by Pyle (1997). Nets and poles were taken down immediately after 5 hours

Figure 2. Mist net locations at Soda Springs Meadow, Devils Postpile National Monument, 2002 – 2006.

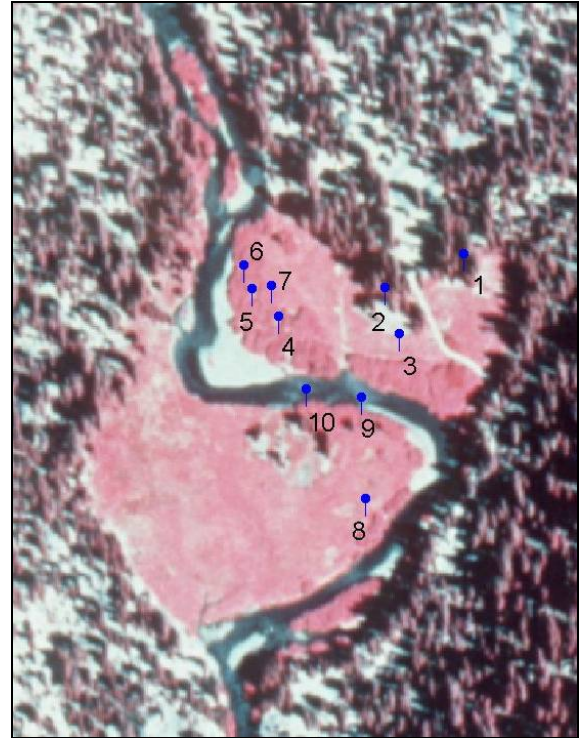


Table 1. Mist netting census dates at Devils Postpile National Monument, 2002 - 2006. Banding site was not accessible during census periods indicated by --, due to snowpack or flooding of the netting site.

	Census Periods										
	1	2	3	4	5	6	7	8	9	10	11
2002	--	--	May 30	Jun 5	Jun 13	Jun 24	July 4	July 14	July 24	Aug 3	Aug 13
2003	--	--	May 30	Jun 7	Jun 13	June 25	July 3	July 15	July 24	Aug 4	Aug 13
2004	--	May 20	May 27	Jun 5	Jun 16	Jun 24	July 5	July 15	July 25	Aug 4	Aug 11
2005	--	--	--	--	Jun 16	Jun 23	July 8	July 15	July 25	Aug 3	Aug 13
2006	--	--	--	--	--	Jun 29	July 6	July 13	July 24	Aug 3	Aug 11

of netting were concluded. PRBO biologists conducted all mist netting and banding under U.S. Department of the Interior, Bird Banding Lab permit # 09316-DZ. Refer to Appendix 2 for GPS coordinates of mist net locations.

In order to contribute to the Monitoring Avian Productivity and Survivorship (MAPS) program database, our procedures also generally followed MAPS program protocol (DeSante et al. 2005). However, because our objectives were different than those solely specified for MAPS, we made a few exceptions to their recommendations. DeSante et al. (2005) recommends that stations within the geographic range occupied by DEPO run from census period 3 through census period 10. PRBO chose to operate our station from census period 1 through census period 11 for two reasons: 1) in addition to documenting productivity and survivorship of breeding birds (the population which MAPS is primarily designed to describe), we also sought information on spring migrants and post-breeding dispersers; 2) other banding stations within PRBO's Eastern Sierra Program were run from periods 1 – 11 for this reason and we required that DEPO data to be comparable to those. The MAPS program also recommends operating nets for 5 hours. By the 6th hour at our other Eastern Sierra locations, we almost always were forced to close nets due to heavy afternoon winds. Though these winds were often not present at DEPO, we again decided to conform to protocols used at our other Eastern Sierra network sites. Additionally, due to DEPO road closures, or heavy spring snow melt resulting in flooded netting sites, we were not able to access and operate our station until the 2nd, 3rd, 5th, or 6th period, depending on the year (Table 1).

Point Counts

We did not conduct point counts in 2006. Point count results and associated habitat relationships were presented in Heath (2005a) and Heath (2005b).

Data Summary Definitions and Statistical Analysis

New Individuals Captured - all new birds captured, including unbanded hummingbirds in 2006 (see below).

Between-year Individuals Recaptured – all individuals recaptured from a previous year (does not include multiple recaptures of the same individual in the same year).

Total Individuals Captured - the sum of the two above groups.

Total Captures - all captures, including same year recaptures, excluding unbanded birds (except hummingbirds in 2006).

Age Ratios and Productivity Summaries

We examined the age ratios (Hatching-Year birds to Adult Birds, also written as HY/AHY) for all species for each of the five years (2002 – 2006). We only included one capture per individual during a given season so as to not bias the ratio in the direction of individuals or age classes that were recaptured multiple times throughout the season. This was true with one exception: we did not band hummingbirds in 2006; we therefore determined the age ratio of overall captures, including unbanded birds in 2006, as there was no way to distinguish individuals from one another. (Of the 60 hummingbirds we banded 2002 – 2005, we only recaptured 1). We excluded from analysis any individuals of species we typically band but who were captured and were released unbanded as they could have been subsequently recaptured and banded.

Survivorship Analysis

We chose the seven most commonly captured breeding species at DEPO for survival analysis. We defined Resident Adults as those captured at least twice (at least seven days apart) during any one breeding season, or individuals captured in multiple years (following Gardali et al. 2003). We suspected that at DEPO this criterion was too conservative, as our banding began after nearly all migrants had traveled through the area (Heath personal observation). For this reason, we also performed analysis on All Adults, assuming that most were breeders for these species.

We used a Program R (Version 2.4.0) interface (R-MARK Version 1.6.4) with MARK Version 3.2 (White and Burnham 1999) to perform all analyses. Because we quickly determined that our sample size was not adequate to estimate survival with confidence, we did not proceed to build or select models best explaining variation in survival estimates.

Breeding Status

We determined breeding status for all species encountered from our surveys between late May and mid August 2002 - 2006, during censuses performed by Parker and Parker (2001) and during censuses performed by the Institute for Bird Populations (Siegel and Wilkerson 2004). We ranked species using the following four criteria of the Riparian Habitat Joint Venture breeding scale, modified from breeding bird atlas criteria (<http://www.prbo.org/calpif/criteria.html>):

No evidence of breeding: Species not detected during breeding season, or species not known to breed within the general study area.

Possible breeding: Species encountered singing or acting territorial only once during the breeding season (in suitable habitat).

Probable breeding: Singing individual encountered on 2 or more different days of standardized censuses (at least one week apart); territorial behavior noted more than once at the same location; pair observed in courtship behavior; female with brood patch (males with cloacal protuberances not used as evidence of breeding locally).

Confirmed breeding: nest building or nest material carry (except woodpeckers and wrens); fecal sack being carried by adult; captured female with eggs in oviduct; dependent juveniles with adults; active territory observed on at least three days (at least one week apart); active nest observed.

Data dictionary and electronic copies of data

A detailed explanation of all data bases derived from this project was provided to the National Park Service and DEPO along with the submission of this report. Electronic versions of all DEPO databases derived from this project were also submitted in Excel format.

