

**SOUTHWESTERN WILLOW FLYCATCHER SURVEYS, DEMOGRAPHY,  
AND ECOLOGY ALONG THE LOWER COLORADO RIVER AND  
TRIBUTARIES, 2006**

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**Annual Report**

Submitted to

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Lower Colorado Region  
500 Fir Street  
Boulder City, Nevada 89005

Submitted by

Mary Anne McLeod  
Thomas J. Koronkiewicz  
Bryan T. Brown  
Steven W. Carothers

**SWCA ENVIRONMENTAL CONSULTANTS**  
114 N. San Francisco St., Suite 100  
Flagstaff, Arizona 86001  
(928) 774-5500  
[www.swca.com](http://www.swca.com)

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## EXECUTIVE SUMMARY

The Southwestern Willow Flycatcher (*Empidonax traillii extimus*), listed as federally endangered in 1995, breeds in dense, mesic riparian habitats at scattered, isolated sites in New Mexico, Arizona, southern California, southern Nevada, southern Utah, southwestern Colorado, and, at least historically, extreme northwestern Mexico. Historical breeding records and museum collections indicate a sizable population of Southwestern Willow Flycatchers may have existed along the extreme southern stretches of the lower Colorado River region. Factors contributing to the decline of flycatchers on the breeding grounds include loss, degradation, and/or fragmentation of riparian habitat; invasion of riparian habitat by nonnative plants; and brood parasitism by Brown-headed Cowbirds (*Molothrus ater*).

Willow flycatcher studies have been conducted along the Virgin and lower Colorado Rivers and tributaries annually since 1996, in compliance with requirements set forth by the U.S. Fish and Wildlife Service (USFWS) regarding U.S. Bureau of Reclamation (Reclamation) routine operations and maintenance along the lower Colorado River. Biological Assessments and the resulting Biological Opinions on operations and maintenance were prepared as steps to developing a Multi-Species Conservation Program (MSCP) for long-term endangered species compliance and management in the historical floodplain of the lower Colorado River. The MSCP calls for continued surveys and monitoring of willow flycatchers along the lower Colorado River. The MSCP was signed in April 2005, and implementation of the program began in October 2005.

Reclamation and USFWS completed a separate consultation on the potential effects to threatened and endangered species from implementation of surplus guidelines through 2016 and an annual change in the point of diversion for up to 400,000 acre-feet of California apportionment water for 75 years. The point of diversion, previously located below Parker Dam, will change to a point above Parker Dam, and there will be no return flow to the Colorado River below Parker Dam. These changes in water regulation could cause a drop in floodplain groundwater levels of 1.55 feet (0.47 m) or less and have the potential to modify riparian habitats below Parker Dam. A Biological Opinion for Interim Surplus Criteria, Secretarial Implementation Agreements, and Conservation Measures was issued in January 2001 and required monitoring of 150.5 ha of existing, occupied southwestern willow flycatcher habitat between Parker and Imperial Dams. In 2004, Reclamation biologists initiated studies of the microclimate within potentially affected areas. In 2005–2006, these studies were continued and expanded by SWCA Environmental Consultants (SWCA) to address how the hydrological changes might affect riparian habitats along the Parker to Imperial reach.

From 1997 to 2005, breeding populations of Southwestern Willow Flycatchers were documented along the Virgin and lower Colorado Rivers and tributaries at eight study areas from Mesquite, Nevada, south to the Bill Williams River in Arizona. Willow flycatchers also have been detected during the breeding season at several sites along the Colorado River south of the Bill Williams River to the Mexico border, with over 200 detections recorded in 2003, over 600 in 2004, and over 300 detections in 2005. Behavioral observations and timing of detections strongly suggest this section of the river corridor is a major flyway for migrant willow flycatchers in spring. The degree to which Southwestern Willow Flycatchers use this riparian corridor is unknown and requires further study.

