# Lower Colorado River Multi-Species Conservation Program

*Balancing Resource Use and Conservation*

# Southwestern Willow Flycatcher Surveys, Demography, and Ecology Along the Lower Colorado River and Tributaries

## 2016 Annual Report

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

June 2017

# Lower Colorado River Multi-Species Conservation Program Steering Committee Members

### Federal Participant Group

Bureau of Reclamation
U.S. Fish and Wildlife Service
National Park Service
Bureau of Land Management
Bureau of Indian Affairs
Western Area Power Administration

### Arizona Participant Group

Arizona Department of Water Resources
Arizona Electric Power Cooperative, Inc.
Arizona Game and Fish Department
Arizona Power Authority
Central Arizona Water Conservation District
Cibola Valley Irrigation and Drainage District
City of Bullhead City
City of Lake Havasu City
City of Mesa
City of Somerton
City of Yuma
Electrical District No. 3, Pinal County, Arizona
Golden Shores Water Conservation District
Mohave County Water Authority
Mohave Valley Irrigation and Drainage District
Mohave Water Conservation District
North Gila Valley Irrigation and Drainage District
Town of Fredonia
Town of Thatcher
Town of Wickenburg
Salt River Project Agricultural Improvement and Power District
Unit "B" Irrigation and Drainage District
Wellton-Mohawk Irrigation and Drainage District
Yuma County Water Users' Association
Yuma Irrigation District
Yuma Mesa Irrigation and Drainage District

### Other Interested Parties Participant Group

QuadState Local Governments Authority
Desert Wildlife Unlimited

### California Participant Group

California Department of Fish and Wildlife
City of Needles
Coachella Valley Water District
Colorado River Board of California
Bard Water District
Imperial Irrigation District
Los Angeles Department of Water and Power
Palo Verde Irrigation District
San Diego County Water Authority
Southern California Edison Company
Southern California Public Power Authority
The Metropolitan Water District of Southern California

### Nevada Participant Group

Colorado River Commission of Nevada
Nevada Department of Wildlife
Southern Nevada Water Authority
Colorado River Commission Power Users
Basic Water Company

### Native American Participant Group

Hualapai Tribe
Colorado River Indian Tribes
Chemehuevi Indian Tribe

### Conservation Participant Group

Ducks Unlimited
Lower Colorado River RC&D Area, Inc.
The Nature Conservancy

# Lower Colorado River Multi-Species Conservation Program

## Southwestern Willow Flycatcher Surveys, Demography, and Ecology Along the Lower Colorado River and Tributaries

## 2016 Annual Report

*Prepared by:*

Mary Anne McLeod and Anne Pellegrini
SWCA Environmental Consultants, Flagstaff, Arizona

**Lower Colorado River**
**Multi-Species Conservation Program**
**Bureau of Reclamation**
**Lower Colorado Region**
**Boulder City, Nevada**
**http://www.lcrmscp.gov**

**June 2017**

McLeod, M.A. and A. Pellegrini. 2017. Southwestern Willow Flycatcher Surveys, Demography, and Ecology Along the Lower Colorado River and Tributaries, 2016 Annual Report. Submitted to the Lower Colorado River Multi-Species Conservation Program, Bureau of Reclamation, Boulder City, Nevada, by SWCA Environmental Consultants, Flagstaff, Arizona, under contract No. R13PD30017.

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ALAM | Alamo Lake study area |
| BA | biological assessment |
| BO | biological opinion |
| BIWI | Bill Williams study area |
| cfs | cubic feet per second |
| CIBO | Cibola study area |
| cm | centimeter(s) |
| cottonwood-willow | Fremont cottonwood(s) (*Populus fremontii*)-Goodding's willow(s) (*Salix gooddingii*) |
| cowbird | brown-headed cowbird(s) (*Molothrus ater*) |
| CVCA | Cibola Valley Conservation Area |
| FR | Federal Register |
| GPS | Global Positioning System |
| ha | hectare(s) |
| HCP | Habitat Conservation Plan |
| KEPI | Key Pittman study area |
| km | kilometer(s) |
| LCR | lower Colorado River |
| LCR MSCP | Lower Colorado River Multi-Species Conservation Program |
| m | meter(s) |
| MESQ | Mesquite study area |
| mm | millimeter(s) |
| MOME | Mormon Mesa study area |
| MSP | Mayfield survival probability |
| MUDD | Muddy River study area |
| MVWA | Meadow Valley Wash study area |
| NDOW | Nevada Department of Wildlife |
| PAHR | Pahranagat study area |
| PVER | Palo Verde Ecological Reserve |
| Reclamation | Bureau of Reclamation |
| RH | relative humidity |
| RIRA | River Ranch study area |
| SE | standard error |
| sp. | single unidentified species |
| spp. | unidentified multiple species in a genus |
| SWCA | SWCA Environmental Consultants |
| T | temperature |
| TES | threatened, endangered, and sensitive |
| TOPO | Topock Marsh study area |
| USFWS | U.S. Fish and Wildlife Service |
| VP | vapor pressure |
| WMSP | Warm Springs study area |
| YUMA | Yuma study area |

## Symbols

| | |
|---|---|
| ≈ | approximately (nearly equal to) |
| x | by |
| °C | degrees Celsius |
| = | equal to |
| > | greater than |
| ≥ | greater than or equal to |
| < | less than |
| ≤ | less than or equal to |
| # | number |
| % | percent |
| – | to |
| ^ | to the power of |

# CONTENTS

Page

**Executive Summary ..... ES-1**

**Chapter 1 – Introduction ..... 1**
Species Introduction ..... 1
Bureau of Reclamation Project History ..... 3
Related Studies ..... 5
Purpose and Description of Studies ..... 6

**Chapter 2 – Presence/Absence Surveys and Site Descriptions ..... 9**
Introduction ..... 9
Methods ..... 10
Site Selection ..... 10
Site Names ..... 12
Habitat Suitability Criteria ..... 12
Additional Site Evaluation ..... 12
Broadcast Surveys ..... 13
Covered Species ..... 14
Incidental, Passive Detections ..... 14
Yellow-billed Cuckoo Broadcast Surveys ..... 14
Site Descriptions ..... 14
Results ..... 15
Flycatcher Broadcast Surveys ..... 15
Key Pittman, Nevada ..... 23
River Ranch, Nevada ..... 25
Pahranagat, Nevada ..... 29
Meadow Valley Wash, Nevada ..... 34
Muddy River, Nevada ..... 36
Warm Springs, Nevada ..... 40
Topock Marsh, Arizona ..... 42
Bill Williams, Arizona ..... 48
Alamo Lake, Arizona ..... 60
Palo Verde Ecological Reserve, California ..... 76
Cibola, Arizona and California ..... 85
Yuma, Arizona ..... 89
Yellow-billed Cuckoo Broadcast Surveys ..... 92
River Ranch, Nevada ..... 92
Pahranagat, Nevada ..... 92
Warm Springs, Nevada ..... 93
Discussion ..... 93

Page

**Chapter 3 – Color Banding and Resighting ..... 101**
Introduction ..... 101
Methods ..... 101
Color Banding ..... 101
Resighting ..... 102
Data Analyses ..... 103
Movement ..... 103
Results ..... 104
All Study Areas ..... 104
Individual Study Areas ..... 113
Key Pittman, Nevada ..... 113
River Ranch, Nevada ..... 113
Pahranagat, Nevada ..... 113
Meadow Valley Wash, Nevada ..... 129
Muddy River, Nevada ..... 129
Warm Springs, Nevada ..... 129
Topock Marsh, Arizona ..... 129
Bill Williams, Arizona ..... 130
Alamo Lake, Arizona ..... 130
Palo Verde Ecological Reserve, California ..... 131
Non-Monitoring Sites ..... 131
St. George, Utah ..... 131
Mesquite, Nevada ..... 131
Mormon Mesa, Nevada ..... 131
Adult Between-Year Return and Dispersal ..... 133
Juvenile Between-Year Return and Dispersal ..... 133
Within-Year, Between-Study Area Movements ..... 135
Discussion ..... 135
Color-Banding Effort ..... 135
Adult and Juvenile Between-Year Dispersal ..... 136
Within-Year, Between-Study-Area Movement ..... 138
Adult and Juvenile Survivorship ..... 139

**Chapter 4 – Nest Monitoring ..... 141**
Introduction ..... 141
Methods ..... 141
Results ..... 144
Nest Monitoring ..... 144
Nest Failure ..... 147
Brood Parasitism ..... 147
Cowbird Egg Addling and Replacement ..... 148
Mayfield Nest Success and Nest Productivity ..... 149
Discussion ..... 149

Page

Number of Breeding Flycatchers .....149
Nest Success.....152
Nest Failure .....154
Brood Parasitism .....155
Cowbird Egg Addling and Replacement .....156

**Chapter 5 – Nest Site Characteristics ..... 159**
Introduction..... 159
Methods..... 159
Surface Hydrology .....159
Vegetation .....160
Temperature and Humidity .....161
Statistical Analyses .....161
Results..... 162
Surface Hydrology .....162
Vegetation .....166
Temperature and Humidity .....166
Discussion ..... 170
Surface Hydrology .....170
Vegetation .....178
Temperature and Humidity .....178

**Chapter 6 – Discussion Summary ..... 181**
Broadcast Surveys and Site Assessment..... 181
Nest Predators ..... 182
Cowbird Control ..... 182

Literature Cited ..... 183

Acknowledgments..... 193

## Tables


Table Page

2-1 Adult willow flycatchers detected during survey and monitoring activities, 2016 ....17

2-2 Summary of hydrologic conditions by survey site, 2016 ....21

3-1 Summary of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season....105

3-2 Summary of resident adult southwestern willow flycatchers detected during the 2016 breeding season ....109

3-3 Details of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season....114

3-4 Banded southwestern willow flycatchers detected at non-monitoring sites, 2016 ....132

3-5 Resident adult southwestern willow flycatcher annual return from 2015 to 2016 ....133

3-6 Adult southwestern willow flycatcher between-year movements for all individuals identified in a previous year and recaptured or resighted at a different study area in 2016 ....134

3-7 Juvenile southwestern willow flycatchers banded as hatch year birds in a prior year and identified as adults for the first time in 2016 ....134

3-8 Adult flycatcher within-year movements for all individuals identified at two different study areas in 2016....135

4-1 Summary of southwestern willow flycatcher nest monitoring results at all study areas, 2016 ....145

4-2 Southwestern willow flycatcher percent apparent nest success recorded at all study areas, 1996–2016....146

4-3 Summary of causes of southwestern willow flycatcher nest failure at all study areas, 2016 ....147

4-4 Fates of southwestern willow flycatcher nests parasitized by brown-headed cowbirds at all study areas, 2016 ....148

4-5 Daily survival rates and MSPs for southwestern willow flycatcher nest stages at all study areas, 2016....150

4-6 Southwestern willow flycatcher nest productivity (young fledged per nest) and fecundity (young fledged per female) at all study areas, 2016* ....151

5-1 Tally of nests by nest substrate and percentage of tamarisk at southwestern willow flycatcher nests by vegetation type in all study areas, 2016....168

## Figures


Figure Page

1-1 Breeding range distribution of the subspecies of the willow flycatcher (*Empidonax traillii*). ....1

2-1 Locations of southwestern willow flycatcher study areas along the LCR and its tributaries, 2016. ....11

2-2 Overview of West Side in the River Ranch (RIRA) study area, July 2012. ....28

2-3 Overview of West Side in the River Ranch (RIRA) study area, May 2015. ....28

2-4 Gage height (feet) at the Cross Dike gage on the North Marsh unit of Upper Pahranagat Lake at the Pahranagat National Wildlife Refuge, 2013–16. ....30

2-5 Elevation (feet above mean sea level) of Upper Pahranagat Lake at the Pahranagat National Wildlife Refuge, 2013–16. ....30

2-6 Average daily discharge (cfs) recorded at Meadow Valley Wash at Caliente, Nevada (U.S. Geological Survey Station #09418500), May 1–August 15, 2016. ....35

2-7 Average daily discharge (cfs) recorded at the Muddy River at Lewis Avenue in Overton, Nevada (U.S. Geological Survey Station #09419507), May 1–August 15, 2016. ....37

2-8 Daily marsh elevation (meters above sea level) measured at the South Dike at Topock Marsh during the flycatcher breeding season, May – August 2015–2016. ....42

2-9 Lake Havasu average daily elevation (feet above sea level), May 1–August 15, 2016. ....49

2-10 Alamo Lake daily elevation (feet above mean sea level), 2010–16. ....61

2-11 Average daily discharge (cfs) recorded at the Santa Maria River near Bagdad, Arizona (U.S. Geological Survey" Station #09424900), May 1–August 15, 2016. ....75

2-12 Monthly average streamflow (cfs) recorded at the Bill Williams River near Parker, Arizona (U.S. Geological Survey Station #09426620), 2002–16. ....98

2-13 Alamo Lake elevation (feet above sea level), 1977–2016. ....99

4-1 Artificial brown-headed cowbird eggs used to replace cowbird eggs in easily accessible southwestern willow flycatcher nests at study areas in Arizona. ....144

## **Figures** (continued)

Figure Page


4-2 Number of pairs of southwestern willow flycatchers detected at Key Pittman (KEPI), Pahranagat (PAHR), Muddy River (MUDD), Topock Marsh (TOPO), and Bill Williams (BIWI) during years of intensive nest monitoring. .....151

4-3 Annual apparent nest success and fecundity (number of young produced per adult female) at Key Pittman (KEPI) and Pahranagat (PAHR), 2003–16. .....153

4-4 Annual percent apparent nest success at Muddy River (MUDD), Topock Marsh (TOPO), Bill Williams (BIWI), and Alamo Lake (ALAM), 2003–16. .....153

4-5 Annual fecundity at the Muddy River (MUDD), Topock Marsh (TOPO), Bill Williams (BIWI), and Alamo Lake (ALAM) study areas, 2003–16. .....154

5-1 Soil moisture characteristics at southwestern willow flycatcher nests at Key Pittman (n = 19) and River Ranch (n = 3), 2016. .....163

5-2 Soil moisture characteristics at southwestern willow flycatcher nests at Pahranagat (n = 19) and Meadow Valley Wash (n = 4), 2016. .....164

5-3 Soil moisture characteristics at southwestern willow flycatcher nests at Muddy River (n = 2), 2016. .....165

5-4 Soil moisture characteristics at southwestern willow flycatcher nests at Topock Marsh (n = 6) and Bill Williams (n = 8), 2016. .....167

5-5 Median maximum daily temperature by vegetation type at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016. .....171

5-6 Mean maximum daily temperature and 95% confidence intervals over 2-week periods by study area at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016. .....171

5-7 Median minimum daily temperature by vegetation type at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016. .....172

5-8 Mean minimum daily temperature and 95% confidence intervals over 2-week periods by study area at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016. .....172

5-9 Median daily temperature range by vegetation type at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016. .....173

## **Figures** (continued)

Figure Page


5-10 Mean daily temperature range and 95% confidence intervals over 2-week periods by study area at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016. .....173

5-11 Median diurnal vapor pressure by vegetation type at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016. .....174

5-12 Mean diurnal vapor pressure and 95% confidence intervals over 2-week periods by study area at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016. .....174

5-13 Median nocturnal vapor pressure by vegetation type at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016. .....175

5-14 Mean nocturnal vapor pressure and 95% confidence intervals over 2-week periods by study area at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016. .....175

5-15 Alamo Lake level (feet above mean sea level), 1990–2016.....177

5-16 Mean maximum daily temperatures and 95% confidence intervals at southwestern willow flycatcher nests at Bill Williams (BIWI) and Alamo Lake (ALAM), 2014–16.....179

5-17 Mean diurnal vapor pressures and 95% confidence intervals at southwestern willow flycatcher nests at Bill Williams (BIWI) and Alamo Lake (ALAM), 2014–16. .....179

## Attachments

Attachment


1 Study Area and Survey Site Organization Within Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Areas and Sites

2 Field Data Forms

3 Orthophotos Showing Study Sites

4 Southwestern Willow Flycatcher (*Empidonax traillii extimus*) Survey Dates for Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Areas and Sites, 2016

5 Southwestern Willow Flycatcher Survey (*Empidonax traillii extimus*) Results for Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Areas and Sites, 2016

6 Detections of Covered Species Within Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Areas and Sites, 2016

7 Orthophotos Showing Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) Survey Sites

8 All Willow Flycatchers (*Extimus traillii)* Color Banded and/or Resighted, 2012–2016

9 Temperature and Humidity at Southwestern Willow Flycatcher Nests (*Empidonax traillii extimus*) at the Topock Marsh, Bill Williams, and Alamo Lake Study Areas, 2016

10 Contributing Personnel

# EXECUTIVE SUMMARY

The southwestern willow flycatcher (*Empidonax traillii extimus*),[1] 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 and western Texas (Unitt 1987). Historical breeding records and museum collections indicate a sizable population of flycatchers may have existed along the extreme southern stretches of the lower Colorado River (LCR) region. Factors contributing to the decline of flycatchers on their breeding grounds include loss, degradation, and/or fragmentation of riparian habitat; invasion of riparian habitat by non-native plants; and brood parasitism by brown-headed cowbirds (*Molothrus ater*) (hereafter cowbirds).

Flycatcher studies have been conducted along the LCR and its tributaries annually since 1996 in compliance with requirements set forth by the U.S. Fish and Wildlife Service regarding Bureau of Reclamation (Reclamation) routine operations and maintenance along the LCR. Biological assessments and the resulting biological opinions on operations and maintenance were prepared as steps in developing a Lower Colorado River Multi-Species Conservation Program (LCR MSCP) for long-term endangered species compliance and management in the historical flood plain of the LCR. The documents for the LCR MSCP were signed in April 2005, and implementation of the program began in October 2005. The LCR MSCP calls for continued surveys and monitoring of flycatchers along the LCR. SWCA Environmental Consultants (SWCA) was contracted by Reclamation to continue surveys, monitoring, and demographic and ecological studies of flycatchers in suitable and/or historical riparian and wetland habitats throughout the LCR region and along its tributaries in 2016. Studies in 2016 were originally intended to include the Virgin River, but per Reclamation's direction, no surveys were conducted in any study area along the Virgin River in 2016, and effort that would have been spent on the Virgin River was redirected to Alamo Lake and Meadow Valley Wash and to supplement effort in the Pahranagat Valley.

SWCA was also retained by the Nevada Department of Wildlife in 2016 to conduct flycatcher surveys, site descriptions, nest monitoring, and color banding in the Pahranagat Valley at the Key Pittman (KEPI) study area in the Key Pittman Wildlife Management Area, the River Ranch (RIRA) study area, and the Pahranagat (PAHR) study area in the Pahranagat National Wildlife Refuge; and by the Southern Nevada Water Authority to conduct similar work at the

[1] Throughout this document, when residency status for an individual is undetermined and the subspecies is unknown, the term "willow flycatcher" is used to refer to *E. traillii*. The term "flycatcher" refers to *E. t. extimus*.

Warm Springs (WMSP) study area in the Warm Springs Natural Area. Broadcast surveys were also completed for yellow-billed cuckoos (*Coccyzus americanus occidentalis*) at RIRA, PAHR, and WMSP.

Approximately 100 sites are included in the Reclamation study of flycatchers along the Virgin and lower Colorado Rivers, but starting in 2013, a portion of the sites were surveyed triennially rather than annually. Sites on the triennial schedule were surveyed in 2015. SWCA searched for nests in all areas occupied in 2016 by territorial flycatchers; monitored flycatcher nests to document nest fate, brood parasitism, and causes of nest failure; and color banded and resighted as many willow flycatchers as possible to determine the breeding status of territorial flycatchers and to document movement and recruitment.

Recorded broadcasts of flycatcher song and calls were used to elicit willow flycatcher responses at 78 sites, ranging in size from < 1 to 41 hectares, along the LCR and its tributaries from Caliente, Nevada, south to Yuma, Arizona, between May 14 and July 20, 2016. Willow flycatchers were detected on at least one occasion at 55 of the 78 sites. In addition to the 78 surveyed sites, 14 sites were occupied by flycatchers throughout the breeding season and were monitored via territory and nest visits. Two additional sites were not occupied but were not surveyed either because of the proximity to occupied habitat or because of poor habitat quality. Breeding or resident flycatchers were detected at 42 sites within the following study areas: KEPI, RIRA, PAHR, Meadow Valley Wash (MVWA), Muddy River (MUDD), and WMSP, Nevada; Topock Marsh (TOPO), Bill Williams (BIWI), and Alamo Lake (ALAM), Arizona; and Palo Verde Ecological Reserve, California. The detection at Palo Verde Ecological Reserve was the second detection of a territorial (i.e., engaging in lengthy, unsolicited song), resident (i.e., one detected for a week or more) flycatcher south of Parker Dam since SWCA began monitoring along the LCR in 2003. The flycatcher was present in the same location for 9 days in early June, at the edge of one of the cottonwood-willow (*Populus fremontii-Salix gooddingii*) (blocks planted as part of the LCR MSCP. This individual sang spontaneously for lengthy periods of time on the first day it was detected. Over the following week, the bird became less territorial and was no longer singing spontaneously shortly before it departed. An additional 81 willow flycatcher detections were recorded south of Parker Dam between May 21 and June 14. Subsequent surveys and behavioral observations suggest these willow flycatchers were not resident, breeding individuals but were most likely spring migrants.

Broadcast surveys were completed for yellow-billed cuckoos at RIRA, PAHR, and WMSP. No yellow-billed cuckoos were detected during surveys at RIRA. One yellow-billed cuckoo was visually and aurally detected in Pahranagat MAPS during a survey on July 6. In addition, two incidental, passive detections of yellow-billed cuckoos were recorded in Pahranagat North on June 15 and June 27, and an additional incidental, passive detection was recorded in Pahranagat MAPS on August 3. At WMSP, a yellow-billed cuckoo was recorded during surveys in

the same general area on June 22, July 5, and July 19. A second detection was noted on July 19, but it was unclear if the detection was of a second individual.

Targeted mist net and passive netting techniques were used to capture and uniquely color band adult and fledgling flycatchers at all sites where resident flycatchers were detected. Nestlings were banded between 7 and 10 days of age. Each individual was banded with a single, numbered U.S. Federal aluminum band on one leg and one pinstriped, aluminum band on the other. Binoculars were used to determine the identity of previously color banded flycatchers by observing, from a distance, the unique color combinations on their legs. Field personnel also used digital cameras (Canon PowerShot SX50 HS) to take pictures of flycatchers; these photos supplemented any resight data.

A total of 277 adult flycatchers and willow flycatchers were detected in all study areas in 2016. Of the 277 adults, 153 were resident adult flycatchers and 124 were willow flycatchers that were not determined to be residents. By the end of the breeding season, 38% of the 277 adult flycatchers and willow flycatchers and 61% of the resident flycatchers detected in the project area were known to be color banded. Across all study areas, 30 adult willow flycatchers were newly color banded and 16 were recaptured.[2] An additional 50 adults were identified to individual via resighting, and 9 adults were known to be banded but did not have their color combinations confirmed. Of the adults that were identified in 2016, 11 were identified for the first time since they were banded in their hatch year. Eighty-seven adults remained unbanded, and banding status was undetermined (i.e., personnel were unable to determine if these individuals were banded) for 85 adults. Fifty-two nestlings were banded from 24 nests; 40 of these nestlings were confirmed as fledging. Thirty-three unbanded fledglings were resighted from an additional 16 nests; personnel captured and banded 3 of the unbanded fledglings.

In 2015, 88 adult, resident flycatchers were individually identified at study areas that were monitored by SWCA in both 2015 and 2016. Of these 88 flycatchers, 49 (56%) were detected in 2016, with 3 (6%) of the 49 returning flycatchers being initially detected at a different study area than where they were resident in 2015. Of all the adult flycatchers identified in 2016, five were detected at a different study area than where they were last detected in a previous year. The median dispersal distance for all returning adult flycatchers exhibiting between-year movements in 2016 was 12.1 kilometers.

In 2015, 75 nestlings and 1 fledgling were banded at all study areas monitored by SWCA. Five of the nestlings were known or suspected to have died before fledging. Of the 71 remaining juveniles, 11 (15%) were identified in 2016. Of

[2] Capture efforts targeted *E. t. extimus*, but migrant individuals of other subspecies may also have been captured.

these 11 returning juveniles, 5 (45%) dispersed away from their natal study area. The median dispersal distance for all returning juvenile flycatchers in 2016 was 1.3 kilometers.

Ninety-seven territories were recorded at all monitored study areas. Of these, 71 (73%) consisted of breeding flycatchers, 2 (2%) consisted of pairs for which no nest could be found, and 24 (25%) consisted of unpaired individuals. Fifteen breeding males were each polygynous with two females, one male was polygynous with three females, and one female bred consecutively with two different males. One unpaired male occupied two different territories.

At all monitored study areas, 101 flycatcher nesting attempts were documented, 91 of which contained flycatcher eggs and were used in calculating nest success and productivity. Thirty-five (39%) nests were successful and fledged young; 54 (59%) failed; and 2 (2%) had an unknown fate. Apparent nest success ranged from 0% at TOPO and MUDD to 57% at BIWI. Depredation was the major cause of nest failure, accounting for 59% (38 of 64) of all failed nests and 70% of nests that failed after flycatcher eggs were laid.

Eight of 76 nests (11%) with flycatcher eggs and known parasitism status were brood parasitized by cowbirds, and 2 flycatcher nests were abandoned with a cowbird egg before flycatcher eggs were laid. Brood parasitism ranged from 0 to 50% and was highest at TOPO. Cowbird eggs were addled via vigorous shaking at all easily accessible flycatcher nests in Nevada, and a cowbird egg was replaced with an artificial egg at one nest in Arizona. Of the two nests where a cowbird egg was addled, one was incubated for over 10 days after the parasitism event, but the cowbird egg did not hatch. Prior to 2016, the hatch rate of cowbird eggs that were incubated for a minimum of 10 days and were not shaken was 67% (36 of 54 eggs) across all years and study areas. In contrast, only 26% (5 of 19 eggs) of the cowbird eggs that were shaken hatched after a minimum of 10 days of incubation, and it was apparent that addling cowbird eggs significantly reduced the cowbird hatch rate. The nest where the cowbird egg was replaced was ultimately deserted, but the female flycatcher continued to incubate the nest for several days after the egg was replaced, and it is unlikely that egg replacement caused nest failure. .

Soil moisture conditions were described up to 4 times during the season at 98 flycatcher nests in KEPI, RIRA, PAHR, MVWA, MUDD, TOPO, BIWI, and ALAM. Descriptions included conditions of soil moisture at the nest (inundated, saturated, damp, or dry), depth of water (if any) at the nest, distance to water from the nest, and the percent of the area within 20 and 50 meters (m) of the nest that contained inundated or saturated soils (hereafter wet soils). Soil moisture conditions were known at the time the nest site was selected by a flycatcher for 79 of the 98 nests. Of the 79 nests, 40 (51%) were built within 5 m of standing water or saturated soil, and an additional 5 nests (6%) were within 30 m of water. All 34 nests that were not within 30 m of water were at ALAM, where the vast

majority of suitable riparian vegetation was much greater than 30 m from water. Flycatchers at ALAM either had to nest at a distance from water or leave the study area entirely to search for nesting sites elsewhere.

Soil moisture conditions at flycatcher breeding sites can vary within as well as between years. Surface hydrology data indicate that soil around nests at KEPI, RIRA, and PAHR experienced a drying trend through the flycatcher breeding season in 2016. Conditions near nests at MVWA, MUDD, TOPO, BIWI, and ALAM did not change through the season.

The species of tree or shrub in which a nest was placed, as well as a visual estimate of the percentage of vegetation volume that consisted of tamarisk (*Tamarix* spp.) within 2 and 5 m of the nest, was recorded at 98 flycatcher nests. Thirty-three percent of the nests in 2016 were built in tamarisk trees, and 50% of nests had tamarisk within 5 m of the nest. No tamarisk foliage was present within 5 m of any nest at RIRA or PAHR or within 5 m of 18 of the 19 nests at KEPI. While the purpose of quantifying the amount of tamarisk in the vicinity of each nest is to determine the potential impact of defoliation due to tamarisk beetles (*Diorhabda* spp.), defoliation around flycatcher nests was noted only at MUDD in 2016. Only two nests were found, and they both failed; it is therefore impossible to determine a threshold percentage of tamarisk foliage at which adverse effects on nest success might occur during a defoliation event. Tamarisk beetles were detected at both BIWI and TOPO in 2016, although no defoliation occurred during the breeding season in the immediate vicinity of flycatcher nests. More extensive defoliation will likely be observed at these study areas in 2017 and may affect breeding flycatchers.

A temperature/humidity data logger was deployed at a subset of flycatcher nests that were confirmed to be in the incubation phase. These loggers recorded data every 30 minutes and remained in place until the end of the breeding season. Temperature and humidity were recorded at 1 nest at TOPO, 6 nests at BIWI, and 30 nests at ALAM. Mean and median maximum daily temperatures at nests at ALAM were generally 3–4 degrees Celsius higher than at nests at BIWI, while minimum temperatures were less variable between study areas, typically being 1–2 degrees Celsius higher at BIWI than at ALAM. Both diurnal and nocturnal vapor pressure were lower at ALAM than at BIWI.

# Chapter 1 – Introduction

## SPECIES INTRODUCTION

The southwestern willow flycatcher (*Empidonax traillii extimus*) is one of four currently recognized subspecies of willow flycatcher (Unitt 1987). It 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 and western Texas (figure 1-1) (Unitt 1987).

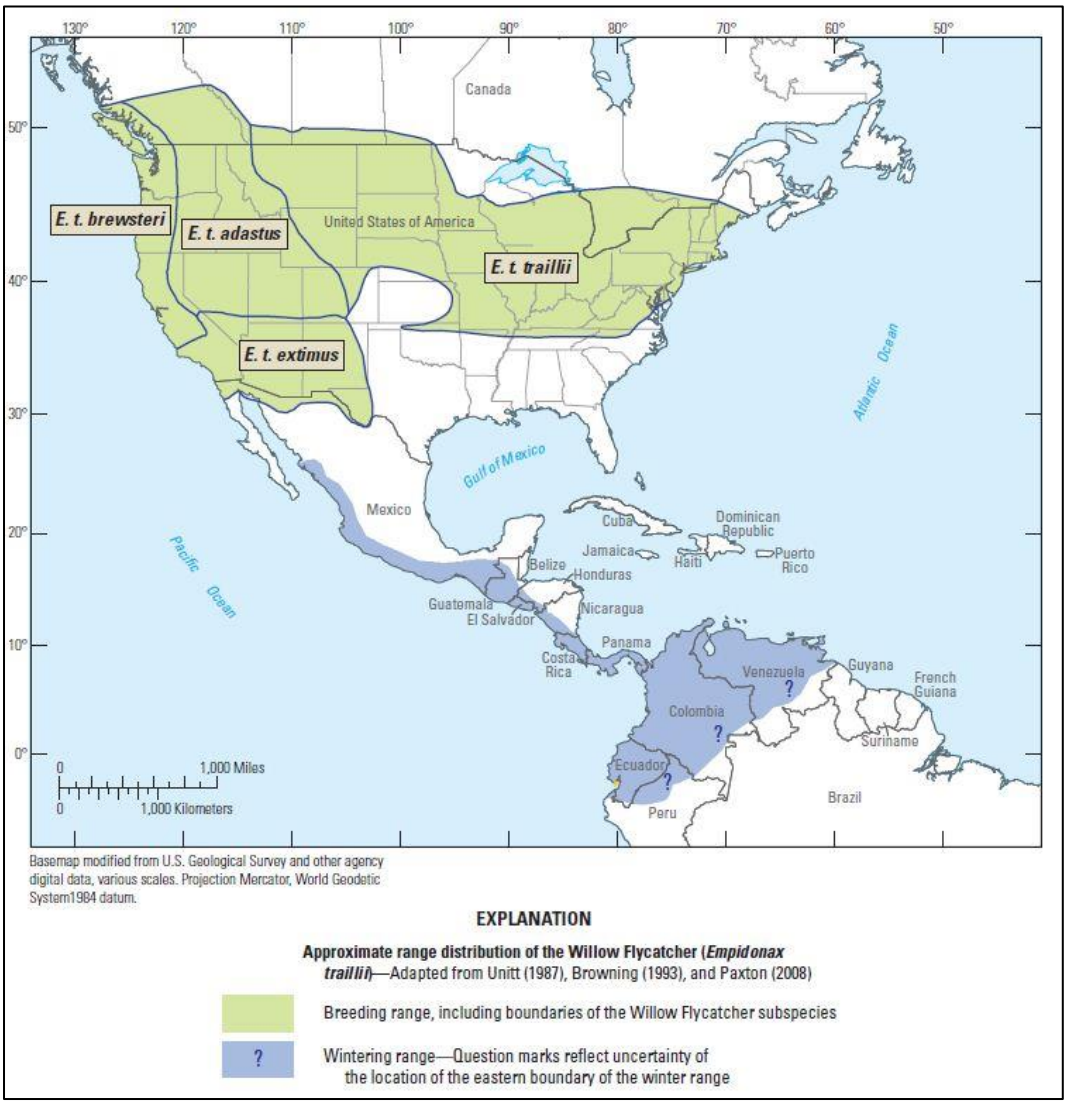



**Figure 1-1.—Breeding range distribution of the subspecies of the willow flycatcher (*Empidonax traillii*).**
From Sogge et al. (2010).

In the Southwest, most flycatcher[1] breeding territories are found within small breeding sites containing five or fewer territories (Durst et al. 2006). One of the last long-distance neotropical migrants to arrive in North America in spring, the flycatcher has a short, approximately 100-day breeding season, with individuals typically arriving in May or June and departing in August (Sogge et al. 2010). All four subspecies of the willow flycatcher spend the non-breeding season in portions of southern Mexico, Central America, and northwestern South America (Howell and Webb 1995; Ridgely and Tudor 1994; Stiles and Skutch 1989; Unitt 1997), with wintering ground habitat similar to their breeding grounds (Lynn et al. 2003). Willow flycatchers have been recorded on their wintering grounds from central Mexico to southern Central America as early as mid-August (Howell and Webb 1995; Stiles and Skutch 1989), and wintering, resident individuals have been recorded in southern Central America as late as the end of May (Koronkiewicz et al. 2006b).

Historical breeding records and museum collections indicate that a sizable population of flycatchers may have existed along the most southerly stretches of the lower Colorado River (LCR) (Unitt 1987). However, no nests have been located along the LCR south of the Bill Williams River, Arizona, in over 65 years (Unitt 1987), though northbound and southbound migrant willow flycatchers use the riparian corridor (Brown et al. 1987; McKernan and Braden 2002; McLeod et al. 2008; McLeod and Pellegrini 2013, 2014, 2015, this document; Phillips et al. 1964). Factors contributing to the decline of flycatchers on their breeding grounds include loss, degradation, and/or fragmentation of riparian habitat; invasion of riparian habitat by non-native plants; and brood parasitism by brown-headed cowbirds (*Molothrus ater*) (hereafter cowbirds) (Marshall and Stoleson 2000; U.S. Fish and Wildlife Service [USFWS] 1995). Because of low population numbers range-wide, identifying and conserving flycatcher breeding sites is thought to be crucial to the recovery of the subspecies (USFWS 2002).

Tamarisk beetles (*Diorhabda* spp.) pose an additional threat to flycatchers. Tamarisk beetles defoliate tamarisk (*Tamarix* spp.) plants during flycatcher breeding season, likely exposing flycatcher nests to adverse microclimate conditions and increased risk of depredation and parasitism. Northern tamarisk beetles (*D. carinulata*) were released in St. George, Utah, in 2006, and widespread defoliation was first observed in St. George in 2008. The area of defoliation on the Virgin River expanded downstream annually, encompassing the entire stretch of the Virgin River to Lake Mead, Nevada, by the end of the breeding season in 2011. Tamarisk beetles continued spreading downstream along the LCR in 2012, and by the end of the 2012 breeding season, they were found as far downstream as the lower end of Lake Mohave (Arizona and California) (T. Dudley 2012, personal communication). By fall 2013,

[1] Throughout this document, when residency status for an individual is undetermined and the subspecies is unknown, the term "willow flycatcher" is used to refer to *E. traillii*. The term "flycatcher" refers to *E. t. extimus*.

tamarisk beetles were detected approximately 11 kilometers (km) south of Lake Mohave at Big Bend State Park, Nevada (B. Bloodworth 2014, personal communication). No substantial southerly movement was recorded in 2014 (T. Dudley 2014, personal communication), but by August 2015, beetles were detected approximately 11 km south of Big Bend (T. Dudley 2015, personal communication). Beetles expanded their range an additional 110 km downstream on the LCR during summer 2016 and were found at Topock Marsh, in Topock Gorge, along the shores of Lake Havasu (Arizona and California), on the Parker Strip, and on the Bill Williams River as far upstream as Kohen Ranch (M.A. McLeod, personal observation; L. Harter 2016, personal communication; S. Ketcham 2016, personal communication). Tamarisk beetles (*D. carinulata* and *D. sublineata*) are also present on the Rio Grande in Texas and New Mexico, and in 2016, beetles arrived at breeding areas that support large numbers of flycatchers at Elephant Butte Reservoir, New Mexico (D. Moore 2016, personal communication).

# Bureau of Reclamation Project History

In 1995, the Bureau of Reclamation (Reclamation); other Federal, State, and Tribal agencies; and environmental and recreational interests agreed to form a partnership to develop and implement the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) for long-term endangered species compliance and management in the historical flood plain of the LCR. As a step in developing the LCR MSCP, Reclamation prepared a biological assessment (BA) in August 1996, evaluating the effects of dam operations and maintenance activities on threatened, endangered, and sensitive (TES) species. These species included the flycatcher, which was listed by the USFWS as endangered in 1995 (60 FR 10694–10715). In response to the BA, the USFWS issued a biological opinion (BO) in April 1997, which outlined several terms and conditions Reclamation must implement in order not to jeopardize these species. Among these terms and conditions was the requirement to survey and monitor occupied and potential habitat for flycatchers along the LCR for a period of 5 years. The studies were intended to determine the number of flycatcher territories, status of breeding pairs, nest success, the biotic and abiotic characteristics of occupied flycatcher sites, and cowbird brood parasitism rates. In 2002, Reclamation reinitiated consultation with the USFWS on the effects of continued dam operations and maintenance of TES species along the LCR. The USFWS responded with a BO in April 2002, requiring continued flycatcher studies along the LCR through April 2005. The BO also required implementation of a study to evaluate the effectiveness of cowbird trapping for conservation of the flycatcher. Trapping was completed at several study areas in 2003–07 (McLeod et al. 2008), and post-trapping monitoring continued through 2012 (McLeod and Pellegrini 2013).