RESULTS AND DISCUSSION

Bird species composition, distribution and breeding status

In total, ninety-nine species have been documented within and in close vicinity to DEPO since 2001; five of those were detected only by Parker and Parker (2001), seven only by the Institute for Bird Population (IBP) surveys (Siegel and Wilkerson 2004), and the remainder by PRBO 2002 – 2006 (Appendix 3).

Sensitive Species

During 2002 – 2006, PRBO detected 16 species that occur on one or more of the following lists: Federal Threatened, State Endangered, California Department of Fish and Game Special Animals (CDFG SA), California Species of Special Concern, USFS Region 5 Inyo National Forest Sensitive Species or USFWS Birds of Conservation Concern for the Sierra Nevada Bird Conservation Region (Table 2).

Table 2. Listed species detected at Devils Postpile National Monument, 2002 – 2006. TL = species listed specifically for this time or location (n = nesting, c = nesting colony, w = wintering). Shaded rows refer to species that use the Monument during threatened time period, other species detected as vagrants, migrants or transients.

Common name	TL	FT	SE	CDFG SA	CA BSSC	USFS R5 INF SS	USFWS BCR 15
Bald Eagle	<i>n/w</i>	x	x	x	--	--	--
Cooper's Hawk	<i>n</i>	--	--	x	--	--	--
Northern Goshawk	<i>n</i>	--	--	x	2nd	x	--
Golden Eagle	<i>n</i>	--	--	x	--	--	--
California Gull	<i>c</i>	--	--	x	--	--	--
Black Swift	<i>n</i>	--	--	x	3rd	--	x
Rufous Hummingbird	<i>n</i>	--	--	x	--	--	x
Williamson's Sapsucker		--	--		--	--	x
Red-breasted Sapsucker	<i>n</i>	--	--	x	--	--	--
White-headed Woodpecker	<i>n</i>	--	--	x	--	--	x
Willow Flycatcher	<i>n</i>	--	x	x	--	x	--
Olive-sided Flycatcher	<i>n</i>	--	--	x	2nd	--	x
Yellow Warbler	<i>n</i>	--	--	x	2nd	--	--
Hermit Warbler	<i>n</i>	--	--	x	--	--	--
Chipping Sparrow	<i>n</i>	--	--	x	--	--	--
Brewer's Sparrow	<i>n</i>	--	--	x	--	--	--

FT = Federal Threatened; SE = State Endangered; CDFG SA = California Department of Fish and Game Special Animals list (CDFG 2005); CA BSSC = California Bird Species of Special Concern draft list, 2003 and priority # (CDFG & PRBO 2005); USFS R5 INF SS = USDA Forest Service Region 5 Inyo National Forest Sensitive Species (USFS 2001), USFWS BCC BCR 15 = United States Fish and Wildlife Service Birds of Conservation Concern, Sierra Nevada Bird Conservation Region (BCR 15; USFWS 2002).

Bald Eagle. We detected this species on 29 May, 2002 circling high above the Soda Springs meadow.

Coopers Hawk. We detected this species 24 May, 2004.

Northern Goshawk. We detected a Northern Goshawk on June 13, 2002 just below Rainbow Falls, perched on a snag on the edge of the Rainbow Fire area (at Point Count # 15). The second sighting, on June 23, 2004 was in a patch of lodgepole pines, just downstream of the junction of Red's Meadow Creek and the San Joaquin River (at Point Count # 9). In 2005, we detected this species August 3 and August 13 in the forested area downstream of the Postpile and soaring downstream along the San Joaquin River near Soda Springs Meadow, respectively. The later observation was an adult male. The nearest current nesting location for the Northern Goshawk is on Inyo National Forest (INF) land a few miles northeast of the northeastern DEPO boundary. It is highly likely that another pair nests at the southern end of DEPO – but we did not observe any breeding behavior.

Golden Eagle. We observed a Golden Eagle 2 June, 2002, and 19, 22 May in 2004. The 19th sighting was an immature.

California Gull. The nearest breeding colony for this species is at Mono Lake, ca. 40 km northeast of Devils Postpile. Gulls were seen in all years circling and flying high above the Monument.

Black Swift. We observed Black Swifts at Rainbow Falls in May and June of 2002 and 2003, and June of 2005. Black Swifts often nest behind active water falls. In the summer of 2001, we did observe them exiting and entering from behind the falls at dusk during the nesting season – indicating a likely breeding colony.

Rufous Hummingbird. Rufous Hummingbirds use DEPO as a migratory stop-over area during their migratory journey from northern breeding grounds (northern California to Alaska) to southern wintering grounds in California and Mexico (Calder 1993). This hummingbird represented 5% of all new individuals captured (2002 – 2006). Interestingly, we captured no adults in 2005 and only 1 in 2006 while we have captured 3 – 9 adults in previous years (Heath 2005). We did, however, capture 9 hatch year birds in 2006.



Figure 3. Rufous Hummingbird at Devils Postpile.

Williamson's Sapsucker. We detected this species in each year and captured a hatching year bird in our mist nets in 2004 and 2005, and two adults in 2006. We observed this species feeding young in Lodgepole Pine groves on at least one occasion.

Red-breasted Sapsucker. We detected this species throughout the breeding season in all years: both during point counts and during mist netting when we captured adults and young. We also located an active nest cavity for this species in a live Lodgepole Pine (*Pinus contorta*), 750 cm from the ground.

White-headed Woodpecker. We observed this species in forested and burn areas around Rainbow Falls in all years. Siegel and Wilkerson (2004) observed this species on 7% (n = 3) of their survey stations.

Willow Flycatcher. The sole observation of a Willow Flycatcher was an adult that we captured in our mist nets on August 8, 2002. The flycatcher was not in breeding condition. The timing of this capture coincides with captures of non-breeding Willow Flycatchers at other banding stations in the Mono Basin and Owens Valley alluvial fan (PRBO data). It is likely that the monument capture represents an adult dispersing from another breeding location. Nearest known current breeding locations for this State Endangered species are at the Owens River near Chalk Bluffs north of Bishop, Inyo County and at Rush Creek in the Mono Basin, Mono County (McCreedy and Heath 2004); nearby historic breeding sites include Mammoth Creek (Gaines 1992). The wet willow meadows found at and near DEPO are representative of typical Willow Flycatcher breeding habitats in the Sierra Nevada (Bombay et al. 2000) and the future occupation of DEPO's meadows by breeding Willow Flycatchers is possible.

Olive-sided Flycatcher. We detected singing individuals of this species in all years. Individuals frequented the forested area west of the San Joaquin River, downstream of Rainbow Falls and on Granite Dome, west of Soda Springs Meadow. Siegel and Wilkerson (2004) detected Olive-sided Flycatchers in 31% of their census points throughout the monument.

Yellow Warbler. In 2006, we found a Yellow Warbler nest 1m high in a Soda Springs Meadow willow patch. The nest contained 5 Yellow Warbler eggs which successfully hatched and fledged. We conducted spot mapping on at least three visits and determined there was one territory in the Soda Springs Meadow in 2006. This record places the Yellow Warbler at the edge of its previously cited high-elevation breeding limit for this region, as it typically nests below 1,981 m on the west slope of the Sierra Nevada (Gaines 1992). Prior to 2006, we did not capture females in breeding condition. It is likely, however, that individuals held territories within DEPO in all years and possibly within Soda Springs Meadow as we captured breeding condition males in all, recaptured one of these individuals 19 days after his initial capture in 2002, and at least one singing male was noted on several occasions in the meadow during June 2005 and 2003.