SWCA was contracted by Reclamation to continue surveys, monitoring, and demographic and ecological studies of the Southwestern Willow Flycatcher in suitable and/or historical riparian and wetland habitats throughout the Virgin and lower Colorado River regions in 2006. We completed presence/absence surveys and site descriptions at 101 pre-selected sites in 15 study areas from the Pahranaagat National Wildlife Refuge (NWR), Nevada, south to Yuma, Arizona. We also conducted intensive life history studies at 4 of the 15 areas: Pahranaagat NWR, Mesquite, and Mormon Mesa, Nevada, and Topock Marsh, Arizona. At these life history study areas, we monitored willow flycatcher nests to document depredation and brood parasitism rates and nesting success; color-banded and resighted as many willow flycatchers as possible to determine the breeding status of territorial flycatchers and document movement and recruitment; and measured characteristics of vegetation and microclimate at nest sites and at unused sites to assess factors important in nest-site selection. We implemented trapping and removal of Brown-headed Cowbirds at three of the four life history study areas to evaluate the effects of trapping on nest brood parasitism and flycatcher nest success. Additionally, we conducted nest monitoring, color-banding, and resighting, and measured characteristics of vegetation at the Muddy River Delta, Nevada, and at Grand Canyon and Bill Williams, Arizona; microclimate studies were also conducted at the Muddy River Delta.

We used recorded broadcasts of willow flycatcher song and calls to elicit responses from willow flycatchers at 101 sites, ranging in size from 1 to 68 ha, along the Virgin and lower Colorado Rivers and tributaries between 15 May and 25 July 2006, following a 10-survey protocol. We detected willow flycatchers on at least one occasion at 73 of these sites. Resident, breeding flycatchers were detected at 13 sites within the following seven study areas: Pahranaagat NWR, Mesquite, Mormon Mesa, Muddy River, Grand Canyon, Topock Marsh, and Bill Williams. South of Bill Williams, over 450 willow flycatchers were recorded between 13 May and 21 June; other than a single detection at one site on 28 July, no flycatcher detections were recorded at any sites south of Bill Williams after 21 June. Monitoring results suggest these flycatchers were not resident, breeding individuals and were most likely spring and/or fall migrants.

We used targeted mist-net and passive netting techniques to capture and uniquely color-band adult and fledgling willow flycatchers at the four life history study areas and at all survey sites where resident willow flycatchers were detected. Nestlings were banded between 8 and 10 days of age. We banded each adult and fledged willow flycatcher with a single anodized (colored), numbered U.S. federal aluminum band on one leg and one colored, aluminum band on the other. Nestlings were banded with a single anodized numbered federal band, uniquely identifying it as a returning nestling in the event it returns in a subsequent year. We used binoculars to determine the identity of previously color-banded flycatchers by observing, from a distance, the unique color combinations on their legs.

At the four life history study areas and at Muddy River, Grand Canyon, and Bill Williams (all monitoring sites), we color-banded 28 new adult flycatchers and recaptured 25 individuals banded in previous years, including 12 flycatchers banded as juveniles in previous years. An additional 56 previously banded flycatchers were resighted, of which 42 could be identified to individual; 10 were banded as juveniles in 2003–2005 but could not be recaptured to determine origin and identity, 1 had a federal band on one leg and an injury on the other leg, and 3 did not have their band combinations confirmed. We banded 55 nestlings from 29 nests.

In addition, we captured three previously unbanded fledglings. We banded flycatchers opportunistically at Key Pittman Wildlife Management Area, capturing and color-banding two new adults and recapturing three returning nestlings; three nestlings from one nest were banded.

