prbo

Mono Basin Willow Flycatcher Project
2003 Progress Report

Chris McCreedy
760.647.6109
cmccreedy@prbo.org
PRBO Contribution # 1184
July 2004
PRBO Conservation Science
4990 Shoreline Highway
Stinson Beach, CA 94970
415.868. 1221
www.prbo.org

SUMMARY

In 2003, PRBO Conservation Science (PRBO) completed the first year of the Mono Basin Willow Flycatcher Project (MBWFP). The project is designed to study the apparent reoccupation of Inyo National Forest (Inyo NF) and Los Angeles Department of Water and Power (LADWP) holdings on lower Rush Creek, Mono County, California, by a population of Willow Flycatchers (*Empidonax trailli*). Willow Flycatchers are a California State Endangered species (CDFG 1993) and United States Forest Service Region V Sensitive Species, and there are only approximately 500 known Willow Flycatcher territories remaining in California today (McCreedy and Heath, *in revision*).

From June through August 2003, PRBO documented 7 territorial males on lower Rush Creek, and six females. Thirteen territorial adults on lower Rush Creek represent the highest summer population since Willow Flycatchers were first documented on Rush by PRBO biologists in 2000.

Thirteen total nests were located on six territories. Of these 13 nests, eight nests held Willow Flycatcher eggs (thus termed "active nests"). Four of eight active nests fledged young. Five of the thirteen total nests were parasitized by the Brown-headed Cowbird (*Molothrus ater*), yet four of the five parasitized nests were abandoned by the host flycatcher female. The fifth nest was reconstructed to bury the cowbird egg.

With the assistance of Mary Whitfield of the Southern Sierra Research Station, PRBO captured and color-banded territorial ten of thirteen territorial adult Willow Flycatchers. Uncaptured adults included one unmated male and two nesting females. Every female that fledged young was captured and color-banded.

Prior to the Mono Basin Willow Flycatcher Project, the subspecies status of the lower Rush Creek population remained unresolved. Eight blood samples from captured adults were obtained and sent to the United States Geologic Survey's Colorado Plateau Field Station (Flagstaff, AZ) for genetic taxonomic analysis. Advertising song recordings were obtained from two territorial males (both mated), and sent to the United States Geologic Survey's Midcontinental Ecological Science Center (Fort Collins, CO) for acoustic taxonomic analysis. Both genetic and acoustic analyses are still pending, and results will be delivered as a supplement to this report.

To monitor future juvenile recruitment and population dispersal, 15 nestlings were color-banded in 2003. Of these 15 nestlings, three were preyed upon roughly two days prior to expected fledging, leaving a total of 12 fledged color-banded young.

Color-banding adults enabled PRBO to document polygyny on one territory, and a mate-switching female that initiated nests with two different males over the course of the breeding season.

We conducted vegetation assessments at each of the 13 nests, and at 30 randomly generated non-nest sites for comparison. We completed vegetation transects across six of the seven lower Rush Creek territories.

PRBO biologists conducted 125 hours of activity budget sessions for inclusion into a wider Sierra Nevada study of Willow Flycatcher activity allocation (McCreedy 2003, M. Morrison unpublished data). In addition, results from the Mono Basin Willow Flycatcher Project will be incorporated into wider USFS Sierra Nevada Willow Flycatcher demographic research.

PRBO presented on these findings at the July 2003 "Refreshments with Refreshing Biologists" lecture series at the Mono Lake Committee (Lee Vining, CA) and at the October 2003 Osher Symposium (San Francisco, CA). Results from the 2003 and 2004 field seasons will be presented at the June 2004 Mono Basin Birding Chautauqua in Lee Vining, CA.

OBJECTIVES

The USFS Partners In Flight (PIF) Program provided funding necessary to the success of the 2003 Mono Basin Willow Flycatcher Project. The Project set out with the following objectives:

- Conduct Willow Flycatcher nest monitoring on lower Rush Creek, to determine factors affecting productivity, parasitism rates, and predation pressures. Conduct nest-site vegetation sampling and territory-scale vegetation sampling to determine Willow Flycatcher nest-site and territory-site selection criteria. **COMPLETE. WILL CONTINUE IN 2004 FOR MORE ROBUST SAMPLE SIZE.**
- Conduct territory spot mapping on color banded individuals to determine population size, phenology, and territory sizes and locations on lower Rush Creek. **COMPLETE.**
- Conduct genetic sampling/analysis and sonic analysis of advertising song to gain insight into the lower Rush Creek population's taxonomic status. **COMPLETE. RESULTS PENDING FROM UNITED STATES GEOLOGIC SURVEY.**
- Color band nestlings and captured adults to determine site fidelity, survivorship, and if nestlings return, recruitment. **COMPLETE.**
- Assist land managers in implementing the Sierra Nevada Forest Plan by incorporating findings into USFS WIFL databases, CDFG WIFL databases, and regional WIFL census networks. **ONGOING. DATA WILL BE INCLUDED IN SIERRA NEVADA WILLOW FLYCATCHER DEMOGRAPHY STUDY.**