Figure 4. Yellow Warbler nest at DEPO, June 28, 2006.

Hermit Warbler. We detected single individuals 16 June and 5 July, 2004 and 11 August, 2006. We captured a male without breeding characteristics 13 August, 2006 and a female with a retreating brood patch on 5 July 2005. Siegel and Wilkerson (2004) detected them at one of their census points throughout the monument.

Chipping Sparrow. We detected this species 8 July, 2002, 3 and 30 June, 2003 and 17 June, 2005.

Brewer's Sparrow. We detected this species infrequently, but did so 5 June 2002, and 11 August 2004.

CalPIF Bird Conservation Plan focal species

We detected 9 riparian and 11 coniferous forest CalPIF Bird Conservation Plan focal species within the study area (Table 3). Focal species are not necessarily sensitive or of concern, but are listed under the assumption that if a landscape is managed to meet the focal species' needs, other species will

benefit. Several of the focal species are also relatively common enough in California to provide adequate sample sizes for trend monitoring, determining habitat relationships or estimating demographic parameters – all factors that can assist in the management of healthy bird populations (RHJV 2004, Chase and Geupel 2005, CalPIF 2002).

Breeding status of the focal species was submitted for inclusion into the CalPIF statewide database to assist in documenting the most current California breeding distribution for these species. Distribution maps for the focal species are periodically updated by CalPIF in order to incorporate the most current data. See <http://www.prbo.org/calpif/livemaps.html> for the most current and interactive California distribution maps for all CalPIF riparian and coniferous focal species and <http://cain.nbj.gov/prbo/calpifmap/> for the study site database in which DEPO has been included.

Table 3. California Partners in Flight riparian and coniferous forest Bird Conservation Plan focal species detected at Devils Postpile National Monument by PRBO 2002 - 2006. See Appendix 3 for breeding status and scientific names.

Common name	CalPIF Bird Conservation Plan Focal Species ¹	
	Riparian	Coniferous Forest
Spotted Sandpiper	x	
Vaux's Swift		x
Black-backed Woodpecker		x
Olive-sided Flycatcher		x
Willow Flycatcher	x	
Warbling Vireo		x
Tree Swallow	x	
Red-breasted Nuthatch		x
Brown Creeper		x
Golden-crowned Kinglet		x
Swainson's Thrush	x	
Yellow Warbler	x	
MacGillivray's Warbler		x
Common Yellowthroat	x	
Wilson's Warbler	x	
Western Tanager		x
Fox Sparrow		x
Song Sparrow	x	
Dark-eyed Junco		x
Black-headed Grosbeak	x	

¹ RHJV 2004, Chase and Geupel 2005, CalPIF 2002

Estimates of abundance and species richness

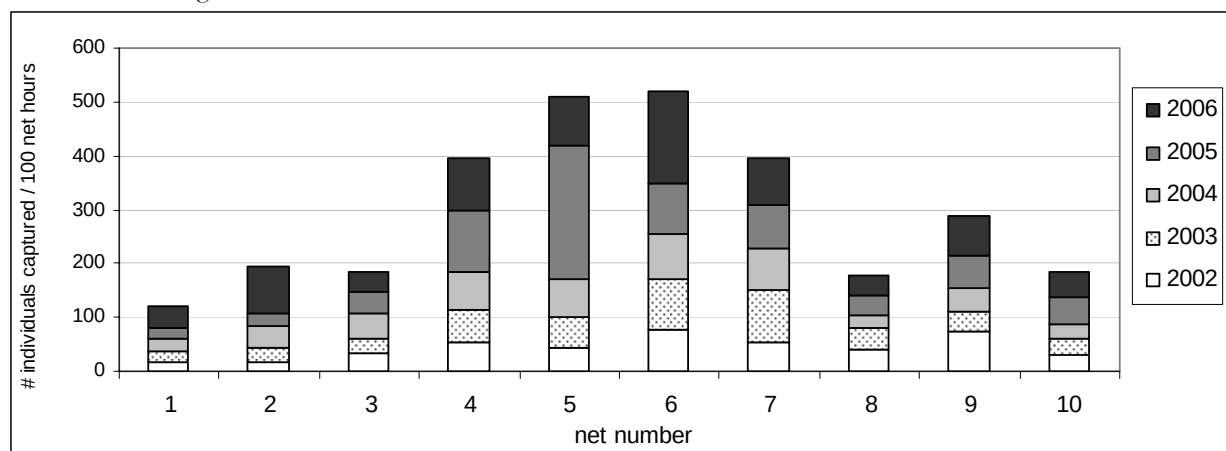
Individuals and total captures per 100 net hours increased each year of the study, while number of species captured was variable (Table 4). Interestingly, we only had 8 fewer individuals captured in 2006 than in 2003, even though we banded during 3 fewer census periods in 2006. Capture numbers at DEPO were considered intermediate when compared to Kings Canyon and Yosemite National Park banding stations (DeSante et al. 2005).

Table 4. Summary of mist net captures at Soda Springs Meadow, Devils Postpile National Monument, 2002 - 2006. See summary group descriptions in methods.

	Number of birds				
	2002	2003	2004	2005	2006
New Individuals Captured	199	165	207	142	156
Between-year Individuals Recaptured	--	10	29	11	11
Total Individuals Captured	199	175	236	153	167
Total Individuals / 100 net hrs	44.97	45.69	49.72	61.94	67.14
Total Captures	251	236	309	181	188
Total Captures / 100 net hrs	56.72	61.62	65.10	73.27	75.58
Captured but Unbanded	5	7	9	1	6
Total Number of Species Captured	30	23	37	29	24

Most of our individuals captured, in all years and in total, were from nets 4 – 7 (Figure 5). It should be noted that it is this area where DEPO implemented the strictest control of visitor access as a part of their meadow rehabilitation efforts. Through these control efforts, which began in spring of 2002 and continued during all years of our study, all users were channeled to one trail, whereas previously multiple trails were forged and maintained. It is likely that limiting visitor use in this area benefited the birds that occupied the willows for nesting; whereas previously they were likely flushed from and kept off nests during times of human traffic.

Figure 5. Captures / net hour for each net in each year, Devils Postpile National Monument, 2002 - 2006. Refer to net locations in Figure 2.



Age Ratios and Estimates of Productivity

The breeding species with highest captures of aged individuals (Table 5) were American Robin (8 – 14 captures /year), Audubon’s Warbler (7 – 27), Wilson’s Warbler (11 – 25), Song Sparrow (8 – 24) and Oregon Junco (2 – 24). American Robins, Audubon’s Warblers and Oregon Juncos had stunningly low productivity in 2002-2004, 2004-2005 and 2005 respectively; no hatching year birds were captured for these species in those years. Examples of high age ratios were Wilson’s Warblers in 2003 and Song Sparrows in 2005 and 2006. The pooled-species ratio in 2004 was the lowest of all years. This was the case even when we further examined this year by removing adult captures during census period two, a time period when capture of northerly migrants was more likely for species such as Wilson’s Warblers (and could thus flood our ratios with non-breeding adults).