For the fourth consecutive year, we conducted color-banding studies from 10–30 June along the lower Colorado River downstream of Parker Dam to better determine flycatcher residency, breeding status, and movement patterns in this area. We recorded 44 willow flycatcher detections at 11 sites along the Colorado River from Picacho NW south to Hunter's Hole, and along the Gila River near Yuma. All these detections were recorded from 10 to 21 June. From 10 to 18 June, field personnel captured and color-banded 22 new adults at Gadsden, of which all but 2 were second-year birds. Reconnaissance efforts from 7 to 9 June resulted in the capture and color-banding of seven second-year willow flycatchers at Hunter's Hole and Gadsden. None of the color-banded individuals were detected post-capture, and other than a single detection at one site on 28 July, no flycatcher detections were recorded at any sites south of Bill Williams after 21 June, suggesting these individuals were northbound migrants.

At the four life history study areas and at Muddy River, Grand Canyon, and Bill Williams we recorded a total of 85 territories. Of these, 66 (77%) consisted of paired flycatchers and 19 (22%) consisted of unpaired individuals. Twelve breeding males were polygynous; 10 were paired with two females, one was paired with three females, and one was paired with four females.

Of the 80 adult willow flycatchers identified to individual in 2005, 48 (60%) returned in 2006; two (4%) were detected at a different study area from where they were detected in 2005. We detected three within-year, between study area movements in 2006. Two of these were from the Grand Canyon RM 285.3N to Mesquite West and the third was from Mesquite West to Mormon Mesa Virgin River #1.

Of 65 juveniles banded in 2005 that were known to have fledged, 10 (15%) were recaptured and identified in 2006. Of these, three were detected at a different study area from where originally banded, and seven were detected at the same study area. Seven individuals originally banded as nestlings in 2004 and one banded in 2003 were also recaptured, of which six returned to a different study area than where originally banded. The median dispersal distance for all returning juvenile flycatchers exhibiting between-year movements in 2006 was 38 km.

We documented a total of 82 willow flycatcher nesting attempts at the four life history study areas, Muddy River, Grand Canyon and Bill Williams, 77 of which contained eggs and were used in calculating nest success and productivity. Thirty-three (43%) nests were successful and fledged young; 41 (53%) failed; and three (4%) were of undetermined fate. Mayfield survival probability at the four life history study areas, Muddy River, Grand Canyon and Bill Williams ranged from 0.002 to 0.628 and was 0.457 for all sites combined. Depredation was the major cause of nest failure, accounting for 48% of all failed nests and 54% of nests that failed after flycatcher eggs were laid.

Eleven of 71 nests (15%) with flycatcher eggs and known contents were brood parasitized by Brown-headed Cowbirds. Brood parasitism at all study areas ranged from 0 to 31% and was highest at Topock Marsh. We observed the fourth consecutive year of no brood parasitism at

Pahrnagat. Nests that contained flycatcher eggs and were brood parasitized were not less likely to fledge flycatcher young than nests that were not parasitized.

For the fourth consecutive year, we used a modification of the Australian crow trap to capture and remove Brown-headed Cowbirds at three of the four life history study areas. Because traps could not be deployed close enough to the flycatcher breeding habitat at Mormon Mesa, trapping there was discontinued. We experimented with slots of two different widths to determine if slight variations in slot size had any effect on capture rates of cowbirds or non-target species.

We captured and removed 70, 125, and 323 Brown-headed Cowbirds at Pahrnagat, Mesquite, and Topock, respectively. We found that cowbird traps with wider slots captured significantly more cowbirds per trap-day than those with narrower slots. The escape rate of captured cowbirds did not differ significantly between the wide and narrow slots. Data also showed a trend toward traps with wider slots capturing more non-target individuals, and these tended to be larger species.

A comparison of the proportion of flycatcher nests parasitized during the pretrapping (1997–2002) and trapping (2003–2006) periods showed a statistical difference only at Pahrnagat, where we documented the fourth consecutive year of no brood parasitism. At Mesquite and Topock, brood parasitism continues to remain high, with 23.8 and 31.2% recorded in 2006, respectively.