BACKGROUND

The Mono Basin Willow Flycatcher Project represents a PRBO, USFS (Inyo NF), and Los Angeles Department of Water and Power (LADWP) collaboration to monitor the recovery of the Willow Flycatcher on lower Rush Creek and in the greater Mono Lake Basin. Lower Rush Creek is under long term, passive restoration after decades of grazing and municipal water diversions. Lower Rush Creek now receives near natural flow, and a grazing moratorium on lower Rush Creek (and across the Mono Basin Scenic Area) has been in place for over ten years.

PRBO's Eastern Sierra Riparian Songbird Conservation Project first documented two territorial Willow Flycatcher males on lower Rush Creek in 2000. As described in McCreedy and Heath (*in revision*), the number of territorial adults on lower Rush Creek has increased in each

year since 2000, with eight in 2001, eleven in 2002, and thirteen in 2003. Notably, the number of detected females has increased from zero in 2000 to three in 2001, four in 2002, and six in 2003.

Over the twentieth century Willow Flycatchers have experienced precipitous declines across California, particularly in the Sierra Nevada and along the Colorado River (Williams and Craig 1998, Serena 1982). After several trips to the Mono Basin and Eastern Sierra in the early twentieth century, biologist Joseph Grinnell termed Willow Flycatchers to be "fairly common", and noted nesting material carries near the Mono Inn, on Mono Lake's western shore (Grinnell and Dixon field notes at the Museum of Vertebrate Zoology). In addition, several Rush Creek nesting records exist prior to the initiation of 1941 municipal diversions to Los Angeles (unpublished records at the Western Foundation of Vertebrate Zoology). However, subsequent Willow Flycatcher nesting records in the Mono Basin are nearly nonexistent. David Gaines reports the most recent and nearby Willow Flycatcher breeding at Mammoth Creek, Mono County, in the early 1970s (Gaines 1992). The USFS Region V has placed a high research priority on Sierra Nevada Willow Flycatcher populations, and the Mono Basin Willow Flycatcher Project complements larger research efforts in the northern Sierra near Truckee, and the southern Sierra near Weldon.

The 2003 season marked an important first step in understanding the demographic processes that have led to the success of the lower Rush Creek population - which unlike other Willow Flycatcher breeding sites, is experiencing population increases. In addition, the lower Rush Creek population has expressed nest site and territory habitat attributes anomalous to other Willow Flycatcher populations in California. These attributes include a predilection for Wood's Rose (*Rosa woodsii*) (22 out of 22 located nests were built in Wood's Rose), and an absence of territory and nest site correlation to surface water (McCreedy and Heath, *in revision)*. Research into the use of these anomalous habitats will identify alternatives to typical habitats, which will assist the USFS and California Department of Fish and Game (CDFG) in the conservation of this endangered species.

METHODS

At 37.93 N° and 119.07° W, lower Rush Creek spans the final seven kilometers of Rush Creek's descent to Mono Lake, extending from the "Narrows" cataract to the Rush Creek – Mono Lake delta (Figure 1). Rush Creek drops from 2011 meters above sea level at the Narrows to 1945 meters above sea level at its delta with Mono Lake.

Surveys began June 1, 2003, and ended August 19, 2003. Initial surveys consisted of territory spot mapping in accordance with International Bird Conservation Committee (IBCC) recommendations (1970) and following Ralph et al. 1993. Lower Rush Creek was divided into four sections of equal size, which were each covered once every four days. Each detected Willow Flycatcher's location was marked using a Garmin GPSII receiver and plotted onto pre-made UTM-gridded maps of the lower Rush Creek riparian corridor. In addition, singing males' perches were marked with a Garmin GPSII receiver and added to GIS coverage to maximize spot-mapping accuracy. Sex and age of detected adults was noted when possible, and color-band identifications were recorded for each encounter.

Nests were located and monitored at least once every four days, following protocols described in Martin and Geupel (1993) and Martin et al. (1995). On each visit to the nest, nest contents were recorded, and Brown-headed Cowbird parasitism noted. After nesting was complete, 5 m-radius vegetation assessments were conducted also following Martin and Geupel (1993), and thirty randomly-generated non-nest vegetation assessments were completed to pair with nest vegetation assessments.