Reclamation and the 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 water for 75 years. A Biological Opinion for Interim Surplus Criteria, Secretarial Implementation Agreements, and Conservation Measures was issued in January 2001. It required monitoring of 150.5 hectares (ha) of existing, occupied flycatcher habitat between Parker and Imperial Dams. Annual monitoring of groundwater levels, vegetation, soil moisture, temperature, and humidity was completed in 2005–12 (McLeod and Pellegrini 2013).

The LCR MSCP is a 50-year program that seeks to protect 26 TES species and their habitats along the LCR while maintaining river regulation and water management required by law. The LCR MSCP was approved in April 2005 with the signing of a Record of Decision by the Secretary of the U.S. Department of the Interior, and implementation of the program began in October 2005. Documentation for the LCR MSCP includes a Habitat Conservation Plan (HCP), BA/BO, and an environmental impact statement. The HCP specifies monitoring and research measures that call for surveys and research to better define habitat requirements for the flycatcher and studies to determine the effects of cowbird nest parasitism on flycatcher reproduction. The HCP also calls for the creation of a system of conservation areas, where habitat would be created for the benefit of many species, including the flycatcher.

Reclamation initiated flycatcher studies along the LCR in 1996 in anticipation of the requirements outlined in the BOs that were part of LCR MSCP development. These studies have been conducted annually since 1996 and were completed in 1996–2002 by the San Bernardino County Museum and in 2003–16 by SWCA Environmental Consultants (SWCA). Prior to 2016, breeding flycatchers were documented in at least 1 year at 10 study areas along the Virgin and lower Colorado Rivers and tributaries: (1) Pahranagat (PAHR), in the Pahranagat Valley, Nevada; (2) Meadow Valley Wash (MVWA), between Caliente and Carp, Nevada; (3) Littlefield (LIFI), along Beaver Dam Wash near Littlefield, Arizona; (4) Mesquite (MESQ) and (5) Mormon Mesa (MOME) on the Virgin River, Nevada; (6) Muddy River (MUDD), along the Muddy River near Overton, Nevada; (7) Grand Canyon (GRCA), on the LCR between Separation Canyon and Lake Mead, Arizona; (8) Topock Marsh (TOPO), on the Colorado River, Havasu National Wildlife Refuge, Arizona; (9) Bill Williams (BIWI), along the Bill Williams River, Arizona; and (10) Alamo Lake (ALAM), Arizona (Braden and McKernan 2006; McLeod et al. 2008; McLeod and Pellegrini 2013, 2014, 2015, 2016). The flycatcher studies also included presence/absence broadcast surveys in several other study areas: Topock Gorge (TOGO), along the LCR between Topock Marsh and Lake Havasu, Arizona and California; Palo Verde Ecological Reserve (PVER), within the PVER conservation area north of Blythe, California; Ehrenberg (EHRE), along the LCR south of Ehrenberg, Arizona; Cibola (CIBO), along the LCR in and around the Cibola National Wildlife Refuge, Arizona and California; Imperial (IMPE), along the LCR in and around the Imperial National

Wildlife Refuge, Arizona and California; Mittry Lake (MITT), along the LCR around Mittry Lake, Arizona and California; and Yuma (YUMA), along the LCR between Yuma and the Southerly International Boundary with Mexico and along the Gila River between Yuma and Dome, Arizona. From 1997 to 2015, willow flycatchers, including two banded migrant flycatchers (Koronkiewicz et al. 2006a; McLeod and Pellegrini 2012), were detected during the breeding season at several sites along the Colorado River south of the Bill Williams River to the Mexico border, but no nesting activity was confirmed.

Following the breeding season of 2008, the USFWS and Reclamation initiated discussions regarding the declining number of flycatcher territories at TOPO in 2004–08. A plan was developed to pump water into a portion of the flycatcher breeding habitat at TOPO and to monitor vegetation, hydrology, and microclimate, as well as flycatcher occupancy, in the target area. This study was completed in 2009–12 (McLeod and Pellegrini 2013). Water delivery did not appear to have any effects on vegetation that would influence flycatcher occupancy. Delivery of water did shift hydrology and microclimate conditions toward those favored by flycatchers, increasing the extent and duration of surface water present in the target area as well as increasing humidity and decreasing the daily temperature range in flooded areas versus non-flooded areas. Water delivery did not, however, result in increased occupancy by flycatchers.

In 2013–15, the flycatcher studies included monitoring for the presence and effects of tamarisk beetles at sampling points at selected study areas. Beetle monitoring originally included sampling points at MESQ, MOME, TOPO, and BIWI. No sampling occurred at MESQ or MOME after 2014 because of safety concerns, and the vegetation at all the sampling points at TOPO was consumed in a fire in August 2015. Reclamation then decided to discontinue beetle monitoring after the 2015 field season.

# RELATED STUDIES

Prior to 2010, the Nevada Department of Wildlife (NDOW) completed nest monitoring at the Key Pittman (KEPI) study area at the Key Pittman Wildlife Management Area, and SWCA banded flycatcher nestlings and adults opportunistically in 2003–09 in cooperation with these monitoring efforts. In 2010, the NDOW retained SWCA to conduct surveys, site descriptions, nest monitoring, and banding at flycatcher breeding areas at KEPI and at the Warm Springs (WMSP) study area in the Warm Springs Natural Area near the headwaters of the Muddy River. This work was expanded in 2011 to include River Ranch (RIRA) in the Pahranagat Valley. PAHR, which had previously been monitored under SWCA's contract with Reclamation, was added in 2013 to the list of study areas monitored under the contract with the NDOW. Starting in 2014, WMSP was monitored under SWCA's contract with the Southern Nevada

Water Authority. SWCA completed flycatcher monitoring at all four study areas in 2016 as well as broadcast surveys for yellow-billed cuckoos (*Coccyzus americanus occidentalis*) at RIRA, PAHR, and WMSP.

MOME and MESQ were monitored under SWCA's contract with Reclamation until 2014, when Reclamation ordered its contractors not to visit these study areas because of safety concerns related to the management of trespass cattle. Personnel from the NDOW monitored these study areas in 2015–16.

The Utah Division of Wildlife Resources monitored breeding flycatchers annually in St. George, Utah, from 2008 through 2016, and SWCA banded adults and nestling flycatchers opportunistically in cooperation with these monitoring efforts.

# PURPOSE AND DESCRIPTION OF STUDIES

The purpose of the 2016 studies was to continue surveys, monitoring, and demographic and ecological studies of the flycatcher in suitable and/or historical riparian and wetland habitats throughout the lower Colorado and Virgin River regions. The lower Grand Canyon was not monitored in 2009–16 as part of Reclamation's study because the declining level of Lake Mead dramatically reduced the amount of potential flycatcher habitat, and the formation of rapids at Pearce Ferry and Iceberg Canyon made access difficult and dangerous.[2] At Reclamation's direction, SWCA did not visit sites on the Virgin River in 2014–16. Effort was redirected to Meadow Valley Wash in Nevada and Alamo Lake in Arizona as well as to supplementing survey and monitoring efforts in the Pahranagat Valley at study areas covered under the NDOW contract. These projects currently encompass three types of studies: (1) presence/absence surveys, including site descriptions, at pre-selected sites along the LCR and portions of major tributaries; (2) intensive studies at all study areas where breeding flycatchers are located to assess flycatcher demographics and productivity; and (3) monitoring of habitat and microclimate conditions at selected study areas. Specific components of the 2016 study include:

**Presence/Absence Surveys.** At pre-selected survey sites along the LCR, conduct presence/absence surveys, following a five-survey protocol (per Sogge et al. 2010). A portion of the sites are surveyed every 3 years, and these were last surveyed in 2015.

[2] Surveys completed in 2010–12 by Grand Canyon National Park personnel between Diamond Creek and Pearce Ferry resulted in the detection of two flycatchers at River Mile 275 on June 24, 2010. Neither flycatcher was detected on subsequent surveys (Stroud-Settles et al. 2013).

**Site Descriptions.** Provide a general site description, including major types of vegetation and hydrological conditions, for each survey site at least three times during the survey season.

**Banding and Resighting.** Band as many adult and juvenile flycatchers as possible at sites with territorial flycatchers and resight banded flycatchers to determine their identity.

**Nest Monitoring.** Search for nests in all areas occupied by territorial flycatchers and monitor all nests to determine nest fate, brood parasitism, and causes of nest failure.

**Nest Microclimate Studies.** Collect data on surface hydrology at all nest locations and collect data on microclimate at nests that proceeded to the incubation phase at selected study areas.

These components are addressed in chapters of this report as follows:

**Chapter 2 – Presence/Absence Surveys and Site Descriptions.** This chapter presents the methodology and results for presence/absence surveys and gives a general description for each survey site.

**Chapter 3 – Color Banding and Resighting.** This chapter presents the details of banding activities and resightings of previously banded flycatchers as well as discussions of within- and between-year movement of individual flycatchers.

**Chapter 4 – Nest Monitoring.** This chapter summarizes nesting attempts, nest fates, and productivity for all flycatcher nesting activity.

**Chapter 5 – Nest Site Characteristics.** This chapter summarizes the conditions of vegetation type, soil moisture, temperature, and humidity recorded at nest sites.

**Chapter 6 – Management and Study Design.** This chapter summarizes the recommendations from all previous report chapters for ease of reference.

# Chapter 2 – Presence/Absence Surveys and Site Descriptions

## INTRODUCTION

Broadcasts of recorded conspecific vocalizations are useful in eliciting responses from nearby willow flycatchers, and multiple broadcast surveys conducted throughout the breeding season are the standard technique for determining the presence or absence of *E. t. extimus* (Sogge et al. 2010). According to Sogge et al. (2010) and the USFWS (2002), willow flycatchers detected between approximately June 15 and July 20 in the breeding range of *E. t. extimus* (see figure 1-1) probably belong to the southwestern subspecies. However, because northbound individuals of all western subspecies of the willow flycatcher migrate through areas where *E. t. extimus* are actively nesting, and southbound migrants occur where *E. t. extimus* are still breeding (Sogge et al. 2010; USFWS 2002), field confirmation of the southwestern subspecies is problematic. For example, the northwestern *E. t. brewsteri*, far more numerous than *E. t. extimus*, has been documented migrating north in southern California as late as June 20 (Garrett and Dunn 1981), and Phillips et al. 1964 (as cited in Unitt 1987) documented *E. t. brewsteri* collected in southern Arizona on June 23. An understanding of willow flycatcher migration ecology in combination with multiple broadcast surveys conducted throughout the breeding season is therefore needed to assess the presence and residency of flycatchers.

Migration routes used by *E. t. extimus* are not well documented, though more is known of northbound migration in spring than southbound migration in fall because willow flycatchers are more vocal in spring and can therefore be distinguished from other *Empidonax* species. During northbound migration, all subspecies of willow flycatchers use riparian habitats similar to breeding habitat along major river drainages in the Southwest such as the Rio Grande (Finch and Kelly 1999), Colorado River (McKernan and Braden 1999), San Juan River (Johnson and Sogge 1997), and the Green River (M. Johnson, unpublished data). Although migrating willow flycatchers may favor young, native willow habitats (Young and Finch 1997), migrants are also found in both spring and fall in a variety of habitats that are unsuitable for breeding. These migration stopover habitats, even though not used for breeding, are likely important for both reproduction and survival. For most long-distance neotropical migrant passerines, migration stopover habitats are needed to replenish energy reserves to continue northbound or southbound migration.

In 2016, as part of SWCA's contract with Reclamation, multiple broadcast surveys were completed at sites in eight study areas[1] (hereafter Reclamation study areas) along the LCR and its tributaries to detect both migrant willow flycatchers and resident flycatchers (figure 2-1). Surveys were completed in three additional study areas (hereafter NDOW study areas) as part of the contract with the NDOW and in one additional study area as part of the contract with the Southern Nevada Water Authority. Per Reclamation's direction, no surveys were conducted in any study area along the Virgin River in 2016, and effort that would have been spent on the Virgin River was redirected to MVWA and ALAM as well as to supplementing survey and monitoring efforts at all NDOW study areas.

# METHODS

## Site Selection

Survey sites were selected based on locations surveyed during previous years of flycatcher studies along the LCR (McLeod and Pellegrini 2013, 2014, 2015, 2016) and reconnaissance on foot during the 2016 survey period. Many survey sites located south of Parker Dam are currently surveyed every 3 years. The sites within conservation areas, however, are surveyed annually. Survey sites in the Topock Gorge and BIWI study areas that were previously placed on a biennial survey schedule (McLeod and Pellegrini 2013) were also placed on the triennial schedule starting in 2013. Sites scheduled for surveys every 3 years were last surveyed in 2015. All sites that are surveyed every 3 years are ones at which resident flycatchers (i.e., those detected for a week or more) have not been detected in recent years and at which vegetation and hydrology are unlikely to change without a major flood event. At Reclamation's request, sites in BIWI that are on the triennial schedule were visited in 2016. Reclamation biologist Chris Dodge guided and approved survey site selection at the eight Reclamation study areas.

Field personnel were provided with high-resolution hard copy and/or digital aerial photographs of all survey sites. Aerial imagery was georeferenced and overlain with an outline of the proposed survey area. If the boundary of a survey site was refined during the season to include potential flycatcher habitat actually present, new boundaries were delineated based on Universal Transverse Mercator coordinates obtained in the field. All coordinates were obtained using Trimble® TerraSync™ 5.61 on a Trimble Juno 3B and were in North American Datum 83 to comply with Federal Geographic Data Committee standards.

[1] Each study area consists of 2–21 survey sites that are grouped geographically (see table 2-1).

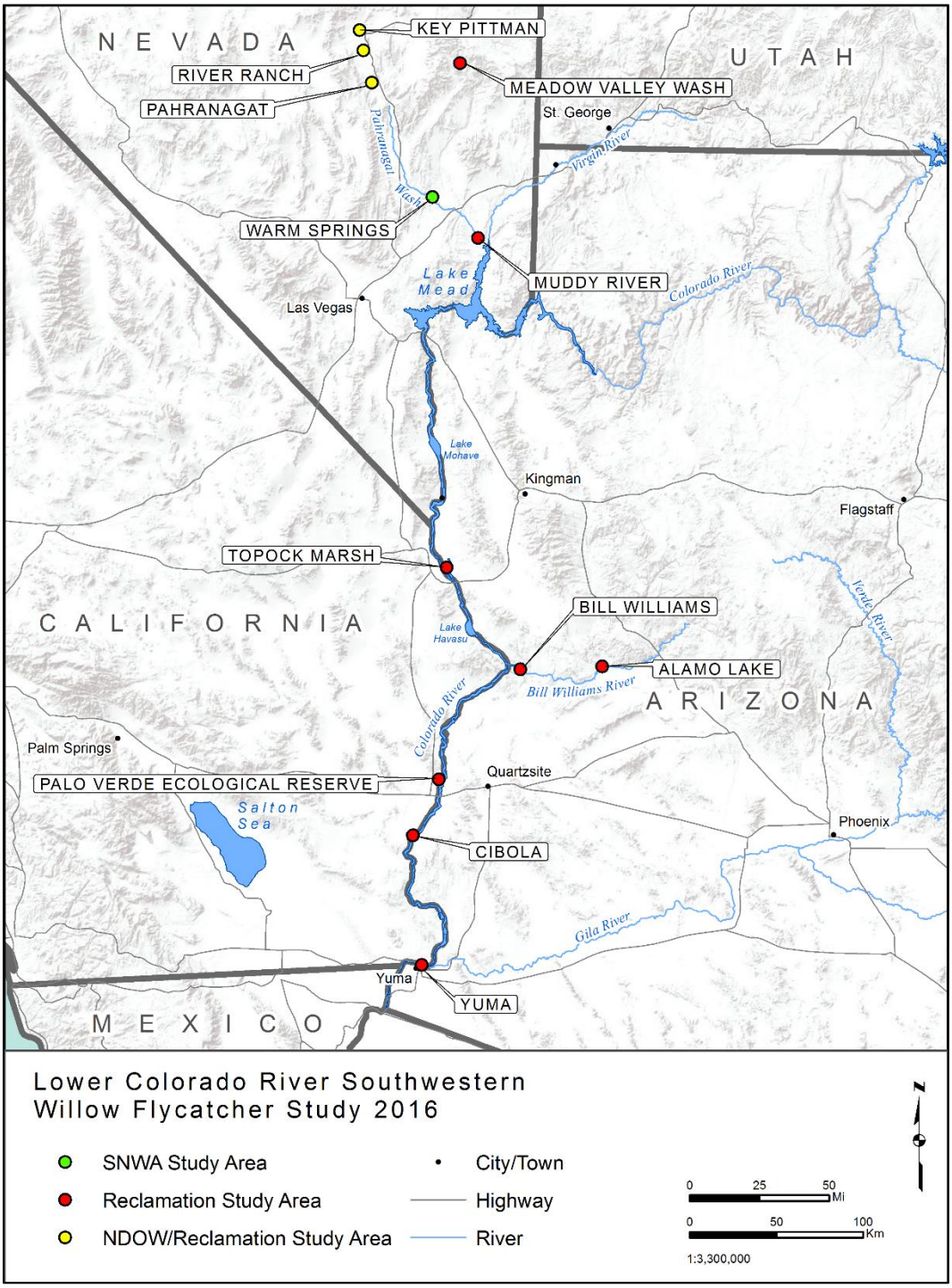



**Figure 2-1.—Locations of southwestern willow flycatcher study areas along the LCR and its tributaries, 2016.**
(Note: Study area labels represent the approximate center of multiple sites within that region; see table 2-1.)

## Site Names

In 2013, a three-tiered geographic naming convention was instituted under the LCR MSCP that designates area, site, and section, with area covering the largest extent and section the smallest. SWCA's designation of "survey site" is equivalent to section. Throughout the history of this project, survey sites have been grouped into "study areas." A study area does not always correspond to an LCR MSCP area; in some cases, a study area encompasses multiple areas, and in others, an area encompasses multiple study areas. The relationship of the new LCR MSCP area and site classifications to the existing designations of survey site and study area is shown in attachment 1. Throughout this report, the terminology of survey site and study area is used for ease of comparison with earlier reports. For most sites surveyed in previous years, original survey site names were retained; in the few instances in which names were changed, the original name is noted in attachment 1.

## Habitat Suitability Criteria

Habitat suitability criteria were based upon the summary of habitat conditions documented in flycatcher territories along the LCR (McLeod and Pellegrini 2013) as well as descriptions of suitable habitat in Sogge et al. (2010). Sites at least 10 meters (m) wide and consisting of mature native or exotic woody riparian vegetation ≥ 4.5 m in height with high canopy closure (≥ 85%), dense vegetation between 2 and 4 m above the ground, and standing water or saturated soil under or adjacent to the vegetation were considered the most suitable habitats for flycatchers. SWCA has also observed that the branching structure in the understory needs to be dense enough to provide cover, with enough twig structure to provide locations for nest building, while not being so dense as to impede flight. Early successional stands of young riparian vegetation > 3 m in height in proximity to surface water or saturated soil were also considered potentially suitable flycatcher habitat. Riparian vegetation contiguous with suitable habitat was often included as part of the survey areas.

## Additional Site Evaluation

During the survey season, on-the-ground habitat reconnaissance and evaluation were conducted to locate additional potentially suitable flycatcher habitat and to re-evaluate areas visited in previous years and noted as having the potential to become suitable habitat. Field personnel were provided high-resolution, georeferenced aerial imagery overlain with a potential site boundary to aide with navigation and the identification of potentially suitable flycatcher habitat. Personnel focused habitat reconnaissance and evaluation in areas that matched the habitat suitability criteria described above. These areas contained or were adjacent to standing water or saturated soils and appeared, from visual estimation, to have vegetation characteristics similar to those of flycatcher breeding sites (i.e., canopy height ≥ 4.5 m, dense vegetation within 2–4 m of the ground, and

high canopy closure) or that had the potential to develop those characteristics. Broadcast surveys were conducted opportunistically during ground reconnaissance. Field personnel formulated qualitative site descriptions of all evaluated areas.

## Broadcast Surveys

To elicit responses from nearby willow flycatchers, field personnel broadcast conspecific vocalizations previously recorded throughout the Southwest from 1996 to 1998. All flycatcher surveys were conducted according to the methods described in Sogge et al. (2010), and surveys at most sites followed the five-survey protocol, which calls for one survey between May 15 and 31, two surveys between June 1 and 24, and two additional surveys between June 25 and July 17. The surveys were separated by a minimum of 5 days whenever logistically possible. At the NDOW sites, surveys followed the three-survey protocol described in Sogge et al. (2010), which calls for one survey between May 15 and 31, one survey between June 1 and 24, and one survey between June 25 and July 17. Field work at ALAM was a lower priority than surveying and monitoring according to protocol at TOPO, BIWI, and the conservation areas. It was not anticipated that field personnel would be able to follow a standard survey protocol at ALAM, and they were instructed to follow the three-survey protocol as closely as possible, while prioritizing the monitoring of known territories. Field personnel surveyed within the habitat wherever possible using a Sansa® Clip MP3 player coupled to a Radio Shack 277-1008C mini amplified speaker. Surveyors stopped every 30–40 m and broadcast flycatcher primary song (*fitz-bew*) and calls (*breets*). Field personnel watched for willow flycatchers and listened for vocal responses for approximately 1 to 2 minutes before proceeding to the next survey station. If an unidentified *Empidonax* flycatcher was observed but did not respond with song to the initial broadcast, other conspecific vocalizations were broadcast, including *creets/breets*, *wee-oos*, *whitts*, *churr/kitters*, and a set of interaction calls given by a mated pair of flycatchers (per Lynn et al. 2003). These calls are frequently effective in eliciting a *fitz-bew* song, thereby enabling surveyors to positively identify willow flycatchers. All survey data, including survey locations, start and stop times, the number of special concern species detected at each survey point, and the location(s) and behavior of all willow flycatchers detected, were collected in TerraSync 5.61 on a Trimble Juno 3B, allowing a spatial representation of each survey area to be created. Field personnel also recorded the presence of cowbirds and livestock, as requested by the Arizona Game and Fish Department. Cowbirds may affect flycatcher populations by decreasing flycatcher productivity (see chapter 4), while livestock may substantially alter the vegetation in an area (USFWS 2002).

Wherever territorial flycatchers were detected, personnel discontinued broadcast surveys within a radius of 50 m of territories and commenced territory and nest monitoring, which involved more frequent visits (see chapter 4). In study areas where breeding activity was previously documented (KEPI, RIRA, PAHR, MVWA, MUDD, WMSP, TOPO, BIWI, and ALAM), all detections of willow flycatchers were assigned a unique alphanumeric code and monitored to determine residency status regardless of the flycatcher's behavior during the initial detection. If no activity was detected after three visits in the vicinity of the original detection, monitoring visits stopped and surveys resumed. In study areas where no breeding activity had been detected in any year from 2003 to 2015 (PVER, CIBO, and YUMA), willow flycatcher detections were followed up with monitoring visits only if territorial behavior was observed.

# Covered Species

## Incidental, Passive Detections

The Yuma clapper rail (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = *R. obsoletus yumanensis*]) is listed as federally endangered by the USFWS, and the western population of the yellow-billed cuckoo is listed as threatened. Both species occur along the LCR and its tributaries and are of concern to managing agencies. Surveys were not conducted specifically for either of these species at the eight Reclamation study areas, but all incidental detections were recorded. Field personnel also recorded incidental detections of two additional avian species, the gilded flicker (*Colaptes chrysoides*) and vermilion flycatcher (*Pyrocephalus rubinus*), both of which are also covered species under the LCR MSCP. Specific locations and behavioral data for the Yuma clapper rail and yellow-billed cuckoo were recorded in TerraSync 5.61 on a Trimble Juno 3B. All incidental detections of these four species were also recorded at the three NDOW study areas and at WMSP.

## Yellow-billed Cuckoo Broadcast Surveys

Broadcast presence/absence surveys were completed for yellow-billed cuckoos at PAHR, RIRA, and WMSP. Field personnel completed three broadcast surveys at PAHR and RIRA at 2-week intervals from early July through early August and four broadcast surveys at WMSP from late June to early August, following methods described in Halterman et al. (2015).

# Site Descriptions

Because vegetation structure and surface soil moisture conditions within riparian habitats are seasonally dynamic, field personnel completed site description forms

(attachment 2) for each flycatcher survey site at least three times throughout the survey season: early season (mid-May), mid-season (mid-June), and late season (mid-July). Habitat suitability in each site was assessed for each site description according to the criteria described above. Vegetation composition (native versus exotic) at survey sites followed the definitions of Sogge et al. (2010) and the flycatcher range-wide database. Vegetation composition was defined as (1) native: > 90% of the vegetation at a site was native, (2) exotic: > 90% of the vegetation at a site was exotic, (3) mixed-native: 50 to 90% of the vegetation at a site was native, or (4) mixed-exotic: 50 to 90% of the vegetation at a site was exotic. Field personnel also recorded visual estimates of vegetation height (to the nearest meter), canopy closure (to the nearest 5%), and various metrics of hydrology. Estimated metrics of hydrology included percentage of soil within the site that was inundated, saturated, damp, or dry (to the nearest 5%, unless one category comprised only 1 or 2% of the site), depth of any standing water (to the nearest centimeter [cm] or nearest 5 cm if > 5 cm), and distance to water (to the nearest meter) if no saturated or inundated soil (hereafter wet soils) was documented in the site. Surface soil moisture categories were qualitatively determined as follows: inundated soils were those that had water visible on the surface; soils were considered saturated if compression of the soil (e.g., by stepping on it) caused water to be expressed; soils were considered dry if squeezing a handful of soil did not result in the soil sticking together; and damp soils were any that did not have surface water and did not meet the criteria for either saturated or dry (i.e., compressing a handful of soil caused the soil to stick together, but no water was expressed). Information from the site description forms was used in conjunction with habitat photographs and comments in field notebooks and on survey forms to formulate qualitative site descriptions. Sites that were surveyed for yellow-billed cuckoos but not for flycatchers were described once at the beginning of yellow-billed cuckoo surveys.

# RESULTS

## Flycatcher Broadcast Surveys

Field personnel spent 390.0 observer-hours conducting flycatcher broadcast surveys at 78 sites across all study areas. Fourteen additional sites were occupied by resident flycatchers throughout the breeding season; these sites were not surveyed, but they were monitored via territory and nest visits. Two additional sites were not occupied but were not surveyed because of either poor habitat quality or proximity to occupied habitat. In the Pahranagat Valley, 6.2 observer-hours were spent conducting flycatcher broadcast surveys at 17 sites at NDOW study areas. An additional seven sites were not surveyed because they were

occupied by resident flycatchers. At WMSP, field personnel conducted flycatcher broadcast surveys at two sites, totaling 2.5 observer-hours. Personnel spent 381.4 observer-hours conducting flycatcher broadcast surveys at 59 of the 68 sites[2] at Reclamation study areas. Flycatcher survey and monitoring results are summarized in table 2-1 and are presented below along with site descriptions. Details of occupancy, pairing, color banding, and breeding are presented in chapters 3 and 4. The boundaries of survey sites and occupancy in 2016 are shown on orthophotos in attachment 3 along with historically occupied habitat.[3] Each site that was not occupied by territorial flycatchers was formally surveyed three to six times,[4] except at ALAM, where effort focused on monitoring known territories, and sites with no known territories were surveyed one to three times. A list of survey dates is given in attachment 4, and a summary of flycatcher survey effort and survey site occupancy status is presented in attachment 5. Field personnel spent an additional 1.2 observer-hours completing habitat reconnaissance and evaluation and opportunistic surveys at a site that was not added as a survey site in 2016. The results of reconnaissance for each study area are presented below following the results for the regularly surveyed sites. Overall numbers of passive detections of all special concern species, as well as details of passive, incidental detections of yellow-billed cuckoos and Yuma clapper rails, are listed in attachment 6. Several incidental detections of yellow-billed cuckoos were recorded during the season at survey sites where yellow-billed cuckoo surveys are conducted as part of another LCR MSCP project (Parametrix, Inc., and Southern Sierra Research Station 2016); numbers or locations of those detections are not presented in this report. Hydrologic characteristics of each survey site are summarized in table 2-2.

---

[2] The survey season started with 62 Reclamation sites scheduled for surveys. One site at MVWA, one site at BIWI, and two sites at ALAM were added following the discovery of resident flycatchers. One additional site at ALAM was added following field evaluation. One site at MVWA, one site at TOPO, and six sites at ALAM were not surveyed because they were occupied by flycatchers the entire season. One site at TOPO was not surveyed because of extensive habitat damage from a fire. Surveys at one site at ALAM were discontinued after the first survey because of poor habitat quality.

[3] Occupied flycatcher habitat was defined as survey sites where willow flycatchers were detected after June 24 and before July 20, or where resident or breeding flycatchers were detected regardless of time of year, in any year since 2003. Historically occupied habitat is depicted as the maximum extent of the survey site in any year(s) it was occupied in 2003–15.

[4] Surveys were discontinued for the season after one survey at five sites at BIWI because of poor habitat quality.

Table 2-1.—Adult willow flycatchers detected during survey and monitoring activities, 2016*

| Study area[1] | Survey site | Area (ha) | Number detected (date[s] of detection)[2,3,4] |
|---|---|---|---|
| KEPI | Frenchy Lake | 0.7 | 2 (June 14 – Aug 5), 1 (May 30 – June 2)[5] |
| | Nesbitt Forest | 0.2 | ND |
| | Patch 00 | 0.05 | 2 (May 19 – July 20) |
| | Patch 01 | 0.1 | 1 (June 8 – July 18)[5] |
| | Patch 02 | 0.1 | 1 (May 19 – July 23) |
| | Patch 03 | 0.1 | 2 (June 8 – July 25) |
| | Patch 04 | 0.1 | 3 (May 26 – July 14)[6] |
| | Patch 04.5 | 0.04 | 1 (May 26) |
| | Patch 05 | 0.1 | 1 (May 30) |
| | Patch 06 | 0.2 | 2 (May 16 – July 27)[7] |
| | Patch 07 | 0.1 | 2 (May 16 – July 27) |
| | Patch 08 | 0.1 | ND |
| | Patch 09 | 0.3 | 1 (May 16 – July 27) |
| | Patch 10 | 0.1 | 3 (May 16 – Aug 14) |
| | Patch 10.5 | 0.05 | ND |
| | Patch 11 | 0.1 | 1 (May 16 – July 27) |
| | Patch 12 | 0.1 | 3 (May 16 – Aug 5) |
| RIRA | East Side | 0.4 | 2 (June 10 – Aug 13)[8], 1 (July 19–21)[6], 1 (July 21)[9] |
| | West Side | 0.3 | 1 (May 26–30)[6] |
| | Smalls | 0.2 | ND |
| PAHR | Pahranagat North | 3.2 | 16 (May 15 – Aug 4), 1 (July 10–19)[10], 1 (July 20)[7], 1 (July 25–26), 1 (July 26)[6], 2 (Aug 2)[8] |
| | Pahranagat West | 1.3 | 2 (May 25 – July 23), 1 (May 15)[10] |
| | Pahranagat MAPS | 0.3 | 5 (May 15 – July 25)[9,10] |
| | Pahranagat South | 1.4 | ND |
| MVWA | Rock Springs Canyon | 0.3 | 2 (June 30 – Aug 3) |
| | Dog Leg | 10.3 | 5 (May 18 – July 24), 1 (May 18) |
| MUDD | Overton WMA Pond | 0.7 | 2 (May 17), 1 (May 28) |
| | Overton WMA | 5.9 | 4 (May 17 – July 28), 1 (June 21–25) |
| WMSP | Muddy Mac | 0.9 | ND |
| | Muddy Stringer 01 | 0.8 | 1 (May 24 – Aug 2), 1 (July 26) |

Table 2-1.—Adult willow flycatchers detected during survey and monitoring activities, 2016*

| Study area[1] | Survey site | Area (ha) | Number detected (date[s] of detection)[2,3,4] |
|---|---|---|---|
| TOPO | Swine Paradise | 0.9 | 4 (May 13 – July 25), 1 (May 13–24), 1 (July 29) |
| | Platform | 1.9 | 1 (June 12–20) |
| | 250M | 1.6 | 1 (May 16) |
| | Hell Bird | 5.8 | 1 (July 25) |
| | Glory Hole | 6.4 | 2 (May 15), 1 (May 25), 1 (July 14) |
| | Farm Ditch Road | 4.4 | 1 (May 16) |
| | CPhase 05 | 11.4 | 1 (June 28) |
| BIWI | Coyote Crossing | 2.1 | 1 (May 25 – June 9) |
| | Bill Willow | 1.6 | 5 (June 12 – Aug 8)[11], 1 (July 28)[12] |
| | Wispy Willow | 1.3 | 4 (May 15 – July 31), 1 (June 15–27), 1 (July 15) |
| | Site 01 | 2.4 | 1 (June 2–23), 1 (May 17), 1 (May 25–26), 1 (May 26) |
| | Burn Edge | 4.1 | 3 (June 8) |
| | Site 04 | 9.9 | ND |
| | Site 03 | 12.9 | 3 (June 9) |
| | Last Gasp[13] | 2.1 | ND |
| | Guinness[13] | 3.4 | ND |
| | Site 05 | 6.8 | ND |
| | Black Rail[13] | 1.2 | ND |
| | Beaver Pond North[13] | 19.0 | ND |
| | Beaver Pond[13] | 21.5 | 3 (June 10) |
| | Site 08 | 12.1 | 1 (May 14 – June 19)[12], 1 (June 10), 1 (June 23) |
| | Upstream from Site 08 | 1.5 | ND |

Table 2-1.—Adult willow flycatchers detected during survey and monitoring activities, 2016*

| Study area[1] | Survey site | Area (ha) | Number detected (date[s] of detection)[2,3,4] |
|---|---|---|---|
| ALAM[14] | Bullard Wash | 1.9 | ND |
| | South Camp | 2.4 | 2 (June 24 – July 24) |
| | Over the Edge | 2.1 | 4 (May 26 – June 30), 1 (May 31) |
| | Sidebar 01 | 1.1 | 4 (May 12 – July 27) |
| | Edgewater 01 | 0.9 | 4 (May 12 – June 28) |
| | Camp 01 | 0.7 | 2 (July 1–8) |
| | Camp 04 | 0.2 | 3 (July 8–26), 1 (July 21) |
| | Camp 02 | 0.3 | ND |
| | Camp 03 | 1.3 | ND |
| | Middle Earth 01 | 2.2 | 2 (May 11 – July 7) |
| | Middle Earth 02 | 5.0 | 16 (May 11 – Aug 4)[11] |
| | Prospect 01 | 1.2 | ND |
| | Burro Wash 01 | 4.1 | 6 (May 26 – July 25) |
| | Burro Wash 02 | 7.9 | 5 (June 28 – July 27), 1 (July 7)[15], 1 (July 11–17), 1 (July 13) |
| | Motherlode 01 | 4.3 | 11 (May 11 – Aug 6), 1 (July 13) |
| | Motherlode 02 | 14.2 | 4 (May 29 – June 29) |
| | Motherlode 03 | 8.3 | 3 (May 18 – June 15) |
| | Motherlode 04 | 0.5 | ND |
| | Confluence 02[16] | 9.8 | ND |
| | Santa Maria South 01 | 25.6 | ND |
| | Santa Maria North 01 | 27.7 | 10 (May 27 – July 30), 1 (June 28)[15], 1 (July 19) |
| PVER | Phase 02 | 21.4 | 1 (June 5–14), 1 (May 22), 1 (June 5), 1 (June 13) |
| | Phase 03 | 21.4 | ND |
| | Phase 04 Block 01 | 7.7 | 1 (May 22) |
| | Phase 04 Block 02 | 4.0 | 1 (May 22) |
| | Phase 04 Block 03 | 23.7 | 1 (May 22) |
| | Phase 05 Block 01 | 15.9 | 4 (May 22) |
| | Phase 05 Block 02 | 23.6 | ND |
| | Phase 05 Block 03 | 29.6 | 6 (May 23) |
| | Phase 06 Block 01 | 38.7 | 1 (May 23), 1 (June 7) |
| | Phase 06 Block 02 | 37.6 | 3 (May 23), 1 (June 7), 1 (June 14) |
| | Phase 07 Block 01 | 36.8 | 5 (May 25), 2 (June 9) |
| | Phase 07 Block 02 | 40.6 | 5 (May 24), 2 (June 9) |

Table 2-1.—Adult willow flycatchers detected during survey and monitoring activities, 2016*

| Study area[1] | Survey site | Area (ha) | Number detected (date[s] of detection)[2,3,4] |
|---|---|---|---|
| CIBO | Phase 01 | 26.2 | ND |
| | Phase 02 | 25.5 | ND |
| | Phase 03 | 38.4 | 5 (May 24), 1 (June 8) |
| | Nature Trail | 13.7 | 4 (May 25), 5 (June 9) |
| | C2729 | 6.0 | 5 (May 25) |
| YUMA | J | 8.4 | 4 (May 25), 2 (June 8) |
| | C (formerly South AC) | 0.9 | 4 (May 25) |
| | I | 6.4 | 14 (May 25) |

* This table includes only sites where regular surveys were scheduled or where flycatchers were detected and does not include sites where habitat reconnaissance or opportunistic surveys were conducted and no flycatchers were detected.

[1] KEPI = Key Pittman, RIRA = River Ranch, PAHR = Pahranagat, MVWA = Meadow Valley Wash, MUDD = Muddy River, WMSP = Warm Springs, TOPO = Topock Marsh, BIWI = Bill Williams, ALAM = Alamo Lake, PVER = Palo Verde Ecological Reserve, CIBO = Cibola, and YUMA = Yuma.

[2] ND = No willow flycatchers were detected.

[3] See chapter 3 for details on territories, residency, pairing, and color banding; see chapter 4 for details on nesting activity.

[4] Flycatchers in territories that were occupied throughout the breeding season are shown as being present throughout the season. Willow flycatchers detected on a single occasion or for a short period of time are listed separately.

[5] One individual was detected in KEPI Frenchy Lake from May 30 to June 2 and in KEPI Patch 01 from June 8 to July 18.

[6] One individual was detected in RIRA West Side from May 26 to 30, in KEPI Patch 04 from June 8 to July 14, in RIRA East Side from July 19 to 21, and in PAHR Pahranagat North on July 26.

[7] One individual was detected in KEPI Patch 06 from June 6 to July 11 and in PAHR Pahranagat North on July 20.

[8] One individual was detected in RIRA East Side from June 10 to July 13 and in PAHR Pahranagat North on August 2.

[9] One individual was detected in PAHR Pahranagat North from May 15 to July 6 and in RIRA East Side on July 21.