At the four life history study areas, Muddy River, Grand Canyon, and Bill Williams, we gathered data on vegetation and habitat characteristics at 72 nest plots, 66 non-use plots, and 46 within-territory plots. To obtain an overall description of entire habitat blocks at each life history study area, we gathered data at an additional 52 randomly selected plots. The life history study areas vary in vegetation age, structure, and species composition. The habitat block at Pahrnagat consists of mature, native, large-diameter trees with little shrub and sapling understory. The habitat blocks at Mesquite, Mormon Mesa, and Topock are composed primarily of very dense stands of both mixed-native (Mesquite and Mormon Mesa) and exotic (Topock) woody vegetation.

We found willow flycatchers nesting in a diverse array of riparian habitats. Willow flycatcher nest heights ranged from 1.0 to 15.0 m (mean = 3.0 m, SE = 0.2). Flycatchers placed 61% of all nests in tamarisk (*Tamarix* sp.), 10% in coyote willow (*Salix exigua*), 24% in Goodding willow (*Salix gooddingii*), 1% in Fremont cottonwood (*Populus fremontii*), 1% in mesquite (*Prosopis pubescens*), and 3% in snags. Differences in nest-site characteristics between study areas were reflective of the differences in overall habitat characteristics of the sites. Nest sites consistently differed from non-use sites in several variables. Nest sites had significantly greater canopy heights than non-use sites at Mesquite, Mormon Mesa, and Muddy River. Canopy closure at nest sites were higher than at non-use sites at four study areas (Mesquite, Mormon Mesa, Muddy River, Topock), though differences were not statistically significant. At all study areas, vertical foliage density was greatest at and immediately above mean nest height, and there was a strong trend for nest sites to be closer to water or saturated soil than non-use sites for the entire season. Breeding riparian birds in the desert Southwest are exposed to extreme environmental conditions, and dense vegetation at the nest may be needed to provide a more suitable microclimate for raising offspring.

We collected microclimate data simultaneously at nest, within-territory, and non-use sites at the four life history study areas and Muddy River between May and August 2006. Similar to findings from 2003, 2004, and 2005, nests in 2006, on average, were located in areas that exhibited greater soil moisture and higher relative humidity. In contrast to the findings of previous study years, however, temperature variables in 2006, on average, were not significantly different between nest and non-nest sites after adjusting for other explanatory variables. Nevertheless, temperature was significantly different between nest and non-nest sites at some study areas in 2006. Other sources of covariance and other alternative explanations will be evaluated in the forthcoming five-year final summary report for the purpose of determining the relationship(s) between yearly findings and meaningful, longer-term microclimatic patterns.

In 2005, we selected 11 sites between Parker and Imperial Dams for inclusion in the habitat monitoring study addressing how changes in water transfer actions might affect riparian habitat. We also selected two control sites above Parker Dam and two below Imperial Dam. At each site we installed 3–5 temperature/humidity data loggers and one groundwater observation well (piezometer). All logger and piezometer locations selected in 2005 were retained in 2006, and loggers have been collecting data since installation. Soil moisture measurements were collected at each data logger location during each of approximately 10 flycatcher surveys between 15 May and 25 July. Vegetation measurements were also collected at each data logger location after surveys were completed.

Daily, weekly, and seasonal cycles in groundwater levels were apparent. Water levels drop during afternoon hours when evapotranspiration is high and on the weekends when water releases from Parker Dam decline. The seasonal cycle in groundwater levels mirrors the seasonal fluctuation in river flow.

Analyses of groundwater data indicate a strong correlation between piezometer water levels and releases from Parker Dam. Data did not show strong correlations between piezometer water level and either soil moisture or absolute humidity within the habitat monitoring sites. Most microclimatic variables at the combined habitat monitoring sites differed significantly from those at Topock Marsh. Topock was cooler, and exhibited higher diurnal/nocturnal relative humidity and diurnal/nocturnal vapor pressure than habitat monitoring sites. In 2006, the habitat monitoring sites had a higher diurnal temperature than that at any of the flycatcher breeding sites where we collected microclimate data.