To assess territory habitat characteristics, vegetation transects were completed for six of seven territories. Cover type (to species), and cover proportions along transects were recorded. Transects ran north-south across each territory, irrespective of riparian corridor geography, and were set on UTM NAD83 coordinates (724000, 724020, 724040, etc.). Transects were spaced 20 m apart. To achieve a more robust sample size, territory transects will be analyzed after the inclusion of data from the 2004 field season.

Target netting, with the assistance of the Southern Sierra Research Station, began on June 14, 2003. We used a combination of passive mist netting (setting a 5m and a 2m mist net across common flight paths on territories) and active mist netting (using hidden speakers placed near nets and playing a series of vocalizations to bring flycatchers to nets).

Willow Flycatchers have exhibited a high sensitivity to leg injury if improperly banded. Special care was used in fashioning customized bands to minimize leg injuries, following recommendations from the Southern Sierra Research Station. Celluloid bands were ground to half-length using a Dremel tool, and ground edges were filed to ensure smooth edges. Only two half-length color bands were placed on one leg, and one metal FWS band was placed on the other leg. All adults were banded with a metal band on the right leg, and all 2003 young were banded with a metal FWS band on the left leg.

The Southern Sierra Research Station also instructed PRBO on blood sampling. Blood samples were taken using a toe-clip to induce two to three drops of blood. The foot was held over a plastic vial, and we rinsed the resultant bead of blood into the vial with alcohol-based preservative. Coagulant was placed on the clipped toe to ensure rapid clotting, and the bird released. Blood samples were not taken from birds overstressed during capture and net extraction. Samples were only taken from adults. Samples were sent to the USGS Forest and Rangeland Ecosystem Science Center for genetic analysis following Paxton et al. 1997.

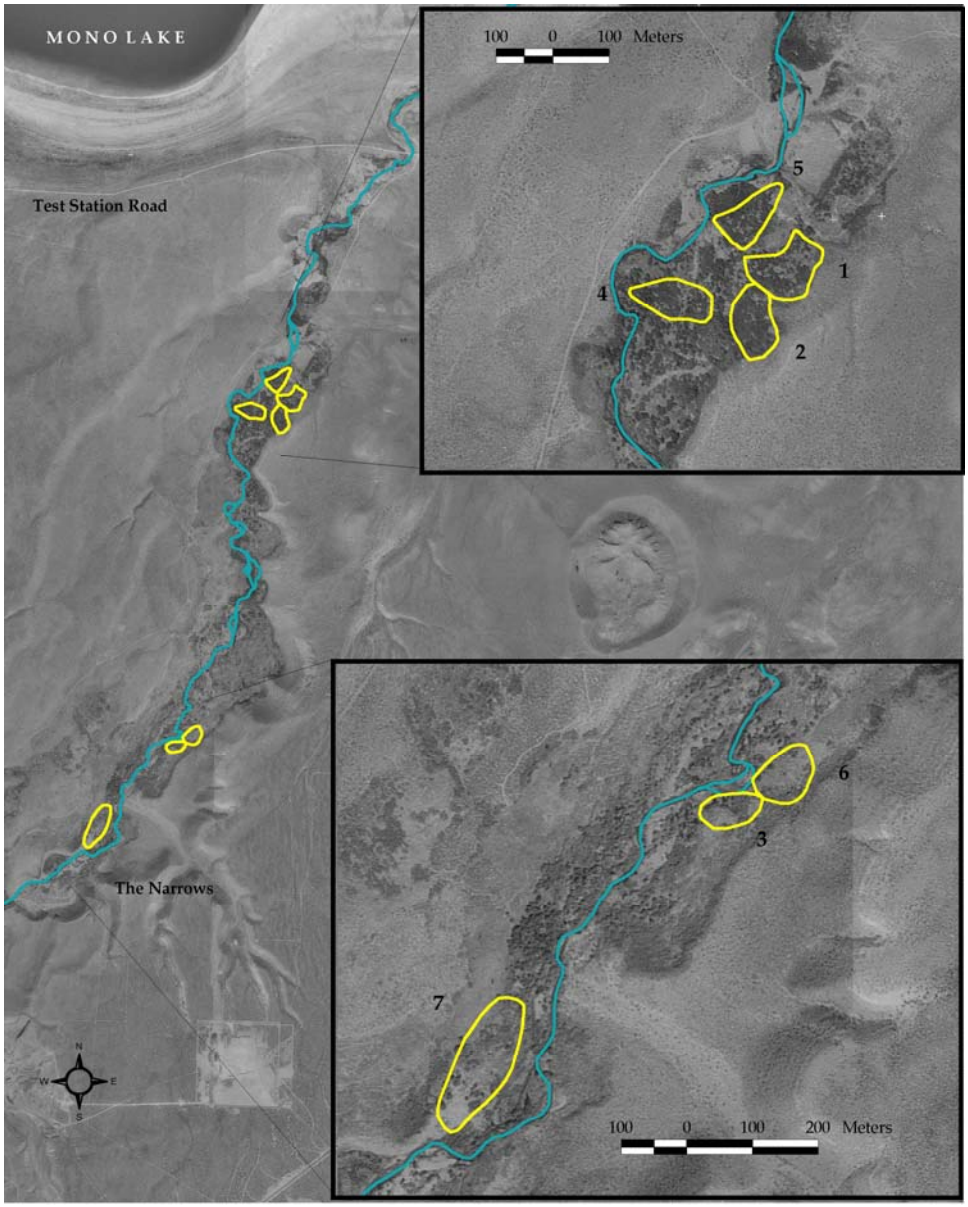
Advertising recordings were completed during the second week of July. Recordings were taken with a Sound Pro stereo microphone using matched Audio Technical 183 omnidirectional microphone bodies mounted in a Telinga 22" parabolic dish and recorded on a Sharp Mt877 minidisc recorder. Samples were sent to the USGS Midcontinetnal Ecological Science Center for sonic analysis following Sedgwick 2001.