[10] One individual was detected in PAHR Pahranagat West on May 15, in PAHR Pahranagat MAPS from May 18 to July 6, and in PAHR Pahranagat North from July 10 to 19.

[11] One individual was detected in ALAM Middle Earth 02 through June 13 and in BIWI Bill Willow from July 3 to 28.

[12] One individual was detected in BIWI Site 08 from May 14 through June 19 and in BIWI Bill Willow on July 28.

[13] Surveys discontinued for the season because of poor habitat quality.

[14] Sites were surveyed one to three times at Alamo Lake, and monitoring visits were less frequent than at the other study areas.

[15] One individual was detected in ALAM Santa Maria North 01 on June 28 and in ALAM Burro Wash 02 on July 7.

[16] Surveys were discontinued after the first visit because of poor habitat quality.

Table 2-2.—Summary of hydrologic conditions by survey site, 2016*

| Study area[1] | Survey site | % site inundated[2] | Depth (cm) of surface water[2] | % site with saturated soil[2,3] | Distance (m) to surface water or saturated soil[2] |
|---|---|---|---|---|---|
| KEPI | Patches 00–12 and Nesbitt Forest[4] | 80 / 38 / 30 | 50 / 17 / 20 | 13 / 9 / 20 | 0 / 0 / 0 |
| | Frenchy Lake[4] | 45 / 70 / 5 | 15 / 15 / 5 | 10 / 5 / 5 | 0 / 0 / 0 |
| RIRA | East Side | 10 / 5 / 0 | 5 / 5 / 0 | 2 / 5 / 0 | 0 / 0 / 60 |
| | West Side | 90 / 98 / 80 | 10 / 15 / 7 | 10 / 2 / 0 | 0 / 0 / 0 |
| | Smalls | 100 / 100 / 100 | 10 / 10 / 7 | 0 / 0 / 0 | 0 / 0 / 0 |
| PAHR | Pahranagat North[4] | 65 / 60 / 45 | 40 / 30 / 20 | 20 / 15 / 25 | 0 / 0 / 0 |
| | Pahranagat West[4] | 40 / 35 / 10 | 50 / 25 / 10 | 3 / 10 / 10 | 0 / 0 / 0 |
| | Pahranagat MAPS[4] | 90 / 75 / 25 | 60 / 30 / 10 | 5 / 15 / 30 | 0 / 0 / 0 |
| | Pahranagat South | 20 / 20 / 1 | 60 / 15 / 20 | 5 / 10 / 0 | 0 / 0 / 0 |
| MVWA | Rock Springs Canyon | – / – / 20 | – / – / 30 | – / – / 10 | – / – / 0 |
| | Dog Leg | 35 / 5 / 10 | 15 / 50 / 10 | 15 / 5 / 10 | 0 / 0 / 0 |
| MUDD | Overton WMA Pond | 3 / 5 / 5 | 15 / 5 / 5 | 1 / 3 / 2 | 0 / 0 / 0 |
| | Overton WMA | < 5 / 4 / < 5 | 35 / 30 / 35 | 2 / 1 / 1 | 0 / 0 / 0 |
| WMSP | Muddy Mac | 10 / 0 / 0 | 10 / 0 / 0 | 10 / 0 / 0 | 0 / 30 / 25 |
| | Muddy Stringer 01 | 5 / 5 / 0 | 10 / 3 / 0 | 5 / 5 / 0 | 0 / 0 / 105 |
| TOPO | Swine Paradise[4] | 45 / 25 / 20 | 25 / 12 / 12 | 15 / 10 / 5 | 0 / 0 / 0 |
| | Platform[4] | 5 / 10 / 2 | 10 / 5 / < 10 | 1 / 0 / 2 | 0 / 0 / 0 |
| | 250M[4] | – / – / 0 | – / – / 0 | – / – / 0 | 0 / 0 / 0 |
| | Hell Bird[4] | 35 / 35 / 75 | 50 / 50 / 25 | 5 / 5 / 10 | 0 / 0 / 0 |
| | Glory Hole[4] | 30 / 50 / 30 | 60 / 75 / 45 | 5 / 5 / 5 | 0 / 0 / 0 |
| | Farm Ditch Road[5] | – / – / – | – / – / – | – / – / – | 0 / 0 / 0 |
| | CPhase 05[6] | 0 / 20 / 0 | 0 / 30 / 0 | 0 / 5 / 0 | 10 / 0 / 10 |
| | Lost Lake[7] | 10 / – / – | 5 / – / – | 5 / – / – | 0 / – / – |
| BIWI | Coyote Crossing[4] | 40 / 50 / 40 | 13 / 16 / 10 | 25 / 30 / 30 | 0 / 0 / 0 |
| | Bill Willow[4] | 18 / 100 / 5 | 7 / 25 / 10 | 12 / 0 / 60 | 0 / 0 / 0 |
| | Wispy Willow[5] | 90 / 70 / 30 | 10 / 20 / 20 | 10 / 20 / 35 | 0 / 0 / 0 |
| | Site 01[5] | 10 / 15 / 15 | 5 / 46 / 35 | 30 / 25 / 35 | 0 / 0 / 0 |
| | Burn Edge | 1 / 1 / 1 | 25 / 10 / 2 | 0 / 0 / 1 | 0 / 0 / 0 |
| | Site 04[5] | 5 / 2 / 4 | 40 / 65 / 30 | 0 / < 1 / 1 | 0 / 0 / 0 |
| | Site 03 | 0 / 0 / 0 | 0 / 0 / 0 | 0 / 0 / 0 | 70 / 74 / 100 |
| | Last Gasp[8] | 0 / – / – | 0 / – / – | 0 / – / – | 500 / – / – |
| | Guinness[8] | 0 / – / – | 0 / – / – | 0 / – / – | 820 / – / – |
| | Site 05 | 2 / 5 / 5 | 50 / 70 / 70 | 0 / 3 / 0 | 0 / 0 / 0 |
| | Black Rail[8] | 0 / – / – | 0 / – / – | 0 / – / – | 640 / – / – |

Table 2-2.—Summary of hydrologic conditions by survey site, 2016*

| Study area[1] | Survey site | % site inundated[2] | Depth (cm) of surface water[2] | % site with saturated soil[2,3] | Distance (m) to surface water or saturated soil[2] |
|---|---|---|---|---|---|
| BIWI (cont.) | Beaver Pond North[8] | 0 / – / – | 0 / – / – | 0 / – / – | 700 / – / – |
| | Beaver Pond[8] | < 1 / – / – | 9 / – / – | 4 / – / – | 0 / – / – |
| | Site 08 | 15 / 5 / 15 | 85 / 60 / 125 | 10 / 1 / 5 | 0 / 0 / 0 |
| | Upstream from Site 08[4] | 15 / 15 / 15 | 20 / 30 / 12 | 5 / 5 / 5 | 0 / 0 / 0 |
| ALAM | Bullard Wash | – / – / 0 | – / – / 0 | – / – / 0 | – / – / 280 |
| | South Camp | – / 0 / 0 | – / 0 / 0 | – / 0 / 0 | – / 10 / 10 |
| | Over the Edge | 0 / – / 0 | 0 / – / 0 | 0 / – / 0 | 291 / – / 415 |
| | Sidebar 01 | 0 / – / 0 | 0 / – / 0 | 0 / – / 0 | 1,093 / – / 1,118 |
| | Edgewater 01 | 0 / – / 0 | 0 / – / 0 | 0 / – / 0 | 427 / – / 427 |
| | Camp 01 | 0 / – / 0 | 0 / – / 0 | 0 / – / 0 | < 1 / – / < 1 |
| | Camp 04 | 0 / – / 0 | 0 / – / 0 | 0 / – / 0 | 5 / – / 10 |
| | Camp 02 | 0 / – / 0 | 0 / – / 0 | 0 / – / 0 | 20 / – / 20 |
| | Camp 03 | 0 / – / 0 | 0 / – / 0 | 0 / – / 0 | 213 / – / 213 |
| | Middle Earth 01 | 0 / – / – | 0 / – / – | 0 / – / – | 752 / – / – |
| | Middle Earth 02 | 0 / – / – | 0 / – / – | 0 / – / – | 835 / – / – |
| | Prospect 01 | 0 / – / – | 0 / – / – | 0 / – / – | 1,145 / – / – |
| | Burro Wash 01 | 0 / – / 0 | 0 / – / 0 | 0 / – / 0 | 674 / – / 705 |
| | Burro Wash 02 | 0 / – / 0 | 0 / – / 0 | 0 / – / 0 | 960 / – / 1,000 |
| | Motherlode 01 | 0 / 0 / – | 0 / 0 / – | 0 / 0 / – | 800 / 846 / – |
| | Motherlode 02 | 0 / 0 / 0 | 0 / 0 / 0 | 0 / 0 / 0 | 1,487 / 1,506 / 2,681 |
| | Motherlode 03 | 0 / 0 / 0 | 0 / 0 / 0 | 0 / 0 / 0 | 1,338 / 1,636 / 2,214 |
| | Motherlode 04 | 0 / – / 0 | 0 / – / 0 | 0 / – / 0 | 1,274 / – / 2,060 |
| | Confluence 02[9] | 0 / – / – | 0 / – / – | 0 / – / – | 50 / – / – |
| | Santa Maria South 01 | 0 / – / 0 | 0 / – / 0 | 0 / – / 0 | 7 / – / 16 |
| | Santa Maria North 01 | 0 / 0 / 0 | 0 / 0 / 0 | 0 / 0 / 0 | 17 / 22 / 20 |
| PVER | Phase 02[6] | 0 / 95 / 0 | 0 / 12 / 0 | 0 / 0 / 0 | 8 / 0 / 30 |
| | Phase 03[6] | 55 / 0 / 0 | 5 / 0 / 0 | 10 / 0 / 0 | 0 / 52 / 260 |
| | Phase 04 Block 01[6] | 0 / 0 / 5 | 0 / 0 / 2 | 0 / 0 / 0 | 56 / 56 / 0 |
| | Phase 04 Block 02[6] | 0 / 0 / 0 | 0 / 0 / 0 | 0 / 0 / 0 | 10 / 20 / 9 |
| | Phase 04 Block 03[6] | 25 / 0 / 50 | 10 / 0 / 7 | 3 / 0 / 10 | 0 / 133 / 0 |
| | Phase 05 Block 01[6] | 5 / 0 / 5 | 3 / 0 / 7 | 20 / 0 / 30 | 0 / 19 / 0 |
| | Phase 05 Block 02[6] | 0 / 0 / 0 | 0 / 0 / 0 | 0 / 0 / 0 | 2 / 35 / 5 |
| | Phase 05 Block 03[6] | 1 / 0 / 0 | 2 / 0 / 0 | 1 / 0 / 0 | 0 / 97 / 97 |
| | Phase 06 Block 01[6] | 0 / 2 / 0 | 0 / 2 / 0 | 0 / 0 / 0 | 98 / 0 / 77 |
| | Phase 06 Block 02[6] | 0 / 0 / 0 | 0 / 0 / 0 | 0 / 0 / 0 | 25 / 25 / 24 |

Table 2-2.—Summary of hydrologic conditions by survey site, 2016*

| Study area[1] | Survey site | % site inundated[2] | Depth (cm) of surface water[2] | % site with saturated soil[2,3] | Distance (m) to surface water or saturated soil[2] |
|---|---|---|---|---|---|
| PVER (cont.) | Phase 07 Block 01[6] | 0 / 0 / 0 | 0 / 0 / 0 | 0 / 0 / 0 | 0 / 9 / 5 |
| | Phase 07 Block 02[6] | 1 / 60 / 0 | 3 / 20 / 0 | 1 / 10 / 0 | 0 / 0 / 10 |
| CIBO | Phase 01[6] | 0 / 0 / 1 | 0 / 0 / 3 | 0 / 0 / 1 | 10 / 7 / 0 |
| | Phase 02[6] | 0 / 0 / 0 | 0 / 0 / 0 | 0 / 0 / 0 | 74 / 74 / 75 |
| | Phase 03[6] | 0 / 15 / 0 | 0 / 8 / 0 | 0 / 5 / 0 | 408 / 0 / 408 |
| | Nature Trail[6] | 50 / 0 / 0 | 5 / 0 / 0 | 15 / 0 / 0 | 0 / 2 / 1 |
| | C2729[6] | 55 / 0 / 2 | 20 / 0 / 5 | 0 / 0 / 0 | 0 / 10 / 0 |
| YUMA | J[6] | 3 / 5 / 5 | 10 / 15 / 10 | 0 / 0 / 5 | 0 / 0 / 0 |
| | C[4] (formerly South AC) | 20 / 30 / 10 | 15 / 15 / 10 | 0 / 0 / 10 | 0 / 0 / 0 |
| | I[6] | 0 / 7 / 0 | 0 / 2 / 0 | 0 / 3 / 0 | 5 / 0 / 137 |

* Values are given for each site as recorded in mid-May, mid-June, and mid-July.

[1] KEPI = Key Pittman, RIRA = River Ranch, PAHR = Pahranagat, MVWA = Meadow Valley Wash, MUDD = Muddy River, WMSP = Warm Springs, TOPO = Topock Marsh, BIWI = Bill Williams, ALAM = Alamo Lake, PVER = Palo Verde Ecological Reserve, CIBO = Cibola, and YUMA = Yuma.
[2] – = Hydrologic information not recorded.
[3] Percent of site with saturated soil does not include inundated areas.
[4] Site borders marsh.
[5] Site bordered by a river, lake, or pond.
[6] Site is irrigated as part of restoration efforts; amount of standing water highly variable throughout survey season.
[7] Surveys discontinued for the season because of fire damage.
[8] Surveys discontinued for the season because of the lack of surface water.
[9] Surveys discontinued because of poor habitat quality.

## Key Pittman, Nevada

The KEPI study area is located in the Key Pittman Wildlife Management Area, near the town of Hiko, Nevada, at the northern end of the Pahranagat Valley approximately 150 km north of Las Vegas, Nevada. It consists of a series of narrow strips of riparian habitat along the edges of Nesbitt and Frenchy Lakes. Both lakes are located within the historic area of the Hiko Spring outflow stream and are currently managed for waterfowl. Nesbitt Lake is also managed for fishing and is supplemented with water from Hiko Spring during the summer months. Water levels in both lakes decline gradually during the flycatcher breeding season; the rate of decline varies from year to year. The land around each lake is periodically grazed, but the survey sites along Nesbitt Lake have been fenced on the upland side to exclude cattle.

### *Frenchy Lake*

Area: 0.7 ha Elevation: 1158 m

The survey site known as Frenchy Lake is located approximately 2 km south of Nesbitt Lake, on the northeastern corner of Frenchy Lake. The site is bordered by bulrush marsh to the west and yerba mansa (*Anemopsis californica*) transitioning to dry alkali desert scrub to the east. Vegetation within the site consists primarily of a stringer of 20–25-m-tall cottonwoods and 15–18-m-tall Goodding's willows (*Salix gooddingii*) with two disjunct patches of 4–6-m-tall coyote willows in the understory. Canopy closure is variable and reaches 90% in the middle of the stringer, with less dense vegetation toward the edges. The overall site is approximately 10 m wide at ground level, with the canopy covering an area 25–30 m wide. Standing water and saturated soils were present along the western edge of the site when site descriptions were recorded in May, June, and July, with a decrease in water levels noted on the July site description (see table 2-2). Although formal site descriptions were completed only three times, field personnel were onsite approximately every 2 to 4 days, and water levels declined gradually over the season and did not fluctuate notably from day to day (C. Hines 2017, personal communication).

Two breeding flycatchers were detected (see table 2-1). One flycatcher, which subsequently established a territory in KEPI Patch 01, was detected for 4 days at Frenchy Lake. This site was surveyed twice, totaling 0.4 observer-hour. Cowbirds were detected during one survey as well as during nest monitoring activities. Signs of shod horses were observed on the road adjacent to the site on one visit. Cattle graze this unit for part of the summer and have access to the habitat, but no signs of them using the site were observed. Vegetation is suitably dense and surface water is present within the site, but the site is too narrow to be considered highly suitable (see "Habitat Suitability Criteria," above), and SWCA's assessment is that habitat suitability in this site is fair. The topography of the upland area limits the expansion of suitable vegetation, as it is steeply sloped away from the lake.

### *Patches 00–12 and Nesbitt Forest*

Area: 1.8 ha Elevation: 1171 m

The survey sites along Nesbitt Lake consist of 15 small patches (Patches 00–12) of coyote willows (*Salix exigua*) plus a small patch (Nesbitt Forest) of Fremont cottonwoods (*Populus fremontii*) (hereafter cottonwoods). The coyote willow patches form a strip of habitat along the western edge of the lake between bulrush (*Schoenoplectus californicus*) marsh to the east and dry alkali desert scrub dominated by saltbush (*Atriplex* sp.) and grasses to the west. Most of the patches are separate from each other, but four patches (Patches 06–09) have grown together, forming a larger contiguous stand. Each coyote willow patch is

characterized by very dense, large-diameter stems. Some areas have fallen or leaning stems with wispy growth in the lower 2 m, making traversing those areas difficult. Canopy height within each coyote willow patch ranges from 4 to 8 m, with the shorter stems occurring around the edges of each stand, creating a rounded look. Large gaps in the canopy occur in the center of several patches, and canopy closure varies from 65 to 95%. The cottonwood patch (Nesbitt Forest) is at the very southern end of Nesbitt Lake and contains 18-m-tall trees planted on either side of an entrance road. The trees form a stand of vegetation roughly 30 x 60 m in size with 85% canopy closure and little understory.
Lake levels were noticeably higher at the beginning of the breeding season in 2016 than they had been in previous years and persisted much longer into the season. This resulted in much of the bulrush marsh thinning out in the deeper water. Surface water and saturated soils were present along the eastern edge of the coyote willow stands when site descriptions were recorded in May, June, and July, with a noticeable decrease in water levels noted on the July site description (see table 2-2). Although formal site descriptions were completed only three times, field personnel were onsite approximately every 2 to 4 days, and water levels declined gradually over the season and did not fluctuate notably from day to day (C. Hines 2017, personal communication).

Sixteen breeding flycatchers and 4 resident, unpaired male flycatchers were located across 11 of the 16 sites (see table 2-1). Two willow flycatchers that were not confirmed as residents were also detected. Nine of the 16 sites were either unoccupied or were occupied for only a portion of the season; these sites were surveyed up to 3 times each, for a total of 12 surveys totaling 0.5 observer-hour. Cowbirds were noted during eight surveys and throughout the season during nest monitoring activities. Deer were present within the sites but do not appear to heavily impact the vegetation structure. The survey sites along Nesbitt Lake meet the habitat suitability criteria (see “Habitat Suitability Criteria,” above), and SWCA’s assessment is that overall habitat suitability of these sites is high. Vegetation with dense canopy (≥ 90%), wet soils, and suitable branching structure is present throughout most of the patches. The gaps that have developed in several of the patches reduce the availability of nesting habitat but increase foraging habitat. The suitability of the three smallest patches (00, 04.5, and 10.5) is improved by proximity to the rest of the patches, with the study area forming a matrix of habitat. Nesbitt Forest has the lowest habitat suitability. Soils beneath the trees are dry, and while canopy closure is suitably dense, there is no understory, and the cottonwoods do not provide much suitable branching structure for nesting. In addition, those limbs with suitable branching structure are exposed, increasing chances of depredation.

## River Ranch, Nevada

The RIRA study area is located on a cattle ranch in the Pahranagat Valley, near the town of Ash Springs and approximately 9 km south of KEPI. It consists of several isolated patches of riparian vegetation, each surrounded on all sides by

grazed, irrigated cattle pasture, as well as a linear swath of trees along the outflow stream from Ash Springs. When monitoring began in 2011, the pasture was irrigated periodically to grow grass, and then the pasture was allowed to dry out while the cattle grazed (A. Pellegrini, personal observation). By 2015, the pasture was flooded for longer periods of time, and grazing frequency decreased; this pattern continued in 2016. The vegetation in the frequently flooded area between West Side and Smalls has changed from grass and *Juncus* sp. to an unidentified sedge-like species that grew to approximately 2 m in height by July. Irrigation was turned off in mid-June for 2–3 weeks, and soils were noticeably drier in the study area during this period (C. Hines 2017, personal communication). Although the isolated patches of vegetation do provide suitable flycatcher habitat (see "Habitat Suitability Criteria," above), SWCA's assessment is that overall habitat suitability is fair. The small areal extent of these patches (< 1 ha total), in combination with their location in a cattle pasture and relative isolation from other breeding sites in the valley, limits the overall suitability of this study area. Signs of cattle were noted in each site, though no obvious browse line was noted during the season.

### *East Side*

Area: 0.4 ha Elevation: 1101 m

The survey site known as East Side is composed primarily of dense, large-diameter coyote willows 4–7 m in height. Tree height is shorter at the perimeter, giving the site a rounded appearance. A couple of Russian olive (*Eleagnus angustifolia*) and emergent velvet ash (*Fraxinus velutina*) trees are present in the site. One large, 10-m-tall cottonwood dominates the northeastern corner of the site, though half of the tree has fallen over and died. There are numerous piles of deadfall scattered throughout the site. Little to no understory is present, except where the coyote willows are able to regenerate and in some small clearings where herbaceous vegetation dominates. Some wild grape (*Vitis* sp.) also grows in the northwestern corner, creating extremely dense habitat. Canopy closure is primarily 70–90%, with lower canopy closure found in a few scattered clearings throughout the site. Standing water was present in the site when site descriptions were recorded in May and June, though no more than 10% of the site was inundated. When the July site description was recorded, only damp soils were noted within the site (see table 2-2). Even though surface water in the site is dependent on flood irrigation, this site is located on the edge of the area typically affected by irrigation activities, and it is unlikely that soil moisture conditions in the majority of the site varied strongly between site descriptions.

East Side was occupied by two breeding flycatchers (see table 2-1). Two additional flycatchers, each of which was known to have held a territory elsewhere in the Pahranagat Valley, were detected in the site for 1 to 3 days each. This site was surveyed once, totaling 0.1 observer-hour. Cowbirds were detected during the survey as well as during nest monitoring activities. Habitat suitability

in this site (see "Habitat Suitability Criteria," above) is fair. Canopy closure is a little thin in places, but there are suitably dense locations with good branching structure for nesting. Wet soils can exist within this site, though it is typically the first of the three RIRA survey sites to dry out. Several gaps exist where cattle can access the interior of the site.

### *West Side*

Area: 0.3 ha Elevation: 1101 m

This survey site known as West Side is composed primarily of dense, large-diameter coyote willows 4–6 m in height. Canopy height is shorter at the perimeter, giving the site a rounded appearance. A couple of corridors in the vegetation run from the exterior of the site into the interior, creating gaps in the canopy. Some Russian olive trees are scattered along the perimeter of these corridors and along the eastern perimeter of the site. There is little to no understory throughout most of the site, except in the northeastern corner, where an extensive patch of wild grape is growing on the trees. In the corridors, no understory is present, but grasses and other herbaceous plants provide groundcover. The coyote willows in the northeastern corner are noticeably stressed compared to the rest of the site, with many dead leaves, dead branches, and reduced canopy closure. A couple of disjunct, 10- x 10-m patches of dead coyote willows are present along the northwestern and eastern edges of the site. Canopy closure is 80–90% throughout the southern two-thirds of the site and is 75% in the northern third. Areas of deadfall up to 1 m deep are scattered throughout the site, making travel difficult in places. When site descriptions were recorded in May, June, and July (see table 2-2), standing water covered at least three-quarters of the site, and a flowing, 1-m-wide channel was also present along the western edge of the site. The site did dry out temporarily in the latter half of June, when damp soils were present throughout the site (A. Pellegrini, personal observation).

One flycatcher, which later held a territory elsewhere in the Pahranagat Valley, was detected May 26–30 (see table 2-1). This individual is not considered resident in the site, and the site is not considered occupied in 2016. West Side was surveyed twice, totaling 0.6 observer-hour. A cowbird was detected during one survey. Habitat suitability in this site is now noticeably lower than it was when SWCA first began monitoring in 2011 (figures 2-2 and 2-3). The northern third of the site does not have adequate canopy closure (see "Habitat Suitability Criteria," above) and also lacks enough live vegetation to attract nesting flycatchers. Areas of suitably dense vegetation with wet soils and good branching structure exist in the southern end of the site but are limited in extent.

**Figure 2-2.—Overview of West Side in the River Ranch (RIRA) study area, July 2012.**

**Figure 2-3.—Overview of West Side in the River Ranch (RIRA) study area, May 2015.**

### *Smalls*

Area: 0.2 ha Elevation: 1099 m

This survey site known as Smalls is composed primarily of coyote willows 3–6 m tall. There is little understory except sparse, regenerating coyote willows in the densely vegetated areas. A large gap in the woody vegetation, approximately 8 x 15 m in size, dominates the northern half of the site. This gap is dominated by herbaceous vegetation and is ringed on the western, northern, and eastern sides by a stand of coyote willows approximately 3–5 m in height and 4 m wide with 80–85% canopy closure. The southern half of the site is more homogenous in structure with coyote willows 5–6 m in height and canopy closure averaging 85–90%. Deadfall is scattered throughout the site but typically does not occur in piles as it does in East Side and West Side. The site was completely covered in about 10 cm of slowly flowing water when site descriptions were recorded in May, June, and July (see table 2-2). Water levels within the site fluctuate with the amount of irrigation water being released into the area, however, and the entire study area dried out temporarily in the latter half of June (A. Pellegrini, personal observation).

No willow flycatchers were detected (see table 2-1). This site was surveyed three times, totaling 0.3 observer-hour. Cowbirds were detected during two surveys. This site is the smallest and wettest of the three in the RIRA study area. Although suitably dense vegetation, wet soils, and good branching structure do exist within the site (see "Habitat Suitability Criteria," above), these components are limited to an area approximately 30 x 35 m in size in the southern portion of the site, and overall habitat suitability is fair. The coyote willows in Smalls are also stressed, in a fashion similar to that of West Side, with the greatest tree mortality on the northern edge of the site.

## Pahranagat, Nevada

The PAHR study area is located around Upper Pahranagat Lake at the northern end of the Pahranagat National Wildlife Refuge, approximately 27 km south of KEPI. Patches of primarily native vegetation exist at the inflow and outflow of Upper Pahranagat Lake and along the lakeshore. Upper Pahranagat Lake is divided into two units by a levee, with the northern portion known as the North Marsh unit. Water flows between the two portions of the lake via a water control structure. Prior to the 2008 survey season, the majority of the riparian vegetation along the northern side of the upper lake (Pahranagat North) was inundated annually with up to 1 m of water, with the highest water levels occurring in May. Major structural problems with the dam that impounds the upper lake resulted in the upper lake being drained in early 2008, and the riparian vegetation at the northern end of the lake was not flooded during the 2008 or 2009 breeding seasons. The dam was repaired prior to the 2010 breeding season, resulting in a limited amount of inundation in May 2010 and in May of each subsequent year. The lake levels in 2013–16 were the highest recorded since the dam was repaired but were still not as high as they had been before 2008. The lake levels did not decline as strongly during the season in 2016 as they had in previous years (figure 2-4), and water levels in June and July were the highest noted in that month since 2005 and 2003, respectively. The North Marsh unit was managed in 2016 to maintain higher water levels for longer into the flycatcher breeding season, while the rest of Upper Pahranagat Lake was managed normally (figure 2-5; J. Vinson 2017, personal communication). From 2003 to 2007, no cattle were observed within any of the survey sites. From 2008 to 2014, cattle from the neighboring ranch began to wander into the northern portion of the lake and adjacent sites (Pahranagat North and Pahranagat West) as lake levels dropped during the season. No cattle were observed in the survey sites during the breeding season in either 2015 or 2016.

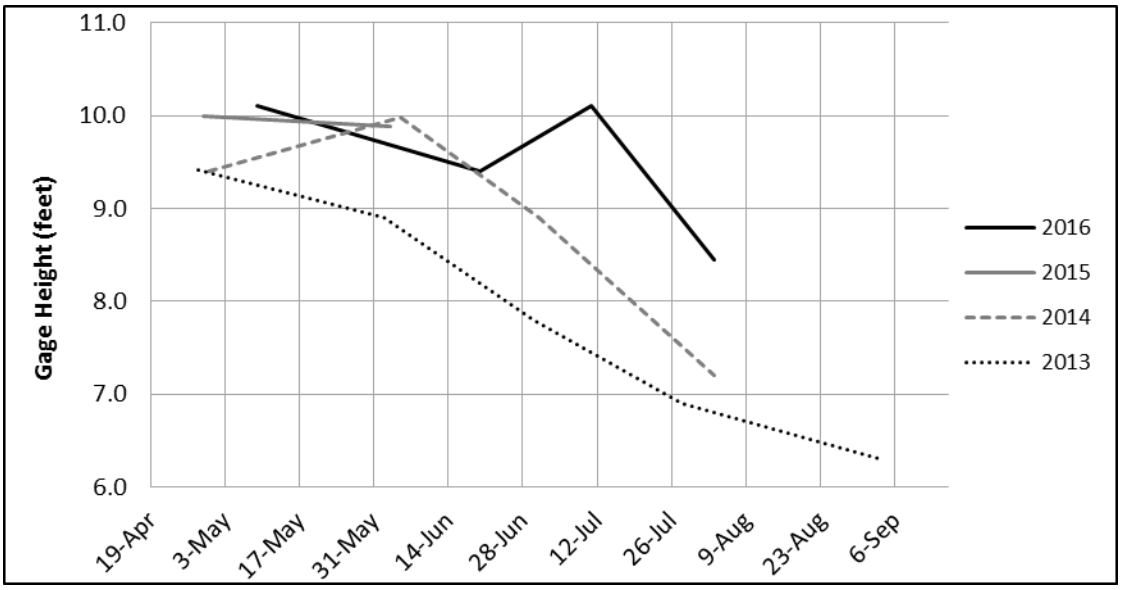



**Figure 2-4.—Gage height (feet) at the Cross Dike gage on the North Marsh unit of Upper Pahranagat Lake at the Pahranagat National Wildlife Refuge, 2013–16.**

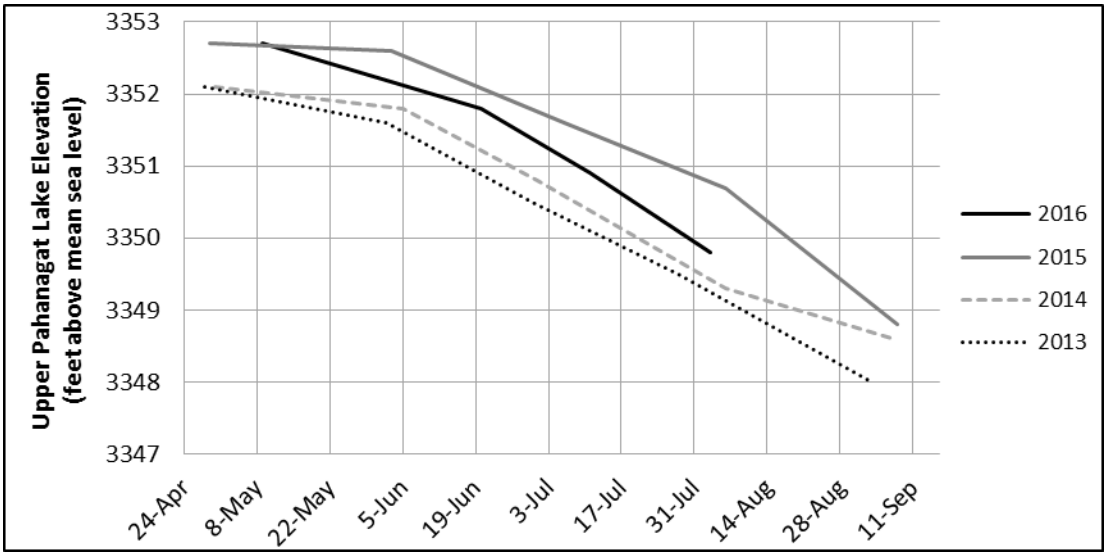



**Figure 2-5.—Elevation (feet above mean sea level) of Upper Pahranagat Lake at the Pahranagat National Wildlife Refuge, 2013–16.**
Elevation measured at the southern end of the lake for the portion below the North Marsh unit.

### *Pahranagat North*

Area: 3.2 ha Elevation: 1019 m

The survey site known as Pahranagat North is a stand of large-diameter Goodding's willows at the inflow of Upper Pahranagat Lake. Cottonwoods line the northern, upland edge of the site and extend in narrow stringers around the edge of the lakebed. Canopy height within the site is around 20 m in the Goodding's willows and 25 m in the cottonwoods. Many of the large trees in the northeastern section of the site are dead or dying. Scattered cottonwoods have fallen throughout the site, creating multiple small clearings. Canopy closure under the Goodding's willows varies from as little as 65% in some of the clearings to as high as 95% under some of the denser trees. Canopy closure in the cottonwood-dominated portions of the site is less variable and not quite as dense at 80–90%. Dense Indian hemp (*Apocynum cannabinum*) up to 2 m in height is present in the understory of the northern third of the site. Very little herbaceous vegetation is present in the understory in the southern two-thirds of the site due to inundation. Many Goodding's willows or portions of the trees have fallen over but continue to grow, creating a distinct understory layer of woody vegetation. Two inflow channels are present in or near the site. One channel flows through the western arm of the site and into the center of the site. The other channel is located north of the site and starts at the very western edge of the site, flows east, and drains into the lake along the eastern edge of the site. Standing water was present in the northern inflow channel, the interior channel, and the center of the site, as well as along the eastern and southern edges of the site, when site descriptions were recorded in May, June, and July (see table 2-2). Although formal site descriptions were completed only three times, field personnel were onsite approximately every 2 to 4 days, and water levels did not fluctuate notably from day to day (C. Hines 2017, personal communication).

Pahranagat North was occupied by 13 breeding flycatchers and 4 resident, unpaired male flycatchers (see table 2-1). In addition to resident flycatchers, three flycatchers known to have held a territory elsewhere in the Pahranagat Valley, one flycatcher detected for the first time since it was banded as a nestling, and one willow flycatcher of unknown origin were each detected for 1 or 2 days in late July or early August. These additional five individuals are not considered resident in the site. Unoccupied portions of the site were surveyed three times, totaling 1.3 observer-hours. Cowbirds were detected during one survey and were also noted several times during monitoring activities. This site meets the habitat suitability criteria (see "Habitat Suitability Criteria," above), and SWCA's assessment is that this site has high habitat suitability. The very shallow slope along the lake edge means that wet soils persist within the site throughout most of the breeding season in years when lake levels are high enough. The Goodding's willows provide suitably dense cover and good branching structure. While several trees have fallen in recent years, many pockets of good habitat exist, especially in the southern end of the site. The northern border of the site, which has a higher prevalence of cottonwoods, tends to lack a woody understory and wet soils, which reduces its suitability.

### *Pahranagat West*

Area: 1.3 ha Elevation: 1023 m

The survey site known as Pahranagat West is a native survey site that consists of a stringer of cottonwoods, one-to-three trees wide and 20 m in height, on the western edge of Upper Pahranagat Lake. A few Goodding's willows 10–15 m in height are present in the northern half of the site, creating a distinct layer beneath the main canopy. The rest of the site has no significant understory vegetation. Canopy closure varies from 50 to 85%, with the densest canopy closure present within the Goodding's willows. The eastern edge of the site is vegetated with bulrush, which extends into the lakebed. The western edge of the site is vegetated in yerba mansa, which transitions into dry, alkali desert scrub. When site descriptions were recorded in May, June, and July (see table 2-2), the upland side of the site was dry, but surface water or saturated soil was present in the lakebed adjacent to the tree trunks. Although formal site descriptions were completed only three times, field personnel were onsite approximately every 2 to 4 days and confirm that water levels did not fluctuate notably from day to day (C. Hines 2017, personal communication).

Two breeding flycatchers were detected (see table 2-1). One additional flycatcher was detected on May 15; this individual later established territories in Pahranagat MAPS and Pahranagat North and is not considered resident in Pahranagat West. Unoccupied portions of the site were surveyed three times, totaling 0.6 observer-hour. Cowbirds were detected during two surveys. No signs of livestock were noted. The majority of the site does not meet the habitat suitability criteria (see "Habitat Suitability Criteria," above), and SWCA's assessment is that habitat suitability is low in most of the site because of the lack of understory, the narrow extent of woody vegetation, and a relatively steep slope along the lake edge that prevents water from encompassing the trees. The combination of these factors creates habitat that lacks cover and good branching structure for nesting. In the northern portion of the site, the presence of Goodding's willows in the understory creates habitat with good branching structure, good cover, and a lower canopy that extends over the lakebed. The slope of the lakebed is also shallower, creating suitable soil moisture conditions when lake levels are high enough.

### *Pahranagat MAPS*

Area: 0.3 ha Elevation: 1022 m

The survey site known as Pahranagat MAPS consists of six distinct patches of dense, mostly small-diameter cottonwoods. Five of the patches are located on tiny hummocks of land in the marsh along the southwestern edge of Upper Pahranagat Lake and the sixth is located just south of the lake on the edge of a large marshy area. The patches range in size from 20 x 25 m to 20 x 45 m and are 70 to 240 m apart. Canopy height in each patch ranges from 8 to 15 m, with one large-diameter, 20-m-tall snag on the highest point in each patch. The snags blew

over during the 2016 season in five of the patches, which resulted in gaps in the canopy. Canopy closure ranges from 60 to 90%. Each patch was mostly inundated when the May and June site descriptions were recorded (see table 2-2), with small exposed islands of land in the middle of each. When the July site description was recorded, standing water was present on the eastern side of each patch, with some isolated pools scattered on the western side. Field personnel were onsite approximately every 2 to 4 days, however, and confirm that water levels within the habitat did not fluctuate notably from day to day (C. Hines 2017, personal communication).

Pahranagat MAPS was occupied by two breeding flycatchers and three resident, unpaired male flycatchers (see table 2-1). Unoccupied portions of the site were surveyed twice, totaling 1.0 observer-hour. Cowbirds were detected during both surveys and during nest monitoring activities. No signs of livestock were noted. The patches at Pahranagat MAPS vary in meeting the habitat suitability criteria (see "Habitat Suitability Criteria," above). All patches have suitable soil moisture conditions, given their location in the lakebed. The smallest patches have the shortest and densest vegetation, with the best branching structure for nesting, but these patches are very limited in areal extent. The largest patches have a taller canopy that is more open, and the lower canopy closure reduces suitability.