Table 5. Hatch Year : After Hatch Year ratios and resulting proportion for species with highest captures at Devils Postpile National Monument, 2002 – 2006. 2006 had reduced effort during the breeding season due to flooding.

	2002		2003		2004		2005		2006	
	HY:AHY	Prop.	HY:AHY	Prop.	HY:AHY	Prop.	HY:AHY	Prop.	HY:AHY	Prop.
American Robin	0:8	0.00	0:8	0.00	0:9	0.00	2:12	0.17	6:8	0.75
Audubon's Warbler	12:10	1.20	5:22	0.23	0:15	0.00	0:7	0.00	5:7	0.71
Wilson's Warbler	2:10	0.20	11:5	2.20	4:21	0.19	4:8	0.50	6:5	1.20
Song Sparrow	11:13	0.85	8:10	0.80	3:9	0.33	6:2	3.00	8:3	2.67
Oregon Junco	4:10	0.40	2:10	0.20	6:18	0.33	0:2	0.00	5:4	1.25
Species Pooled	29:51	0.57	26:55	0.47	13:72	0.18	12:31	0.39	30:27	1.11

Late road opening and flooding of the netting site through June 2006 kept us from garnering enough census days during the breeding season to allow for inclusion of 2006 data in the MAPS program productivity analysis (MAPS program pers. com.). However, given that we had so few census days in 2006, it is interesting to note that captures of young birds for all species we investigated were intermediate to high relative to most other years and relative to adults in that year. After pooling species, number of young birds captured was higher in 2006 than in all other years, indicating a relatively successful reproductive year. Also, capture numbers for young and adults were similar between species in 2006, unlike other years when capture rates between species was highly variable. Number of captures for all other species, regardless of sample size, are presented in Appendix 4.

Investigations of Adult Survival

Five years of capture / recapture data at DEPO was insufficient to confidently estimate adult annual survival. Due to low sample sizes even for species that we captured most frequently at DEPO, adult survival rate ranges at 95% confidence intervals far exceeded what we consider appropriate for estimating accurate survival rates (Appendix 5). For example, although we estimated a 60% apparent annual survival rate for Mountain-white Crowned Sparrows, the 95% confidence interval for this estimate ranged from 20% to 90% (Appendix 5).

Phenology

Figure 6. Summary of adult and young birds captured / 100 net hours, by census period, at Devils Postpile National Monument, 2002 – 2006.

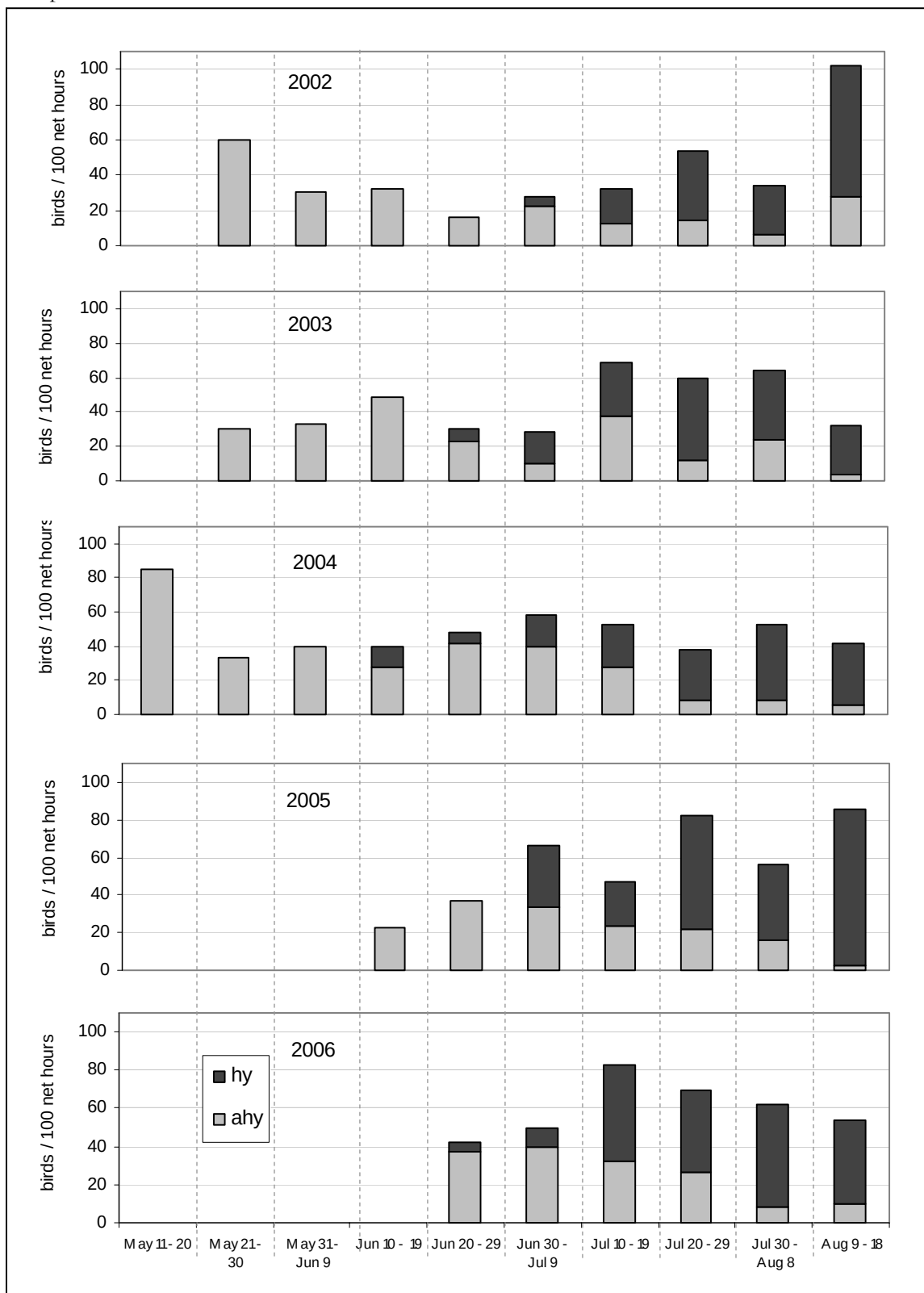


Figure 6 represents the annual variation in breeding and migration phenology. Our first-of-the-year hatch year captures were as early as 2nd week of June (2004) to as late as last week of June (2002 & 2005; Figure 6). Hatch year birds could have been captured earlier in 2006, but we were not able to operate nets until 3rd week of June. Greater than 80 birds/ 100 net hours during second week of May in 2004 likely represents a combination of spring migrants and local breeders. It is likely that high capture rates during period 11 (second week of August) in 2002 and 2005 represented a combination of local breeders, post-breeding elevational dispersers and late summer migrants.

Visitor Education

We interpreted bird monitoring, Monument restoration efforts and general avian ecology to over 1,500 visitors (Figure 7).

Figure 7. Number of visitors attending PRBO's mist netting at Devils Postpile National Monument, 2002 – 2006.

Year	Number of Visitors
2002	220
2003	362
2004	539
2005	176
2006	252
Total	1,594



REVIEW OF AND RECOMMENDATIONS FOR CURRENT AND FUTURE BIRD MONITORING PROGRAMS AT DEVILS POSTPILE NATIONAL MONUMENT.