RESULTS AND DISCUSSION

We detected seven territorial males during the course of the 2003-breeding season on lower Rush Creek. Six females were detected on six of the territories; one male remained unmated throughout the summer. One polygynous male held two nesting females through June.

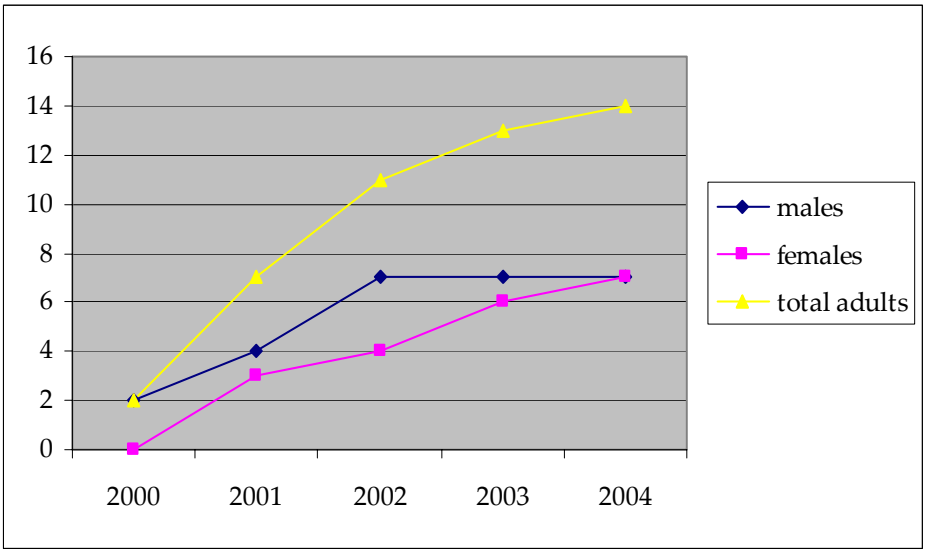
Around July 1, this territory's second female (after two failed nesting attempts) moved to an adjacent male's territory – which until then was unmated. Figure 1 depicts the seven 2003 territories.

Figure 1. Willow Flycatcher territories on Rush Creek, Mono County, 2003. Territory numbers are referred to in subsequent tables and text.



The Rush Creek population has risen every year since PRBO first detected Willow Flycatchers in 2000 (Heath et al 2001) (Table 1).

Table 1. Number of detected territorial Willow Flycatchers on Rush Creek, Mono County, CA 2000-2004.



A summary of 2003 territories, nests, and outcomes is provided in Table 2. In total, PRBO located 13 nests for six nesting females in 2003.

Table 2. Willow Flycatcher color combinations, nests initiated, and nest outcomes at lower Rush Creek, 2003.