### *Pahranagat South*

Area: 1.4 ha Elevation: 1025 m

Vegetation within this survey site consists of a 20-m-tall cottonwood stringer along a human-made channel that carries the outflow from Upper Pahranagat Lake. Canopy closure within the cottonwood stringer ranges from 40 to 75% and varies depending on the width of the stringer and abundance of standing snags. The understory contains mostly Indian hemp, yerba mansa, rabbitbrush (*Ericameria nauseosa*), cattails (*Typha* sp.), and bulrush. Some coyote willows are scattered through the understory as single, small-diameter stems along the channel. In addition to the scattered stems, two small (10 x 40 m) patches of coyote willows 3–4 m in height are present near the center of the site. Canopy closure within these patches is > 90%, and stem density is extremely high, creating very tangled vegetation. A third patch of coyote willows 10 x 30 m in size and 4 m in height is present at the northern end of the site. This patch contains young, small-diameter stems, and canopy closure does not exceed 80%. The channel held water, and soils immediately adjacent to the channel were saturated when site descriptions were recorded in May, June, and July (see table 2-2). In addition, soils on the western edge of the site, including in the northern coyote willow patch, held either inundated or saturated soils when the May and June site descriptions were recorded but were damp when the July site description was recorded. All other soils during the May, June, and July site descriptions were dry. Factors influencing water levels along the western side of the site are unknown, and it is possible that fluctuations in water levels occurred between site descriptions.

No willow flycatchers were detected (see table 2-1). This site was surveyed three times, totaling 1.2 observer-hours. Cowbirds were detected during two surveys. No signs of livestock use were noted. The majority of this site does not meet the habitat suitability criteria (see "Habitat Suitability Criteria," above) because it lacks an understory, and SWCA's assessment is that habitat suitability is low in this site. The understory has been slowly growing back following a fire in 2010, but most of the species present will not develop into an understory suitable for flycatchers. Some coyote willows are present, but two of the three patches are too small and too dense and have not increased in extent since the fire. A promising patch of coyote willow is present on the northern end of the site, but it has yet to develop suitably dense canopy closure. The other factor limiting suitability is the distribution of wet soils within the site. In many years since 2008, surface water has been limited to the human-made channel that runs through the site, which has likely influenced the slow rate of regeneration of a woody understory. Water has intermittently been present in the field to the west of the site, and in some years, this field was an open marsh. Surface water was again noted in this field in 2016, increasing the areal extent of wet soils within the site.

## Meadow Valley Wash, Nevada

The MVWA study area is located in Meadow Valley Wash, which extends south from Caliente, Nevada, through a narrow canyon known as Rainbow Canyon, and past Elgin, Nevada. Habitat within the canyon consists of narrow bands of native vegetation along a perennial stream. Streamflow is typically minimal during the flycatcher breeding season (figure 2-6), but scouring floods do occur regularly, and habitat within the wash is therefore dynamic. Water within the study area is ponded in several places due to beaver activity and is also subsurface in several locations. A tree-like willow species that did not resemble a Goodding's willow was noted in several survey sites but was not identified to species. This willow species had leaves that were proportionately wider, with a glossier dark green upper surface and a noticeably more glabrous underside than those of a Goodding's willow; twigs were also noticeably redder. A researcher not associated with this project collected a sample of willow in 2014 within 1 km of Etna, Nevada, and identified it as red willow (*Salix laevigata* Bebb) (Southwest Environmental Information Network 2014).

### *Rock Springs Canyon*

Area: 0.3 ha Elevation: 1218 m

The survey site known as Rock Springs Canyon is located approximately 14 km downstream from Caliente, Nevada. This survey site consists of a small patch of habitat approximately 50 m x 60 m in size. The dominant overstory of the site consists of coyote willows 4–5 m in height. A few emergent 6–7-m-tall cottonwoods and some unidentified willow trees 4–5 m in height are scattered in the site. Stem diameter of all the trees is small, and very little deadfall was

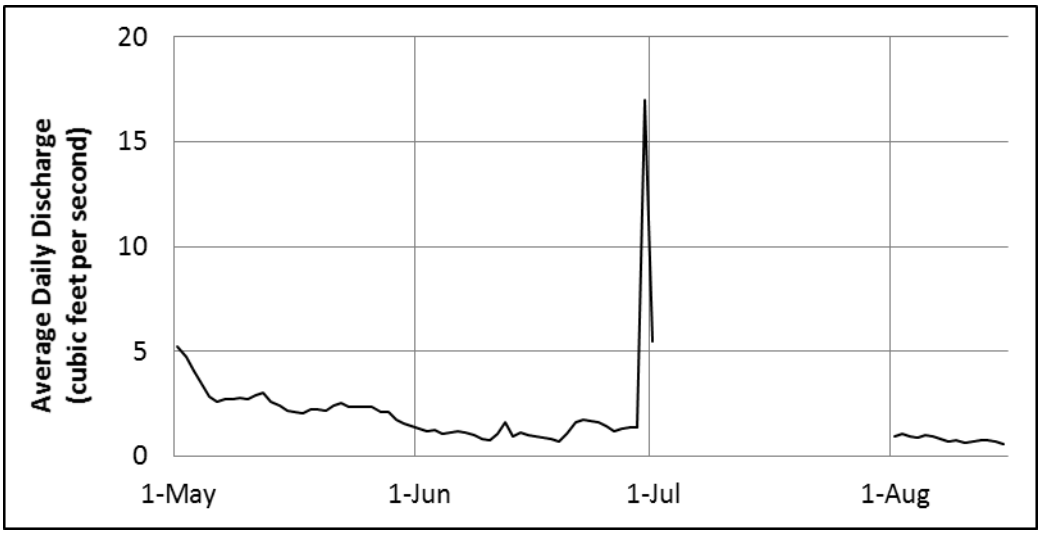



**Figure 2-6.—Average daily discharge (cubic feet per second) recorded at Meadow Valley Wash at Caliente, Nevada (U.S. Geological Survey Station #09418500), May 1–August 15, 2016.**

noted, indicating that this is a very young site. Canopy closure is typically 80–90% but is as low as 60% in a couple of drier, sparser areas. Small, shallow streams meandered through the eastern and southern portions of the site when the site description was recorded in July (see table 2-2). The streams were ponded to a depth of 40 cm in a few places by beavers. Soils away from the streams and ponds were damp to dry. Water levels in this site are dependent upon both streamflow in Meadow Valley Wash and local beaver activity. The site was not discovered until late June, and surface water conditions at the site prior to its discovery are unknown. Field personnel were onsite approximately every 2 to 4 days, however, and water levels within the habitat did not fluctuate notably from day to day in July and early August (C. Hines 2017, personal communication).

Rock Springs Canyon was occupied by two breeding flycatchers (see table 2-1). Due to occupancy status, no surveys were conducted in the site. No cowbirds were noted during nest monitoring activities. Signs of horses were noted on a visit in July. A majority of this site meets the habitat suitability criteria (see "Habitat Suitability Criteria," above). The extent of suitable habitat is limited but could increase, as the vegetation is still young and the beaver ponds could grow in size.

### *Dog Leg*

Area: 10.3 ha Elevation: 1207 m

The survey site known as Dog Leg is located approximately 400 m downstream from Rock Springs Canyon and consists of a complex mosaic of vegetation types

and various hydrological conditions. Coyote willows 4–7 m in height are present throughout a majority of the site. In some places, they form the main overstory with 60–90% canopy closure, with the denser vegetation occurring closer to wet areas. In areas with predominantly dry soils, many of the coyote willows are either dead or dying. Tamarisk 5 m in height is sporadically mixed with the coyote willows throughout the site. Taller tree species, including cottonwood, velvet ash, and an unidentified willow species, are also present throughout the site. In some places, these trees are present as scattered, emergent individuals in larger coyote willow patches. In other places, these three tree species form an overstory 8–20 m in height with 20–85% canopy closure. In drier areas of the site, the overstory of these taller trees is generally broken with little to no understory. In wetter areas of the site where the taller tree species form an overstory, coyote willows and tamarisk are often present in the understory, and canopy closure is higher. Wet soils are predominant along the western border of the site, and dry soils are more prevalent along the eastern site border. Dry soils vary in composition from clay to loose gravel bars. In areas where gravel is more dominant, the number of trees is lower, the proportion of snags is higher, and overall canopy closure is lower. In areas adjacent to standing water, canopy closure and tree density are higher. When site descriptions were recorded in May, June, and July (see table 2-2), surface water was present in the form of a narrow stream that was braided in places and flowed through a small cattail marsh and several beaver ponds. The extent of the surface water was noticeably lower during the June and July site descriptions than it had been during the May site description, with water primarily present only in the northern half of the site in June and July. Soils away from the streams and beaver ponds were damp to dry during each site description.

Dog Leg was occupied by five breeding flycatchers (see table 2-1). In addition to resident adults, one willow flycatcher that was not determined to be a resident was detected on May 18. Unoccupied portions of the site were surveyed five times, totaling 10.2 observer-hours. Cowbirds were detected during one visit. Signs of horses were observed during four visits, and signs of cattle were observed during one visit. A large portion of this site does not meet the habitat suitability criteria (see “Habitat Suitability Criteria,” above) because of low canopy closure and a lack of wet soils. Areas with high suitability are scattered in small patches throughout the larger matrix of habitat with mostly low suitability. The best habitat, which has the densest canopy closure, is located along the stream that flows through the site, especially in areas where the stream is braided and beaver ponds increase the amount of surface water within the woody vegetation.

## Muddy River, Nevada

The MUDD study area is located along the Muddy River in the Overton Wildlife Management Area near Overton, Nevada. Within the study area, the Muddy River is contained within a narrow, incised channel. River levels typically fluctuate during the flycatcher breeding season but are not high enough to result

in overbank flooding (figure 2-7), and soil away from the river channel is typically dry. Tamarisk in this study area was defoliated by tamarisk beetles throughout summer 2012, and a reduction in live tamarisk canopy has been evident in some areas since 2013. In 2016, spotty tamarisk defoliation was noted in the study area by mid-June, with more extensive defoliation noted by mid-July.

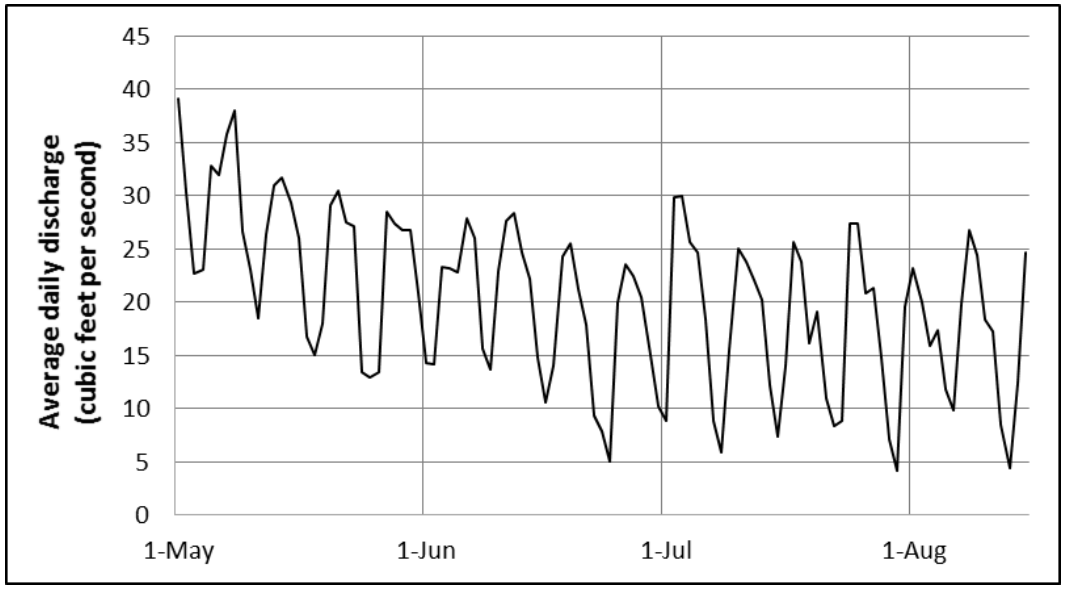



**Figure 2-7.—Average daily discharge (cubic feet per second) recorded at the Muddy River at Lewis Avenue in Overton, Nevada (U.S. Geological Survey Station #09419507), May 1 – August 15, 2016.**

### *Overton WMA Pond*

Area: 0.7 ha Elevation: 378 m

This survey site known as Overton WMA Pond consists of a patch of mixed-native vegetation approximately 150 m long and 75 m wide at the northern end of the Overton Wildlife Management Area just south of Honeybee Reservoir. A channel bisects the site from north to south and carries outflow from the reservoir. The dominant vegetation consists of Goodding's willows 15–20 m in height and 5–7-m-tall tamarisk. The two species rarely overlap, and there is only a sparse understory beneath the Goodding's willows. Arrowweed (*Pluchea sericea*) and common reed (*Phragmites australis*) are present in scattered, dense patches within and along the edges of the site. Common reed is also present along the channel in patches up to 4 m wide. Canopy closure is variable, ranging from 70% by the channel up to 90% elsewhere. In areas under the Goodding's willows where there is little understory, yerba mansa forms a dense groundcover. Surface water was present in the channel when site descriptions were recorded in May, June, and July, with soils away from the channel being mostly dry (see table 2-2). Water levels in the channel are dependent on releases from Honeybee Reservoir and could fluctuate. However, Honeybee Reservoir is not a large body of water,

and the resulting outflow is unlikely to affect the site beyond the immediate vicinity of the channel. Overall soil moisture conditions within the site likely did not change substantially between site descriptions.

Two willow flycatchers were detected on May 17, and one willow flycatcher was detected on May 28 (see table 2-1). Field personnel followed up on each detection with three subsequent monitoring visits, but no further detections were recorded during the monitoring visits or on subsequent surveys. None of the willow flycatchers were determined to be residents, and this site is not considered occupied in 2016. This site was surveyed five times, totaling 1.5 observer-hours. Cowbirds were detected during four surveys, and no signs of livestock use were noted. Portions of the site meet the habitat suitability criteria (see "Habitat Suitability Criteria," above) in that they have dense canopy closure, wet soils, and suitable branching structure. These areas are limited in areal extent, however, and SWCA's assessment is that overall habitat suitability is fair. Many areas lack dense canopy closure, lack an understory with woody vegetation, or have an understory too thickly vegetated with arrowweed or common reed.

### *Overton WMA*

Area: 5.9 ha Elevation: 375 m

The survey site known as Overton WMA is a mixed-exotic survey site that lies along the Muddy River approximately 600 m south of Overton WMA Pond and is bordered to the southwest by open agricultural fields and to the northeast by sparser areas of riparian vegetation. The site consists of two disjunct polygons. The northern polygon is 50–70 m wide by 550 m long and is bisected by the Muddy River. This portion of the site is dominated by very dense tamarisk 4–9 m in height with canopy closure ranging from 50 to 90%. Vegetation is tallest on the eastern bank of the river channel, reaching 7–9 m in height. Vegetation height, density, and canopy closure decrease with increasing distance from the channel. Many of the tamarisk are heavily damaged from previous years' defoliation, and the tops of many trees are dead. As a result, canopy height is not uniform in any part of the site. Several small patches of coyote willows 5–6 m in height with 90–95% canopy closure are present on the eastern bank of the river near the southern end of this portion of the site. Two stretches of the channel of the Muddy River within this portion of the site were dredged with heavy equipment over the 2007–08 winter, resulting in a cleared swath 10–15 m wide on the western bank of the river. This swath is now thickly vegetated with quailbush (*Atriplex lentiformis*), willow baccharis (*Baccharis salicina*), and tamarisk 2–3 m in height. Canopy closure in this area is as low as 20%. The river channel in the northern portion of the site is incised 2–3 m below the surrounding land surface and contained flowing water when site descriptions were recorded in May, June, and July (see table 2-2). Field personnel were onsite approximately every 2 to 4 days throughout the field season, and although flow rates in the Muddy River

fluctuated regularly throughout the season (see figure 2-7), water remained confined to the channel, and soils outside the channel were dry throughout the survey season (C. Hines 2017, personal communication).

The southern polygon consists of a 125- x 275-m stand of mixed-exotic vegetation along an old channel of the river. This portion of the site is dominated by a stand of Goodding's willow 10–15 m in height with a tamarisk understory 3–5 m in height. Many of the Goodding's willows have fallen over or lost limbs, creating gaps in the canopy. Canopy closure ranges from 60% in areas with large gaps to 90% in the few areas of denser vegetation. Several open areas with dead cattails are scattered throughout this portion of the site. Some willow baccharis is present in the southwestern corner of this portion of the site. A 25- x 20-m patch of coyote willows up to 6 m in height with 90% canopy closure is present near the center of this portion of the site. The densest, most suitable vegetation in this portion of the site is located between the center, near the coyote willows, and the southern edge of the site. The far eastern end of this portion of the site is primarily 4-m-tall tamarisk that shows signs of damage from tamarisk beetle defoliation and has 70% canopy closure. The Muddy River flows into the northern end of this portion of the site and then splits into two channels, one of which runs through the site and another that skirts the southwestern edge of the site. The channel that runs through the site was dredged in 2005 as part of the efforts at the Overton Wildlife Management Area to repair flood damage to the water control system. This dredged channel carried water through the southern part of the site in subsequent years but slowly filled in with sediment and cattails. Starting in 2013, the channel that runs through the site has been dry, and the river has flowed only in the channel along the southwestern boundary of the site. As is the case in the northern portion of the site, this channel is incised 2–3 m below the surrounding soil surface, and only the channel contained surface water when site descriptions were recorded in May, June, and July. As noted above, river depth fluctuated regularly, but soils away from the channel were dry throughout the survey season (C. Hines 2017, personal communication).

This survey site was occupied by four breeding flycatchers, with one pair in each polygon (see table 2-1). One additional willow flycatcher was detected from June 21 to 25. This individual was not detected on any of three subsequent monitoring visits, and it was not determined to be a resident. Portions of this site not known to be occupied by flycatchers were surveyed five times, totaling 8.1 observer-hours. No signs of livestock were observed, but cowbirds were detected during all surveys. The best habitat within the site is within 10–15 m of the bank along a 150-m stretch of river in the northern portion, where canopy height and canopy closure are adequate (see "Habitat Suitability Criteria," above). Some suitable vegetation exists along the river in the southern portion of the site, and there is also a patch of vegetation approximately 50 x 50 m in size with suitably dense canopy closure in the south-central portion of the southern portion of the site, but soils here are dry. Habitat elsewhere in the site is too open and too dry and sometimes too short. The lack of suitably dense canopy closure is exacerbated by damage from tamarisk beetle defoliation.

## Warm Springs, Nevada

The WMSP study area is located in the Warm Springs Natural Area at the northern end of the Moapa Valley, at the headwaters of the Muddy River. Surface water occurs in the study area in several incised stream channels and some low-lying areas. The streams are perennial, but there is an obvious seasonal drying trend in the intermittently wet, low-lying areas. On July 1, 2010, a wildfire burned at least part of every survey site at WMSP. Due to the severity of fire damage, surveys were discontinued after the fire at all sites except Muddy Mac. Personnel continued to monitor the recovery of vegetation at Muddy Stringer 01, and surveys resumed at this site in 2014.

### *Muddy Mac*

Area: 0.9 ha Elevation: 535 m

The survey site known as Muddy Mac is a native survey site that lies near the head of Apcar Stream. It is bordered by a grassy field to the west and a small cattail marsh to the east and south. The northern half of the site was heavily damaged in the 2010 fire, with the overstory being completely killed. Dense basal regeneration of velvet ash has occurred, resulting in dense clusters of stems, and this half of the site was again included in surveys in 2016. The majority of the site is vegetated with velvet ash 5–15 m in height. In the northern half of the site, the velvet ash is 5–6 m in height with 95% canopy closure. The understory structure feels relatively open, despite the dense canopy closure, as each tree comprises a cluster of narrow stems spaced relatively far from the next cluster. A few emergent cottonwoods and palm trees (*Washingtonia* sp.) are scattered in this portion of the site. The southeastern quarter of the survey site consists of closely spaced, small-diameter (5–8 cm), single stems of velvet ash 6–7 m in height with no understory and 85–90% canopy closure. The close spacing of the stems creates a stand that feels very dense, yet the canopy of each tree in this portion of the site is relatively sparse, resulting in lower canopy closure than in the northern half. The southwestern quarter of the site is dominated by sparse velvet ash 12–15 m in height with 60–90% canopy closure. An understory layer exists in this portion of the site and consists of sparsely distributed regenerating 4–5-m-tall velvet ash, some tamarisk, and a few honey mesquite (*Prosopis glandulosa*), with thick grasses and yerba mansa forming a dense groundcover in areas without an understory. The area immediately south of the site has been cleared as part of a restoration effort. Surface water was present in the very southern portion of the site when a site description was recorded in May. When site descriptions were recorded in June and July, no more than 10% of the site contained damp soils, and all other soils were dry (see table 2-2); the adjacent cattail marsh also lacked standing water or saturated soils. This site is not directly connected to any of the perennially flowing streams in the study area, and water levels are subject to seasonal drying trends. It is unlikely that any significant fluctuations in soil moisture conditions occurred between site descriptions.

No willow flycatchers were detected (see table 2-1). This site was surveyed five times, totaling 2.4 observer-hours. Cowbirds were detected during three surveys. No evidence of livestock was observed. With the exception of the southwestern quarter, the site has suitably dense canopy cover and good vegetation structure (see "Habitat Suitability Criteria," above), and habitat suitability within this site is fair to good. Overall habitat suitability would be improved if wet soils covered a larger areal extent and were present for a longer portion of the season.

### *Muddy Stringer 01*

Area: 0.8 ha Elevation: 530 m

The survey site known as Muddy Stringer 01 is located approximately 100 m north of the main stem of the Muddy River and contains two distinct portions: a narrow, linear northern arm and a bulbous southern end. A narrow stringer of 10–15-m-tall palm trees runs the entire length of the site along an irrigation canal. The northern arm of the site is dominated by the palm tree stringer, which consists of widely spaced single trees. The understory of the northern arm contains scattered clumps less than 5 x 5 m in size of tamarisk or velvet ash no more than 2 m tall. Areas in the northern arm lacking woody vegetation are covered by dense yerba mansa. Near the very northern end of the site is a small patch of coyote willows approximately 5 x 20 m in size, reaching 4 m in height and 80% canopy closure. The southern end of the site is vegetated with two distinct vegetation types. The western half of the southern end is vegetated with 4–6-m-tall coyote willows with 85–90% canopy closure and a dense groundcover of yerba mansa. The eastern half of the southern end is vegetated in a more heterogeneous mix of 5–8-m-tall velvet ash and 5-m-tall tamarisk on either side of the palm tree stringer. Some honey mesquite and cattails are also scattered throughout the eastern half. Canopy closure in the eastern half of the southern end ranges from 60 to 95%. Standing water was present in the channel when site descriptions were recorded in May and June. Almost all soils were dry when the July site description was recorded (see table 2-2). This site is not directly connected to any of the perennially flowing streams in the study area, and water levels are subject to seasonal drying trends. Field personnel were onsite approximately every 4 to 6 days, and water levels within the habitat did not fluctuate notably from day to day (C. Hines 2017, personal communication).

This site was occupied by one resident, unpaired male flycatcher (see table 2-1). In addition, one willow flycatcher that was not determined to be a resident was detected on July 26. Unoccupied portions of the site were surveyed once, totaling 0.1 observer-hour. A cowbird was detected during the survey, and no evidence of livestock was noted. Most of the northern arm of this site lacks any type of closed canopy or understory and does not provide suitable habitat for breeding flycatchers. The small coyote willow patch at the northern end of the site could develop into suitable habitat if it increased in height, areal extent, and density. Surveys could be discontinued in the northern arm of the site, but the coyote

willow patch could be checked at the beginning of future seasons to determine if suitability has improved. Habitat suitability in the southern portion of the site is fair and would be improved if canopy closure within the coyote willows increased and if the areal extent of wet soils increased within the site.

## Topock Marsh, Arizona

Topock Marsh lies within the Havasu National Wildlife Refuge and encompasses over 3,000 ha of open water, cattail and bulrush marsh, and riparian vegetation. A large expanse (over 2,000 ha) of riparian vegetation occupies the Colorado River flood plain between the Colorado River on the western edge of the flood plain and the open water of Topock Marsh on the eastern edge of the flood plain. The TOPO study area is located in this large expanse of riparian vegetation, which is primarily monotypic tamarisk with isolated patches of tall Goodding's willows. Seasonally wet, low-lying areas are interspersed throughout the riparian area. Marsh elevation data recorded at the South Dike gaging station show that water levels within Topock Marsh declined during the flycatcher breeding season and were approximately 0.03–0.1 m higher throughout the 2016 breeding season than they were on the corresponding day in 2015 (figure 2-8). In August 2015, a wildfire burned through TOPO north of the Firebreak Canal, consuming all or most of each survey site within the burned area. Habitat within the burned area began to regenerate in 2016 but is still completely unsuitable for flycatchers, and only survey sites south of the Firebreak Canal were monitored in 2016. Tamarisk beetles had not yet reached the TOPO study area by the end of the flycatcher breeding season, but beetles were detected in August on the eastern side of Topock Marsh, near the community of Golden Shores. Feral pigs are present throughout the TOPO study area, and evidence of pigs was observed in most survey sites.

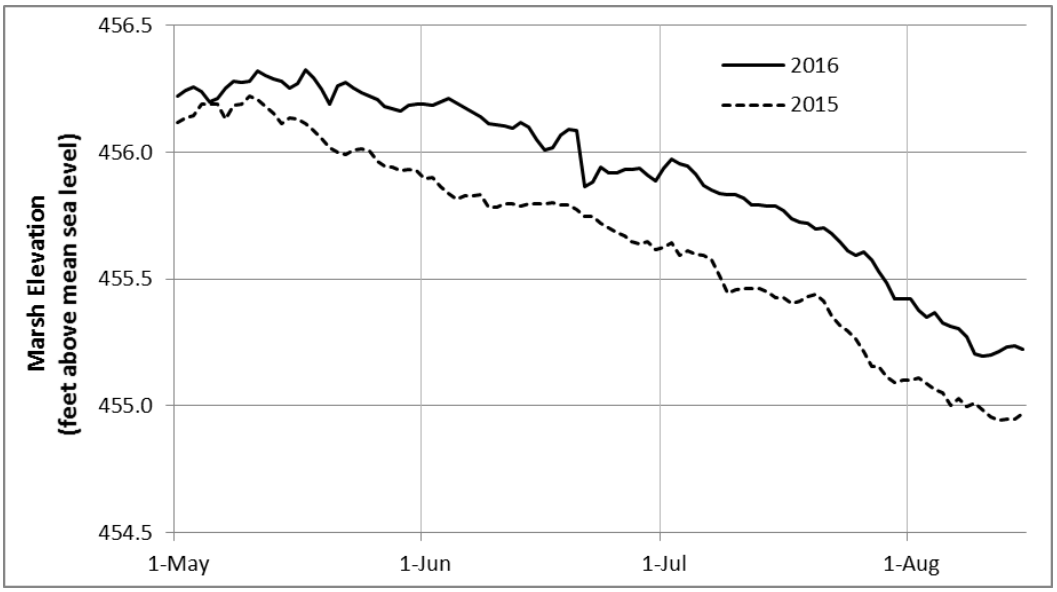



**Figure 2-8.—Daily marsh elevation (meters above sea level) measured at the South Dike at Topock Marsh, May – August, 2015–16.**

### *Swine Paradise*

Area: 0.9 ha Elevation: 144 m

The survey site known as Swine Paradise is a mixed-exotic survey site that is adjacent to and south of the Firebreak Canal. Vegetation consists of tamarisk 3–8 m in height and scattered, emergent Goodding's willows up to 18 m in height. Both the tamarisk and Goodding's willows are significantly shorter in the very southern quarter of the site, with no woody vegetation exceeding 8 m in height. A dense, 25- x 60-m patch of coyote willows 4–7 m in height is present in the northeastern corner of the site, adjacent to the Firebreak Canal, with the shorter trees in this range adjacent to the marsh. Large patches of arrowweed dominate the understory in the southern half of the site. Canopy closure ranges from 80 to 90% in the monotypic tamarisk and under the Goodding's willows. Canopy closure ranges from 70 to 90% in the coyote willows, with shorter coyote willows being more open than the taller coyote willows. The coyote willows were inundated when site descriptions were recorded in May, June, and July (see table 2-2), but the remainder of the site was dry during these visits. Swine Paradise borders the open water of Topock Marsh, and water levels within the site vary directly with those in the marsh (see figure 2-8); therefore, water levels did not fluctuate significantly from day to day.

Swine Paradise was occupied by four breeding flycatchers and one resident, unpaired male flycatcher (see table 2-1). One additional flycatcher was detected on July 29; this individual was not confirmed to be resident at the site, but it was identified to subspecies by band status. Due to occupancy status, this site was not surveyed. Cowbirds were detected several times during nest monitoring activities. Habitat suitability is high in the portion of the site where tamarisk borders the inundated coyote willows (see "Habitat Suitability Criteria," above). Tamarisk are taller in this portion, with good branching structure and dense canopy closure, and soils are at least damp and very close to standing water. Suitability within the coyote willows decreases away from the tamarisk and becomes poor to fair near the marsh edge as canopy closure decreases. The southern half of the site has extremely low suitability because of dry sandy soils, low canopy closure, and an understory that is too thickly vegetated to permit easy flight.

### *Platform*

Area: 1.9 ha Elevation: 145 m

The survey site known as Platform is an exotic survey site that lies between the main refuge road to the west and an open bulrush and cattail marsh to the east. Vegetation at the site consists of tamarisk 8–10 m in height with a few emergent Goodding's willows. Most of the site lacks a distinct understory layer, though tamarisk are very dense and covered with a thick layer of duff in many areas.

Screwbean (*Prosopis pubescens*) and honey mesquite trees are present along the western edge of the site. A 5-m-wide strip of 4–6-m-tall coyote willows runs along a portion of the eastern edge of the site adjacent to the marsh. This coyote willow strip has expanded at the northern end of its extent to cover an area approximately 30 x 40 m. Canopy closure is 90–95% in the tamarisk and is typically 50% in the coyote willows but reaches 70–80% in some places. The very eastern edge of the site bordering the marsh had inundated or saturated soils when site descriptions were recorded in May, June, and July (see table 2-2), but the remainder of the site was very dry. Platform borders the open water of Topock Marsh, and water levels within the site vary directly with those in the marsh (see figure 2-8); therefore, water levels did not fluctuate significantly from day to day.

Platform was occupied by one resident, unpaired male flycatcher (see table 2-1). Unoccupied portions of the site were surveyed five times, totaling 2.4 observer-hours. Cowbirds were detected during all five surveys. Habitat suitability is low in most of this site because soils are dry and vegetation structure in the understory is too thick (see "Habitat Suitability Criteria," above). Some suitable habitat is present along the marsh edges but is extremely limited in areal extent.

### *250M*

Area: 1.6 ha Elevation: 145 m

The survey site known as 250M is a mixed-exotic survey site that lies between the main refuge road to the west and open marsh to the east. Vegetation composition and structure varies with distance from the road. A majority of the site is vegetated in tamarisk 7–8 m in height with 95% canopy closure. Within 30 m of the road, the tamarisk are only 4–6 m in height with 80–90% canopy closure. A few emergent Goodding's willows approximately 12 m in height are present near the marsh. Some honey mesquite 9 m in height are also scattered throughout the site. A patch of coyote willows 45 x 90 m in size is present along the northern edge of the site. Canopy closure in the willows ranges from 60% in the coyote willow patch to 85% under the Goodding's willows. Only dry soils were noted on the May site description, but the observer did not traverse the marsh edge. Damp soils were noted near the marsh when site descriptions were recorded in June and July. 250M borders the open water of Topock Marsh, and water levels within the site vary directly with those in the marsh (see figure 2-8); therefore, damp soils were certainly present along the marsh edge in June, and water levels did not fluctuate significantly from day to day.

One willow flycatcher was detected on May 16 (see table 2-1). No willow flycatchers were detected on three subsequent monitoring visits or on subsequent surveys, and this individual was determined not to be a resident. This site is not considered occupied in 2016. This site was surveyed five times, totaling 4.1 observer-hours. Cowbirds were detected during all five surveys. Most of this

site contains very dry soils and either branching structure that is too dense to permit easy flight or canopy closure that is too low to be suitable (see "Habitat Suitability Criteria," above). The eastern side of the site closest to the marsh is marginally suitable with 85% canopy closure, decent branching structure, and damp soils, but suitability would be improved by increased areal extent of wet soils.

### *Hell Bird*

Area: 5.8 ha Elevation: 142 m

The survey site known as Hell Bird is a mixed-exotic survey site located on an island separated from the main riparian area by a narrow, deep channel. Vegetation composition and structure are highly variable, with the survey area vegetated primarily by a mosaic of tamarisk 6–8 m in height and Goodding's willows 15 m in height. Screwbean mesquite trees 4–6 m in height are also scattered throughout the site. Canopy closure ranges from 50 to 90%. The survey area is bordered to the north by the open channel and to the east and south by marshes. Marshes vegetated by cattails and bulrush are also interspersed throughout the site. The marshes, totaling approximately 50% of the areal extent of the site, were inundated up to 50–75 cm in depth when site descriptions were recorded in May, June, and July (see table 2-2). Adjacent soils were dry to damp. The marshes in the site are connected to Topock Marsh, and water levels within the site vary directly with those in Topock Marsh; therefore, water levels did not fluctuate significantly from day to day (see figure 2-8).

One willow flycatcher was detected on July 25. No detections were recorded on three subsequent monitoring visits, and this individual was determined not to be a resident. Because the detection was after July 20, this site is not considered occupied in 2016 (see table 2-1). This site was surveyed five times, totaling 12.1 observer-hours. Many cowbirds were detected during all five surveys. Overall habitat suitability within the site is good (see "Habitat Suitability Criteria," above). All components of suitable habitat are present in a mosaic within the site and combine into several small patches of suitable habitat distributed within the larger matrix of the site.

### *Glory Hole*

Area: 6.4 ha Elevation: 143 m

The survey site known as Glory Hole is a mixed-exotic survey site that is contiguous with and immediately to the southwest of Hell Bird. Vegetation composition and structure are highly variable, with the survey area vegetated primarily by a mosaic of tamarisk 6–8 m in height and Goodding's willows 15 m in height. Screwbean mesquite trees 9–10 m in height are also scattered

throughout the site. Canopy closure ranges from 50 to 90%. The survey area is bordered on the north by a sand dune and on other sides by a mix of woody vegetation and marshes. Marshes vegetated by cattails and bulrush are interspersed throughout the site. The marshes, totaling approximately 40% of the areal extent of Glory Hole, were inundated 50–80 cm in depth when site descriptions were recorded in May, June, and July (see table 2-2). Adjacent soils were dry to damp. The marshes in the site are connected to Topock Marsh, and water levels within the site vary directly with those in Topock Marsh; therefore, water levels did not fluctuate significantly from day to day (see figure 2-8).

Four willow flycatchers were each detected for 1 day, with two on May 15, one on May 25, and one on July 14 (see table 2-1). Each of the four detections was followed by three monitoring visits. No further detections were recorded, and none of the individuals were determined to be resident. Because one of the four willow flycatcher detections occurred between June 24 and July 20, this site is considered occupied in 2016. This site was surveyed five times, totaling 8.9 observer-hours. Cowbirds were detected during all five surveys. Overall habitat suitability within the site is good (see "Habitat Suitability Criteria," above). All components of suitable habitat are present in a mosaic within the site and combine into several small patches of suitable habitat distributed within the larger matrix of the site.

### *Farm Ditch Road*

Area: 4.4 ha Elevation: 143 m

The survey site known as Farm Ditch Road is located on the north side of the Farm Ditch canal, about 500 m west of the boat launch to Glory Hole and Hell Bird. The interior of the site was described in 2015, and it was determined that the site could be surveyed in future years, but only from the road, which is on the south side of the Farm Ditch canal. Due to the site being surveyed from the road in 2016, a thorough assessment of vegetation structure and hydrology is not available. The southern edge of the site consists of a mosaic of coyote willows and tamarisk 5–7 m in height and likely dense canopy closure, approximately 90%. Cattails and bulrush are present along the very southern edge of the site and occasionally extend into the site. In 2015, vegetation north of the coyote willows was primarily 2–2.5-m-tall arrowweed and willow baccharis with emergent 4–6-m-tall tamarisk, screwbean mesquite, honey mesquite, and 8–10-m-tall Goodding's willows. The trees were widely spaced and did not form a closed canopy; canopy closure north of the coyote willows ranged from 0 to 40%. The extent of inundated soils within the site is unknown in 2016, but it is surmised that some wet soils exist given the presence of marsh vegetation extending into the site. A quick exploration of the very northeastern corner of the site in July yielded dry soils (see table 2-2) along the upland edge.

One willow flycatcher was detected on May 16 (see table 2-1). No further detections were recorded on any of three subsequent monitoring visits or on subsequent surveys, and this individual was determined not to be a resident. This site is not considered occupied in 2016. This site was surveyed five times, totaling 3.4 observer-hours. Cowbirds were detected during two surveys. Habitat suitability was not thoroughly assessed in 2016, as surveys were conducted from the exterior of the site. The area with coyote willows along the southern edge of the site appears be suitable, with high canopy closure and suitable vegetation structure adjacent to a permanent water source (see "Habitat Suitability Criteria," above), but suitable habitat within the site is likely limited in areal extent.

### *CPhase 05*

Area: 11.4 ha Elevation: 143 m

The survey site known as CPhase 05 is within a conservation area and consists of a mosaic of cottonwoods, Goodding's willows, coyote willows, honey mesquite, screwbean mesquite, and arrowweed, with some tamarisk scattered throughout the site. Canopy height is highly variable and averages approximately 3–4 m over most of the site and up to 15 m in the cottonwood stands. Canopy closure is sparse and averages 40%, reaching 90% in the cottonwood stands. Soils were dry within the site when site descriptions were recorded in May and July. Up to 25% of the site contained saturated or inundated soils when a site description was recorded in June (see table 2-2). The amount of standing water and saturated soil is highly variable because the site is flood irrigated and sandy soil allows the water to drain rapidly after irrigation.

One willow flycatcher was detected on June 28 (see table 2-1). This individual vocalized in response to playback at a few survey points and then sang at a slow rate for about 20 minutes following cessation of playback; the overall determination was that this individual was not highly territorial. No willow flycatchers were detected on any of three subsequent monitoring visits, and this individual was determined not to be a resident. CPhase 05 is considered occupied in 2016, however, because the detection occurred between June 24 and July 20. This site was surveyed five times, totaling 13.7 observer-hours. Cowbirds were detected during four surveys. Vegetation in a majority of the site does not provide suitable breeding habitat for flycatchers (see "Habitat Suitability Criteria," above) because it is too short and open, or, in the case of the cottonwoods, lacks woody vegetation in the understory and does not have good branching structure for nesting. The most suitable vegetation structure noted within the site is in very small patches of coyote willows.