Comparisons of microclimate characteristics between 2005 and 2006 at the habitat monitoring sites indicated generally hotter and drier conditions in 2006. However, these differences could be caused by interannual variation in regional climatic conditions. Additional analyses will examine differences at the test sites compared to the control sites to determine if any of the interannual differences in microclimate conditions could be related to changes in river operations.

We noted between-year differences at the habitat monitoring sites for distance to water, tree counts, and vertical foliage densities within the first two meters of the ground. There was no evidence that these differences occurred exclusively at control sites or at test sites; rather, the differences occurred across all sites. Ground cover did not differ between years at test locations but increased at control plots. This may represent an actual increase in the amount of woody

ground cover or may be a spurious result of observer variation. Additional years of vegetation measurements will help clarify these trends.

## **PAHRANAGAT NORTH**

Area: 4.5 ha

Elevation: 1,026 m

Pahranagat North is a stand of large-diameter Goodding willow (*Salix gooddingii*) at the inflow of Upper Pahranagat Lake. Fremont cottonwood (*Populus fremontii*) lines the northern, upland edge of the site and extends in narrow stringers around the edge of the lake. Canopy height within the patch is 15–18 m, and canopy closure is >90%. The majority of the site is inundated annually, with up to 1 m of water present in mid-May and becoming progressively drier through the survey season. In mid-May this year, 75% of the site had standing water, with less than 10% of the site inundated by late July. Water levels in early spring in Upper Pahranagat Lake were higher in 2006 than in previous years of this study (M. Maxwell, pers. comm.).

We located 23 resident, breeding willow flycatchers at Pahranagat North. We detected three additional unpaired males and two additional flycatchers that were likely migrants. Details of occupancy, pairing, color-banding, and breeding are presented in Chapters 3 and 4. Areas of Pahranagat North not known to be occupied by willow flycatchers were surveyed seven times throughout the breeding season, totaling 7.3 observer-hours. The site lies immediately adjacent to a cattle pasture, but livestock have access only to the cottonwood stringer on the northwest corner of the lake. No Brown-headed Cowbirds were detected during surveys.

## **PAHRANAGAT WEST**

Area: 0.6 ha

Elevation: 1,026 m

This native site consists of a stringer of Fremont cottonwood 20 m in height on the west edge of Upper Pahranagat Lake. A few Goodding willow 2–4 m in height are also present, and the edge of the lake is vegetated with bulrush (*Schoenoplectus californicus*). The upland edge of the site was dry, while the lake edge had standing water throughout the survey season.

We did not detect any flycatchers at this site. We surveyed the site six times throughout the breeding season, totaling 1.3 observer-hours. No cowbirds or sign of livestock use were detected.

## **PAHRANAGAT MAPS**

Area: 2.7 ha

Elevation: 1,026 m

Pahranagat MAPS is a mixed native stringer consisting predominantly of Fremont cottonwood on the west edge of Upper Pahranagat Lake. Canopy height is 15–20 m, and canopy closure is approximately 50%. Tamarisk (*Tamarix* spp.) and Russian olive (*Elaeagnus angustifolia*) form a very sparse understory, and cattail (*Typha* sp.) and bulrush line the east edge of the tree line. Portions of the site held standing water and saturated soils throughout the survey season.



We detected one unpaired male at the site. Details of banding status and residency are presented in Chapter 3. We surveyed the site five times throughout the breeding season, totaling 3.9 observer-hours. No cowbirds or sign of livestock use were detected.