Territory	Male color combination	Female color combination	Date of first egg	Date of fledge or failure	Outcome
1	RM/S	MB/S	--	8-Jun	Abandoned
	RM/S	MB/S	15-Jun	15-Jul	Fledged 4
	RM/S	unbanded*	--	21-Jun	Abandoned one BHCO egg
	RM/S	unbanded*	26-Jun	29-Jun	Abandoned two BHCO eggs and one WIFL egg
2	WR/S	GK/S	10-Jun	6-Jul	Fledged 3
3	RG/S	GB/S	--	13-Jun	Abandoned
	RG/S	GB/S	17-Jun	19-Jul	Fledged 2
4	GO/S	unbanded	24-Jun	28-Jun	Abandoned one BHCO egg and two WIFL eggs
	GO/S	unbanded	--	1-Jul	Abandoned
	GO/S	unbanded	--	5-Jul	Abandoned one BHCO egg
	GO/S	unbanded	10-Jul	30-Jul	Preyed upon 3 young
5	OK/S	unbanded*	17-Jul	11-Aug	Preyed upon 3 young
6	OO/S	GW/S	5-Jul	3-Aug	Fledged 3
7	Unbanded	Not mated	-	-	-

Colors Used: **R**= Red; **M**= Mauve; **B**=Blue; **W**=White; **G**=Green; **K**= Black; **O**=Orange; **Y**=Yellow; **S**= Silver FWS Band. Combinations are read left leg/right leg, and body to toe. Asterisk (*) signifies an unbanded female that switched mates around 1 July. BHCO=Brown-headed Cowbird, and WIFL=Willow Flycatcher.

BANDING

Ten adult Willow Flycatchers were captured and color-banded by the Mono Basin Willow Flycatcher Project in 2003. Of these, four had been previously captured and silver-banded by the PRBO Eastern Sierra Riparian Project (PRBO unpublished data). Fifteen young were color-banded, three were preyed upon prior to fledging. To coordinate with USFS Willow Flycatcher research in the Sierra Nevada, color combinations and estimated arrival and departure dates are presented in Table 3. Color-banding nestlings enabled PRBO to track post-fledgling survival on Rush Creek. Though 12 young fledged, three of these fledglings perished within three days of leaving the nest.

Table 3. Color combinations used in 2003 on Rush Creek. All adults present on June 2 assumed to arrive approximately around May 21, when PRBO mist-nets captured GO/S. Color combination abbreviations described in Table 2. "ASY" = After Second Year, "AHY" = After Hatch Year, and "HY" = Hatch Year.

Territory	Age/Sex	Color Combination	Arrival/Fledge	Last Seen
1	ASY Male	RM/S	May 21	August 3
	AHY Female	MB/S	May 21	August 3
	HY	S/YY	July 15	August 3
	HY	S/WM	July 15	August 3
	HY	S/BG	July 15	August 3
	HY	S/RO	July 15	August 3
2	ASY Male	WR/S	May 21	July 30
	ASY Female	GK/S	May 21	July 14
	HY	S/WO	July 6	July 14
	HY	S/MM	July 6	Preyed Upon July 7
	HY	S/BK	July 6	Preyed Upon July 7
3	ASY Male	RG/S	May 21	August 2
	AHY Female	GB/S	May 21	August 1
	HY	S/WW	July 19	August 1
	HY	S/RK	July 19	August 1
4	AHY Male	GO/S	May 21	July 30
5	AHY Male	OK/S	May 21	August 11
	HY	S/RW	-	Preyed upon August 11
	HY	S/RY	-	Preyed upon August 11
	HY	S/WG	-	Preyed upon August 11
6	AHY Male	OO/S	May 21	August 13
	AHY Female	GW/S	June 23	August 17
	HY	S/WB	August 3	August 17
	HY	S/GR	August 3	August 17
	HY	S/KY	August 3	Preyed Upon August 4

PRBO's Eastern Sierra Riparian Songbird Project (ESRSP) has employed all-species mist-netting at four Mono Basin stations (Rush, Lee Vining, Wilson, and Mill Creeks) since 2000. The ESRSP utilizes only metal FWS bands, and has captured and banded 43 Willow Flycatchers since

2000. The majority of these captures are migrants. However, 6 ESRSP captures have been subsequently recaptured, either by the Mono Basin Willow Flycatcher Project, or by the ESRSP itself. These recaptures are reported in Table 4. It is of note that the 02 territory pair were aged as "After Second Year" in 2001, these birds were at least five years old in 2003. The 02 territory has been occupied since at least 2001, when the pair occupying this territory fledged 4 young (McCreedy and Heath *in revision*). There is a reasonable probability that the two juveniles and two adults caught by the ESRSP on July 29, 2001 were from this 02 territory, and that one of these juveniles has recruited into the Rush Creek breeding population (the 03 male, RG/S).