### *Lost Lake*

Area: 3.3 ha Elevation: 142 m

The survey site known as Lost Lake is a mixed-native site that was heavily damaged in a fire early in 2016. It now consists of a narrow (< 40 m wide) strip of riparian vegetation separated from the Colorado River to the southwest by a low ridge of barren sand dunes and bordered to the northeast by marshy areas. The northern portion of the unburned area consists of an overstory of planted cottonwoods 25 m in height on the edge of a cattail marsh, with an understory of 6-m-tall tamarisk and screwbean mesquite and 75–90% canopy closure. Southeast of the cottonwood stringer, the site is a narrow (5–10 m wide) strip of either tamarisk or coyote willows 5–6 m in height. Surface water from the marsh extended 5 m into the woody vegetation under the cottonwoods during the visit in May.

No willow flycatchers were detected during the visit in May, although no broadcast surveys were completed. Suitable vegetation and hydrology components still exist (see "Habitat Suitability Criteria," above) but are quite limited in areal extent. Surveys were discontinued in 2016, but this site may be examined in future years to determine if the extent of suitable habitat has increased.

## Bill Williams, Arizona

The BIWI study area encompasses the Bill Williams River National Wildlife Refuge and the adjacent Planet Ranch property. The Bill Williams River National Wildlife Refuge contains the last expanse of naturally occurring native cottonwood-willow forest in the LCR region. The refuge encompasses over 2,500 ha along the Bill Williams River upstream of its mouth at Lake Havasu and contains a mixture of native forest, stands of monotypic tamarisk, beaver ponds, and cattail marsh. The Planet Ranch property is located adjacent to the upstream portion of the refuge and was incorporated into the LCR MSCP in 2015. The property is not currently being monitored, and in 2016, surveys were limited to sites on the Bill Williams River National Wildlife Refuge. Survey sites within the BIWI study area are listed below from west to east, moving progressively farther upstream. Signs of burros (*Equus asinus*) were seen between the Mohave Wash area and the eastern border of the refuge. Tamarisk beetles were detected in the Bill Williams River delta in July 2016, immediately south and west of the furthest downstream survey sites. The extent of surface water within the study area was relatively high in 2010, intermediate and variable in 2011–13, and restricted to deep channels and beaver ponds in 2014–16. Water levels within survey sites in the Bill Williams River delta in 2016 varied with the level of Lake Havasu (figure 2-9); the rate of discharge from the Bill Williams River (U.S. Geological Survey Station #09426620, which is between Site 05 and Beaver Pond North) was 0.0 cubic feet per second (cfs) throughout the flycatcher breeding season.

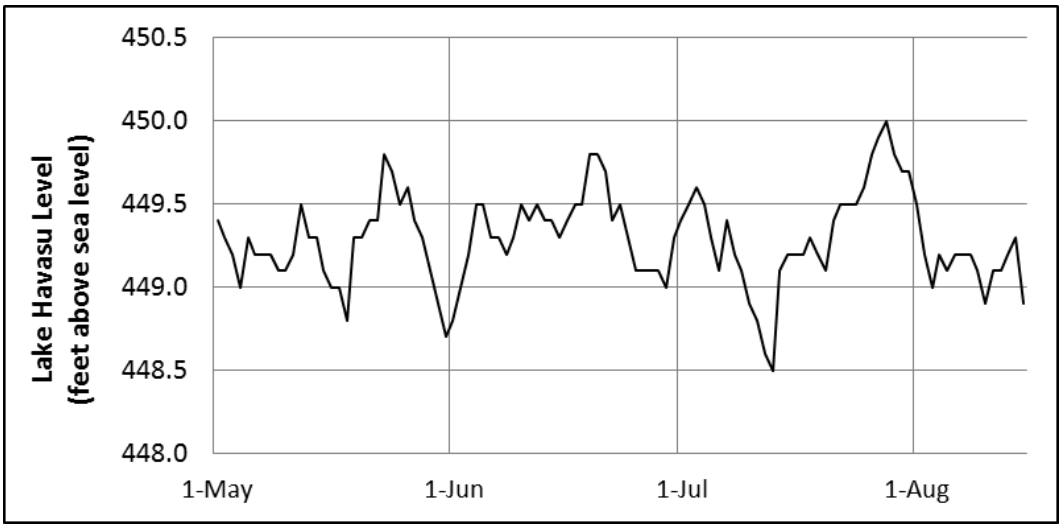



**Figure 2-9.—Lake Havasu average daily elevation (feet above sea level), May 1 – August 15, 2016.**
Data sourced from Lakes Online (2016).

### *Coyote Crossing*

Area: 2.1 ha Elevation: 141 m

The survey site known as Coyote Crossing is located along the very southwestern extent of riparian vegetation along the Bill Williams River and borders cattail marsh to the north, south, and west. Vegetation consists of 3–7-m-tall tamarisk with cattails around the periphery of the site. Canopy height is shortest near the southern and western edges where the tamarisk mixes with cattails and is tallest along the northeastern edge near the river. Canopy closure ranges from 30 to 90% and varies directly with canopy height. Up to one-half of the site was inundated when site descriptions were recorded in May, June, and July (see table 2-2), with surface water present around the periphery of the site as well as within narrow channels. This site is located within the Bill Williams River delta, and water levels within the site vary with those in Lake Havasu (see figure 2-9).

Coyote Crossing was occupied by one resident, unpaired male flycatcher (see table 2-1). Unoccupied portions of the site were surveyed three times, totaling 5.1 observer-hours. Cowbirds were detected during all three surveys. Habitat with high suitability (see "Habitat Suitability Criteria," above) is located along the northeastern edge of the site. Vegetation in this area has high canopy closure, adequate canopy height, and surface water within woody vegetation. Vegetation in the southwestern portion of the site is currently too open and too short to be suitable.

### *Bill Willow*

Area: 1.6 ha Elevation: 142 m

The survey site known as Bill Willow is located along the very northwestern extent of riparian vegetation along the Bill Williams River and borders cattail marsh to the north and west. Vegetation within the site consists of 4–8-m-tall tamarisk with dead cattail stands in the understory, particularly near the northern and western borders. A few emergent Goodding's willows are present along the southern and eastern borders. Canopy closure ranges from 80 to 90% and varies directly with canopy height. Vegetation is noticeably taller and denser in the southwestern two-thirds of the site than in the northeastern third. Surface water covered the entire site when the June site description was recorded, but only the periphery of the site was inundated when the May and July site descriptions were recorded (see table 2-2). This site is located within the Bill Williams River delta, and water levels within the site vary with those in Lake Havasu (see figure 2-9).

Bill Willow was occupied by five breeding flycatchers (see table 2-1). One of the resident flycatchers moved from Alamo Lake. One additional flycatcher, which had previously held a territory in Site 08, was detected on July 28. Unoccupied portions of the site were surveyed twice, totaling 2.0 observer-hours. Cowbirds were detected during both surveys. The vegetation in the site appears to have grown slightly since 2015, with vegetation structure in the northeastern third of the site improving enough to be suitable. The entire site now provides suitable habitat (see "Habitat Suitability Criteria," above), with good vegetation height, density, and branching structure, as well as surface water.

### *Wispy Willow*

Area: 1.3 ha Elevation: 142 m

The survey site known as Wispy Willow is a mixed-exotic survey site located approximately 75 m southwest of Bill Willow and 60 m northeast of Coyote Crossing on the northern side of the Bill Williams River. The western and southern portions of the site are vegetated primarily with 5–7-m-tall coyote willows, occasionally mixed with tamarisk. Tamarisk 5–7 m in height dominate the northern arms and eastern side of the site and are scattered along the southern border. Small cattail marshes are scattered within the site along the western and northern borders. Canopy closure is 70–80% within the coyote willows, 80–90% within the tamarisk, and as low as 60% within the marshy areas. Vegetation is generally shorter and less dense along the western edge of the site and taller and denser along the northern and eastern edges. Standing water was present within the majority of the site when site descriptions were recorded in May and June but was restricted to the isolated cattail marshes when the July site description was recorded (see table 2-2). This site is located within the Bill Williams River delta, and water levels within the site vary with those in Lake Havasu (see figure 2-9).

Wispy Willow was occupied by four breeding flycatchers and one resident, unpaired male flycatcher (see table 2-1). One willow flycatcher was detected on July 15 but not on either of two subsequent monitoring visits, and this individual was determined not to be a resident. Unoccupied portions of the site were surveyed once, totaling 0.8 observer-hour. Cowbirds were detected during the survey and during subsequent nest monitoring activities. The site provides highly suitable habitat (see "Habitat Suitability Criteria," above) because of the extensive presence of surface water within woody vegetation, sufficient vegetation height, dense canopy closure, and an understory that is not too thick and contains good branching structure for nest placement. Canopy closure is slightly low in some parts of the site, and the best vegetation structure is in the tamarisk, with the coyote willow being slightly too open in comparison.

### *Site 01*

Area: 2.4 ha Elevation: 142 m

The survey site known as Site 01 is a mixed-native survey site just upstream of Wispy Willow, on the southern edge of an area that burned in 2006. Goodding's willows dominate the overstory at a height of 15 m but do not form a continuous canopy. Tamarisk 4–8 m in height are scattered in the understory throughout much of the northern half of the site. Toward the center of the site, there are patches of dense arrowweed 2–3 m in height. A stand of large-diameter coyote willows 4–6 m in height is present along the western and southern edges of the site. Canopy closure is approximately 70–90% within the coyote willows and 60–80% throughout the rest of the site. Standing water was present within the coyote willow stand when the May, June, and July site descriptions were recorded (see table 2-2). This site is located within the Bill Williams River delta, and water levels within the site varied with those in Lake Havasu (see figure 2-9).

Site 01 was occupied by one resident, unpaired male flycatcher (see table 2-1). In addition to the resident male, three willow flycatchers were each detected for 1 or 2 days on May 17, May 25–26, and May 26, respectively. Each detection was followed by three subsequent monitoring visits, none of which resulted in further detections, and these three willow flycatchers were determined not to be resident at the site. Unoccupied portions of the site were surveyed three times, totaling 6.2 observer-hours. Cowbirds were detected during all three surveys. Habitat suitability ranges from good to poor. Most of the site lacks suitably dense canopy closure and wet soils. The very southern edge of the site contains the highest canopy closure in combination with wet soils and good branching structure.

### *Burn Edge*

Area: 4.1 ha Elevation: 145 m

The survey site known as Burn Edge is near the northern edge of the Bill Williams riparian corridor, on the eastern edge of an area that burned in 2006. Vegetation within the site consists of an overstory of 12–15-m-tall Goodding's willows and 20-m-tall cottonwoods with an understory of 5–8-m-tall tamarisk. In the eastern third of the site, the cottonwoods are more prevalent than the Goodding's willows, which show signs of stress with many dead branches. The understory is widely scattered with some willow baccharis and mule fat (*Baccharis salicifolia*) in addition to tamarisk. Canopy closure in the eastern third of the site is 40–50%. The vegetation structure is very similar in the western two-thirds of the site, but the Goodding's willows become more dominant and less stressed, and the tamarisk understory becomes taller and more prevalent. Canopy closure increases to 85–90% near the western edge of the site. An open area that was once a cattail marsh runs east-west through the center of the site. Some coyote willows, willow baccharis, mule fat, arrowweed, and honey mesquite are present in the understory immediately adjacent to the old marsh. Standing water and saturated soils were noted in a small (3 x 9m) and gradually shrinking pool at the western end of the old marsh when the May, June, and July site descriptions were recorded (see table 2-2). Some damp soils were noted in the western portion of the site during the May site description, but otherwise all soils away from the small pool were completely dry. Water levels within the site were primarily influenced by the water table during the 2016 breeding season and therefore were likely not highly variable between site descriptions.

Three willow flycatchers were detected on June 8. No further detections were recorded on any of three subsequent monitoring visits. All three individuals were determined not to be residents, and this site is not considered occupied in 2016 (see table 2-1). This site was surveyed six times, totaling 5.7 observer-hours. Cowbirds were detected during each survey. Habitat suitability ranges from fair to poor (see "Habitat Suitability Criteria," above). Suitable vegetation structure and dense canopy closure exist within the largest and densest patches of tamarisk on the western side of the site. Vegetation in the rest of the site lacks dense canopy closure and has an understory that is too widely scattered and lacks an appropriate branching structure. Habitat suitability would be improved if surface water covered a wider extent in the western end of the site.

### *Site 04*

Area: 9.9 ha Elevation: 144 m

The survey site known as Site 04 is a mixed-native survey site located on the very southern edge of the riparian area. Vegetation consists of an overstory of Goodding's willows 15–20 m in height with patches of tamarisk 3–7 m in height

in the understory. Several 20-m-tall cottonwoods are scattered throughout the overstory as single trees. A few small patches of coyote willows 3–5 m in height are also present throughout the site as well as some scattered mule fat and yerba mansa. Vegetation structure within the site is highly variable. In much of the center of the site and along the eastern edge of the site, there are big gaps (30–40 m across) in the canopy with thick piles of deadfall. Small patches of tamarisk spaced widely (> 20 m) apart are scattered in the understory in this portion of the site. Canopy closure in these areas is 30–50%. The Goodding's willows and tamarisk become denser around the northern, western, and southern edges of the site. The best habitat is immediately adjacent to a deep, incised backwater channel on the western side of the site, with the tamarisk reaching 6–7 m in height and canopy closure reaching 80–95%, with an average of 90%. Surface water was present in the deep, backwater channel on the western side of the site and in a small stream channel in the middle of the site during the May and June site descriptions, with all other soils noted as mostly dry. When the July site description was recorded, soils were dry (see table 2-2) except for the deep, backwater channel on the western side of the site. The backwater channel connects to the Bill Williams River delta, and water depth within the channel was influenced by water levels in Lake Havasu, which did not fluctuate enough to result in overbank flooding (see figure 2-9). Given that neither lake nor river levels fluctuated strongly during the season, it is unlikely that surface soil moisture conditions were variable from day to day between site descriptions.

No willow flycatchers were detected (see table 2-1). This site was surveyed five times, totaling 14.9 observer-hours. Cowbirds were detected during all surveys. Habitat suitability is currently very low in the majority of this site and has declined in recent years as trees and large limbs have fallen, decreasing canopy closure. Most of the site lacks suitably dense canopy closure (see "Habitat Suitability Criteria," above) and wet soils. Understory vegetation dense enough to provide suitable nesting habitat is also limited in areal extent.

### *Site 03*

Area: 12.9 ha Elevation: 146 m

The survey site known as Site 03 is a mixed-native survey site that is contiguous with Site 04 and is located immediately to the east; together Site 03 and Site 04 are known as Mosquito Flats. Vegetation consists of an overstory of Goodding's willows 10–20 m in height and patches of monotypic tamarisk 3–7 m in height. Several cottonwoods are scattered throughout the overstory, and mule fat are scattered throughout the understory. The eastern half of the site has a small patch where velvet ash dominate the overstory. The understory in some areas is very open, and the ground in these areas is covered with thick yerba mansa. Many large willows and cottonwoods have fallen over the past several years, leaving large gaps in the canopy and creating patches of thick, dead, fallen woody vegetation. Canopy closure is variable and ranges from 40% in areas with open

understory and fallen trees to 90% in areas with dense tamarisk. Several stands of dead cattails and formerly marshy areas are present, primarily along the northern and southern edges of the site. Some damp soils were noted during the May site description, but all soils in the site were dry when the June and July site descriptions were recorded (see table 2-2). Given that neither lake nor river levels fluctuated strongly during the season, it is unlikely that surface soil moisture conditions were variable from day to day between site descriptions.

Three willow flycatchers were detected on June 9 (see table 2-1). No further detections were recorded on three subsequent monitoring visits or subsequent surveys, and these individuals were determined not to be residents. This site is not considered occupied in 2016. This site was surveyed five times, totaling 15.5 observer-hours. Cowbirds were detected during each survey. As in Site 04, canopy closure has decreased in recent years, and overall habitat suitability is currently low (see "Habitat Suitability Criteria," above). The highest canopy closure and the best vegetation structure are in a patch of tamarisk with a Goodding's willow overstory that surrounds a small former marsh in the southern end of the site. The marsh was completely dry throughout the season, and habitat suitability would be improved if surface water were present.

### *Last Gasp*

Area: 2.1 ha Elevation: 146 m

The survey site known as Last Gasp is a narrow, mixed-native survey site along a channel on the northern edge of the Bill Williams River riparian area, approximately 250 m east of Burn Edge. Due to a lack of both flycatcher detections and high quality habitat, this site was put on a periodic survey schedule after 2011 and was last visited in 2015. Vegetation within the site consists of a broken overstory of 15-m-tall cottonwoods and 8–10-m-tall Goodding's willows. Tamarisk, 3–5 m tall, dominates the understory. Both the Goodding's willows and cottonwoods look stressed with many dead limbs and sparse foliage. Tamarisk are scattered in loose patches rather than forming a continuous understory, and arrowweed and honey mesquite are present in the gaps between the tamarisk patches. Canopy closure varies from 40% in the channel to 60% under the densest cottonwood overstory. All soils in the site were dry (see table 2-2) and sandy during the May survey.

No willow flycatchers were detected (see table 2-1), but this site was surveyed only once, totaling 0.9 observer-hour, and occupancy status could not be determined from the limited survey effort. Cowbirds were detected during the survey. Surveys were discontinued for the remainder of the season following the initial visit due to poor habitat quality within the site. Although vegetation components capable of developing suitable structure do exist within the site, vegetation density throughout the site is too low to be considered suitable. If water levels increased enough to fill the channel and wet soils persisted outside of

the channel, the vegetation could increase in density and suitability. Periodic surveys would help determine if vegetation structure improves in future years at this site.

### *Guinness*

Area: 3.4 ha Elevation: 148 m

The survey site known as Guinness is a mixed-native survey site located approximately 150 m east of Site 03. Due to a lack of surface water away from a narrow, incised channel, this site was put on a periodic survey schedule in 2012 and was last surveyed in 2015. This site is dominated by a patchy overstory of Goodding's willows 10–15 m in height with an understory of 5–7-m-tall tamarisk. Some emergent cottonwoods are scattered along the northern and southern edges of the site. Canopy closure is approximately 70%, occasionally reaching 90% in some of the denser tamarisk. A stream channel bisects the site, but all soils were dry during the survey in May (see table 2-2).

No willow flycatchers were detected (see table 2-1), but this site was surveyed only once, totaling 0.6 observer-hour, and occupancy status could not be determined from the limited survey effort. Cowbirds were detected during the survey. Surveys were discontinued for the remainder of the season following the initial visit due to poor overall habitat quality. Small patches of suitably dense vegetation are present, but canopy closure in the majority of the site is too low to be considered suitable, and overall habitat suitability is low (see "Habitat Suitability Criteria," above). If water levels increased enough to fill the channel and wet soils persisted outside of the channel, the vegetation could increase in density and suitability. Periodic surveys would help determine if vegetation structure improves in future years at this site..

### *Site 05*

Area: 6.8 ha Elevation: 153 m

The survey site known as Site 05 is located on the northern edge of the Bill Williams River flood plain, approximately 1 km southeast of Guinness, and is bordered to the northeast by steep cliffs and to the southwest by a dry river channel. Vegetation in the site is mixed-native, with Goodding's willows 12–20 m in height and cottonwoods 15–25 m in height forming a broken overstory. The overstory is predominantly Goodding's willow in the western two-thirds of the site, with the willows transitioning from widely scattered and emergent near the western edge to a broken overstory in the center of the site. Cottonwoods are more dominant in the overstory in the eastern third of the site. The understory consists of scattered patches of tamarisk 3–8 m in height, which are taller and denser in the western third and shorter and more widely scattered in

the eastern third of the site, as well as some young Goodding's willows and cottonwoods. Many gaps are present in the canopy, particularly in areas dominated by Goodding's willows; the willows have numerous dead limbs, many of which have fallen in recent years. Groundcover in portions of the site consists of thick, dead, fallen woody vegetation. Canopy closure in the site is variable, ranging from 40 to 50% in the western portion of the site to 70–75% in the eastern portion. Standing water was present along the northeastern edge of the site in a series of isolated beaver ponds when the May, June, and July site descriptions were recorded, and all other soils were dry (see table 2-2). These beaver ponds have the capacity to be over 2 m deep and were noticeably shallower at the beginning of the season than they had been in previous years. They also grew progressively shallower during the season. Given that river levels did not fluctuate strongly during the season, it is unlikely that surface soil moisture conditions were variable from day to day between site descriptions.

No willow flycatchers were detected (see table 2-1). This site was surveyed five times, totaling 11.4 observer-hours. Cowbirds were detected during four surveys. Habitat suitability is currently low in this site and has declined in recent years as canopy closure and the extent of wet soils have decreased. Since SWCA began monitoring this site in 2003, only one resident, unpaired male flycatcher has been detected. This detection was in 2009, when surface water was much more widely distributed throughout the site and canopy closure in the denser parts of the site reached 90%. This site may be evaluated at the beginning of 2017 and surveys discontinued for the season if habitat conditions have not improved.

### *Black Rail*

Area: 1.2 ha Elevation: 153 m

This survey site known as Black Rail is located approximately 250 m southeast of Site 05 on the eastern edge of the Bill Williams River flood plain. Vegetation in this mixed-native site is showing signs of stress due to lack of water. The overstory consists of cottonwoods 15–20 m tall with a layer of Goodding's willows 10–12 m tall. The cottonwoods are slightly more predominant in the northeastern portion of the site, while the Goodding's willows are slightly more predominant in the southwestern portion. Most of the Goodding's willows beneath the cottonwoods are almost completely dead, with basal sprouts as the only live foliage. Where the Goodding's willows are more predominant, each tree is ≥ 50% dead. Tamarisk 3–4 m in height are loosely scattered in the understory. Patches of dense, completely brown cattails and bulrush 1–2 m in height are also scattered through the interior of the site. Canopy closure in the majority of the site is 60–80%, but is only 40–75% in the southwestern portion, where the Goodding's willows are more predominant. Due to the stressed nature of the trees, the canopy is very thin, and the entire site feels open and sunny despite the occasionally dense canopy closure. Soils were completely dry during a survey in May (see table 2-2).

No willow flycatchers were detected (see table 2-1), but this site was surveyed only once, totaling 0.3 observer-hour, and occupancy status could not be determined from the limited survey effort. No cowbirds were detected during the survey. Surveys were discontinued for the season after one visit because soils at the site were completely dry and canopy closure was low, resulting in low habitat suitability (see "Habitat Suitability Criteria," above). As water levels have decreased over the years, canopy closure has decreased and some trees have died. If wet soils were once again present in the site, the trees might recover and canopy closure could improve. This site may be revisited again in future years to determine if soil moisture conditions and vegetation structure have improved.

### *Beaver Pond North*

Area: 19.0 ha Elevation: 165 m

The survey site known as Beaver Pond North is a mixed-native survey site located approximately 2 km upstream of Black Rail. This site has been on a periodic survey schedule since 2008 because of a lack of both resident flycatchers and wet soils away from the main river channel; it was last surveyed in 2015. Two channels of the Bill Williams River are present in the site; one channel runs along the southern border of the site and the other through the center. Both channels were devoid of surface water; some damp soils were present. Sedges and grasses, as well as some dead or dying cattails, were noted in several places within the river channels. Vegetation within 50 m of the river channel in the center of the site consists of an overstory of 8–12-m-tall Goodding's willows and 12–15-m-tall cottonwoods with an understory of tamarisk averaging 5 m in height. In the northern third of the site, the vegetation changes to a mix of tamarisk, honey mesquite, and arrowweed. A few emergent cottonwoods and Goodding's willows with narrow canopies are present in this portion of the site but do not form a closed canopy. Vegetation more than 50 m away from the river channel in the center of the site is largely a mix of tamarisk and arrowweed. Canopy closure over the river channel in the center of the site reaches 65%. No wet (i.e., saturated or inundated) soils were noted during a survey in May (see table 2-2).

No willow flycatchers were detected (see table 2-1), but this site was surveyed only once, totaling 2.3 observer-hours, and occupancy status could not be determined from the limited survey effort. Cowbirds were detected during the survey. Surveys were discontinued for the remainder of the season following the initial visit due to poor habitat quality within the site. Historically, most of the site has lacked dense canopy closure, making it largely unsuitable for nesting flycatchers (see "Habitat Suitability Criteria," above). Some patches of vegetation adjacent to the river had suitably dense canopy closure in previous years, and this could again be the case if wet soils were present and resulted in increased vegetation density. This site may be kept on the periodic survey list to determine if either the hydrology or vegetation structure improves in future years.

### *Beaver Pond*

Area: 21.5 ha Elevation: 170 m

The survey site known as Beaver Pond is a mixed-native survey site that is contiguous with the upstream end of Beaver Pond North. Due to a lack of resident flycatchers and a lack of wet soils away from the river channel, this site was put on a periodic survey schedule; it was last surveyed in 2015. Two channels of the Bill Williams River are present in the site; one channel runs along the southern border of the site and the other through the center. Vegetation within 50 m of the river channel in the center of the site consists of an overstory of 8–12-m-tall Goodding's willows and 12–14-m-tall cottonwoods with an understory of tamarisk 5–7 m in height. Some willow baccharis, mule fat, screwbean mesquite, and honey mesquite are scattered in the understory adjacent to the river channel. Vegetation more than 50 m away from the river channel in the center of the site consists of tamarisk and honey mesquite 5–7 m in height. Cattails and bulrush are present along most of the southern river channel. In the river channel in the center of the site, a series of beaver dams create several pools with relatively little vegetation. Portions of the channel between the pools are vegetated in either cattails or sedges, which are dying at the northeastern end of the site. Canopy closure over the river channel in the center of the site reaches 60%. Three small puddles with some surrounding saturated soils were noted in May in the river channel in the center of the site; all other soils were dry (see table 2-2).

Three willow flycatchers were detected on June 10 (see table 2-1); none of these individuals were detected during three subsequent monitoring visits or on subsequent surveys, and all three individuals were determined not to be residents at the site. This site was surveyed once, totaling 2.0 observer-hours, and occupancy status could not be determined from the limited survey effort. Cowbirds were detected during the survey. Surveys were discontinued for the remainder of the season following the initial visit due to poor habitat quality. Historically, most of the site has lacked dense canopy closure, making it largely unsuitable for nesting flycatchers (see "Habitat Suitability Criteria," above). Some patches of vegetation adjacent to the river had suitably dense canopy in previous years, and this could again be the case if wet soils were present and resulted in increased vegetation density. This site may be kept on the periodic survey list to determine if either the hydrology or vegetation structure improves in future years.

### *Site 08*

Area: 12.1 ha Elevation: 181 m

The survey site known as Site 08 is a linear, mixed-native survey site approximately 3 km upstream of Beaver Pond, at the confluence of the

Mohave Wash and the Bill Williams River. This stretch of the river is confined to the north and south by high cliffs, creating a riparian zone 150 m wide. Due to a lack of resident flycatchers and a lack of wet soils away from the river channel, this site had been on a periodic survey schedule until breeding flycatchers were discovered in 2015 adjacent to the original site. Vegetation immediately adjacent to the river channel consists of an overstory of 10–12-m-tall Goodding's willows and some12–15-m-tall cottonwoods with an understory of 2–6-m-tall tamarisk. Some young Goodding's willows, cottonwoods, and coyote willows are scattered in the understory immediately adjacent to the river channel. Vegetation away from the river channel is dominated by 5–6-m-tall tamarisk with some arrowweed and honey mesquite and a loose overstory of 10–12-m-tall cottonwoods and a few Goodding's willows. In the very northeastern portion of the site, vegetation consists of 12–15-m-tall cottonwoods with 5–6-m-tall tamarisk surrounding openings of willow baccharis. Canopy closure ranges from 50 to 90% but averages 70%. The Bill Williams River bisects the site, and water was present in a series of deep, stagnant beaver ponds on the eastern side of the site and as a small, flowing stream on the western side when site descriptions were recorded in May, June, and July (see table 2-2). All other soils were dry. This site is located in an area where the Bill Williams River had surface flow in 2016. In this reach, surface water is affected by riverflow but not by water levels in Lake Havasu. Water levels within the site declined gradually over the flycatcher breeding season (Q. Yeates-Burghart 2017, personal communication).

Site 08 was occupied by one resident, unpaired male flycatcher (see table 2-1). In addition to the resident male, one willow flycatcher was detected on June 10 and one on June 23. Each of these detections was followed by three monitoring visits; no further detections were recorded, and both individuals were determined not to be residents. Unoccupied portions of the site were surveyed five times, totaling 8.1 observer-hours. Cowbirds were detected during four surveys. Most of the site lacks moist soils and dense canopy closure, making it largely unsuitable for nesting flycatchers (see "Habitat Suitability Criteria," above). Some suitable habitat is present in the recently annexed northeastern corner of the site, but the total areal extent of suitable habitat is limited. The original extent of the site continues to lack wet soils outside of the river channel, and it lacks suitably dense canopy closure in most areas. Some patches of vegetation adjacent to the river in the original portion of the site have suitably dense canopy. Continuing periodic surveys in the original extent of this site is recommended because of the presence of some patches of suitable habitat. Annual surveys could be completed in the area that was occupied in 2015 and 2016, and further exploration of the area between Site 08 and Upstream from Site 08 is warranted.

### *Upstream from Site 08*

Area: 1.5 ha Elevation: 181 m

The survey site known as Upstream from Site 08 is located on the northern side of the riparian zone, approximately 100 m east of Site 08. Vegetation in the site consists of a broken overstory of 15–20-m-tall cottonwoods and 10–15-m-tall Goodding's willows with an understory of 3–7-m-tall tamarisk. The northern and western edges of the site border a cattail marsh. Vegetation is healthiest near the western edge of the site and becomes increasingly stressed with many dead or partially dead cottonwoods and Goodding's willows on the eastern side of the site. Canopy closure is variable and ranges from 60 to 80%, with an average of 70%, though it tends to be higher on the western side of the site where vegetation is healthier. Standing water was present in the very western portion of the site and along the northern border of the site in the cattail marsh when the May, June, and July site descriptions were recorded (see table 2-2). The eastern half of the site contained dry to damp soils during each of the three site descriptions. Upstream from Site 08 is located in an area where the Bill Williams River had surface flow in 2016. In this reach, surface water is affected by riverflow but not by water levels in Lake Havasu.

No willow flycatchers were detected (see table 2-1). This site was surveyed five times, totaling 3.5 observer-hours. Cowbirds were detected during three surveys. Habitat suitability is low within a majority of the site, as canopy closure in most places is not dense enough. The highest canopy closure is located in the western portion of the site, where habitat suitability is fair. While most of the site lacked wet soils, they were present adjacent to the northern and western edges.

## Alamo Lake, Arizona

The ALAM study area is located along the Big Sandy and Santa Maria Rivers, near their confluence, and downstream along the Bill Williams River to the current shore of Alamo Lake. The level of Alamo Lake rose early in 2010 following a large rain event but declined over the next 5 years, falling over 5 feet each year from 2012 to 2014 (figure 2-10). Imagery available on Google Earth shows that South Camp, Over the Edge, Sidebar 01, Edgewater 01, Camp 01–04, Middle Earth 01–02, and Burro Wash 01–02 were still under water as of June 24, 2011. Imagery also shows that as of November 2, 2013, South Camp was still partially under water, and Over the Edge had only recently been exposed. Lake levels have fluctuated between 2014 and 2016, but no wet (saturated or inundated) soils have been documented within any of the sites during those years (McLeod and Pellegrini 2015, 2016; this document). Documented soil conditions have been dry to damp, with the proportion of damp soils typically increasing temporarily late in the breeding season due to seasonal storms. The river channel can also contain water temporarily as the result of these seasonal

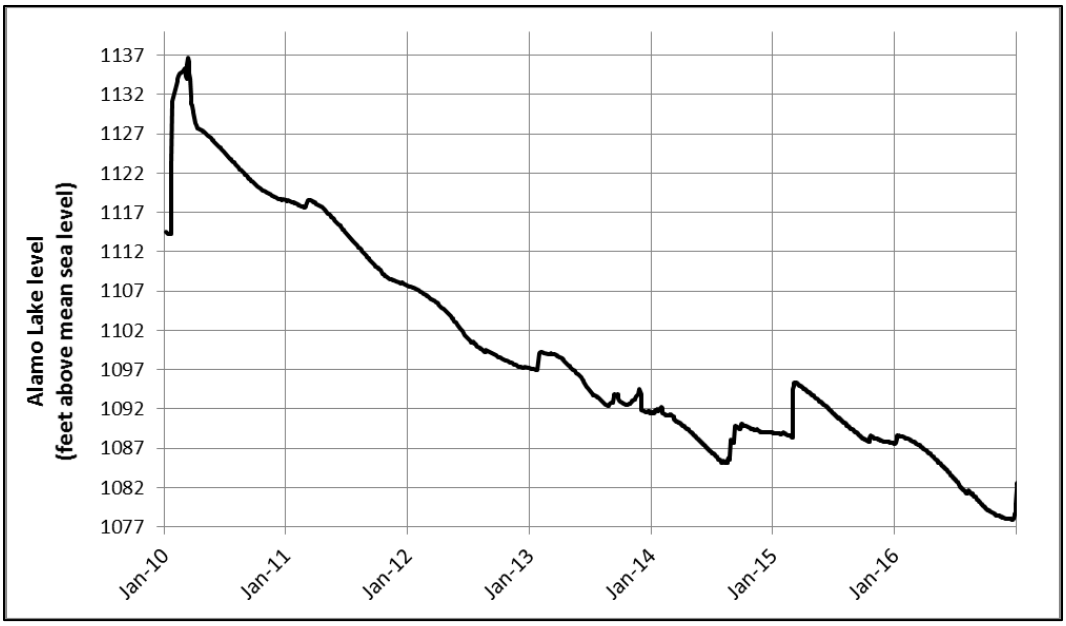



**Figure 2-10.—Alamo Lake daily elevation (feet above mean sea level), 2010–16.**
Data sourced from Lakes Online (2016).

storms; however, field personnel, who were onsite almost daily over the breeding season, did not observe any instances of there being water in the channel between Santa Maria North and Camp 02 in 2016 (J. Kreiser 2017, personal communication). During the flycatcher breeding season of 2016, water levels in Alamo Lake declined steadily (see figure 2-10), and field personnel did not observe any changes in soil moisture conditions through the season in any of the survey sites, except for damp soils that lasted for less than a day following overnight rain showers in the latter half of the season (D. Blood 2017, personal communication). Burros and cattle were noted in and near many of the survey sites. As described in the methods section, sites at ALAM were not surveyed according to protocol, and effort at Alamo Lake in 2016 was focused on monitoring known territories. No site was surveyed more than three times, and most sites were described only once or twice. Occupancy status remained undetermined in several sites where no willow flycatchers were detected and survey effort did not meet the three-survey protocol.

### *Bullard Wash*

Area: 1.9 ha Elevation: 335 m

The survey site known as Bullard Wash is mixed-native survey site located on the eastern edge of the riparian area at the outflow of Bullard Wash at the end of Wickenburg Road. A large portion of the site consists of Goodding's willows 10–12 m in height with no understory and 80% canopy closure. The site experiences periodic flooding, as evidenced by flood debris on the trunks of

the trees. The Goodding's willows are surrounded by honey mesquite and tamarisk 3–5 m in height with 0–40% canopy closure. Soils were completely dry when the site description was recorded in July (see table 2-2), and the nearest water was 280 m away in Alamo Lake. Although Alamo Lake was higher earlier in the season than it was in July (see figure 2-10), it is unlikely that soil moisture conditions at this site varied throughout the season, aside from temporarily damp soils caused by seasonal rains.

No willow flycatchers were detected (see table 2-1), but this site was surveyed only once, totaling 1.2 observer-hours, and occupancy status could not be determined from the limited survey effort. A cowbird was detected during the survey. Additional evaluations are needed in future seasons to determine habitat suitability.

### *South Camp*

Area: 2.4 ha Elevation: 335 m

The survey site known as South Camp is a mixed-native survey site located on the western edge of the riparian area, approximately 2 km due north of Bullard Wash and 100 m downstream from Camp 01. Vegetation within the site consists of Goodding's willows 6–10 m in height with tamarisk 2–3 m in height scattered in the understory. Some arrowweed and mule fat are present in the understory and are more prevalent near the edges of the site than in the interior. Some young, 4–6-m-tall Goodding's willows are present in the southwestern portion of the site. Canopy closure ranges from 30% in the shortest and sparsest Goodding's willows to 70–90% in the tallest vegetation. Soils were dry when site descriptions were recorded in June and July (see table 2-2), but a shallow flowing stream was present adjacent to the site. Soil moisture conditions at the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

South Camp was occupied by two breeding flycatchers (see table 2-1). This site was surveyed twice, totaling 1.4 observer-hours. Cowbirds were detected during both surveys. Habitat suitability in the site ranges from poor to fair. Portions of the site contain suitable vegetation structure, with good vegetation height, high canopy closure, and good branching structure, with many locations for nest placement and a good density of stems. Canopy closure is patchy, however, and the southwestern portion of the site appears to be younger than the rest and may develop suitable structure in another year or two. Overall habitat suitability would be improved if wet soils were present within the site for part or all of the flycatcher breeding season

### *Over the Edge*

Area: 2.1 ha Elevation: 335 m

The survey site known as Over the Edge is a mixed-native survey site located in the middle of the riparian area, approximately 500 m southeast of South Camp. Vegetation within most of the site consists of 7–8-m-tall Goodding's willows with tamarisk 3–5 m in height in the understory. Canopy closure averaged 80–90% at the beginning of the season, and by the end of the season, it ranged from 50 to 80% and averaged 70%. The northwestern arm of the site is 6-m-tall tamarisk with 70–80% canopy closure. Cattle have used the site extensively and trampled most of the herbaceous groundcover in places. Soils were completely dry when site descriptions were recorded in May and July (see table 2-2). Willows within the site had slight early leaf abscission in late July. Soil moisture conditions at the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

Over the Edge was occupied by four breeding flycatchers (see table 2-1). In addition, one willow flycatcher was detected on May 31. This individual was not detected on any of three subsequent monitoring visits, and it was determined that the individual was not resident at the site. Because the site was occupied, it was not surveyed. At the beginning of the season, most of the site contained suitable vegetation structure, with good vegetation height, high canopy closure, and good branching structure, with many locations for nest placement and a good density of stems. Soils were completely dry, however, and overall habitat suitability was thus fair (see "Habitat Suitability Criteria," above). Canopy closure declined during the season due to early leaf abscission, and overall habitat suitability at the end of the season was poor. With increased soil moisture, canopy closure would likely increase, and overall habitat suitability would be improved if wet soils were present in or adjacent to the site for part or all of the flycatcher breeding season.