A proposed task of PRBO's DEPO bird monitoring project was to assist in the design of a long term adaptive management monitoring plan for birds utilizing meadow and riparian habitats in the monument. In Table in 6, we evaluate PRBO and DEPO's objectives established at the onset of the project in 2002 (and refined through the years), discuss whether the current bird monitoring program at DEPO successfully achieved the objectives, and provide suggestions to improve or alternatives to the existing program.

Overall, we recommend that DEPO and Sierra Nevada Network Inventory & Monitoring Program determine desired outcomes and specific goals and objectives for continuing a bird monitoring program at DEPO. This will greatly assist us in determining which methods are most applicable and appropriate.

We provide several options in the Recommendation column of Table 6 as suggestions for how to meet un-accomplished 2002-2006 objectives, though in some cases, eliminating said objective might be the best option.

Table 6. Objectives, outcomes and recommendations for PRBO's Bird Monitoring Program at Devils Postpile National Monument.

Objectives (2002 – 2006)	Outcome	Recommendation
1. Determine over-winter survivorship rates for select short and long distance migrants that breed at DEPO.	After five years of data collection, capture rates were insufficient to estimate apparent annual adult survivorship.	Capture rates can be increased (thus increasing the ability to assess annual survival at DEPO) by adding more net locations and by increasing the frequency of banding.
2. Determine annual productivity for select species that breed at DEPO.	Due to limited access in spring and early summer (because of snowpack and River flooding), 1 of 5 years of productivity data was unusable due to an insufficient number of operating days. Variable start dates will infringe on our ability to accurately estimate productivity in every year.	No Recommendation.
3. Document post-fledgling and migration timing and movement of select species.	During heavy snowpack years, we have been unable to operate nets until well into June. Variable start dates (due to snowpack and River flooding) will not allow us to accurately measure arrival or start dates for breeders or spring migrants. We are able to document general arrival dates for late summer migrants and movement and arrival of upslope dispersers, and the timing of the onset of fledging. The frequency of banding that satisfy MAPS program requirements (banding once every 10-day census period) will not allow us to accurately measure changes in fall migration, dispersal, and breeding phenology.	No Recommendations for breeders. Recommended banding protocols for fall migration monitoring include more frequent banding (for example every day, every other day, or three days in a row once every week). Radar can be a powerful tool for measuring migration movements in birds and bats and is not limited by many of the logistical constraints that we face at DEPO. Among other data, radar can record timing, density, direction, speed, altitude and heading of flying birds and bats.

Continued-

Table 6 – Continued-		
4. Determine bird species diversity, richness and abundance of birds utilizing meadow and riparian habitats at DEPO.	We successfully accomplished this objective in all years.	We recommend conducting all point counts established by PRBO and IBP (during the all-Monument inventory) for 2 visits annually in order to garner the greatest number of sample points, and to monitor all habitats that exist in DEPO.
5. Monitor long-term trends in 1, 2, 3 and 4.	Due to low capture rates, we will not be able to determine trends in annual adult survival (1). Limited access during heavy snowpack and runoff years during the breeding season will infringe on our ability to accurately estimate productivity (2) in every year. Therefore, any examination of annual trends will be biased in that data from heavy snowpack and run-off years will not be included. This also negates the ability to determine the effects of local and regional climate fluctuations on breeding productivity. Possibilities and challenges for documenting trends in item 3 is discussed above (in Item 3).	If point counts are continued, we will likely be able to measure changes in bird species richness, diversity and abundance over time. We recommend conducting all point counts established by PRBO and IBP (during the all-Monument inventory) for 2 visits annually in order to garner the greatest number of sample points, and to monitor all habitats that exist in DEPO. Radar can be used to measure trends in migration phenology.
6. Provide a baseline from which to measure bird responses to stochastic events.	We did establish a relatively solid baseline from which to measure bird response to large stochastic events.	We recommend continuing some form of long-term bird monitoring at DEPO by conducting all point counts established by PRBO and IBP (during the all-Monument inventory) for 2 visits annually in order to garner the greatest number of sample points, and to monitor all habitats that exist in DEPO.
Continued-		

Table 6. – Continued-		
7. Educate up to 500 visitors per year on bird monitoring techniques, bird and habitat conservation issues and ecology, and the importance of National Park Service lands for the protection of healthy bird populations.	The education component of the monitoring program was very successful. Though we did not reach the goal of 500 visitors per year, over 1,500 DEPO visitors have been introduced to avian and restoration ecology, scientific methodology, and the role of National Parks in preserving and restoring habitat for birds. We have found that introducing visitors to hands-on science and providing them with the opportunity to observe live wild birds in the hand is a truly unique experience, unmatched by traditional interpretive methods.	There is much value in continuing some form of a bird banding program at DEPO for the purpose of educating visitors. Combining banding demonstrations with a more frequent fall banding program would allow for our engagement with school programs.
8. Contribute to regional and national bird monitoring and conservation efforts such as PRBO's eastern Sierra bird monitoring program, MAPS (DeSante et al. 2005), CalPIF Bird Conservation Plans, and CDFG Natural Diversity Database.	We successfully contributed to CalPIF, CDFG and PRBO's eastern Sierra bird monitoring program in all years. Late road opening and flooding of the netting site through June 2006 kept us from garnering enough census days during the breeding season to allow for inclusion of 2006 data in the MAPS program productivity analysis (MAPS program pers. com.). Variable start dates will infringe on our ability to contribute to the MAPS program in every year.	NPS and DEPO continue to contribute to CalPIF.

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Appendix 1. Project recommendations (from Heath 2005).

With the goal of enhancing and protecting riparian and meadow breeding bird populations and their habitat, we provide 13 habitat, management, and monitoring recommendations. Recommendations are based on results derived from PRBO's 2002 - 2004 DEPO bird monitoring program and from PRBO's wider bird monitoring effort in the eastern Sierra Nevada (1998 – 2004), unless otherwise cited. Recommendations 9 – 12 (labeled "CalPIF RBCP") are taken directly from the Riparian Bird Conservation Plan (RHJV 2000) and Recommendation 13 (labeled "CalPIF SNBCP") is taken directly from the draft Avian Conservation Plan for the Sierra Nevada Bioregion (Siegel and DeSante 1999). Results presented in these recommendations are also presented in detail in the Results and Discussion section of this report.