Table 4. Recaptured Willow Flycatchers in 2003 previously captured by the PRBO Eastern Sierra Riparian Songbird Project (ESRSP). A recapture by the ESRSP on Lee Vining Creek (July 26, 2003) was not territorial and thus not color banded. Band color abbreviations described in Table 1

ESRSP Capture date	Age At Capture	Location	Recapture Date	Color Combination	2003 Territory
July 29, 2001	After Second Year	Rush	June 24, 2003	WR/S	02 male
July 29, 2001	After Second Year	Rush	June 24, 2003	GK/S	02 female
July 29, 2001	Juvenile	Rush	July 16, 2003	RG/S	03 male
July 29, 2001	Juvenile	Rush	July 26, 2003	-	Caught on Lee Vining Creek (not territorial)
August 2, 2002	After Hatch Year	Rush	June 17, 2003	RM/S	01 male
May 21, 2003	After Hatch Year	Rush	June 30, 2003	GO/S	04 male

Nest Success

Rush Creek's nesting Willow Flycatchers did very well in 2003. Four of the eight nests that held Willow Flycatcher eggs ("active nests") fledged 2-4 young. Table 5 presents Mayfield success estimates for the 2003 nests.

Table 5. Willow Flycatcher nest success (*n*=8) on Rush Creek, Mono County CA, 2003.

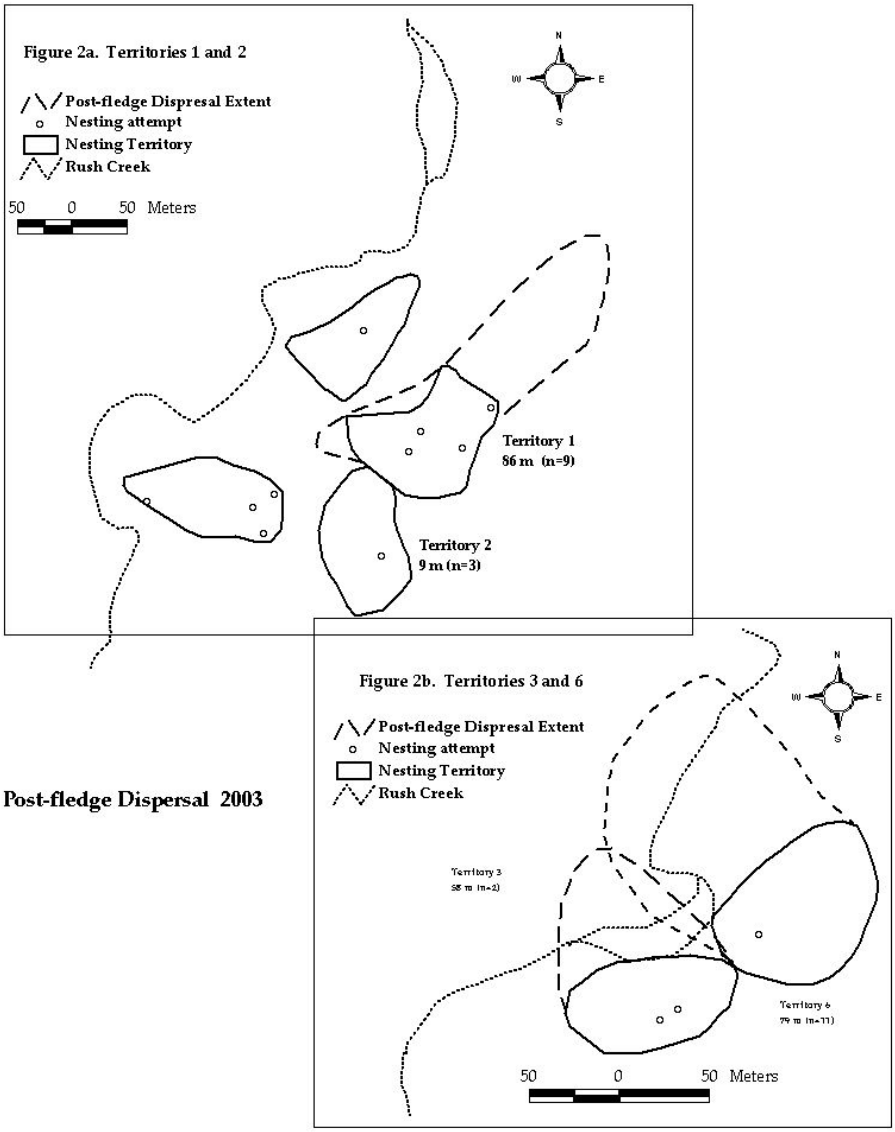
Period	# Nests	Losses	Observer days	Standard Period Days	Daily nest survival	Total Nest Survival	Standard Error
Laying	8	0	20.5	2.5	1.00000	1.00000	-
Incubation	8	2	80.5	12	0.97516	0.73941	0.01735
Nestling	6	2	66	13	0.96970	0.67030	0.02110
Laying and Incubation	8	2	101	13.5	0.98020	0.76337	0.01386
Incubation and Nestling	8	4	146.5	25	0.97270	0.50053	0.01346
Laying, Inc, and Nestling	8	4	167	27.5	**0.97605**	**0.51340**	**0.01183**