#### **PAHRANAGAT SOUTH**

Area: 2.5 ha

Elevation: 1,023 m

Pahranagat South consists of a relatively small stringer of Goodding willow, coyote willow (*Salix exigua*), and Fremont cottonwood lining a human-made channel that carries the outflow from Upper Pahranagat Lake. The cottonwoods reach approximately 20 m in height, while the willows are generally less than 10 m. In 2005, we noted that dense coyote willow was increasing on the west side of the patch; this area of willow had very sparse canopy in 2006. The site is bordered to the west by an open marsh and to the east by upland scrub. Tamarisk and Russian olive form a sparse understory. Overall canopy closure at this site is approximately 50%.

We detected six resident, breeding willow flycatchers at Pahranagat South and an additional unpaired male. Details of occupancy, color-banding, and breeding are presented in Chapters 3 and 4. Areas of Pahranagat South not known to be occupied by willow flycatchers were surveyed seven times throughout the breeding season, totaling 1.6 observer-hours. No cowbirds or sign of livestock use were detected.

#### **PAHRANAGAT SALT CEDAR**

Area: 3.1 ha

Elevation: 975 m

This site consists of dense clumps of tamarisk 3–4 m in height interspersed with open areas at the south end of Lower Pahranagat Lake. Canopy closure at the site is approximately 50%. The site is bordered to the north by the lake and to the south by upland desert. We investigated this site in 2003 and 2004 but did not survey it those years because it was completely dry. The site was surveyed in 2005, with the site containing standing water until July. Only 5% of the site was inundated in May 2006, and the site completely dried out by mid-June. We surveyed the site in 2006 at the request of the refuge manager in preparation for tamarisk removal at the site.

We did not detect any flycatchers at this site. We surveyed the site six times, totaling 3.9 observer-hours. Cowbirds were detected on two visits, and signs of cattle were noted.

#### ***LITTLEFIELD, ARIZONA***

From 2003 to 2005, we surveyed two adjacent sites at Littlefield; one at the confluence of the Virgin River with Beaver Dam Wash just upstream of the I-15 overpass (Littlefield North) and the other just downstream of the I-15 overpass (Littlefield South). No detections were recorded in 2003, and flycatcher breeding was documented at North in 2004. During the winter of 2004–2005, both sites were completely scoured by floods that removed most of the understory vegetation. Two males were detected at North on a single occasion in 2005; one of these males was subsequently detected breeding in Mesquite West. Surveys at Littlefield South were

Table 3.1. Summary of Willow Flycatchers Detected at Monitored Sites during the 2006 Breeding Season\*