1. Maintain a diversity of riparian habitat types within the monument. Sites characterized as willow habitat types tended to harbor the highest number of breeding bird species, but black cottonwood, alder and aspen habitat types were also rich in bird species. These habitat types are structurally different from one another and provide different habitat niches for riparian breeding birds. Maintaining a diversity of riparian habitat types will sustain breeding bird diversity monument-wide.
2. Maintain and encourage vegetative structural diversity and habitat complexity. When considering the habitat needs of an entire breeding bird community, versus the needs of a few indicator species, it becomes clear that maintaining diverse vegetative structure and complexity is highly beneficial. The abundances of six bird species at the monument were positively correlated with vegetation found in three vertical layers: herb-class cover (< 50 cm), shrub-class cover (50 cm – 5 m) and tree-class cover (> 5 m). Diverse vegetation (in terms of height, structure and species) provides more available nesting substrate and more complex cover and protection from a variety of nest predators (Martin 1992). Additionally, a more diverse vegetative structure may benefit other important elements of avian breeding ecology such as easy access to nesting material, more singing perches or a wider variety of prey items.
3. Maintain and encourage willow cover. Breeding bird species richness and breeding bird abundance had a very strong positive correlation with percent willow cover at DEPO. This easy to plant and quick growing riparian shrub stabilizes stream banks and provides nesting habitat for numerous species breeding in the monument including Yellow Warblers, Song Sparrows, Dusky Flycatchers, Warbling Vireos, Calliope Hummingbirds and Mountain White-crowned Sparrows.
4. Maintain herbaceous cover and height. The abundance of several bird species was positively correlated with herbaceous cover. High growing herbaceous cover, (e.g. forbs and grasses that measured > 50 cm) were associated with Oregon Junco and MacGillivray's Warbler abundance in particular. Forbs and grasses (which often serve as forage for domestic livestock or wild ungulates) permitted to reach their full vertical height, provide optimum nesting substrate and concealment for ground and low shrub nesting species.
5. Monitor pine encroachment into the riparian zone. Conifer encroachment is one of the leading causes of aspen decline in the Sierra Nevada (D. Burton, Aspen Delineation Project, pers. com.). Across the eastern Sierra, conifer encroachment into aspen groves was

negatively correlated with bird species richness and abundance (Richardson and Heath 2005) and conifer dominated riparian habitats were not as bird species rich as aspen or willow dominated riparian habitats (Heath and Ballard 2005). However, some pine cover in the riparian zone enhances structural diversity and provides nesting substrate for several species. Also, streamside pines stabilize banks and provide shade which regulates water temperatures for fish and aquatic invertebrates. Discerning an encroachment threshold and a careful consideration of trade-offs is recommended before management action is taken.

6. Limit management activities in riparian habitat (such as vegetation disturbance or removal) to the non-breeding season (mid September through early May). The breeding season for birds begins prior to the laying of an egg, when pair bonding, nest location choices and nest building takes place, and songbirds will take at least a month after the first egg is laid to fledge and care for young. Based on the timing of hatch year and reproductively active female captures, we deduce the breeding season for riparian and meadow breeding birds in the monument to be mid May through early September. June and July are peak breeding season months.
7. Avoid constructing new human facilities within or adjacent to riparian areas. We have no direct evidence from this study that riparian campgrounds or other riparian developments are detrimental to songbirds. However, other studies have connected high concentrations of Brown-headed Cowbirds to artificially rich sources of food associated with campgrounds, roads, towns, pack stations and small horse corrals in the eastern Sierra (Rothstein et al.1980, Rothstein et al. 1984). Songbirds should indirectly benefit from bear management practices that reduce the availability of human food at campgrounds, as this practice also reduces food availability for songbird nest predators such as Steller's Jays.
8. Meadow management and restoration efforts should, if possible, be coordinated with Inyo National Forest. Soda Springs meadow is geographically linked to a string of other meadow systems upstream from the northern DEPO boundary. These meadows (e.g. near Mineral Falls and Pumice Flat) are over twice the size of Soda Springs meadow and likely provide similar nesting and foraging habitat to that found in DEPO. It is also reasonable to assume that breeding birds disperse and move between these meadows (e.g. birds that fledge from DEPO may move upstream to INF meadows or visa-versa). Coordinating management and restoration efforts within geographically linked habitats should benefit wildlife species that disregard political boundaries.
9. CalPIF RBCP. Use standardized monitoring protocols. By standardizing monitoring techniques, researchers ensure that results can be compared across space and time. The USDA Forest Service published guidelines for standardized monitoring techniques for monitoring birds (Ralph et al. 1993).
10. CalPIF RBCP. Maximize the cost effectiveness and value of existing specialized monitoring programs for listed species (e.g., those oriented toward Northern Goshawk and Willow Flycatcher) by collecting standardized data on multiple species (such as point counts) in addition to any specialized protocols aimed at one species. Many state and federally sponsored surveys only monitor special-status species. By adding a standard protocol that provides information on multiple species while conducting special-status species surveys, researchers could rapidly expand their knowledge of California's birds. Such data could be shared and analyzed and results would be added to conservation plans and incorporated into management regimes. Even if resources are not immediately available for analysis, the

information will provide a baseline or historical perspective on bird distribution and abundance, thus allowing for preemptive measures to be taken to avoid the future listing of species we now consider common.

11. *CalPIF RBCP. Consider reproductive success when monitoring populations and assessing habitat value. Conduct selective monitoring at key sites to determine factors influencing nest success for currently common species.* The number of young produced (productivity) critically influences a bird population's presence and viability in an area. Low nest success could indicate a nonviable population. Relatively recent, local extirpation and declines of some western songbird species from their historical breeding range appear to be caused by low productivity (Johnson and Geupel 1996, Chase et al. 1997, Gardali et al. 2000, Ballard et al. 2003). Local extirpation may signal the early stages of a process of species extinction. By determining the factors associated with low reproductive success, monitoring may identify which management and restoration actions will help reverse songbird population declines. Monitoring common species has the dual benefit of providing statistical power for analysis, and providing gauges that allow management changes before it is too late.
12. *CalPIF RBCP. Conduct intensive, long-term monitoring at selected sites. In order to analyze trends, long-term monitoring should continue for more than five years.* Long-term monitoring should be conducted at reference sites that embody the characteristics restoration and management efforts strive to recreate. Long-term monitoring at key experimental sites can test the assumptions that currently drive restoration and management practices. Intensive monitoring includes collecting data on primary demographic processes and associated habitat characteristics and seeks to identify causal connections between habitat variables and species viability. Biologists collect data on reproductive success, breeding densities, reproductive success, parasitism, survival, vegetation data, suitable habitat requirements, and general life-history information. Managers can employ these data to make well informed, adaptable management plans.
13. *CalPIF SNBCP. Where feasible, promote active restoration of meadows, including revegetation and restoration of natural hydrologic processes, in an adaptive management framework.* Recent advances in stream restoration suggest that even deeply incised meadow streams can be successfully altered to restore natural flooding regimes to unnaturally dried-out meadows (Jim Wilcox pers. comm.). This is especially true where stream incision and associated drying of meadows primarily reflect the effects of past, rather than current land management practices. Meadow restoration projects, incorporating hydrologic as well as vegetative restoration, should be encouraged on public and private lands throughout the Sierra.

Appendix 2. GPS locations of mist nets at Devils Postpile National Monument, 2002 - 2006 in decimal degrees, NAD83.

Net Number	lat	lon
DEPO NET 1	37.62940228	-119.0846247
DEPO NET 2	37.62967587	-119.0841902
DEPO NET 3	37.62912870	-119.0845979
DEPO NET 4	37.62912333	-119.0855152
DEPO NET 5	37.62921989	-119.0856386
DEPO NET 6	37.62960613	-119.0858478
DEPO NET 7	37.62950421	-119.0854777
DEPO NET 8	37.62838304	-119.0847588
DEPO NET 9	37.62882829	-119.0848179
DEPO NET 10	37.62872636	-119.0852363

Appendix 3. Breeding status of all bird species observed at and within close vicinity to Devils Postpile National Monument, May 20 – August 13, 2002 – 2005, including Parker and Parker (2001), and Institute for Bird Populations surveys (Siegel and Wilkerson 2004).