### *Sidebar 01*

Area: 1.1 ha Elevation: 335 m

The survey site known as Sidebar 01 is a mixed-native survey site located on the eastern edge of the riparian area, 1 km downstream from the end of Brown's Crossing Road. Vegetation within the site consists of a 30–50-m-wide strip of Goodding's willows, 10–12 m in height, with a few cottonwoods. Tamarisk 2–4 m in height are scattered in the understory. Some arrowweed and mule fat are present in the understory and are more prevalent near the edges of the site than in the interior. There are several areas with standing snags, and trees in the southern 25 m of the site are completely dead. Canopy closure varied with tree health and generally declined during the season. At the beginning of the season, canopy closure varied from 30% in areas with snags to 90% in the densest vegetation. At the end of the season, many of the Goodding's willows in the

northern third and along the western edge of the site became leafless, with 30–40% canopy closure. Canopy closure in the remaining Goodding's willows was 60 to 70% in the center portion of the site and 70–80% in the southern portion. Soils were completely dry when site descriptions were recorded in May and July (see table 2-2). Surface soil moisture conditions at the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

Sidebar 01 was occupied by three breeding flycatchers and one resident, unpaired male flycatcher (see table 2-1). Because the site was occupied, it was not surveyed. At the beginning of the season, most of the site contained suitable vegetation structure, with good vegetation height, high canopy closure, and good branching structure, with many locations for nest placement and a good density of stems. Soils were completely dry, however, and overall habitat suitability was thus fair (see "Habitat Suitability Criteria," above). Canopy closure declined during the season due to early leaf abscission, and overall habitat suitability at the end of the season was poor. With increased soil moisture, canopy closure would likely increase, and overall habitat suitability would be improved if wet soils were present in or adjacent to the site for part or all of the flycatcher breeding season.

### *Edgewater 01*

Area: 0.9 ha Elevation: 335 m

The survey site known as Edgewater 01 is located 100 m northeast of Over the Edge, in the middle of the riparian zone. Vegetation in the site consists of Goodding's willows 7–8 m in height with an understory of 1–4-m-tall tamarisk. The Goodding's willows are surrounded by 3–4-m-tall tamarisk with 50–70% canopy closure. Canopy closure under the Goodding's willows was 80–90% at the beginning of the season. Canopy closure decreased to 70% during the season as many of the Goodding's willows lost up to half of their leaves. Soils were dry when site descriptions were recorded in May and July (see table 2-2). Soil moisture conditions at the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

Edgewater 01 was occupied by four breeding flycatchers (see table 2-1). Because the site was occupied, it was not surveyed. At the beginning of the season, most of the site contained suitable vegetation structure, with good vegetation height, high canopy closure, and good branching structure, with many locations for nest placement and a good density of stems. Soils were completely dry, however, and overall habitat suitability was thus fair (see "Habitat Suitability Criteria," above). Canopy closure declined during the season due to early leaf abscission, and overall habitat suitability at the end of the season was poor. With increased soil

moisture, canopy closure would likely increase, and overall habitat suitability would be improved if wet soils were present in or adjacent to the site for part or all of the flycatcher breeding season.

### *Camp 01*

Area: 0.7 ha Elevation: 335 m

The survey site known as Camp 01 is a native survey site located approximately 200 m northwest of Edgewater 01 on the western edge of the riparian area. The site is bordered by dry upland scrub to the northwest and the main river channel to the southeast. Dominant vegetation within the survey site consists of Goodding's willows 10–12 m in height with 80–90% canopy closure. Much of the site is lacking an understory, but clumps of tamarisk 2–3 m in height and arrowweed up to 2 m tall occur along the edges of the site. Water was present in a stream channel southeast of and adjacent to the site when site descriptions were recorded in May and July (see table 2-2), but an incised, 2-m-tall bank separates the site from the stream channel. Soil moisture conditions within the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

Camp 01 was occupied by two breeding flycatchers (see table 2-1). This site was surveyed once, totaling 0.4 observer-hour. No cowbirds were detected during the survey. Vegetation structure within the site is generally suitable, with decent branching structure, good vegetation height, and dense canopy closure. The site is adjacent to surface water, and overall habitat suitability is fair to good. Overall habitat suitability would be improved if wet soils were present within the site for part or all of the flycatcher breeding season.

### *Camp 04*

Area: 0.2 ha Elevation: 335 m

The survey site known as Camp 04 is located approximately 180 m northeast of Camp 01. Vegetation in this survey site consists of a narrow, linear stand of 7–8-m-tall Goodding's willows with 3–4-m-tall tamarisk in the understory. Canopy closure is typically 90%, except in a few small gaps, where it is 70%. The site is bordered to the east by a dense stand of arrowweed and to the west by the river channel. The bank of the channel is at least 1 m in height. Standing water was present in the river channel when site descriptions were recorded in May and July (see table 2-2). Soil moisture conditions within the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

Camp 04 was occupied by three breeding flycatchers (see table 2-1). In addition to resident adults, one willow flycatcher was detected on July 21. This individual

was not detected on either of two subsequent monitoring visits, and residency of this individual was not confirmed. This site was surveyed once, totaling 0.1 observer-hour. No cowbirds were detected during the survey. Vegetation structure within the site is generally suitable, with decent branching structure, good vegetation height, and dense canopy closure. The site is adjacent to surface water, and overall habitat suitability is fair to good. Overall habitat suitability would be improved if wet soils were present within the site for part or all of the flycatcher breeding season.

### *Camp 02*

Area: 0.3 ha Elevation: 335 m

The survey site known as Camp 02 is located 45 m northwest of Camp 04 and lies at the outflow of a small wash. It is bordered to the west, north, and south by dry upland scrub and to the east by the main river channel. Vegetation within the site consists primarily of Goodding's willows 10–12 m in height with 90% canopy closure. Tamarisk 3–4 m in height is present around the site periphery and dominates the western 15% of the site, with some emergent cottonwoods. Canopy closure is 60–70% in the western end of the site. There was water in the main river channel to the east when site descriptions were recorded in May and July (see table 2-2). The site sits on a bench 1 m above the water. Soil moisture conditions at the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

No willow flycatchers were detected (see table 2-1), but the site was only surveyed twice, totaling 0.5 observer-hour, and occupancy status could not be determined from the limited survey effort. No cowbirds were detected during the surveys. Vegetation structure within the site is generally suitable, with decent branching structure, good vegetation height, and dense canopy closure. The site is adjacent to surface water, and overall habitat suitability is fair to good (see "Habitat Suitability Criteria," above). Overall habitat suitability would be improved if wet soils were present within the site for part or all of the flycatcher breeding season.

### *Camp 03*

Area: 1.3 ha Elevation: 335 m

The survey site known as Camp 03 is located 150 m north of Camp 02. This survey site is located at the outflow of a wash and is bordered to the north and west by dry upland scrub and to the south and east by the river channel. The site is primarily vegetated by Goodding's willows 10–12 m in height with 3–4-m-tall tamarisk scattered in the understory. Some cottonwoods 12–18 m in height are scattered in the overstory and are most prevalent in the northwestern portion of the site. Mule fat is also present in the understory. Canopy closure averages 80%

but ranges from 70 to 90%. Some of the Goodding's willows began to die in July, and canopy closure was as low as 40–50% in the area with stressed trees. Soils were completely dry when site descriptions were recorded in May and July (see table 2-2). The site sits on a bench 3 m above the adjacent wash, and the nearest standing water was adjacent to Camp 02. Soil moisture conditions at the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

No willow flycatchers were detected (see table 2-1), but the site was only surveyed twice, totaling 1.0 observer-hour, and occupancy status could not be determined from the limited survey effort. No cowbirds were detected during the surveys. Vegetation structure within the site is generally suitable, with decent branching structure, good vegetation height, and dense canopy closure. Soils were completely dry, however, and overall habitat suitability was thus fair (see "Habitat Suitability Criteria," above). Overall habitat suitability would be improved if wet soils were present in or adjacent to the site for part or all of the flycatcher breeding season.

### *Middle Earth 01*

Area: 2.2 ha Elevation: 335 m

The survey site known as Middle Earth 01 is a mixed-native survey site located approximately 700 m southwest of the end of Brown's Crossing Road on the eastern side of the riparian zone. The site is surrounded on all sides by historic lakebed, which is patchily vegetated with 2-m-tall tamarisk and mule fat, scattered patches of arrowweed, and several herbaceous species. Vegetation within the site consists of tamarisk up to 5 m in height with several disjunct patches of Goodding's willows 7–12 m in height. Where the Goodding's willows are present, they form an overstory above the tamarisk. The tamarisk are patchy as an understory but become very dense in places. About 50% of the tamarisk were dead or dying in May. Canopy closure ranges from 50 to 70% in monotypic tamarisk and reaches 70–80% in areas with Goodding's willows. Soils within the site were completely dry when the site description was recorded in May (see table 2-2). Soil moisture conditions at the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

Middle Earth 01 was occupied by two paired flycatchers (see table 2-1). This site was not surveyed due to its occupancy status. In areas with monotypic tamarisk, habitat suitability was low because of low canopy closure. Within the Goodding's willows patches, vegetation structure was generally suitable, with decent branching structure, good vegetation height, and marginally adequate canopy closure. No signs of stress were noted in the Goodding's willows, but the

only site description was completed in May before willows in other sites began to show signs of stress. Overall habitat suitability would be improved if wet soils were present in the site for part or all of the flycatcher breeding season.

### *Middle Earth 02*

Area: 5.0 ha Elevation: 335 m

The survey site known as Middle Earth 02 is a mixed-native survey site located 75 m north of Middle Earth 01 and 400 m due west of the end of Brown's Crossing Road. It is surrounded on all sides by historic lakebed. Vegetation within the southern portion of the site consists of Goodding's willows 10–12 m in height with clumpy tamarisk 3–5 m in height in the understory. Several gaps in the overstory exist in the center of the site and are dominated by mule fat. Canopy closure averages 70–80% but reaches 90% in the denser willows. The Goodding's willows in the west-central portion of the site, just northeast of the road, showed signs of stress in May, with new deadfall and thin canopies resulting from loss of leaves. In 2014, the northern arm of the site consisted of clumps of Goodding's willows 6–8 m in height surrounded by tamarisk 2–4 m in height and mule fat up to 2 m in height. In 2016, most of the willows in the northern arm were completely dead and the remainder were obviously stressed. A significant portion of the tamarisk in the northern arm was brown, and the densest canopy closure was 30–50%. This portion of the site was not visited again after the initial assessment in May. Soils throughout the site were dry when the site description was recorded in May (see table 2-2). Soil moisture conditions at the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

Middle Earth 02 was occupied by 16 breeding flycatchers (see table 2-1). One of the resident flycatchers moved to BIWI after a failed nesting attempt. Because the site was occupied, it was not surveyed. The portion of the site with the densest willows contains suitable vegetation structure, with good canopy closure and good branching structure for nesting. Soils were completely dry, however, and habitat suitability was thus fair (see "Habitat Suitability Criteria," above). Overall canopy closure seems to have decreased slightly since 2015, and canopy closure would likely increase with increased soil moisture. Overall habitat suitability would be improved if wet soils were present in the site for part or all of the flycatcher breeding season.

### *Prospect 01*

Area: 1.2 ha Elevation: 335 m

The survey site known as Prospect 01 is a mixed-native survey site that runs north-south along a bench 100 m west of the end of Brown's Crossing Road on

the eastern edge of the riparian zone. The eastern side of the site is on top of the bench, and the western side of the site is at the bottom of the bench. Soils between the two sides slope gradually in transition, rather than being sharply incised, and in total there is an approximate 1-m difference in elevation between the two sides. Vegetation within the site consists of a 20–30-m-wide strip of Goodding's willows 10–12 m in height with 2–3-m-tall tamarisk scattered throughout the understory. Some mule fat are also scattered throughout the understory. Tamarisk are more prevalent on top of the bench, and many of the Goodding's willows have died in this area, creating gaps with 50% canopy closure. On the western side of the site, below the bench, Goodding's willows are the dominant vegetation, with little to no tamarisk and canopy closure averaging 70%. Many of the Goodding's willows throughout the site are stressed and dying. Soils were completely dry when the site description was recorded in May (see table 2-2). Soil moisture conditions at the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

No willow flycatchers were detected (see table 2-1), but this site was surveyed only once, totaling 0.7 observer-hour, and occupancy status could not be determined from the limited survey effort. No cowbirds were detected during the survey. Habitat suitability at this site is low (see "Habitat Suitability Criteria," above). Some suitable vegetation structure is present in less than half of the site, where canopy closure is the highest, but areas with suitable structure are currently too limited in areal extent to provide nesting habitat for flycatchers. Because of marginal habitat quality, surveys could be discontinued at this site in future seasons.

### *Burro Wash 01*

Area: 4.1 ha Elevation: 335 m

The survey site known as Burrow Wash 01 is a mixed-native survey site located 350 m northwest of the upper arm of Middle Earth 02, near the western edge of the riparian zone. The site is bordered to the north by a dry cattail marsh and to the south by open, dry river channel. The western half of the site is vegetated with Goodding's willows 10–12 m in height in the overstory and 2–4-m-tall tamarisk and mule fat in the understory. Canopy closure in this portion of the site is 85%. In the east-central portion of the site, vegetation transitions to 10–15-m-tall cottonwoods with tamarisk understory and 70% canopy closure. In the very southeastern corner of the site, 3–5-m-tall tamarisk with 70–80% canopy closure dominates. Soils were completely dry when site descriptions were recorded in May and July (see table 2-2). Soil moisture conditions at the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

Burro Wash 01 was occupied by four breeding flycatchers and one resident, unpaired male flycatcher (see table 2-1). In addition, one willow flycatcher for which residency was not confirmed was detected on June 28. This site was surveyed once, totaling 1.2 observer-hours. Four cowbirds were detected during the survey. Habitat suitability ranges from poor in areas with sparser canopy closure to fair in areas with the densest canopy closure. Overall habitat suitability would be improved if wet soils were present in the site for part or all of the flycatcher breeding season.

### *Burro Wash 02*

Area: 7.9 ha Elevation: 335 m

The survey site known as Burrow Wash 02 is a mixed-native survey site located approximately 100 m northeast of Burro Wash 01 and forms a long strip of riparian vegetation 75–170 m wide that is oriented north-south. It is bordered to the west by dry cattail marsh, to the east by a large swath of dead and downed trees, to the north by dry upland scrub, and to the south by live riparian forest in Motherlode 01. Vegetation within the site consists of small-diameter Goodding's willows 10–14 m in height with 2–4-m-tall tamarisk in the understory and 70–85% canopy closure. Mule fat and cattails are also present in the understory, mostly in the middle section of the site. In the southern third of the site, canopy closure is higher, trees are taller, and the understory is less dense and widely scattered. More gaps are present in the northern half of the site, and canopy closure is lower. Some damp soils were noted in the middle section of the site when a site description was recorded in May, but all other soils were completely dry (see table 2-2). Soils were completely dry when a site description was recorded in July. Soil moisture conditions at the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

Burro Wash 02 was occupied by four breeding flycatchers and one resident, unpaired male flycatcher (see table 2-1). In addition to resident adults, three flycatchers for which residency could not be determined were detected on July 7, July 13, and July 11–17. The flycatcher detected on July 7 moved from Santa Maria North 01, where it was originally captured. This site was surveyed once, totaling 1.3 observer-hours. Four cowbirds were detected during the survey. The best vegetation structure is in the southern third of the site, where canopy closure is highest. Soils were completely dry, however, and habitat suitability was thus fair (see "Habitat Suitability Criteria," above). Habitat suitability decreases in the northern half of the site with decreasing canopy closure, but small patches of suitable habitat are still present. Overall habitat suitability would be improved if wet soils were present in the site for part or all of the flycatcher breeding season.

### *Motherlode 01*

Area: 4.3 ha Elevation: 335 m

The survey site known as Motherlode 01 is a native survey site located east of Burro Wash 01 and south of Burro Wash 02 and is contiguous with both sites. It is bordered to the south by open, dry river channel, to the north by a large swath of dead and downed trees, and to the east by sparse riparian forest. Vegetation within the western third of the site consists of a dense stand of small-diameter Goodding's willows 8–12 m in height with 1–6-m-tall tamarisk widely scattered in the understory. Canopy closure reaches 90% in this portion of the site. The eastern two-thirds of the site is vegetated with tamarisk 3–5 m in height, with larger-diameter, emergent Goodding's willows 10–20 m in height. This portion of the site contains canopy gaps that are filled with deadfall; canopy closure in this section reaches 75%. Mule fat are also scattered through this portion of the site. Soils were completely dry when site descriptions were recorded in May and June (see table 2-2). Soil moisture conditions at the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

Motherlode 01 was occupied by 10 breeding flycatchers and 1 resident, unpaired male flycatcher (see table 2-1). In addition to resident adults, one flycatcher, identified to subspecies by band status, was detected on July 13. Residency status for this individual could not be confirmed. This site was not surveyed due to occupancy status. Vegetation structure is suitable in the western third of the site because of the high canopy closure, good vegetation height, and densely spaced stems with many twigs in the understory for nest locations. Soils were completely dry, however, and habitat suitability was thus fair (see "Habitat Suitability Criteria," above). Habitat suitability would be improved if wet soils were present in the site for part or all of the flycatcher breeding season. The eastern two-thirds of the site lacks dense canopy closure, and habitat suitability in this portion of the site is low.

### *Motherlode 02*

Area: 14.2 ha Elevation: 335 m

The survey site known as Motherlode 02 is a mixed-native survey site located 275 m east of Burro Wash 02. It is bordered to the north by dry upland scrub, to the east and south by a matrix of live riparian forest and pockets of deadfall, and to the west by a large swath of dead and downed trees. Vegetation within the site consists of Goodding's willows 12–18 m in height with significant amounts of deadfall scattered in the understory. Some tamarisk and mule fat are scattered in a narrow band around the southern, western, and northern borders of the site. There is little to no understory in the interior of the site, which is thick with deadfall. The trees are shorter (12–15 m in height) in the southern portion of the

site, with wide crowns and canopy closure reaching 80%. In the northern two-thirds of the site, tree height averages 15–18 m. Most tree canopies are narrow in the northern portion of the site, creating a more broken canopy than in the southern end of the site, and canopy closure varies between 40 and 80%. Several tall, large-diameter willows (> 40 cm diameter at breast height) are present within the site, but many of the trees have relatively narrow diameters (< 20 cm diameter at breast height) and are starting to lean. By July, the Goodding's willows were starting to lose leaves. Soils were completely dry when site descriptions were recorded in May, June, and July (see table 2-2). Soil moisture conditions at the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

Motherlode 02 was occupied by three breeding flycatchers and one resident, unpaired male flycatcher (see table 2-1). This site was surveyed once, totaling 2.5 observer-hours. No cowbirds were detected during the survey. Most of the site lacks suitably dense canopy closure, and it appears that vegetation density is declining. Areas with suitable canopy closure are very limited in extent and occur only in the southern end and along the western border of the site. Habitat suitability in areas with the densest canopy closure was fair, and habitat suitability in the remainder of the site was poor. Canopy closure would likely increase with increased soil moisture, and overall habitat suitability would be improved if wet soils were present in the site for part or all of the flycatcher breeding season.

### *Motherlode 03*

Area: 8.3 ha Elevation: 353 m

The survey site known as Motherlode 02 is a mixed-exotic survey site located 200 m east of Motherlode 02 and consists of two disjunct polygons. It is bordered to the east by open, dry river channel, to the west and south by a matrix of live riparian forest and dead trees, and to the north by dry upland scrub. Vegetation within the site consists primarily of tamarisk 4–6 m in height with a scattered, non-contiguous overstory of Goodding's willows 10–15 m in height. A few cottonwoods 10–15 m in height are present in the northern half of the southern section. Many dead willows are scattered throughout the site, and several large gaps in the canopy were noted. Thick deadfall is also prevalent in the understory. Canopy closure ranges from 60 to 95% and is higher in areas dominated by tamarisk. Soils were dry when site descriptions were recorded in May, June, and July (see table 2-2). Soil moisture conditions at the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

Motherlode 03 was occupied by two paired flycatchers and one resident, unpaired male flycatcher (see table 2-1). This site was surveyed twice, totaling 2.3 observer-hours. Four cowbirds were detected during one survey. Habitat suitability within the site ranges from fair to poor. A large amount of tree

mortality has occurred since 2014, and most of the site is now too open to be suitable for flycatchers. Suitable canopy closure is limited to areas with thick tamarisk, but soils were completely dry and habitat suitability was thus fair. Overall habitat suitability would be improved if wet soils were present in the site for part or all of the flycatcher breeding season.

### *Motherlode 04*

Area: 0.5 ha Elevation: 346 m

The survey site known as Motherlode 04 is located 200 m east of Motherlode 03 and consists of a patch of vegetation 120 x 50 m in size in the middle of the dry, open river channel. Vegetation within the site consists of dense Goodding's willows 10–12 m in height with 1–4-m-tall tamarisk in the understory. Some arrowweed and mule fat 1–2 m in height and a few cottonwoods are scattered around the perimeter of the site. At the beginning of the season, canopy closure within the willows reached 80–90% in the densest vegetation and was 20–60% along the perimeter where the understory is more prevalent. By the end of the season, the Goodding's willows were showing signs of stress, with 90% of the trees either dead or having dropped most of their leaves, and canopy closure reached 65–70% in the densest vegetation. Soils within the site were dry when site descriptions were recorded in May and July (see table 2-2). Soil moisture conditions at the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

No willow flycatchers were detected (see table 2-1). This site was surveyed three times, totaling 1.5 observer-hours, and this site is not considered occupied in 2016. Cowbirds were detected during two surveys. Vegetation structure within the site was suitable at the beginning of the season because of the high canopy closure and good vegetation height, but by the end of the season the site was largely unsuitable because of sparse canopy closure.

### *Confluence 02*

Area: 9.8 ha Elevation: 354 m

The survey site known as Confluence 02 is a mixed-exotic survey site located along the eastern edge of the riparian zone and extends from the confluence of the Big Sandy and Santa Maria Rivers south for 1.3 km. The site sits on a terrace several meters above the river channel and is bordered by dry upland scrub to the east and open river channel to the west. Two-thirds of the site is vegetated with scattered emergent Goodding's willows and cottonwoods 15–18 m in height with tamarisk 3–7 m in height in the understory. Many of the emergent trees look stressed with dead branches, and many had already fallen, creating large piles of deadfall throughout the site. Canopy closure varies widely in this portion of the

site, ranging from 50% in the gaps to 90% under the densest tamarisk. The remaining third of the site is vegetated with tamarisk 5–12 m in height. The tallest tamarisk are of enormous proportions, having stems > 30 cm diameter at breast height and emerging above the rest of the tamarisk. Canopy closure is quite variable in this portion of the site, ranging from 50 to 90%. Soils were dry during the survey in May (see table 2-2).

No willow flycatchers were detected (see table 2-1). This site was surveyed once, totaling 2.3 observer-hours. No cowbirds were detected during the survey. Surveys were discontinued at this site after the initial visit, as SWCA concluded that habitat conditions were poor overall and unlikely to improve. While some patches of tamarisk do have sufficient canopy closure, the areal extent of dense vegetation is too limited and patchy to be considered suitable. In general, the site lacks suitably dense vegetation and any type of soil moisture and is too open and hot.

### *Santa Maria South 01*

Area: 25.6 ha Elevation: 360 m

The survey site known as Santa Maria South 01 is a mixed-exotic survey site located along the southern edge of the riparian area bordering the Santa Maria River and stretches upstream for 1.8 km from the confluence with the Big Sandy River. The site is bordered to the south by dry upland scrub and to the north by a mixture of riparian forest and open river channel. Vegetation within the site consists primarily of tamarisk 4–7 m in height with 35–90% canopy closure. The areas with the highest canopy closure are only ≈4 m tall and contain piles of downed, woody debris. Some emergent cottonwoods 25 m in height are present along the northern edge of the site. In the northeastern corner of the site, some Goodding's willows and cottonwoods are present, generally as emergent trees, and canopy closure under these trees is 70–85%. Water was present in the river channel adjacent to the western end of the site, but the site sits on a terrace, preventing water from entering the vegetation, and all soils were dry when site descriptions were recorded in May and July (see table 2-2). This site is adjacent to the Santa Maria River, which did not flood during the breeding season (figure 2-11). Soil moisture conditions therefore were unlikely to have fluctuated between site descriptions.

No flycatchers were detected (see table 2-1), but the site was only surveyed twice, totaling 5.8 observer-hours, and occupancy status could not be determined from the limited survey effort. Eight cowbirds were detected during one survey. Although some suitable habitat components exist within the site, dense canopy closure does not typically occur in areas with sufficient vegetation height, and the

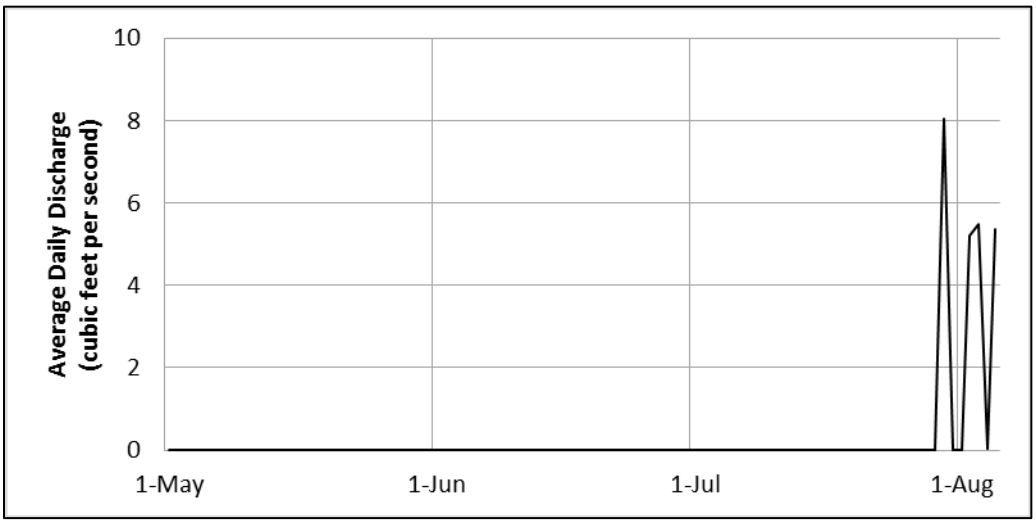



**Figure 2-11.—Average daily discharge (cfs) recorded at the Santa Maria River near Bagdad, Arizona (U.S. Geological Survey Station #09424900), May 1 – August 15, 2016.**

entire interior of this site was very dry. Overall habitat suitability is poor (see "Habitat Suitability Criteria," above) and unlikely to improve without a scouring flood event. Surveys could be discontinued in future seasons.

### *Santa Maria North 01*

Area: 27.7 ha Elevation: 362 m

The survey site known as Santa Maria North 01 is a mixed-exotic survey site located along the northern edge of the riparian area bordering the Santa Maria River and stretches upstream for 1.4 km from the confluence with the Big Sandy River. The site is bordered by open river channel to the south and dry upland scrub to the north. Only the western half of the site was visited in 2016. Vegetation within the western half of the site consists primarily of tamarisk 4–7 m in height with emergent cottonwoods and Goodding's willows 15–20 m in height. Large amounts of thick deadfall are found throughout the site, and tamarisk become quite dense in places, both in canopy closure and stem density. In areas dominated by tamarisk, canopy closure ranges from 60 to 90%, with an average of 75–80%. In areas with a robust cottonwood-willow overstory, canopy closure is highly variable, depending on the density of stems. It ranges between 30 and 90%, with an average of 85% on the western side of the site. The southern edge of the site has a steep bank 1–2 m in height that separates the vegetation from the river channel. The river channel held water throughout the season; all surface soils within the site were dry when site descriptions were recorded in May, June, and July (see table 2-2). Soil moisture conditions at the site did not fluctuate through the season, aside from temporarily damp soils caused by seasonal rains (D. Blood 2017, personal communication).

Santa Maria North 01 was occupied by 10 breeding flycatchers (see table 2-1). In addition to resident adults, one flycatcher was detected on June 28 and one on July 19. Neither individual was confirmed to be a resident in Santa Maria North 01, but the latter individual was identified to subspecies by its band status, and the former individual was later detected in Burro Wash 02 and was confirmed as being a resident at ALAM. Unoccupied portions of the site were surveyed twice, totaling 2.0 observer-hours. Cowbirds were detected during one survey. Suitable vegetation structure exists where the tamarisk are dense enough to have suitable canopy closure but not too dense as to impede flight. Soils were completely dry, however, and habitat suitability was thus fair (see "Habitat Suitability Criteria," above). Overall habitat suitability would be improved if wet soils were present in the site for part or all of the flycatcher breeding season.

### *Reconnaissance*

#### Bullard Wash North

This native reconnaissance site is located on the eastern edge of the riparian area, 400 m downstream from Sidebar 01. Vegetation consists of a stringer of Goodding's willows two to three trees wide with a broken canopy. Arrowweed and mule fat are present in the understory. Soils were completely dry during a visit in May. Given the lack of any kind of dense vegetation or sufficient areal coverage of the Goodding's willows, the site was deemed unsuitable for flycatchers and was not added to the official survey list; therefore, this site could be removed from monitoring in future years.

## Palo Verde Ecological Reserve, California

The PVER is a conservation area located on the California bank of the Colorado River. All sites are periodically flood irrigated and typically become completely dry between irrigation bouts. Soil moisture monitoring at Phase 02 found that surface water was only present in the site during irrigation, which in 2013 was no more than 8% of the time between March 1 and July 31 (GeoSystems Analysis, Inc. 2014). Near-saturated soils were present only during and shortly after irrigation, which in 2014 was up to 15% of the time between March 1 and July 31. While conditions vary between sites depending on soil type and irrigation schedule, it is possible for surface soil moisture conditions to be dry a majority of the time within the conservation area. Lands immediately to the west are dominated by agricultural fields. No evidence of livestock has been documented in or around the PVER study area.

### *Phase 02*

Area: 21.4 ha Elevation: 86 m

The survey site known as Phase 02 is composed of distinct cells of vegetation, each dominated by a single tree species. The northern three-quarters of the site contains alternating 30–40-m-wide swaths of 10–12-m-tall Goodding's willows and coyote willows up to 6 m in height. The southern portion of the site is dominated by two large (225 x 60 m) patches of 12–15-m-tall cottonwoods. Height and density of the vegetation varies within and between cells of the site. Canopy closure is highly variable and is 70–85% in the Goodding's willows, 75–90% in the coyote willows, and 80% in the cottonwoods. Some *Baccharis* sp. bushes were sparsely scattered in the understory of the site. When the June site description was recorded, most of the site was inundated (see table 2-2). When the May and July site descriptions were recorded, soils were completely dry. Conclusions on the frequency and duration of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation. However, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

Phase 02 was occupied by one resident, unpaired male flycatcher (see table 2-1). This individual was highly territorial on the first day it was detected and sang spontaneously for lengthy periods of time. Over the following week, this individual became less territorial and was no longer singing spontaneously shortly before it departed. It was present in roughly the same area for 9 days and is therefore considered resident per the definition used in this project. In addition to this individual, three willow flycatchers for which residency was not determined were detected on May 22, June 5, and June 13. None of these three willow flycatchers demonstrated territorial behavior, and no subsequent monitoring visits were scheduled. This site was surveyed five times, totaling 9.6 observer-hours. Cowbirds were detected during all surveys. Overall habitat suitability is low (see "Habitat Suitability Criteria," above). Some suitable vegetation structure is present within the site, but few areas have both canopy closure ≥ 85% and a suitable branching structure in the understory.

### *Phase 03*

Area: 21.4 ha Elevation: 86 m

The survey site known as Phase 03 is vegetated primarily with cottonwoods 12–15 m in height. Rows ≤ 10 m wide of mixed Goodding's willows 4–7 m in height and small-diameter coyote willows up to 4 m in height are spaced roughly 40–50 m apart throughout the site. *Baccharis* sp. shrubs 1.5 m in height occur occasionally along the borders between the willows and cottonwoods. The overall effect is a mosaic of vegetation types. The entire site has many dead branches, dead branch tips, and thin or oddly shaped crowns. This may be the

result of past water stress because all leaves were shiny, green, and healthy looking. Canopy closure is 70–80% in the cottonwoods and as low as 50% in the willow rows. The eastern 20% of the site is vegetated with smaller-diameter Goodding's willows reaching 10 m in height and clumps of *Baccharis* sp. reaching 1.5 m in height. Canopy closure here reaches 80%. When the May site description was recorded, surface water was noted within the site as part of active irrigation (see table 2-2). When the June site description was recorded, soils within the site were damp; soils were completely dry when the July site description was recorded. In these cases, the nearest surface water was located either in the Colorado River or in an irrigation ditch immediately adjacent to the site. Conclusions on the frequency and duration of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation. However, if conditions are similar to those observed in Phase 02, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

No willow flycatchers were detected (see table 2-1). This site was surveyed five times, totaling 9.3 observer-hours. Cowbirds were detected during four surveys. Habitat suitability within the site is poor because canopy closure is too low.

### *Phase 04 Block 01*

Area: 7.7 ha Elevation: 87 m

The survey site known as Phase 04 Block 01 is vegetated primarily by Goodding's willows 10–12 m in height. Five evenly spaced, 20-m-wide strips of cottonwoods up to 15 m in height are dispersed throughout the site. Some coyote willows 2–3 m in height are present near the cottonwood-Goodding's willow boundaries. Canopy closure is 80–90% in the cottonwoods and 75–85% in the Goodding's willows. *Baccharis* sp. is planted on the northern edge of the survey site. When the May and June site descriptions were recorded, all soils were dry, with the nearest surface water located in the Colorado River. When the July site description was recorded, a small amount of standing water was present in the site, but all other soils were dry (see table 2-2). Conclusions on the presence of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation. However, if conditions are similar to those observed in Phase 02, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

One willow flycatcher was detected on May 22 (see table 2-1). This willow flycatcher did not demonstrate territorial behavior, and no subsequent monitoring visits were scheduled. This site is not considered occupied in 2016. This site was surveyed five times, totaling 5.4 observer-hours. Cowbirds were detected during all surveys. While canopy closure reaches suitable density in the cottonwoods, the cottonwoods cover < 25% of the site, and the lack of understory and available

branching structure for nest placement limits habitat suitability within the cottonwoods. Canopy closure is generally too low in the Goodding's willows, and overall habitat suitability is low.

### *Phase 04 Block 02*

Area: 4.0 ha Elevation: 87 m

The survey site known as Phase 04 Block 02 lies due east of Phase 04 Block 01 and is adjacent to the Colorado River. This survey site is primarily vegetated with Goodding's willows 12–15 m in height. Some coyote willows 3–5 m in height are present in small clumps in the understory or in strips along the perimeter of the site. Cottonwoods 15–20 m in height are present in a square patch approximately 35 x 35 m in size near the center of the site. Canopy closure is 80–95% in the Goodding's willows and 75–90% in the cottonwoods. When site descriptions were recorded in May, June, and July (see table 2-2), no surface water was documented within the site, and the nearest surface water was located either in the Colorado River or in an irrigation canal adjacent to the site. Conclusions on the presence of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation. However, if conditions are similar to those observed in Phase 02, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

One willow flycatcher was detected on May 22 (see table 2-1). This willow flycatcher did not demonstrate territorial behavior, and no subsequent monitoring visits were scheduled. This site is not considered occupied in 2016. This site was surveyed five times, totaling 4.2 observer-hours. Cowbirds were detected during all surveys. Overall vegetation structure is suitable within the site, although canopy closure is a little low in places. Habitat suitability would be improved with a more consistent presence of wet soils.

### *Phase 04 Block 03*

Area: 23.7 ha Elevation: 87 m

The survey site known as Phase 04 Block 03 lies due north of Phase 04 Block 02 and is also located adjacent to the Colorado River. This survey site is vegetated with cottonwoods, Goodding's willows, and coyote willows that occur in a much more heterogeneous mix than in the other two blocks in Phase 04. Cottonwoods 10–18 m in height form the overstory for the majority of the block. Goodding's willows 6–10 m in height and spindly coyote willows 3–5 m in height occur throughout the understory. Vegetation is generally taller along the southern edge of the site than along the northern edge. There are a few narrow (20 m wide) strips containing only Goodding's and coyote willows. A few gaps in the

cottonwood canopy are present along the north-central portion of the site, and coyote willows 3–5 m in height are the dominant woody species in the gaps between the cottonwoods. Canopy closure is 75–85% within the cottonwoods and varies directly with canopy height, but it is as low as 60% in areas with only coyote willows. When the May and July site descriptions were recorded, surface water was noted in up to one-half of the site. Soils were completely dry when the June site description was recorded (see table 2-2). Conclusions on the frequency and duration of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation. However, if conditions are similar to those observed in Phase 02, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

One willow flycatcher was detected on May 22 (see table 2-1). This willow flycatcher did not demonstrate territorial behavior, and no subsequent monitoring visits were scheduled. This site is not considered occupied in 2016. This site was surveyed five times, totaling 13.6 observer-hours. Cowbirds were detected during all surveys. Overall habitat suitability at this site is low because canopy closure is too low in a majority of the site (see "Habitat Suitability Criteria," above).

### *Phase 05 Block 01*

Area: 15.9 ha Elevation: 88 m

Of the three survey sites in Phase 05, Block 01 contains the greatest proportion of grassy fields, which dominate the center of the site. The most suitable habitat is located within 100 m of the eastern and southern edges and the northwestern corner of the site, and these were the only portions surveyed. The site consists of a mosaic of cottonwoods 8–15 m in height, Goodding's willows 10–12 m in height, and coyote willows 4–5 m in height. Cottonwood is the dominant woody species, with interspersed small patches and rows of Goodding's willows. Some small coyote willow patches are present along the northern and southern borders of the site. Canopy closure varies directly with height, ranging from 70% in the northeastern corner of the site to 85% along the southern edge. The northwestern corner of the block contains 15-m-tall cottonwoods and 10-m-tall Goodding's willows with 75–85% canopy closure. When site descriptions were recorded in May and July, surface water and saturated soil were noted in up to one-third of the site (see table 2-2). Soils were completely dry when the June site description was recorded, and the nearest standing water was in the Colorado River. Conclusions on the frequency and duration of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation. However, if conditions are similar to those observed in Phase 02, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

Four willow flycatchers were detected on May 22 (see table 2-1). None of these four willow flycatchers demonstrated territorial behavior, and no subsequent

monitoring visits were scheduled. This site is not considered occupied in 2016. This site was surveyed five times, totaling 10.1 observer-hours. Cowbirds were detected during all surveys. Habitat suitability ranges from fair to poor. Most of the site, with the exception of vegetation along the southern and northwestern borders, lacks suitably dense canopy closure. Habitat suitability would be improved with a more consistent presence of wet soils.