Rush Creek's 51% Mayfield nesting success (50% proportional success) is higher than 39% Mayfield success (45% proportional success,) reported at northern-central Sierra Nevada sites for 2002 (Bombay and Morrison 2003) and 37% proportional success at sites in Ohio in 1972 (Holcomb 1972). Four successful 2003 nests fledged 12 young, yielding a fecundity estimate of 1 female produced for every nesting female.

Post-fledging dispersal

Color-banding nestlings yielded post-fledging dispersal data for each of four successful nests. Figures 2a and 2b present post-fledging dispersal for four fledged nests at Rush Creek in 2003. Fledglings require a significantly greater area than the traditional territory defended by their father prior to fledging. Males remained on territory well after fledging, possibly accounting for minimal overlap between families in post-fledging distribution. In cases when juveniles ventured off-territory, they were accompanied and fed by their mother, while their father remained on territory. When juveniles returned on territory, the father would assist in feeding.

Figures 2a and 2b. Post-fledging dispersal for four successful nests at Rush Creek, 2004. Distances represent average distance from sighting to nest for *n* number of sightings.



CONCLUSION

The Rush Creek population continues to increase. The Mono Basin Willow Flycatcher Project seeks to compile six years of demographic data (Nur et al. 1999) to build an adequate investigation into the reoccupation of the Mono Basin by this California State Endangered Species and USFS Sensitive Species. Furthermore, the repopulation of Rush Creek, a riparian corridor under long-term restoration (McCreedy and Heath *in revision*), provides critical insight into what this declining species requires in riparian restoration projects in arid habitats.

In 2003, the Rush Creek population grew to its highest-recorded number since its first detection in 2000. Nesting success was high relative to other Willow Flycatcher sites in California and Ohio. The greatest known threat to Willow Flycatcher breeding at Rush Creek appears to be the Brown-headed Cowbird. Seven out of 27 Willow Flycatcher eggs (25.9%) were lost to cowbird activity, compared to 1.5% in Ohio (Holcomb 1972) and 0% in the central-northern Sierra Nevada (perhaps due to addling of one known cowbird egg) (Bombay and Morrison 2003). This relatively high loss to cowbird activity at Rush Creek makes the population's high nesting success that much more remarkable, and the Rush Creek population will continue to be an important comparison population against work in the northern and southern Sierra Nevada.

In addition, 25 Willow Flycatchers (territorial adults and nestlings combined) were color banded in 2003. As these flycatchers return to Rush and nearby drainages, PRBO will be able to contribute adult survivorship, juvenile recruitment, and dispersal data to our growing understanding of Willow Flycatcher declines in the Sierra Nevada. If Rush Creek continues its success in 2003, this will represent a crucial (and perhaps the only) source population in the central Sierra Nevada.

Once the USGS has completed its genetic and sonic analyses of the Rush Creek population's subspecies status, these results will be submitted to all project partners in a supplemental report.

ACKNOWLEDGEMENTS

We are grateful for the financial and logistical support of USFS Region 5 Partners in Flight, Inyo National Forest, Bureau of Land Management Bishop Field Office, Mono Lake Committee, Eastern Sierra Audubon Society, Mono Lake Tufa State Reserve, California Department of Fish and Game, and the White Mountain Research Station. LADWP provided access to their Rush Creek lands. Mary Whitfield of the Southern Sierra Research Station provided hours of target netting, color banding, and blood sampling assistance. Eben Paxton and James Sedgwick of the USGS contributed genetic and sonic analyses. Eben Paxton and Gernot Huber provided equipment for genetic and sonic sampling. Sacha Heath instructed on nestling color banding. River Gates assisted with target-netting and banding data. Arya Degenhardt, Rosanne Wilson, Christopher Tonra, and Jessica DeLong assisted with nestling banding. Mark Sogge, Barbara Kus, Chris Stermer, Rosemary Stefani, Helen Bombay, Greg Reis, Joel Ellis, Jim Sedgwick, Brian Tillemans, and John Bair provided invaluable, expert information. Grant Ballard was the first to detect Willow Flycatchers, in 2000, Quresh Latif located two of the 2002 nests, while Crow White, Kristie Nelson, and Robin Hirsch-Jacobson provided countless hours of spot-mapping and nest searching assistance. David Gaines' extensive work in the Mono Basin provided endless inspiration. This is PRBO Contribution # 1184