Common name	Latin name	Breeding status	Common name	Latin name	Breeding status
Turkey Vulture	<i>Cathartes aura</i>	0	Belted Kingfisher	<i>Ceryle alcyon</i>	2
Mallard	<i>Anas platyrhynchos</i>	1	Lewis' Woodpecker	<i>Melanerpes lewis</i>	0*
Bufflehead	<i>Bucephala albeola</i>	2***	Williamson's Sapsucker	<i>Sphyrapicus thyroideus</i>	1
Common Merganser	<i>Mergus merganser</i>	1	Red-breasted Sapsucker	<i>Sphyrapicus ruber</i>	1
Bald Eagle	<i>Haliaeetus leucocephalus</i>	0	Downy Woodpecker	<i>Picoides pubescens</i>	2
Cooper's Hawk	<i>Accipiter cooperii</i>	2	Hairy Woodpecker	<i>Picoides villosus</i>	1
Northern Goshawk	<i>Accipiter gentilis</i>	2	White-headed Woodpecker	<i>Picoides albolarvatus</i>	2
Red-tailed Hawk	<i>Buteo jamaicensis</i>	2	Black-backed Woodpecker	<i>Picoides arcticus</i>	3
Golden Eagle	<i>Aquila chrysaetos</i>	0	Red-shafted Flicker	<i>Colaptes auratus</i>	1
American Kestrel	<i>Falco sparverius</i>	2**	Olive-sided Flycatcher	<i>Contopus cooperi</i>	3
Mountain Quail	<i>Oreortyx pictus</i>	2	Western Wood-Pewee	<i>Contopus sordidulus</i>	1
Virginia Rail	<i>Rallus limicola</i>	2**	Willow Flycatcher	<i>Empidonax traillii</i>	0
Spotted Sandpiper	<i>Actitis macularia</i>	1	Hammond's Flycatcher	<i>Empidonax hammondi</i>	2
Killdeer	<i>Charadrius vociferus</i>	2	Gray Flycatcher	<i>Empidonax wrightii</i>	0*
Wilson's Snipe	<i>Gallinago delicata</i>	2	Dusky Flycatcher	<i>Empidonax oberholseri</i>	3
California Gull	<i>Larus californicus</i>	0	Cassin's Vireo	<i>Vireo cassinii</i>	2
Mourning Dove	<i>Zenaida macroura</i>	2	Warbling Vireo	<i>Vireo gilvus</i>	1
Great Horned Owl	<i>Bubo virginianus</i>	0	Steller's Jay	<i>Cyanocitta stelleri</i>	1
Common Nighthawk	<i>Chordeiles minor</i>	0	Clark's Nutcracker	<i>Nucifraga columbiana</i>	2
Black Swift	<i>Cypseloides niger</i>	1	Common Raven	<i>Corvus corax</i>	1
Vaux's Swift	<i>Chaetura vauxi</i>	0**	Tree Swallow	<i>Tachycineta bicolor</i>	2
White-throated Swift	<i>Aeronautes saxatalis</i>	2**	Violet-green Swallow	<i>Tachycineta thalassina</i>	2
Anna's Hummingbird	<i>Calypte anna</i>	2	Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	2
Calliope Hummingbird	<i>Stellula calliope</i>	1	Mountain Chickadee	<i>Poecile gambeli</i>	3
Broad-tailed Hummingbird	<i>Selasphorus platycercus</i>	0	Red-breasted Nuthatch	<i>Sitta canadensis</i>	2
Rufous Hummingbird	<i>Selasphorus rufus</i>	0	White-breasted Nuthatch	<i>Sitta carolinensis</i>	2

Confirmed Breeding - 1 Probable Breeding - 3 Possible Breeding - 2 No Evidence of Breeding, Migrant, Transient, or Disperser - 0 (see methods for further explanation of codes)

* observed only by Parker and Parker (2001), **observed only by IBP (Siegel and Wilkerson 2004), *** observed only by Parker and Parker (2001) outside of DEPO boundaries

Appendix 3 continued. Breeding status of all bird species observed at and within close vicinity of Devils Postpile National Monument, May 20 – August 13, 2002 - 2005, including Parker and Parker (2001), and Institute of Bird Populations surveys (Siegel and Wilkerson 2004).

Common name	Latin name	Breeding status	Common name	Latin name	Breeding status
Brown Creeper	<i>Certhia americana</i>	1	Spotted Towhee	<i>Pipilo maculatus</i>	3
Rock Wren	<i>Salpinctes obsoletus</i>	2**	Chipping Sparrow	<i>Spizella passerina</i>	2
Bewick's Wren	<i>Thryomanes bewickii</i>	2	Brewer's Sparrow	<i>Spizella breweri</i>	2
House Wren	<i>Troglodytes aedon</i>	1	Black-throated Sparrow	<i>Amphispiza bilineata</i>	0
Marsh Wren	<i>Cistothorus palustris</i>	0	Savannah Sparrow	<i>Passerculus sandwichensis</i>	0
American Dipper	<i>Cinclus mexicanus</i>	1	Fox Sparrow	<i>Passerella iliaca</i>	3
Golden-crowned Kinglet	<i>Regulus satrapa</i>	3	Song Sparrow	<i>Melospiza melodia</i>	1
Ruby-crowned Kinglet	<i>Regulus calendula</i>	2***	Lincoln's Sparrow	<i>Melospiza lincolnii</i>	1
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>	2	Mtn. White-crowned Sparrow	<i>Zonotrichia leucophrys oriantha</i>	1
Mountain Bluebird	<i>Sialia currucoides</i>	2	Oregon Junco	<i>Junco hyemalis thurberi</i>	1
Townsend's Solitaire	<i>Myadestes townsendii</i>	1	Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>	2
Swainson's Thrush	<i>Catharus ustulatus</i>	0	Lazuli Bunting	<i>Passerina amoena</i>	1
Hermit Thrush	<i>Catharus guttatus</i>	3	Red-winged Blackbird	<i>Agelaius phoeniceus</i>	0**
American Robin	<i>Turdus migratorius</i>	1	Western Meadowlark	<i>Sturnella neglecta</i>	2***
Orange-crowned Warbler	<i>Vermivora celata</i>	0	Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	1
Nashville Warbler	<i>Vermivora ruficapilla</i>	3	Brown-headed Cowbird	<i>Molothrus ater</i>	3
Yellow Warbler	<i>Dendroica petechia</i>	1	Pine Grosbeak	<i>Pinicola enucleator</i>	3
Audubon's Warbler	<i>Dendroica coronata auduboni</i>	1	Purple Finch	<i>Carpodacus purpureus</i>	0
Hermit Warbler	<i>Dendroica occidentalis</i>	2	Cassin's Finch	<i>Carpodacus cassinii</i>	1
Mac Gillivray's Warbler	<i>Oporornis tolmei</i>	1	Red Crossbill	<i>Loxia curvirostra</i>	2
Common Yellowthroat	<i>Geothlypis trichas</i>	2	Pine Siskin	<i>Carduelis pinus</i>	3
Wilson's Warbler	<i>Wilsonia pusilla</i>	1	Lesser Goldfinch	<i>Carduelis psaltria</i>	2
Western Tanager	<i>Piranga ludoviciana</i>	1	Evening Grosbeak	<i>Coccothraustes vespertinus</i>	2
Green-tailed Towhee	<i>Pipilo chlorurus</i>	3			

Confirmed Breeding - 1 Probable Breeding - 3 Possible Breeding - 2 No Evidence of Breeding, Migrant, Transient, or Disperser - 0 (see methods for further explanation of codes)

* observed only by Parker and Parker (2001), **observed only by IBP (Siegel and Wilkerson 2004), *** observed only by Parker and Parker (2001) outside of DEPO boundaries

Appendix 4. All birds captured during constant effort mist netting, by species, age and year, at Devils Postpile National Monument, 2002 – 2006.