### *Phase 05 Block 02*

Area: 23.6 ha Elevation: 88 m

The survey site known as Phase 05 Block 02 lies due east of Phase 05 Block 01 and is adjacent to the Colorado River. This survey site contains a lower percentage of open, grassy fields than Block 01. It is primarily vegetated with cottonwoods 7–15 m in height in the western two-thirds of the site and Goodding's willows up to 6–10 m in height in the eastern third. Some Goodding's willows are mixed in under the cottonwoods as well. Where the cottonwoods are taller, the Goodding's willows are stressed or dead. Canopy closure averages 60–85% in the Goodding's willows and 70–90% in the cottonwoods. When site descriptions were recorded in May, June, and July, no surface water or saturated soil was documented within the block, though soils were mostly or completely damp when site descriptions were recorded in May and July (see table 2-2). Conclusions on the presence of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation. However, if conditions are similar to those observed in Phase 02, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

No willow flycatchers were detected (see table 2-1). This site was surveyed five times, totaling 11.1 observer-hours. Many cowbirds were detected during all surveys. Habitat suitability ranges from fair to poor. Though suitably dense canopy closure does exist within the site, it is limited in extent and typically does not co-occur with suitable branching structure in the understory. Habitat suitability would be improved with a more consistent presence of wet soils.

### *Phase 05 Block 03*

Area: 29.6 ha Elevation: 88 m

The survey site known as Phase 05 Block 03 is located due north of Phase 05 Block 02. It contains the smallest proportion of open grassy areas of the three survey sites in Phase 05. This site is primarily vegetated with a mix of cottonwoods and Goodding's willows. The eastern and western portions of the site are predominantly cottonwoods 10–12 m in height, with many narrow (≤ 10 m wide) strips of Goodding's willows 8–10 m in height. Canopy closure

ranges from 60 to 85% in these portions of the site. Open, grassy areas are more abundant in the eastern portion of the site than elsewhere. The center quarter of the site is predominantly Goodding's willows 5–10 m in height with 65–70% canopy closure. A few patches of 2–5-m-tall coyote willows are scattered in the understory. A small portion of the site was inundated when the May site description was recorded. Soils were completely dry when site descriptions were recorded in June and July (see table 2-2). Conclusions on the presence of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation. However, if conditions are similar to those observed in Phase 02, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

Six willow flycatchers were detected on May 23 (see table 2-1). None of the six willow flycatchers demonstrated territorial behavior, and no subsequent monitoring visits were scheduled. This block is not considered occupied in 2016. This site was surveyed five times, totaling 15.9 observer-hours. Cowbirds were detected during all surveys. Overall habitat suitability at this site is poor because of low canopy closure (see "Habitat Suitability Criteria," above).

### *Phase 06 Block 01*

Area: 38.7 ha Elevation: 87 m

The survey site known as Phase 06 Block 01 is located immediately north of Phase 06 Block 02, which is in turn immediately north of Phase 05 Block 03. This survey site contains a few open areas but is vegetated primarily with a mosaic of cottonwoods and Goodding's willows. The two species occasionally occur in monotypic strips but more often occur together in mixed strips. The cottonwoods are 10–18 m in height, and the Goodding's willows are 10–15 m in height. Canopy closure ranges from 60% in open areas to 90% in the tallest, densest cottonwoods and is typically 85–90%. Where the cottonwoods are more dominant, the Goodding's willows are showing signs of stress and are half dead. Coyote willows up to 5 m in height are also present in narrow (1–5 m wide) rows throughout the site, with canopy cover ranging from 60 to 85%. Mule fat and *Baccharis* sp. are scattered throughout the understory. When site descriptions were recorded in May, June, and July, soils were dry except for some damp soil in May and a tiny patch of surface water in June (see table 2-2). The nearest surface water was in the river. Conclusions on the presence of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation. However, if conditions are similar to those observed in Phase 02, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

One willow flycatcher was detected on May 23 and a second on June 7 (see table 2-1). Neither willow flycatcher demonstrated territorial behavior, and no subsequent monitoring visits were scheduled. This site is not considered occupied

in 2016. This site was surveyed five times, totaling 17.5 observer-hours. Many cowbirds were detected during all surveys. Habitat suitability is low. Canopy closure reaches suitable density within the cottonwoods, but there is no understory, and the trees do not provide suitable branching structure for nesting.

### *Phase 06 Block 02*

Area: 37.6 ha Elevation: 87 m

The survey site known as Phase 06 Block 02 is located between Phase 06 Block 01 and Phase 05 Block 03. This survey site is vegetated with a mosaic of Goodding's willows, cottonwoods, and coyote willows, with Goodding's willows being most prevalent and coyote willows least prevalent. Vegetation height is 10–15 m in areas with cottonwoods and 8–12 m in areas with Goodding's willows. Canopy closure varies from 80 to 95% with no discernable pattern. Coyote willows 3–5 m in height are widely scattered in small patches (5 x 10 m in size) throughout the site, with canopy closure reaching 90%. Mule fat is also scattered widely throughout the site. Both the mule fat and coyote willow patches are so widely scattered that they do not form an understory layer. When site descriptions were recorded in May, June, and July (see table 2-2), soils were completely dry within the site, and the nearest standing water was in the Colorado River. Conclusions on the presence of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation. However, if conditions are similar to those observed in Phase 02, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

Three willow flycatchers were detected on May 23, one on June 7, and one on June 14 (see table 2-1). None of these five willow flycatchers demonstrated territorial behavior, and no subsequent monitoring visits were scheduled. This site is not considered occupied in 2016. This site was surveyed five times, totaling 16.7 observer-hours. Many cowbirds were detected during all surveys. Vegetation structure looks suitable in many places. Habitat suitability would be improved with a more consistent presence of wet soils.

### *Phase 07 Block 01*

Area: 36.8 ha Elevation: 87 m

The survey site known as Phase 07 Block 01 is located due north of Phase 07 Block 02, which in turn is located due north of Phase 06 Block 01. This survey site is vegetated with a mosaic of cottonwoods, Goodding's willows, and coyote willows, with cottonwoods being most prevalent and coyote willows least prevalent. The cottonwoods and Goodding's willows tend to be planted together,

alternating with rows of coyote willows. The cottonwoods reach 10–15 m in height, and the Goodding's willows reach 6–10 m in height. Canopy closure is 70–85% in the cottonwoods and is as low as 60–70% in areas dominated by Goodding's willows. The coyote willows vary from 3-m-tall, widely spaced wispy stems to 5-m-tall stands with 60% canopy closure. *Baccharis* sp. is scattered throughout the site. When site descriptions were recorded in May, June, and July, soils were either mostly to completely dry or completely damp (see table 2-2). The nearest standing water was either in the irrigation canal immediately to the south or in the Colorado River. Conclusions on the presence of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation. However, if conditions are similar to those observed in Phase 02, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

Five willow flycatchers were detected on May 25 and two on June 9 (see table 2-1). One individual on June 9 responded to playback more enthusiastically than is typical of presumed migrants, though this response was not considered classic territorial behavior (e.g., unsolicited singing). This individual was not detected during a subsequent monitoring visit, and residency was not confirmed. None of the other six willow flycatchers demonstrated territorial behavior, and no subsequent monitoring visits were scheduled for these individuals. This site is not considered occupied in 2016. This site was surveyed five times, totaling 18.5 observer-hours. Many cowbirds were detected during all surveys. Habitat suitability is currently low because of low canopy closure in a majority of the site. This is one of the youngest sites surveyed by SWCA, and vegetation structure is likely to continue to develop in future years.

### *Phase 07 Block 02*

Area: 40.6 ha Elevation: 87 m

The survey site known as Phase 07 Block 02 is located between Phase 07 Block 01 and Phase 06 Block 01. This survey site is vegetated with a mosaic of cottonwoods, Goodding's willows, and coyote willows, with cottonwoods being most prevalent and coyote willows least prevalent. The cottonwoods and Goodding's willows tend to be planted together, alternating with narrow rows of coyote willows. The cottonwoods reach 8–12 m in height, and the Goodding's willows reach 8–10 m in height. Canopy closure varies directly with canopy height and is typically 70–90%. Coyote willows vary from 2-m-tall, widely spaced wispy stems to 5-m-tall stands with 40–80% canopy closure. *Baccharis* sp. is also scattered throughout the site. Several open areas with widely spaced Goodding's and coyote willows are present within the site. Thick stands of grass and alfalfa (*Medicago sativa*) are present in these open areas. Standing water was noted when site descriptions were recorded in May and June, and soils were dry to damp when the July site description was recorded (see table 2-2). Conclusions on the presence of surface water within the site could not be drawn because of the

high variability in water levels associated with flood irrigation. However, if conditions are similar to those observed in Phase 02, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

Five willow flycatchers were detected on May 24 and two on June 9 (see table 2-1). The two individuals on June 9 responded to playback more enthusiastically than is typical of presumed migrants, though this response was not considered classic territorial behavior (e.g., unsolicited singing). Neither of the individuals were detected during a subsequent monitoring visit or on subsequent surveys, and neither individual was determined to be a resident. None of the other five willow flycatchers demonstrated territorial behavior, and no subsequent monitoring visits were scheduled for these individuals. This site is not considered occupied in 2016. This site was surveyed five times, totaling 17.0 observer-hours. Many cowbirds were detected during all surveys. Canopy closure has increased to suitable levels (see "Habitat Suitability Criteria," above) in many places within this site, and overall habitat suitability is fair. Habitat suitability is likely to continue to improve as this relatively young site matures.

## Cibola, Arizona and California

The survey sites in this study area are a mix of conservation area sites and existing, unrestored riparian sites, though only the former were surveyed in 2016. The conservation area sites are located in the Cibola Valley Conservation Area (CVCA) and in the Cibola National Wildlife Refuge near the headquarters. All sites within the conservation areas are periodically flood irrigated and typically become dry between irrigation bouts. The CVCA sites are surrounded by agricultural fields. No evidence of livestock was documented in or around any sites in the study area.

### *Phase 01*

Area: 26.2 ha Elevation: 74 m

The survey site known as Phase 01 at the CVCA consists of a mosaic of rectangular cells of cottonwoods, Goodding's willows, and coyote willows of varying sizes and densities. Each cell generally contains a single species and age class, though some emergent Goodding's willows are present in the coyote willow cells. The cottonwoods are 10–15 m in height, and the Goodding's willows are 10–12 m in height. Coyote willows reach 2–5 m in height. Canopy closure is 85–95% in the cottonwoods and 70% in the Goodding's willows. Most of the coyote willows are dead or nearly dead. A few of the cells have scattered trees in grassy fields. When site descriptions were recorded in May, June, and July, at least some portion of the site contained damp soil. All other soils were dry, except for a tiny amount of surface water documented within the site in July. An

irrigation canal adjacent to the western edge of the site held water when site descriptions were recorded in May and June. Conclusions on the frequency and duration of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation. However, if conditions are similar to those observed in PVER Phase 02, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

No willow flycatchers were detected (see table 2-1). This site was surveyed five times, totaling 11.2 observer-hours. Cowbirds were detected during all surveys. Habitat suitability within the site is low because of low canopy closure and/or the lack of suitable understory structure. Canopy closure is suitably high in portions of the cottonwoods, but good branching structure for nesting is lacking.

### *Phase 02*

Area: 25.5 ha Elevation: 74 m

The survey site known as Phase 02 at the CVCA is located immediately south of Phase 01. It consists of rectangular cells of mixed cottonwoods and Goodding's willows alternating with cells of coyote willows with emergent cottonwoods. The mixed cottonwood-Goodding's willow cells consist of cottonwoods 10–12 m in height with Goodding's willows up to 8–10 m in height. The coyote willows are 2–6 m in height. The Goodding's willows are dying back in some places, with live foliage present only on the lower half of the trees. Canopy cover ranges from 40 to 90% and varies inversely with the proportion of coyote willows, many of which are severely stressed or completely dead. The healthiest vegetation is in the very center of the site, where canopy closure reaches 90%. When site descriptions were recorded in May and June, soils were completely or mostly damp within the site. When the July site description was recorded, soils were completely dry (see table 2-2). An irrigation canal 80 m west of the site held surface water throughout the season. Conclusions on the frequency and duration of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation. However, if conditions are similar to those observed in PVER Phase 02, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

No willow flycatchers were detected (see table 2-1). This site was surveyed five times, totaling 12.3 observer-hours. Cowbirds were detected during four surveys. Habitat suitability is fair in the very center of the site, where canopy closure is the highest and branching structure is good. In the rest of the site, habitat suitability is low because canopy closure is too low. Habitat suitability would be improved with a more consistent presence of wet (i.e., saturated or inundated) soils.

### *Phase 03*

Area: 38.4 ha Elevation: 73 m

The survey site known at Phase 03 at the CVCA is located 2.5 km west of Phases 01 and 02. It consists of a mosaic of rectangular cells of cottonwoods, Goodding's willows, and coyote willows of varying sizes and densities. Each cell generally contains one species and age class, though some emergent cottonwoods and Goodding's willows are present in the coyote willow cells. The tallest cottonwoods reach approximately 12 m in height, Goodding's willows reach 8 m, and coyote willows reach 3 m. Many of the willows of both species are mostly dead, with only basal sprouts present. Canopy closure ranges from 50 to 90% and is lowest in the coyote willows and highest in the cottonwoods. When the June site description was recorded, standing water and saturated soil were noted in one-fifth of the site. Soils were completely dry when site descriptions were recorded in May and July (see table 2-2). The nearest surface water was in the river. Conclusions on the frequency and duration of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation. However, if conditions are similar to those observed in PVER Phase 02, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

Five willow flycatchers were detected on May 24 and one on June 8 (see table 2-1). None of the six willow flycatchers demonstrated territorial behavior, and no subsequent monitoring visits were scheduled. This site is not considered occupied in 2016. This site was surveyed five times, totaling 13.6 observer-hours. Cowbirds were detected during all surveys. Most of the site lacks dense canopy closure, and in areas where canopy closure is sufficiently high, the trees lack suitable branching structure for nesting; overall habitat suitability is consequently low.

### *Nature Trail*

Area: 13.7 ha Elevation: 71 m

The survey site known as Nature Trail is approximately 700 m west of the Cibola National Wildlife Refuge headquarters and consists of a mosaic of cottonwoods, Goodding's willows, mesquite, and willow baccharis. Approximately one-half of the site consists of scattered screwbean and honey mesquite up to 6 m in height with a thick understory of willow baccharis. Canopy closure is 65–70% in the mesquite. The northern half of the site contains an extensive, but sparse, stand of Goodding's willows 6–10 m in height. The interior of the willow stand contains the shorter trees with a canopy closure of 25%, and many of the willow trees are dead. The tallest willows are present around the perimeter of the willow stand, and canopy closure reaches 90% under these trees. The southwestern corner of the site has a small stand of cottonwoods 12–18 m in height with canopy closure

of 75–85%, and stringers of cottonwoods up to 18 m in height occur throughout the site. The site was 50% inundated when the May site description was recorded, but soils were dry when site descriptions were recorded in June and July (see table 2-2). Conclusions on the frequency and duration of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation. However, if conditions are similar to those observed in PVER Phase 02, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

Four willow flycatchers were detected on May 25 and five on June 9 (see table 2-1). One individual on June 9 responded to playback more enthusiastically than is typical of presumed migrants, though this response was not considered classic territorial behavior (e.g., unsolicited singing). This individual was not detected during a subsequent monitoring visit or on subsequent surveys, and this individual was determined not to be a resident. None of the other eight willow flycatchers demonstrated territorial behavior, and no subsequent monitoring visits were scheduled for these individuals. This site is not considered occupied in 2016. This site was surveyed five times, totaling 6.0 observer-hours. Cowbirds were detected during all surveys. Although the cottonwood stringers do have suitable canopy closure, the trees lack suitable understory structure for nesting. Canopy closure is too low in the rest of the site for it to be suitable for nesting flycatchers, and suitable vegetation structure is unlikely to develop in areas dominated by willow baccharis and mesquite. Overall habitat suitability of the site is low.

### *C2729*

Area: 6.0 ha Elevation: 70 m

The survey site known as C2729 is approximately 2 km west of the Cibola National Wildlife Refuge headquarters in the area known as Crane Roost and consists of a mosaic of cottonwoods and coyote willows. The site is bisected east to west by a road, and cottonwoods form a 10–12-m-tall overstory with a 4–7-m-tall coyote willow understory in the northern half of the site. Some tamarisk, willow baccharis, and honey mesquite are scattered around the understory. Trees in the south-central portion of the northern half of the site are noticeably shorter and less dense than the rest of trees in this portion of the site. Canopy closure in the northern half of the site ranges from 40% in the shorter, sparser trees to 90%. The southern half of the site is vegetated primarily with coyote willows 5–6 m in height with emergent 10–12-m-tall cottonwoods. An area of sparse 3-m-tall coyote willows is present in the southeastern portion of this half. Some tamarisk and honey mesquite are scattered throughout the southern half. Canopy closure in the southern half of the site ranges from 40 to 90%. Approximately one-half of the site was inundated when the May site description was recorded. Soils were completely dry when the June site description was recorded, and a tiny amount of standing water was noted during the July site description (see table 2-2). Water

was present in an irrigation canal on the western side of the site in June. Conclusions on the frequency and duration of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation. However, if conditions are similar to those observed in PVER Phase 02, surface water was likely present only during active irrigation (see GeoSystems Analysis, Inc. 2014).

Five willow flycatchers were detected on May 25 (see table 2-1). None of the five willow flycatchers demonstrated territorial behavior, and no subsequent monitoring visits were scheduled. This site is not considered occupied in 2016. This site was surveyed five times, totaling 6.8 observer-hours. Cowbirds were detected during all surveys. Habitat suitability within the site ranges from poor to fair. The best habitat is in the coyote willows immediately south of the road and in the very northwestern corner of the site. The rest of the site lacks suitably dense canopy closure. In areas where vegetation structure is good, habitat suitability would be improved by a more consistent presence of wet soils.

## Yuma, Arizona

The Yuma study area is located along the Colorado and Gila Rivers, starting at Yuma East Wetlands approximately 4 km downstream from the confluence and moving upstream along the Gila River. Yuma East Wetlands is a flood-irrigated conservation area located on either side of the Colorado River and is bordered by urban landscape to the west. Flood-irrigated sites within the conservation area are typically dry between irrigation bouts. All survey sites within the study area are located within a matrix of agricultural lands. Cowbirds are widespread throughout the study area and were detected during all surveys. No evidence of livestock was noted within or around any of the survey sites.

### *J*

Area: 8.4 ha Elevation: 38 m

The survey site known as J is located in Yuma East Wetlands on the northern side of the Colorado River and is bisected by a dirt road and irrigation channel. Vegetation within the site consists primarily of cottonwoods 8–10 m in height, occasionally reaching 10–12 m in height. The understory is composed of 2-m-tall willow baccharis and 2–6-m-tall honey and screwbean mesquite. The cottonwoods are taller and the understory less prevalent on the northern side of the site. Canopy closure varies from 70 to 90% and averages 80% throughout the cottonwoods. A stand of 4–6-m-tall coyote willows 60 x 120 m in size with 90% canopy closure is present along the western edge of the site. Standing water was noted in small puddles at the irrigation canal outlets when site descriptions were recorded in May, June, and July (see table 2-2). A small amount of standing water was also noted in the coyote willows during the May site description; all

other soils were dry during all three site descriptions. Conclusions on the frequency and duration of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation.

Four willow flycatchers were detected on May 25 and two on June 8 (see table 2-1). None of the six willow flycatchers demonstrated territorial behavior, and no subsequent monitoring visits were scheduled. This site is not considered occupied in 2016. This site was surveyed five times, totaling 4.6 observer-hours. Cowbirds were detected during all surveys. Overall habitat suitability is low. Most of the site lacks suitably dense canopy closure with good branching structure in the understory. The stand of coyote willows on the western side of the site has good vegetation height and canopy closure, but the stems are wispy and closely spaced, providing few flyways. Structure may improve as the coyote willow stand matures.

### *C (formerly South AC)*

Area: 0.9 ha Elevation: 37 m

The survey site known as C is located in Yuma East Wetlands immediately south of the Colorado River and consists of a stringer of cottonwoods and Goodding's willows along the northern edge of a cattail-bulrush marsh. The site is bisected by an open water channel extending north from the marsh. East of the channel, the stringer consists of 5–10-m-tall cottonwoods with a few Goodding's willows and is rarely more than one tree wide. The trees are shorter nearest the channel. Canopy closure ranges from 60 to 90% and varies inversely with canopy height. Honey mesquite is scattered in low density in the understory. West of the channel, the stringer widens slightly and consists of 8–10-m-tall Goodding's willows and 15-m-tall cottonwoods. Mule fat, willow baccharis, and honey mesquite form a dense understory. Canopy closure varies from 75% in areas dominated by Goodding's willows to 90% in more mixed vegetation. The very western end of the stringer is bordered to the south by a dense stand of coyote willows approximately 80 x 10 m in size and 4–5 m in height with 95% canopy closure. Standing water was documented within the coyote willows when the May and June site descriptions were recorded and in the marsh when all three site descriptions were recorded (see table 2-2). Soils away from standing water were generally dry. Conclusions on the frequency and duration of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation.

Four willow flycatchers were detected on May 25 (see table 2-1). None of the four willow flycatchers demonstrated territorial behavior, and no subsequent monitoring visits were scheduled. This site is not considered occupied in 2016. This site was surveyed five times, totaling 2.8 observer-hours. Cowbirds were detected during all surveys. Habitat suitability within the site is low. The coyote

willow patch on the western side of the site has suitable structure but is barely wide enough to be considered suitable flycatcher habitat (see "Habitat Suitability Criteria," above). Canopy closure within the remainder of the site is not dense enough to be considered suitable habitat.

***I***

Area: 6.4 ha Elevation: 38 m

The survey site known as I is located in Yuma East Wetlands, consists primarily of cottonwoods 8–15 m in height with a patchy understory of 2-m-tall willow baccharis and 2–6-m-tall honey mesquite. The habitat is divided into cells that are separated by dirt roads, and vegetation density varies by cell, with canopy closure ranging from 60 to 90%. Areas with lower canopy closure are characterized by more widely spaced trees and a more dominant understory. One cell on the western side of the site contains a 20-m-wide, dense stand of cottonwoods 10–12 m in height with 85–90% canopy closure and no understory. This cottonwood stand is bordered to the west by a stand of coyote willows roughly 70 x 50 m in size and 3–5 m in height with 95% canopy closure. Standing water was noted in culverts under the roads when the May site description was recorded, with the majority of soils in the site dry otherwise. Standing water was noted under a small portion of the cottonwoods when the site description was recorded in June; soils were dry otherwise. All soils were dry when the site description was recorded in July (see table 2-2). Conclusions on the frequency and duration of surface water within the site could not be drawn because of the high variability in water levels associated with flood irrigation.

Fourteen willow flycatchers were detected on May 25 (see table 2-1). None of the 14 willow flycatchers demonstrated territorial behavior, and no subsequent monitoring visits were scheduled. This site is not considered occupied in 2016. This site was surveyed five times, totaling 7.1 observer-hours. Cowbirds were detected during four surveys. Habitat suitability within the site ranges from poor to fair. Canopy closure within most of the site is not dense enough, and areas dominated by sparse cottonwoods interspersed with mesquite are unlikely to develop suitable vegetation density. Areas with a dense cottonwood overstory and a willow baccharis understory may provide suitable habitat, and vegetation structure is generally suitable within both the dense cottonwood patch and the adjacent coyote willow on the western side of the site. Habitat suitability would be improved if the cottonwoods covered a larger areal extent and if the coyote willows were taller and had better branching structure. In areas where vegetation structure is good, habitat suitability would be improved by a more consistent presence of wet soils.

# Yellow-billed Cuckoo Broadcast Surveys

Field personnel spent 18.4 observer-hours conducting yellow-billed cuckoo broadcast surveys at RIRA, PAHR, and WMSP. Results of the surveys and site descriptions are summarized below. Sites that were also surveyed for flycatchers are described earlier in this chapter. The boundaries of survey areas are shown on orthophotos in attachment 7.

## River Ranch, Nevada

Surveys were conducted in a portion of a linear patch of trees located due south of the RIRA flycatcher survey sites. The cuckoo survey site begins approximately 275 m southeast of Smalls and extends south for 900 m. Vegetation within this linear patch consists primarily of 6–10-m-tall velvet ash growing on either side of the stream flowing from Ash Springs, with the shorter trees at the northern end of the site. The width of the linear patch varies from 30 to 170 m. Approximately 10% of the site contains cottonwoods 10–15 m in height. Some 2–6-m-tall Russian olive and some dense patches of grape vine are also scattered throughout the site. Canopy closure varies from 80 to 90%. The stream channel held flowing water throughout the season, but soils away from the channel were dry to damp, with crunchy leaves covering the ground. Most of this site is surrounded by grazed cattle pasture, and some cattle were intermittently present on the western side of the site during the season.

Three surveys were completed in July and early August, totaling 4.1 observer-hours. No yellow-billed cuckoos were detected during surveys.

## Pahranagat, Nevada

Yellow-billed cuckoo surveys were conducted at all four flycatcher survey sites, and descriptions of these sites can be found earlier in this chapter. In addition to flycatcher sites, two stringers of habitat on either side of Upper Pahranagat Lake were surveyed. The stringer on the eastern side of the lake starts 220 m north of the eastern terminus of the levee that bisects the lake and continues 210 m south of the levee. Vegetation within this stringer consists of 10–15-m-tall cottonwoods that cover an area 15–30 m wide. Canopy closure reaches 90%. The stringer on the western side of the lake is located immediately south of the levee. It consists of cottonwoods 15 m in height, one to three trees wide with several gaps. Canopy closure reaches 70% in the widest part of the stringer, which is approximately 40 m wide. Soils beneath both stringers were damp to inundated, depending on lake levels.

Three surveys were completed in July and early August, totaling 9.8 observer-hours. One yellow-billed cuckoo was visually and aurally detected in Pahranagat MAPS during a survey on July 6. In addition, incidental, passive detections of a

yellow-billed cuckoo were recorded in Pahranagat North on June 15 and June 27, and an additional incidental, passive detection was recorded in Pahranagat MAPS on August 3. Residency status is difficult to determine, as one individual could use the entirety of the fragmented habitat along the lake for a territory, or the detections could represent a series of individuals moving through the area.

### Warm Springs, Nevada

Yellow-billed cuckoo surveys were conducted at Muddy Mac, Muddy Stringer 01, and a small (70 x 20 m) patch of velvet ash located approximately 150 m south of Muddy Stringer 01. This patch of velvet ash trees is located 10 m south of the north fork of the Muddy River and approximately 45 m west of the end of a dirt road that dead-ends at the river. It consists of a stringer bisected by the dirt road and is surrounded by a matrix of quailbush and mesquite. The trees reach 10–12 m in height, and canopy closure reaches 80–90%.

Four surveys were completed, totaling 4.5 observer-hours. A yellow-billed cuckoo was recorded during surveys in the same general area of Muddy Mac on June 22, July 5, and July 19. A second detection was noted on July 19, but it was unclear if the detection was of a second individual. According to the yellow-billed cuckoo survey protocol (Halterman et al. 2015), "three or more total detections in an area during at least three survey periods and at least 10 days between each detection" qualifies as a probable breeding territory. The Muddy Mac survey site was therefore determined to have a probable breeding territory, though breeding activity was not positively confirmed. According to protocol for the LCR MSCP, this territory would be classified as a possible breeding territory since there was no confirmation of the presence of a pair, nest building, or food carrying.

## DISCUSSION

Six of the 10 study areas occupied in 2016 by resident or breeding flycatchers (KEPI, PAHR, MUDD, TOPO, BIWI, and ALAM) held resident or breeding flycatchers in each year they were surveyed (Braden and McKernan 2006; McLeod et al. 2008; McLeod and Pellegrini 2013, 2014, 2015, 2016; details of residency and breeding in 2016 are presented in chapters 3 and 4 of this document). While resident flycatchers were detected in all of the typically occupied study areas, breeding and resident flycatchers were detected in new locations within KEPI, BIWI, and ALAM. Of the other four occupied study areas, three (RIRA, WMSP, and MVWA) have been intermittently occupied over the years, and one (PVER) was occupied for the second time since surveys began in 2009. Each study area is discussed in detail below.

As was the case in each year (2010–16) that KEPI was surveyed, resident and breeding flycatchers were found in the patches of coyote willows surrounding Nesbitt Lake. Breeding flycatchers were also discovered along Frenchy Lake, which was surveyed for the first time. Overall habitat suitability within KEPI has not changed over the years, though it has declined slightly in some places while increasing in others. Any local declines in habitat suitability are due to the increasing size of some gaps in the center of several patches. Local increases in habitat suitability have occurred where some of the patches are growing together. The thinning of the bulrush marsh along Nesbitt Lake may have influenced nest placement, with nests more likely to be placed 1 or more meters within the riparian vegetation rather than along the very edge. The number of resident flycatchers detected at KEPI was low for the second consecutive year; 22 and 23 resident flycatchers were detected in 2016 and 2015, respectively, compared to 31–39 resident flycatchers in 2010–14. Both 2015 and 2016 were preceded by years with exceptionally poor nest success (see chapter 4).

RIRA was occupied by one pair of breeding flycatchers in 2016, which is within the range of number of resident flycatchers observed 2011–15 (0–7 flycatchers). Occupancy has been intermittent since SWCA began monitoring in 2011, with some amount of habitat occupied in 5 out of 6 years of monitoring. Occupancy has also been variable, ranging from a single flycatcher detected for 1 day up to several pairs of breeding flycatchers. Of the three sites in the study area, East Side has been occupied the most years (5), whereas West Side and Smalls have been occupied 3 and 2 years, respectively. East Side is the largest of the three sites in the study area, and in 2016, it also had the best vegetation structure. The vegetation structure in East Side has not changed noticeably since 2011, unlike at Smalls and West Side, where trees that have been looking stressed for a couple of years are now dead. It is unclear what is causing the tree mortality. Smalls and West Side were exceptionally wet in 2016, remaining inundated throughout the survey season, and these sites were also wetter in 2015 than in previous years.

Overall habitat suitability at RIRA was assessed by SWCA to be fair, primarily because of the limited extent of suitable vegetation structure. Intermittent occupancy also suggests that habitat quality is not very good. In addition, all but 1 of 18 adult flycatchers identified at RIRA from 2011–15 were second-year birds. Second-year birds of many species are known to disperse greater distances than returning adults (Gill 1995), and they frequently colonize new habitats. The best habitats are typically occupied by older individuals, who may be more competitive or arrive sooner on the breeding grounds, leaving habitat of lesser quality for younger birds (Hill 1988; Holmes et al. 1996). Habitat at RIRA was established many years prior to 2011, and the presence of young flycatchers for so many years in a row indicates suboptimal habitat conditions. Several within-season dispersal events from RIRA to other breeding areas in the Pahranagat Valley have been observed and are also suggestive of suboptimal habitat conditions at RIRA. The most recent breeding season was the first one when

the majority of adult flycatchers detected at RIRA did not consist of second-year birds, and it follows the first year (2015) of successful breeding in the study area since SWCA began monitoring in 2011. Site fidelity is strongly influenced by reproductive success (McLeod and Pellegrini 2013; Paxton et al. 2007), and two of the adult flycatchers detected at RIRA in 2016 had successfully fledged young there in 2015. It is likely nest success, and not an improvement in habitat conditions, that influenced site fidelity in 2016.

From the start of flycatcher monitoring at PAHR in 1997 through 2007, occupied flycatcher habitat at Pahranagat North, near the inflow to Upper Pahranagat Lake, was inundated annually with up to 1 m of water recorded under the vegetation in mid-May. From 2003 to 2007, as much as 100% of the site contained standing water in mid-May, and as much as 95% of the site contained standing water and saturated soil until mid-July. Major structural problems with the dam that impounds the upper lake resulted in the upper lake being drained in early 2008, and the riparian vegetation at the northern end of the lake was not flooded during the 2008 and 2009 flycatcher breeding seasons. The dam was repaired prior to the 2010 breeding season, and lake levels appear to have reached a new normal starting in 2013, which is almost, but not quite, as high the levels maintained prior to dam failure. While the number of resident flycatchers at Pahranagat North has not changed since 2003, the distribution of breeding pairs has shifted away from the center of the site toward the lakeside edge. This distribution shift began shortly after the dam was repaired and has persisted through 2016, with all but one nest located within the maximum extent of water documented within the site in May (SWCA, unpublished data).

Resident, breeding flycatchers were again documented at Pahranagat West. Occupancy has been documented in this site in only two other years (2013 and 2015) since SWCA began monitoring in 2003. As in 2013 and 2015, the pair occupied the only portion of the site that has any type of understory, which occurs in the form of two 10-m-tall Goodding's willows. The lakebed extends under the canopy of these two trees, and standing water or saturated soil was present up to the base of the trees throughout the season, creating a small area of dense canopy cover with wet soils. Occupancy at this site is likely intermittent because of the extremely limited areal extent of suitable habitat. A review of habitat photos also suggests that vegetation density has improved in this portion of the site over the years, which may be why occupancy has only occurred in recent years.

Breeding flycatchers were documented at Pahranagat MAPS for the third year in a row. Surveys were conducted annually in 2006–10, but only one resident flycatcher was documented. The original survey site was heavily damaged by a fire in 2010, and surveys were discontinued until 2014. The burned area remained unoccupied in 2014–16. The currently occupied portion of the site consists of three small (no larger than 25 x 30 m) patches of small-diameter, regenerating cottonwoods and two patches of larger-diameter cottonwoods adjacent to the original survey site, plus one additional small regenerating patch

just south of the lake. Despite their small size, each patch of small-diameter trees contained suitable structure and hydrology, and each was occupied. Vegetation structure has changed noticeably in the small patches since 2014, with height increasing from 5 m to 8–15 m and canopy closure decreasing from 85–95% to 60–90%. Canopy closure was further reduced in 2016 when the large snags in each patch blew over during a storm. Habitat suitability is likely to diminish as the cottonwoods mature, self-thin, and lose the understory structure and density typically used by flycatchers along the LCR and its tributaries.

Breeding flycatchers were again documented in MVWA, which has been intermittently occupied over the years. Sites within MVWA were surveyed in 1998–2001, and flycatchers were detected only in 1998 (Braden and McKernan 2006). The study area was first monitored by SWCA in 2003. It was unoccupied in that year, and surveys were discontinued for a lack of suitable habitat. NDOW biologists located breeding flycatchers in the largest swath of riparian habitat in the canyon (approximately 120 x 950 m) in 2013 (C. Klinger 2013, personal communication), and MVWA was added to the survey areas in 2014 because of that discovery. In 2016, breeding flycatchers were also discovered in a small (50 x 60 m) patch of habitat that has developed over the last several years 400 m to the north the main breeding area. Hydrology within the main breeding site consists of a series of beaver ponds and shallow, braided streams within the woody vegetation. Within a majority of the rest of Meadow Valley Wash, surface water and saturated soils are limited to an incised streambed and a series of beaver ponds, and woody vegetation occurs in intermittent patches. Meadow Valley Wash is a narrow canyon, and the width of the riparian vegetation rarely exceeds 100 m. This is considerably narrower than the wide expanses of riparian habitat found in other systems like the Virgin River, Topock Marsh, Bill Williams River, or Alamo Lake, and Meadow Valley Wash is, therefore, unlikely to support a large flycatcher population. In addition, the canyon is subject to periodic scouring floods, and the amount and quality of riparian habitat thus fluctuates between years. As an example, the new habitat discovered in 2016 has slowly grown since 2011, when the area was largely scoured sediments. MVWA is > 50 km from the nearest flycatcher population in the Pahranagat Valley, and this distance likely results in the study area not being rapidly recolonized once vegetation has recovered after a flood event (Paxton et al. 2007). All these factors contribute to MVWA being periodically occupied by small numbers of flycatchers.

Breeding flycatchers have been documented at MUDD annually since 2005. In 2016, the number of resident flycatchers (4) in MUDD was the lowest recorded in all years except 2015 (2005–15 range = 3–15 resident adults; median = 11). Almost all breeding activity has been documented in the survey site known as Overton WMA, in which there are two distinct breeding areas approximately 800 m apart that have each been intermittently occupied over the years. Various factors have influenced habitat quality in both breeding areas at different times, and the flycatchers have responded by shifting between the areas accordingly. The amount of surface water present within the breeding areas has declined over

the years, and since 2013, no wet soils have been documented outside of the main river channel, which is incised 2–3 m throughout the study area. Vegetation density in the southern breeding area, which used to have extensive surface water and contains stands of Goodding's willows, has declined noticeably since 2013. Tamarisk beetles have been present in the study area since 2012, and much of the tamarisk has reduced foliage density as the result of several seasons of defoliation. This has impacted habitat suitability, particularly in the northern breeding area, which consists of a narrow band of native vegetation surrounded by tamarisk. The combined effect of tamarisk beetle defoliation and a reduction in surface water has been a significant reduction in suitable habitat in the study area. If surface water remains confined to the river channel, the amount of available habitat is unlikely to increase, and the flycatcher population at MUDD is likely to remain small.

WMSP was occupied by several breeding pairs of flycatchers in 2010, when SWCA began monitoring, but the amount of available habitat was reduced sharply by a fire during the 2010 breeding season. WMSP has been occupied in 5 of 6 years since the fire, either by an unpaired male or by one breeding pair. Occupancy has been influenced by a particular male who has held a territory in WMSP every year since 2010 except 2013. In 2013, this male bred in TOPO, and no flycatchers were detected in WMSP. This male was the only resident flycatcher at WMSP in 2016, despite some of the burned areas having recovered enough to attract resident flycatchers. WMSP is > 30 km from the nearest flycatcher population at MUDD, and this distance likely limits recruitment even though available habitat is increasing.

The number of resident flycatchers (6) detected in TOPO in 2016 was considerably less than in 2015 (15) but is consistent with the number detected in recent years (2011–15 range = 2–15 resident adults; median = 6). The reduction in number of resident flycatchers is not surprising given that a majority of available habitat in TOPO was consumed in the Willow Fire in August 2015. All of the remaining suitable habitat within TOPO contains a high proportion of tamarisk. In late July 2016, tamarisk beetles were detected due east of the remaining unburned survey sites, by the town of Golden Shores. Defoliation by tamarisk beetles is likely in 2017 and may render all survey sites unsuitable for flycatchers. Without restoration of native vegetation at TOPO, the study area may become unoccupied.