LITERATURE CITED

Bombay, H.L., and Morrison, M.L. 2003. 2002 Annual report and preliminary demographic analysis for Willow Flycatcher monitoring in the central Sierra Nevada: in partial fulfillment of contract RFQ-IBET-17-02-062. White Mountain Research Station, University of California San Diego, and USDA Forest Service, 43pp.

California Department of Fish and Game. 1993. Annual report on the status of California state-listed threatened and endangered animals and plants. http://www.dfg.ca.gov/hcpb/species/t_e_spp/tebird/tebirda.shtml

Gaines, D. 1992. Birds of Yosemite and the East Slope, 2nd ed. Artemesia Press, Lee Vining, CA.

Heath, S. K., Ballard, G., and McCreedy, C. 2001. Eastern Sierra riparian songbird conservation: 1998-2000 final report and 2000 Mono Basin progress report.

Holcomb, L.C. 1972. Nest success and age-specific mortality in Traill's Flycatcher. Auk 89:837-841.

International Bird Conservation Committee. 1970. An international standard for a mapping method in bird census work recommended by the International Bird Census Committee. Audubon Field Notes 24:722-726.

Martin, T. E., and Geupel, G.R. 1993. Nest monitoring plots: Methods for locating nests and monitoring success. J. Field Ornithol. 64:507-519.

Martin, T. E., Paine, C., Conway, C. J., Hochachka, W. M., Allen P., and Jenkins, W. 1997. The Breeding Biology Research and Monitoring Database (BBIRD) Field Protocol. Univ. of Montana Coop. Unit, Missoula, MT. http://pica.wru.umt.edu/BBIRD/protocol/protocol.html.

McCreedy, C. 2003. Willow Flycatcher activity budgets on Rush Creek, Mono County, CA: summary of the 2003 field season. Point Reyes Bird Observatory (Contrib. 1155), 4990 Shoreline Hwy, Stinson Beach, CA 94970.

McCreedy, C. and Heath, S.K. *In revision*. Atypical Willow Flycatcher Nesting Sites in a Recovering Riparian Corridor at Mono Lake, CA. Accepted by *Western Birds* and in revision.

Nur, N. Jones, S.L., and Geupel, G.R. 1999. A statistical guide to data analysis of avian monitoring programs. U.S. Department of the Interior, Fish and Wildlife Service, BTP-R6001-1999, Washington D.C.

Paxton, E., Langridge, S., and Sogge, M.K. 1997. Banding and population genetics of Southwestern Willow Flycatchers in Arizona – 1997 summary report. United States Geologic Survey, Colorado Plateau Field Station, Northern Arizona University, Flagstaff, AZ.

Ralph, C. J., Geupel, G. R., Pyle, P., Martin, T. E., and DeSante, D. F. 1993. Field methods for monitoring landbirds. USDA Forest Service Publication: PSW-GTR 144.

Ralph, C. J., Droege, S., and Sauer, J. R. 1995. Managing and monitoring birds using point counts: Standards and applications (in) monitoring bird populations by point counts. USDA Forest Service General Technical Report: PSW-GTR 149.

Sedgwick, J. A. 2000. Willow Flycatcher (*Empidonax traillii*), in The Birds of North America (A. Poole and F. Gill, eds.), no. 533. Acad. Nat. Sci., Philadelphia.

Sedgwick, J. A. 2001. Geographic variation in the song of Willow Flycatchers: Differentiation between *Empidonax traillii adastus* and *E. t. extimus*. Auk 118(2): 366-379.

Serena, M. 1982. The status and distribution of the Willow Flycatcher (*Empidonax traillii*) in selected portions of the Sierra Nevada, 1982. Wildlife Mgmt. Branch Admin. Rep. 82-85. Calif. Dept. Fish & Game, Sacramento.

Williams, P. L., and Craig, D. 1998. Willow Flycatcher (*Empidonax traillii*), in California Partners In Flight riparian conservation plan.
http://www.prbo.org/CPIF/Riparian/Wifl.html.