	2002		2003		2004		2005		2006	
	HY	AHY	HY	AHY	HY	AHY	HY	AHY	HY	AHY
Spotted Sandpiper	0	0	1	0	0	0	0	1	0	1
Anna's Hummingbird	0	0	0	0	0	0	1	0	0	0
Calliope Hummingbird	4	3	2	2	1	1	1	0	0	1
Broad-tailed Hummingbird	0	0	0	0	2	0	0	0	0	0
Rufous Hummingbird	9	3	3	2	5	7	6	0	9	1
Williamson's Sapsucker	0	0	0	0	1	0	1	0	0	2
Red-breasted Sapsucker	5	5	5	3	8	6	2	3	2	5
Red-shafted Flicker	0	0	0	0	2	0	0	0	0	0
Western Wood-Pewee	0	0	0	0	0	0	0	1	0	1
Willow Flycatcher	0	1	0	0	0	0	0	0	0	0
Dusky Flycatcher	1	2	0	0	0	2	0	1	1	0
Cassin's Vireo	0	1	0	0	0	0	0	0	1	0
Solitary Vireo	0	0	0	0	0	1	0	0	0	0
Warbling Vireo	1	13	0	3	2	13	0	10	0	12
Steller's Jay	1	0	0	2	0	0	1	1	0	0
Mountain Chickadee	0	0	0	3	0	1	0	1	1	1
Red-breasted Nuthatch	0	0	0	0	0	1	0	0	0	0
Brown Creeper	1	0	0	0	0	1	0	0	0	0
Bewick's Wren	0	0	0	0	0	0	1	0	0	0
House Wren	1	0	0	0	1	0	2	0	1	0
Marsh Wren	0	0	0	0	1	0	0	0	0	0
Golden-crowned Kinglet	0	1	0	0	0	0	0	0	0	0
Swainson's Thrush	0	0	0	0	0	1	0	0	0	0
American Robin	0	8	0	8	0	9	2	12	6	8
Orange-crowned Warbler	15	17	27	9	21	9	39	2	35	1
Nashville Warbler	1	1	1	1	0	2	8	1	1	1
Yellow Warbler	0	4	0	3	2	5	1	0	3	4
Audubon's Warbler	12	10	5	22	0	15	0	7	5	7
Hermit Warbler	0	1	0	0	0	1	0	0	0	0
Mac Gillivray's Warbler	2	0	5	4	7	10	3	2	4	2
Common Yellowthroat	0	0	0	0	0	0	2	0	0	0
Wilson's Warbler	2	10	11	5	4	21	4	8	6	5
Western Tanager	0	0	0	3	0	0	0	0	0	0
Spotted Towhee	2	0	0	0	0	0	0	0	0	0

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Appendix 4. Continued.

	2002		2003		2004		2005		2006	
	HY	AHY	HY	AHY	HY	AHY	HY	AHY	HY	AHY
Brewer's Sparrow	1	0	0	0	1	0	0	0	0	0
Black-throated Sparrow	1	0	0	0	0	0	0	0	0	0
Savannah Sparrow	0	0	0	0	1	1	1	0	0	0
Fox Sparrow	1	0	0	0	1	0	1	0	0	0
Song Sparrow	11	13	8	10	3	9	6	2	8	3
Lincoln's Sparrow	0	0	0	0	1	1	0	0	7	2
Mtn. White-crowned Sparrow	8	2	0	2	4	5	7	2	3	4
Oregon Junco	4	10	2	10	6	18	0	2	5	4
Lazuli Bunting	0	1	1	1	2	1	2	2	1	2
Brewer's Blackbird	0	0	1	3	0	4	0	1	0	0
Brown-headed Cowbird	0	1	0	1	0	1	0	1	0	0
Pine Grosbeak	0	0	0	1	0	3	0	0	0	0
Cassin's Finch	0	3	0	0	0	11	0	0	0	0
Pine Siskin	0	7	0	0	0	1	0	0	0	1
Lesser Goldfinch	0	0	0	0	1	0	0	0	0	0

Appendix 5. Investigations of apparent annual adult survival and recapture probability for all adults (residents and transients) and residents for breeding species with highest number of captures (Mountain-white Crowned Sparrow, Song Sparrow, Red-breasted Sapsucker, Oregon Junco, MacGillivray's Warbler, Audubon's Warbler and American Robin) at Devils Postpile National Monument, 2002 – 2006. Estimate, standard error and 95% confidence intervals.

			95% Confidence Interval		
Parameter		Estimate	Standard Error	Lower	Upper
<u>Mountain White-crowned Sparrow</u>					
All Adults	Apparent annual survival	0.38	0.171	0.13	0.72
	Recapture probability	1.00	0.000	1.00	1.00
Resident Adults	Apparent annual survival	0.60	0.219	0.20	0.90
	Recapture probability	1.00	0.000	1.00	1.00
<u>Song Sparrow</u>					
All Adults	Apparent annual survival	0.51	0.136	0.26	0.75
	Recapture probability	0.43	0.188	0.15	0.77
Resident Adults	Apparent annual survival	0.66	0.131	0.38	0.86
	Recapture probability	0.54	0.182	0.22	0.83
<u>Red-breasted Sapsucker</u>					
All Adults	Apparent annual survival	0.64	0.253	0.17	0.94
	Recapture probability	0.31	0.218	0.06	0.77
Resident Adults	Apparent annual survival	0.72	0.197	0.28	0.95
	Recapture probability	0.47	0.248	0.11	0.86
<u>Oregon Junco</u>					
All Adults	Apparent annual survival	0.50	0.124	0.28	0.73
	Recapture probability	0.49	0.187	0.18	0.81
Resident Adults	Apparent annual survival	0.63	0.130	0.37	0.84
	Recapture probability	0.57	0.185	0.23	0.85
<u>MacGillivray's Warbler</u>					
All Adults	Apparent annual survival	0.20	0.103	0.07	0.47
	Recapture probability	1.00	0.000	1.00	1.00
Resident Adults	Apparent annual survival	0.50	0.204	0.17	0.83
	Recapture probability	1.00	0.000	1.00	1.00
<u>Audubon's Warbler</u>					
All Adults	Apparent annual survival	0.29	0.198	0.06	0.73
	Recapture probability	0.26	0.240	0.03	0.80
Resident Adults	Apparent annual survival	0.50	0.184	0.19	0.81
	Recapture probability	0.58	0.310	0.10	0.95
<u>American Robin</u>					
All Adults	Apparent annual survival	0.69	0.214	0.24	0.94
	Recapture probability	0.23	0.132	0.07	0.56
Resident Adults	Apparent annual survival	1.00	0.000	1.00	1.00
	Recapture probability	0.41	0.105	0.23	0.62