Study Area	Site	Adults										Nestlings Banded (# Nests)	Fledglings Captured	% of All Adults Banded	
		Total Adults Detected		Recaptured		Resighted		Color combination confirmed		Banded (color combinations unconfirmed)	Band Status Undetermined				Unbanded
		New Captured	Not including returning Nestlings	Returning Nestlings	Individual identified	Individual not identified	Individual not identified								
Pahrnanagat	North	28	4	8	3	3	11	0	2	0	0	18(7)	3 <sup>1</sup>	93	
	MAPS	1	0	0	0	0	0	0	0	0	0	0	0	100	
	South	7	0	0	2	2	4	0	0	0	0	0	0	86	
	Study Area Total	36	4	8	5	5	16	0	2	0	0	18(7)	3	92	
	East	2	0	0	0	0	0	0	0	0	0	0	0	0	
Mesquite	West	25	3	2 <sup>3</sup>	2	2	11 <sup>2,4</sup>	1 <sup>5</sup>	4	1	1	24(11)	0	80	
	Bunker Farm	1	0	0	0	0	0	0	0	0	0	0	0	0	
	Study Area Total	28	3	2	2	2	11	1	4	1	1	24(11)	0	71	
	Mormon Mesa South	1	0	0	0	0	0	0	1	0	0	0	0	0	
	Virgin River #1 South	4	1	0	0	0	1 <sup>3</sup>	0	2	0	0	0	0	50	
Mormon Mesa	Virgin River #2	18	4	3	0	0	7	1 <sup>6</sup>	2	0	1	7(3)	0	89	
	Study Area Total	23	5	3	0	0	8	1	5	0	1	7(3)	0	78	
	Oveton WMA	11	2	0	4	4	3	1 <sup>4</sup>	1	0	0	8(4)	0	91	
	RM 274.5N	3	2	0	0	0	0	0	1	0	0	0	0	67	
	Pearce Ferry	1	1	0	0	0	0	0	0	0	0	0	0	100	
Grand Canyon	RM 285.3N	5	3 <sup>4</sup>	0	1 <sup>4</sup>	0	0	0	0	1	0	0	0	80	
	Kowip Corner	1	0	0	0	0	0	0	1	0	0	0	0	0	
	Twin Coves	2	1	0	0	0	0	0	0	1	0	0	0	50	
	Chuckwalla Cove	3	3	0	0	0	0	0	0	0	0	0	0	100	
	Study Area Total	15	10	0	1	1	0	0	2	2	0	8(4)	0	73	
Topock	Pipes #3	3	1	0	0	0	0	0	0	0	0	0	0	33	
	The Willows	2	1	0	0	0	0	0	1	0	0	0	0	50	
	Pig Hole	1	0	0	0	0	0	0	1	0	0	0	0	0	
	In Between	9	0	0	0	0	2	2 <sup>6</sup>	5	0	0	0	0	44	
	800M	2	0	0	0	0	0	1 <sup>6</sup>	1	0	0	0	0	50	
	Pierced Egg	6	1	0	0	0	1	2 <sup>6</sup>	2	0	0	4(2)	0	67	
	Swine Paradise	2	0	0	0	0	0	0	1	1	0	0	0	0	
	250M	1	0	0	0	0	0	0	1	0	0	0	0	0	
	Glory Hole	9	0	1	0	0	1	3 <sup>6</sup>	4	0	0	2(2)	0	56	
	Beal Lake	1	0	0	0	0	0	0	0	1	0	0	0	0	
	Lost Lake	1	0	0	0	0	0	0	0	1	0	0	0	0	
	Study Area Total	37	3	1	0	0	4	8	16	5	0	6(4)	0	43	
	Bill Williams	Site 1	1	0	0	0	0	0	0	0	0	0	0	0	0
Site 11		1	0	0	0	0	0	0	1	0	0	0	0	0	
Site 4		2	0	0	0	0	0	0	1	0	0	0	0	50	
Site 3		5	1	0	0	0	2	0	1	1	0	0	0	60	
Study Area Total		9	1	0	0	0	2	0	3	2	0	0	0	44	
<b>Total</b>	<b>156<sup>7</sup></b>	<b>28</b>	<b>13<sup>7</sup></b>	<b>12</b>	<b>12</b>	<b>42<sup>7</sup></b>	<b>11</b>	<b>33</b>	<b>14</b>	<b>3</b>	<b>55(29)</b>	<b>3</b>	<b>70</b>		

\* Individuals are identified as new captures (previously unbanded), recaptures of previously banded birds, resightings of previously banded birds for which band combinations were confirmed, birds known to be unbanded, birds for which band status could not be determined, and resighting of previously banded birds for which band combinations were undetermined. Included are total numbers of adults detected and percent of all adults banded. For breeding and/or residency status of adults see Tables 3.2-3.15.

<sup>1</sup> All three fledglings previously unbanded.

<sup>2</sup> One individual moved from Mesquite to Mormon Mesa.

<sup>3</sup> One individual moved from Mesquite to Mormon Mesa.

<sup>4</sup> One individual banded in Grand Canyon; then moved to Mesquite.

<sup>5</sup> Bird had silver federal band only and had a visible injury on the unbanded left leg; a male with silver federal band number 2390-92434 and a visible injury on the unbanded left leg was captured at Mesquite in 2005, and this is likely the same individual.

<sup>6</sup> Returning nestlings.

<sup>7</sup> The individuals that moved between sites are tallied only once in the total.