The number of resident flycatchers (13) at BIWI in 2016 is tied with previous high records in 2007 and 2009 (2003–15 range = 1–13 resident adults; median = 7) and was very similar to that of 2015 (11). In contrast with the high number of resident flycatchers, streamflow was extremely low throughout the breeding season (figure 2-12). Average monthly discharge at the U.S. Geological Survey gaging station (#09426620) on the Bill Williams River near Parker, Arizona, has been 0.0 cfs since May 2015. This is the longest period of 0.0 cfs

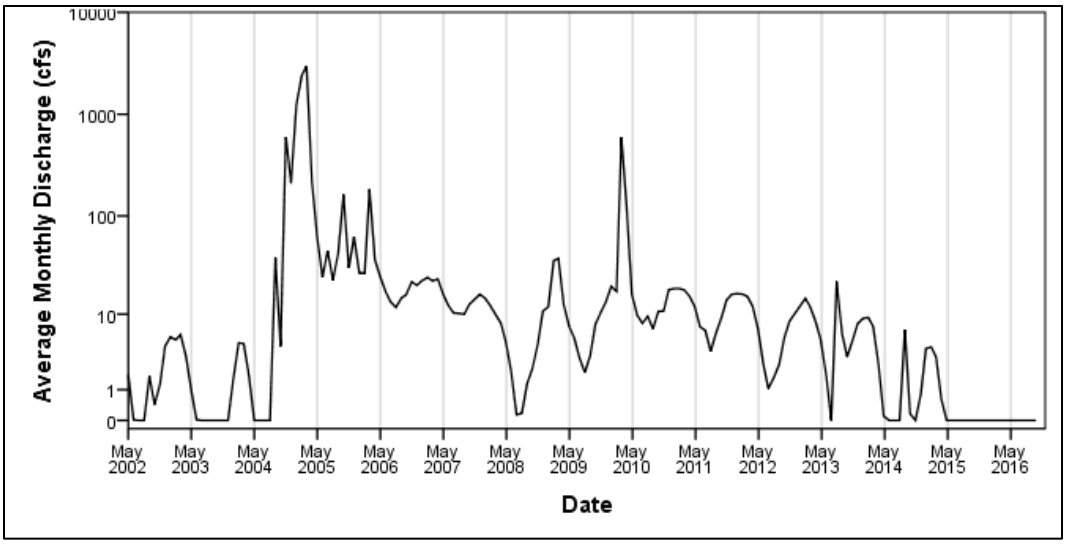



**Figure 2-12.—Monthly average streamflow (cfs) recorded at the Bill Williams River near Parker, Arizona (U.S. Geological Survey Station #09426620), 2002–16.**

recorded at this gaging station since SWCA began monitoring in 2003 and since the U.S. Geological Survey began recording in late 1988. At the beginning of the season, water was present only in the main river channel and in marsh vegetation surrounding the main stem of the river. As the season progressed, shallow stretches of the river dried up, leaving water only in the deepest channels, and the depth in isolated pools grew shallower. As the dry conditions continue within the study area, canopy closure appears to be decreasing. This is associated with the collapse of several large limbs and trees in formerly occupied areas with large-diameter Goodding's willows or cottonwoods. Native tree mortality, both in young and older stands of native riparian habitat, is becoming more prevalent and appears to be spreading both upstream and downstream from the Cougar Point area. Occupancy has shifted within the landscape as habitat quality declines in formerly occupied areas.

The occupied sites in BIWI in 2016 were those that are closest to perennial surface water. Occupied habitat in these sites is characterized by the typically dense vegetation structure preferred by flycatchers, which is provided by substantial stands of tamarisk or coyote willows. These sites include Coyote Crossing, Bill Willow, Wispy Willow, Site 01, and a recently added area on the northeastern edge of Site 08. All but one of these sites are in the Bill Williams River delta. This was the first year that breeding or resident flycatchers were documented in Bill Willow and Coyote Crossing, which is a new survey site that was discovered in 2016 with a resident flycatcher. Both of these sites are primarily tamarisk in composition, and occupied habitat in the other sites was also primarily tamarisk. Toward the end of the 2016 field season, tamarisk beetles were detected in the Bill Williams River delta. Tamarisk beetles are very likely to reduce suitable habitat along the Bill Williams River, as the majority of

currently suitable habitat contains a significant proportion of tamarisk. There are relatively few patches of dense coyote willow within the BIWI study area and, as mentioned above, many of the larger stands of native trees are thinning or dying as low water levels in the river persist.

ALAM was not surveyed as part of this project until 2014, but it was known to be occupied annually from 1996 to 2006, with 5–24 territories, of which 1–19 were pairs, documented in each year (Ellis et al. 2008). In 2014 and 2015, the number of territories recorded in the study area was 31 and 32 territories, respectively. In each year, 28 of the territories consisted of paired flycatchers. The total number of detected resident adults (56) was also the same each year. In 2016, the number of detected resident adults apparently increased to 76, the number of territories to 44, and the number of pairs to 36. This apparent increase in the size of the resident flycatcher population in 2016 is likely partially the result of an overestimate of the number of individual flycatchers. Relatively few flycatchers at ALAM were banded (36% of resident adults; see chapter 3), and the high proportion of unbanded individuals meant that mid-season movements could go undetected. Water levels in Alamo Lake during the breeding season were at a low not recorded since 1978 (figure 2-13). Field personnel documented a decline in habitat suitability at several sites where trees either lost a majority of their leaves or died outright. Signs of water stress in the trees became very apparent in late June, and it was about this time that several pairs abandoned their territories. Several new pairs were initially detected in other, less stressed portions of the study area in early July. It is likely that the flycatchers were moving about the landscape as habitat suitability changed. One banded female did leave ALAM after a failed breeding attempt in June and subsequently nested successfully in BIWI (see chapter 3).

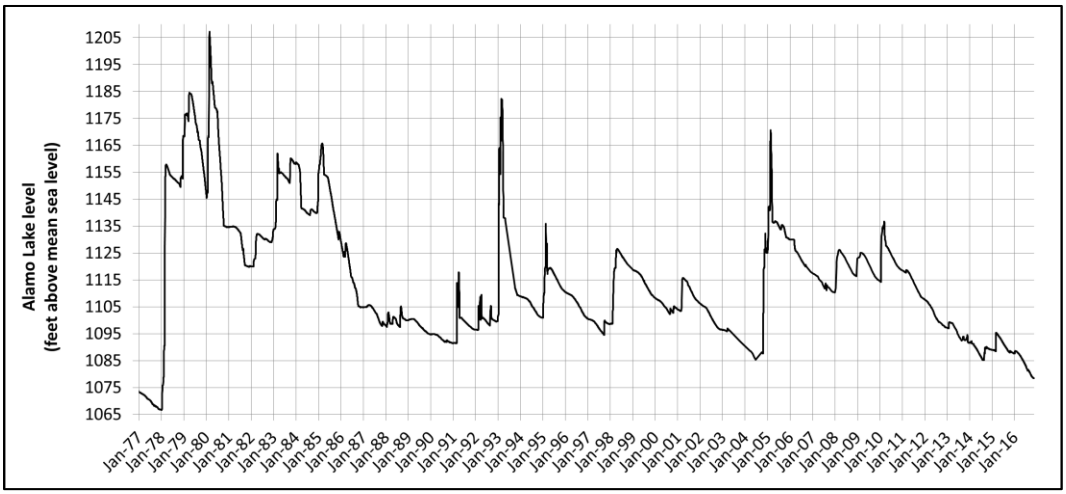



**Figure 2-13.—Alamo Lake elevation (feet above sea level), 1977–2016.**
Data sourced from Lakes Online (2016) and Arizona Game and Fish Department, unpublished data.

ALAM consists of a wide (> 1 km) riparian area on the Bill Williams River that transitions into the lake. As lake levels have dropped from the recent peak in 2010, a 3-km stretch of sediment within the riparian zone has been slowly exposed. Several patches of woody native or mixed-native vegetation have grown on the exposed sediments and have since been colonized. In all survey sites that have developed as lake levels have receded, vegetation in the occupied portions has consisted primarily of relatively small-diameter, even-aged Goodding's willows that were no more than 3–4 years old when resident flycatchers were first detected. The colonization of young habitat that emerges on recently exposed sediment has also been documented at Roosevelt Lake, Arizona. There, new habitats were colonized when they were 2.5–3.5 years old (Paxton et al. 2007), and occupancy declined at older sites as they became farther from water (Ellis et al. 2008). This same pattern is being observed in areas of occupancy at Alamo Lake. Several new sites were colonized in 2016, while occupancy in several older sites has declined as habitat suitability has declined. Surface water conditions at ALAM do not resemble those of typical occupied flycatcher habitat along the LCR and its tributaries; however, the dynamic nature of the availability of suitable vegetation structure allows the local flycatcher population to persist despite apparently unsuitable hydrology.

For the second time since SWCA began monitoring flycatchers along the LCR in 2003, a territorial, resident flycatcher was detected south of Parker Dam. As in 2015, the individual was located in the PVER, though the 2016 location was in a different site than in 2015. Also as in 2015, this individual defended a territory on the edge of one of the cottonwood-willow blocks. Unlike in 2015, there was not a significant mesquite component adjacent to the territory center, though a narrow (< 20 m wide) row of mesquite was present. No evidence of pair behavior was observed, and the individual left 9 days after arriving. Also unlike in 2015, this individual became increasingly less territorial as time progressed, and it was not actively defending its territory toward the end of its stay. The early dates and short window of occupancy, combined with declining territorial behavior, suggest that this individual might have been prospecting for potential habitat (Paxton et al. 2007) during its northbound migration.

There were an additional 81 flycatcher detections recorded south of the Bill Williams River in 2016, all before June 24. Monitoring results and behavioral observations (lack of territorial and aggressive behaviors exhibited toward conspecific broadcasts) at these sites suggest these flycatchers were not resident or breeding individuals but migrants. These results are consistent with those recorded in the same survey sites in 2003–15 (McLeod et al. 2008; McLeod and Pellegrini 2013, 2014, 2015, 2016). Given that willow flycatchers are one of the last long-distance neotropical migrant passerines to arrive in the Southwest in spring, the occurrence of northbound, migrant flycatchers along the Colorado River until late June is not surprising.

# Chapter 3 – Color Banding and Resighting

## INTRODUCTION

Long-term monitoring of flycatchers of known identity, sex, and age is the only effective way to determine demographic life history parameters such as annual survivorship of adults and young, site fidelity, seasonal and between-year movements, and population structure. Thus, as an integral part of SWCA's studies, personnel captured and uniquely color banded as many flycatchers as possible, allowing field personnel to resight individuals throughout the breeding season, as well as in subsequent years. Resighting consisted of using binoculars to determine the identity of a color-banded flycatcher by observing, from a distance, the unique color combination on its legs. This allowed field personnel to detect and monitor individuals without recapturing each bird. This was SWCA's 14$^{th}$ consecutive year of color-banding studies, which build upon color banding initiated at these sites in 1997 (McKernan and Braden 1998).

## METHODS

### Color Banding

From mid-May through mid-August, personnel captured, uniquely color banded, and subsequently monitored adult and nestling flycatchers at all study areas where resident flycatchers were detected. Adult flycatchers were captured with mist nets, which provide the most effective technique for live-capture of adult songbirds (Ralph et al. 1993). A targeted capture technique was used (per Sogge et al. 2001) whereby a variety of conspecific vocalizations were broadcast from a compact disc player and remote speakers to lure territorial flycatchers into the nets. In addition, field personnel used passive netting, whereby several mist nets were erected and periodically checked, with no broadcast of conspecific vocalizations. Occasionally, individuals of an unknown subspecies (i.e., "willow flycatcher") were captured, especially when passive netting was employed. These individuals were processed like known territorial flycatchers as differentiation of subspecies in the field, even when the bird is in hand, is difficult. Each adult willow flycatcher was banded with a single, numbered U.S. Federal aluminum band on one leg and a colored metal band on the other. The aluminum Federal bands are either standard silver or anodized in one of several colors. All color combinations were coordinated with the Federal Bird Banding Laboratory and all other flycatcher banding projects to minimize duplication of color combinations. Field personnel visually inspected the legs of each recaptured, banded flycatcher and noted any evidence of irritation or injury that might be related to the presence of leg bands.

Nestlings were banded at 7 to 10 days of age, when they were large enough to retain the leg bands, yet young enough that they would not prematurely fledge from the nest (Paxton et al. 1997; Whitfield 1990). Nestlings were banded only when the location of the nest was such that nest access and removal and replacement of the nestlings would not endanger the nest, nest plant, or nestlings. Nestlings were also banded with a single, numbered Federal band (standard silver or anodized) on one leg and a metal color band on the other leg.

For each captured adult willow flycatcher, morphological measurements were recorded, including culmen, tail, wing, fat level, and molt, onto standardized data forms (attachment 2). Sex was determined based on the presence of a cloacal protuberance in males or brood patch and/or egg(s) in the oviducts of females. Captured adults lacking breeding characteristics or diagnostic wing chord (female ≤ 66 millimeters [mm]; male ≥ 71 mm), and not observed engaging in male advertising song (see below), were sexed as unknown. Adults with retained primary, secondary, and/or primary covert feathers (multiple-aged remiges) were aged as second-year adults, and those without (uniformly aged remiges) were aged as after hatch year (per Kenwood and Paxton 2001 and Koronkiewicz et al. 2002). Individuals in juvenile plumage (unworn flight feathers and body plumage with broad, buff-colored wing bars and fleshy gape) were aged as hatch year.

## Resighting

The identity of a color-banded flycatcher was determined by observing with binoculars, from a distance, the unique color combination on its legs. Field personnel also used digital cameras (Canon PowerShot SX50 HS) to take pictures of flycatchers; these photos supplemented any resight data. Typically, territories and active nests were focal areas for resighting, but entire sites were surveyed. Field personnel typically spent the early part of each morning color banding and directed their efforts to resighting as daylight increased and flycatchers became more difficult to capture. All banding, monitoring, and survey field personnel coordinated resighting efforts and recorded observations of color-banded and unbanded flycatchers into an electronic database. For resighted flycatchers (i.e., ones for which at least one leg was seen clearly enough to determine the presence or absence of a band), color-band combinations, territory number, site, standardized confidence levels of the resight, and behavioral observations were recorded. Flycatchers for which detections spanned 1 week or longer were considered resident at a site regardless of the portion of the breeding season in which the bird was observed or whether a possible mate was observed. Flycatchers observed engaging in breeding behaviors (e.g., carrying nest material) were also considered resident regardless of the period of time over which they were observed. Flycatchers observed engaging in lengthy, primary song from high perches (male advertising song) were sexed as male, and flycatchers

observed carrying nest material or constructing or incubating a nest were sexed as female. Flycatchers not observed engaging in one of these diagnostic activities were sexed as unknown.

Prior to July 25, inactive territories were visited at least three times (each visit 4 days apart) before territory visits stopped. After July 25, inactive territories were visited at least two times (each visit 4 days apart) before the territory was deemed closed for the season. All territories were assigned a unique alphanumeric code and plotted onto high-resolution aerial photographs, thus producing a spatial representation of the flycatcher population at each study location. If multiple females were paired with a single male, each female received a unique territory number. Flycatchers were determined to be unpaired if none of the following breeding behaviors were observed: presence of another unchallenged flycatcher in the immediate vicinity, counter calling (*whitts*) with a nearby flycatcher, interaction twitter calls (*churr/kitters*) with a nearby flycatcher, a flycatcher in the immediate vicinity carrying nesting material, a flycatcher in the immediate vicinity carrying food or fecal sac, or adult flycatchers feeding young (per Sogge et al. 2010).

Unbanded flycatchers could not be identified to individual, but an unbanded flycatcher detected in a given location on multiple, consecutive visits was assumed to be the same individual. If an unbanded flycatcher or a flycatcher whose legs were not observed was detected at a given location on multiple visits, but one or more intervening visits failed to detect a flycatcher, the detections were considered to be different individuals in the absence of behavioral observations that indicated the flycatcher was actively defending a territory or was a member of a breeding pair.

# Data Analyses

## Movement

All movements were defined as the straight-line distance between two known locations of activity. Activity could include breeding, defense of a territory, or the brief (< 7 days) detection of an individual in a particular area. Adult movements could occur either between years or within season but were always between study areas; movements within a study area are not described. All adult between-year movement distances were calculated from the last known location in one study area in a given year (year t) and the first known location in another study area in a subsequent year (year t + 1). Years are not always consecutive. For juvenile dispersal, the last known location was always the nest location even if the juvenile was detected as a fledgling elsewhere. The distance between the nest location and the first known location of the juvenile in a subsequent year was always calculated even if the individual returned to its natal survey site. All

known movements were summarized as described above and are presented as the median, minimum, and maximum movement distances for all adult between-year movements and juvenile dispersal.

# RESULTS

## All Study Areas

A total of 277 adult flycatchers and willow flycatchers were detected in all study areas in 2016. Of the 277 adults, 153 were resident adult flycatchers and 124 were willow flycatchers that were not determined to be residents. The 153 resident flycatchers occupied 97 territories across all monitored study areas. Of the 97 flycatcher territories, 71 (73%) consisted of breeding flycatchers, 2 (2%) consisted of pairs for which no nest could be found, and 24 (25%) consisted of unpaired individuals. Fifteen breeding males were each polygynous with two females, one male was polygynous with three females, and one female bred consecutively with two different males. One unpaired male occupied two different territories.

Overall, 38% of the 277 adult flycatchers and willow flycatchers detected in the project area were known to be color banded by the end of the breeding season (table 3-1). Field personnel color banded 30 new adults and recaptured 16 adults. An additional 50 adults were identified to individual via resighting, while 9 individuals were resighted but did not have their color combinations confirmed. Eighty-seven adult flycatchers and willow flycatchers remained unbanded, and the presence of bands was undetermined for 85 adults. Fifty-two nestlings were banded from 24 nests; 40 of these nestlings were confirmed as fledging. Thirty-three unbanded fledglings were resighted from an additional 16 nests; personnel captured and banded 3 of the unbanded fledglings.

Of the 153 resident adult flycatchers. 61% were known to be color banded by the end of the breeding season (table 3-2). Of the adult flycatchers identified in 2016, 11 were identified for the first time since they were banded in their hatch year (see “Juvenile Between-Year Return and Dispersal,” below). For details on all banded flycatchers detected at the study areas from 2012 to 2016, see attachment 8. Details on all banded flycatchers detected at the study areas from 2003 to 2012 can be found in McLeod and Pellegrini (2013).

Table 3-1.—Summary of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| | | Adults | | | | | | | | | Juveniles | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Resighted | | | | | | | | | |
| Study area[1] | Survey site[1] | Total adults detected | New captured | Recaptured | Identity confirmed | Banded (identity unknown) | Unbanded | Band status unknown | % of adults resident | % of adults banded | Nestlings banded (# nests) | Fledglings captured (# nests) | Unbanded fledglings (# nests) | % of fledglings banded[2] (# fledglings) |
| KEPI | Frenchy Lake | 3[3] | 0 | 0 | 3[3] | 0 | 0 | 0 | 67 | 100 | 1 (1) | 0 | 0 | – (0) |
| | Patch 00 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 100 | 100 | 1 (1) | 0 | 0 | – (0) |
| | Patch 01 | 1[3] | 0 | 0 | 1[3] | 0 | 0 | 0 | 100 | 100 | 0 | 0 | 0 | – |
| | Patch 02 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 100 | 100 | 0 | 0 | 0 | – |
| | Patch 03 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 100 | 100 | 0 | 0 | 0 | – |
| | Patch 04 | 3[4,5] | 0 | 0 | 2[4] | 1[5] | 0 | 0 | 67 | 100 | 2 (1) | 0 | 0 | – (0) |
| | Patch 04.5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 | – |
| | Patch 05 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 | – |
| | Patch 06 | 2[6] | 0 | 0 | 2[6] | 0 | 0 | 0 | 100 | 100 | 0 | 0 | 0 | – |
| | Patch 07 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 100 | 100 | 0 | 0 | 0 | – |
| | Patch 09 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 100 | 100 | 0 | 0 | 0 | – |
| | Patch 10 | 3 | 0 | 0 | 2 | 0 | 1 | 0 | 100 | 67 | 0 | 0 | 2 (1) | 0 (2) |
| | Patch 11 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 100 | 100 | 0 | 0 | 0 | – |
| | Patch 12 | 3 | 0 | 1 | 2 | 0 | 0 | 0 | 100 | 100 | 3 (1) | 0 | 0 | – (0) |
| | **Study area total** | **24[3,4,5,6]** | **2** | **2** | **19[3,4,6]** | **0[5]** | **1** | **0** | **92** | **96** | **7 (4)** | **0** | **2 (1)** | **0 (2)** |
| RIRA | East Side | 4[4,7,8] | 0 | 2[7] | 2[4,8] | 0 | 0 | 0 | 50 | 100 | 1 (1) | 0 | 0 | 100 (1) |
| | West Side | 1[4] | 0 | 0 | 1[4] | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 | – |
| | **Study area total** | **4[4,7,8]** | **0** | **2[7]** | **2[4,8]** | **0** | **0** | **0** | **50** | **100** | **1 (1)** | **0** | **0** | **100 (1)** |
| PAHR | Pahranagat North | 22[4,6,8,9] | 4 | 7[4,6,8] | 11[9] | 0 | 0 | 0 | 77 | 100 | 17 (6) | 3 (1) | 1 (1) | 95 (19) |
| | Pahranagat West | 3[9] | 0 | 0 | 3[9] | 0 | 0 | 0 | 67 | 100 | 4 (1) | 0 | 0 | 100 (4) |
| | Pahranagat MAPS | 5[7,9] | 1 | 2 | 2[7,9] | 0 | 0 | 0 | 100 | 100 | 0 | 0 | 0 | – |
| | **Study area total** | **28[4,6,7,8,9]** | **5** | **9[4,6,8]** | **14[7,9]** | **0** | **0** | **0** | **82** | **100** | **21 (7)** | **3 (1)** | **1 (1)** | **96 (23)** |
| MVWA | Rock Springs Canyon | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 100 | 100 | 2 (1) | 0 | 0 | 100 (2) |
| | Dog Leg | 6 | 1 | 0 | 4 | 0 | 0 | 1 | 83 | 83 | 0 | 0 | 3 (1) | 0 (3) |
| | **Study area total** | **8** | **2** | **1** | **4** | **0** | **0** | **1** | **88** | **88** | **2 (1)** | **0** | **3 (1)** | **40 (5)** |
| MUDD | Overton WMA Pond | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | – |
| | Overton WMA | 5 | 3 | 0 | 2 | 0 | 0 | 0 | 80 | 100 | 0 | 0 | 0 | – |
| | **Study area total** | **8** | **3** | **0** | **2** | **0** | **3** | **0** | **50** | **63** | **0** | **0** | **0** | **–** |
| WMSP | Muddy Stringer 01 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 50 | 50 | 0 | 0 | 0 | – |
| | **Study area total** | **2** | **0** | **0** | **1** | **0** | **0** | **1** | **50** | **50** | **0** | **0** | **0** | **–** |
| TOPO | Swine Paradise | 6 | 0 | 1 | 0 | 2 | 2 | 1 | 83 | 50 | 0 | 0 | 0 | – |
| | Platform | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 100 | 0 | 0 | 0 | 0 | – |
| | 250M | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | – |
| | Hell Bird | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | – |
| | Glory Hole | 4 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | – |
| | Farm Ditch Road | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | – |
| | CPhase 05 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | – |
| | **Study area total** | **15** | **0** | **1** | **0** | **2** | **7** | **5** | **40** | **20** | **0** | **0** | **0** | **–** |

Table 3-1.—Summary of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| | | Adults | | | | | | | | | Juveniles | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Resighted | | | | | | | | | |
| Study area[1] | Survey site[1] | Total adults detected | New captured | Recaptured | Identity confirmed | Banded (identity unknown) | Unbanded | Band status unknown | % of adults resident | % of adults banded | Nestlings banded (# nests) | Fledglings captured (# nests) | Unbanded fledglings (# nests) | % of fledglings banded[2] (# fledglings) |
| BIWI | Coyote Crossing | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 100 | 0 | 0 | 0 | 0 | – |
| | Bill Willow | 6[10] | 1 | 0 | 2[10,11] | 0 | 3 | 0 | 100 | 40 | 8 (3) | 0 | 0 | 100 (6) |
| | Wispy Willow | 6 | 1 | 0 | 2 | 0 | 1 | 2 | 83 | 50 | 1 (1) | 0 | 0 | 100 (1) |
| | Site 01 | 4 | 1 | 0 | 0 | 0 | 0 | 3 | 25 | 25 | 0 | 0 | 0 | – |
| | Burn Edge | 3 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | – |
| | Site 03 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | – |
| | Beaver Pond | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | – |
| | Site 08 | 3[10] | 0 | 0 | 1[10] | 0 | 0 | 2 | 33 | 33 | 0 | 0 | 0 | – |
| | **Study area total** | **28[10]** | **3** | **0** | **4[10,11]** | **0** | **9** | **12** | **46** | **25** | **9 (4)** | **0** | **0** | **100 (7)** |
| ALAM[12] | South Camp | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 50 | 0 | 0 | 0 | – |
| | Over the Edge | 5 | 0 | 0 | 0 | 1 | 3 | 1 | 80 | 20 | 0 | 0 | 0 | – |
| | Sidebar 01 | 4 | 2 | 0 | 0 | 1 | 1 | 0 | 100 | 75 | 1 (1) | 0 | 0 | 100 (1) |
| | Edgewater 01 | 4 | 1 | 0 | 0 | 0 | 3 | 0 | 100 | 25 | 0 | 0 | 0 | – |
| | Camp 01 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 100 | 50 | 0 | 0 | 0 | – |
| | Camp 04 | 4 | 1 | 1 | 1 | 0 | 1 | 0 | 75 | 75 | 1 (1) | 0 | 0 | 100 (1) |
| | Middle Earth 01 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 100 | 50 | 0 | 0 | 0 | – |
| | Middle Earth 02 | 16 | 2 | 0 | 3[11] | 0 | 7 | 4 | 100 | 31 | 7 (4) | 0 | 4 (3) | 64 (11) |
| | Burro Wash 01 | 6 | 1 | 0 | 0 | 0 | 3 | 2 | 100 | 17 | 0 | 0 | 0 | – |
| | Burro Wash 02 | 8[13] | 2 | 0 | 1[13] | 2 | 3 | 0 | 63 | 63 | 0 | 0 | 3 (2) | 0 (3) |
| | Motherlode 01 | 12 | 0 | 0 | 5 | 2 | 4 | 1 | 92 | 58 | 0 | 0 | 10 (4) | 0 (10) |
| | Motherlode 02 | 4 | 0 | 0 | 0 | 0 | 4 | 0 | 100 | 0 | 0 | 0 | 0 | – |
| | Motherlode 03 | 3 | 0 | 0 | 0 | 0 | 2 | 1 | 100 | 0 | 0 | 0 | 0 | – |
| | Santa Maria North 01 | 12[13] | 2[13] | 0 | 1 | 1 | 7 | 1 | 83 | 33 | 3 (1) | 0 | 10 (4) | 0 (10) |
| | **Study area total** | **83[13]** | **14[13]** | **1** | **10[11,13]** | **7** | **41** | **10** | **92** | **39** | **12 (7)** | **0** | **27 (13)** | **25 (36)** |
| PVER | Phase 02 | 4 | 1 | 0 | 0 | 0 | 1 | 2 | 25 | 25 | 0 | 0 | 0 | – |
| | Phase 04 Block 01 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | – |
| | Phase 04 Block 02 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | – |
| | Phase 04 Block 03 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | – |
| | Phase 05 Block 01 | 5 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | – |
| | Phase 05 Block 03 | 6 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | – |
| | Phase 06 Block 01 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | – |
| | Phase 06 Block 02 | 5 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | – |
| | Phase 07 Block 01 | 7 | 0 | 0 | 0 | 0 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | – |
| | Phase 07 Block 02 | 7 | 0 | 0 | 0 | 0 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | – |
| | **Study area total** | **39** | **1** | **0** | **0** | **0** | **15** | **23** | **3** | **3** | **0** | **0** | **0** | **–** |
| CIBO | CVCA Phase 03 | 6 | 0 | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | – |
| | Nature Trail | 9 | 0 | 0 | 0 | 0 | 3 | 6 | 0 | 0 | 0 | 0 | 0 | – |
| | C2729 | 5 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | – |
| | **Study area total** | **20** | **0** | **0** | **0** | **0** | **7** | **13** | **0** | **0** | **0** | **0** | **0** | **–** |

Table 3-1.—Summary of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site[1] | Adults | | | | | | | | | Juveniles | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Resighted | | | | | | | | | |
| | | Total adults detected | New captured | Recaptured | Identity confirmed | Banded (identity unknown) | Unbanded | Band status unknown | % of adults resident | % of adults banded | Nestlings banded (# nests) | Fledglings captured (# nests) | Unbanded fledglings (# nests) | % of fledglings banded[2] (# fledglings) |
| YUMA | J | 6 | 0 | 0 | 0 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | – |
| | C | 4 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | – |
| | I | 14 | 0 | 0 | 0 | 0 | 1 | 13 | 0 | 0 | 0 | 0 | 0 | – |
| | **Study area total** | **24** | **0** | **0** | **0** | **0** | **4** | **20** | **0** | **0** | **0** | **0** | **0** | **–** |
| **Total** | | **277[4,6,7,8,11]** | **30** | **16** | **50[4,6,7,8,11]** | **9** | **87** | **85** | **55** | **38** | **52 (24)** | **3 (1)** | **33 (16)** | **55 (74)** |

* Adults are identified as new captures (previously unbanded), recaptures of previously banded birds, resightings of banded birds for which band combinations were confirmed, resightings of banded birds for which band combinations were undetermined, birds known to be unbanded, and birds for which band status was unknown. The total numbers of adults detected, percent of adults that were resident, and percent of adults banded are included. Juveniles are identified as banded in the nest, banded as fledglings, or unbanded. The percent of all fledglings banded is included.

[1] KEPI = Key Pittman, RIRA = River Ranch, PAHR = Pahranagat, MVWA = Meadow Valley Wash, MUDD = Muddy River, WMSP = Warm Springs, TOPO = Topock Marsh, BIWI = Bill Williams, ALAM = Alamo Lake, PVER = Palo Verde Ecological Reserve, CIBO = Cibola, and YUMA = Yuma.
[2] Percentage calculated based on birds confirmed to have fledged; total number of fledglings in parentheses represents the total number of nestlings confirmed to have fledged.
[3] One individual was detected in both Frenchy Lake and Patch 01 and is tallied only once in the study area total.
[4] One individual was detected in KEPI Patch 04, RIRA East Side, and RIRA West Side and recaptured in PAHR Pahranagat North and is tallied only once in the RIRA total and once, as a recapture, in the overall total.
[5] One individual of known identity displaced a banded individual of unknown identity; the individual of unknown identity is suspected to have occupied a nearby territory and is not counted in the study area total.
[6] One individual was detected in KEPI Patch 06 and recaptured at PAHR Pahranagat North and is tallied only once, as a recapture, in the overall total.
[7] One individual was detected in PAHR Pahranagat MAPS and recaptured in RIRA East Side and is tallied only once, as a recapture, in the overall total.
[8] One individual was detected in RIRA East Side and recaptured in PAHR Pahranagat North and is tallied only once, as a recapture, in the overall total.
[9] One individual was detected in Pahranagat North, Pahranagat West, and Pahranagat MAPS and is tallied only once in the study area total.
[10] One individual was detected in both Site 08 and Bill Willow and is tallied only once in the study area total.
[11] One individual was detected in both ALAM Middle Earth 02 and BIWI Bill Willow and is tallied only once in the overall total.
[12] It is likely that several flycatchers moved within the ALAM study area during the breeding season, leading to a possible over-estimate in the total number of flycatchers detected.
[13] One individual was captured in Santa Maria North 01 and then detected in Burro Wash 02 and is tallied only once, as a new capture, in the study area total.

Table 3-2.—Summary of resident adult southwestern willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site[1] | Total resident adults detected | New captured | Recaptured | Resighted | | | | % of resident adults banded |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Identity confirmed | Banded (identity unknown) | Unbanded | Band status unknown | |
| KEPI | Frenchy Lake | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 100 |
| | Patch 00 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 100 |
| | Patch 01 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 100 |
| | Patch 02 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 100 |
| | Patch 03 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 100 |
| | Patch 04 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 100 |
| | Patch 06 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 100 |
| | Patch 07 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 100 |
| | Patch 09 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 100 |
| | Patch 10 | 3 | 0 | 0 | 2 | 0 | 1 | 0 | 67 |
| | Patch 11 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 100 |
| | Patch 12 | 3 | 0 | 1 | 2 | 0 | 0 | 0 | 100 |
| | **Study area total** | **22** | **0** | **2** | **19** | **0** | **1** | **0** | **95** |
| RIRA | East Side | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 100 |
| | **Study area total** | **2** | **0** | **1** | **1** | **0** | **0** | **0** | **100** |
| PAHR | Pahranagat North | 17[2] | 3 | 3 | 11[2] | 0 | 0 | 0 | 100 |
| | Pahranagat West | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 100 |
| | Pahranagat MAPS | 5[2] | 1 | 2 | 2[2] | 0 | 0 | 0 | 100 |
| | **Study area total** | **23[2]** | **4** | **5** | **14[2]** | **0** | **0** | **0** | **100** |

Table 3-2.—Summary of resident adult southwestern willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site[1] | Total resident adults detected | New captured | Recaptured | Resighted | | | | % of resident adults banded |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Identity confirmed | Banded (identity unknown) | Unbanded | Band status unknown | |
| MVWA | Rock Springs Canyon | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 100 |
| | Dog Leg | 5 | 0 | 0 | 4 | 0 | 0 | 1 | 80 |
| | **Study area total** | **7** | **1** | **1** | **4** | **0** | **0** | **1** | **86** |
| MUDD | Overton WMA | 4 | 2 | 0 | 2 | 0 | 0 | 0 | 100 |
| | **Study area total** | **4** | **2** | **0** | **2** | **0** | **0** | **0** | **100** |
| WMSP | Muddy Stringer 01 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 100 |
| | **Study area total** | **1** | **0** | **0** | **1** | **0** | **0** | **0** | **100** |
| TOPO | Swine Paradise | 5 | 0 | 1 | 0 | 1 | 2 | 1 | 40 |
| | Platform | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | **Study area total** | **6** | **0** | **1** | **0** | **1** | **3** | **1** | **33** |
| BIWI | Coyote Crossing | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | Bill Willow | 5[3] | 1 | 0 | 1[3] | 0 | 3 | 0 | 40 |
| | Wispy Willow | 5 | 1 | 0 | 2 | 0 | 1 | 1 | 60 |
| | Site 01 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 100 |
| | Site 08 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 100 |
| | **Study area total** | **13** | **3** | **0** | **4** | **0** | **5** | **1** | **54** |

Table 3-2.—Summary of resident adult southwestern willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site[1] | Total resident adults detected | New captured | Recaptured | Resighted | | | | % of resident adults banded |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Identity confirmed | Banded (identity unknown) | Unbanded | Band status unknown | |
| ALAM[4] | South Camp | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 50 |
| | Over the Edge | 4 | 0 | 0 | 0 | 1 | 2 | 1 | 25 |
| | Sidebar 01 | 4 | 2 | 0 | 0 | 1 | 1 | 0 | 75 |
| | Edgewater 01 | 4 | 1 | 0 | 0 | 0 | 3 | 0 | 25 |
| | Camp 01 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 50 |
| | Camp 04 | 3 | 1 | 1 | 1 | 0 | 0 | 0 | 100 |
| | Middle Earth 01 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 50 |
| | Middle Earth 02 | 16[3] | 2 | 0 | 3[3] | 0 | 7 | 4 | 31 |
| | Burro Wash 01 | 5 | 1 | 0 | 0 | 0 | 3 | 1 | 17 |
| | Burro Wash 02 | 5 | 0 | 0 | 0 | 2 | 3 | 0 | 40 |
| | Motherlode 01 | 11 | 0 | 0 | 5 | 1 | 4 | 1 | 55 |
| | Motherlode 02 | 4 | 0 | 0 | 0 | 0 | 4 | 0 | 0 |
| | Motherlode 03 | 3 | 0 | 0 | 0 | 0 | 2 | 1 | 0 |
| | Santa Maria North 01 | 10 | 1 | 0 | 1 | 0 | 7 | 1 | 20 |
| | **Study area total** | **75** | **11** | **1** | **10** | **5** | **39** | **9** | **36** |

Table 3-2.—Summary of resident adult southwestern willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site[1] | Total resident adults detected | New captured | Recaptured | Resighted | | | | % of resident adults banded |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Identity confirmed | Banded (identity unknown) | Unbanded | Band status unknown | |
| PVER | Phase 02 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 100 |
| | **Study area total** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **100** |
| **Total** | | **153[3]** | **22** | **11** | **54[3]** | **6** | **48** | **12** | **61** |

* Adults are identified as new captures (previously unbanded), recaptures of previously banded birds, resightings of banded birds for which band combinations were confirmed, resightings of banded birds for which band combinations were undetermined, birds known to be unbanded, and birds for which band status was unknown. The total numbers of resident adults detected and percent of all resident adults banded are included. For breeding status of resident adults, see table 3-3.

[1] KEPI = Key Pittman, RIRA = River Ranch, PAHR = Pahranagat, MVWA = Meadow Valley Wash, MUDD = Muddy River, WMSP = Warm Springs, TOPO = Topock Marsh, BIWI = Bill Williams, ALAM = Alamo Lake, and PVER = Palo Verde Ecological Reserve.
[2] One individual was detected in both Pahranagat MAPS and Pahranagat North and is tallied only once in the study area total.
[3] One individual was detected in both BIWI Bill Willow and ALAM Middle Earth 02 and is tallied only once in the overall total.
[4] There is a possible over-estimate in the total number of flycatchers detected at ALAM due to likely within-study area movement that went undetected.

# Individual Study Areas

## Key Pittman, Nevada

Twenty-two resident, adult flycatchers were detected from 14 territories at KEPI (table 3-3). Of the 14 territories at KEPI, 10 consisted of breeding flycatchers, and 4 consisted of unpaired males. Field personnel recaptured two adult flycatchers. Nineteen adults were resighted and identified, and one adult remained unbanded. Of the adults identified in 2016, four were identified for the first time since their hatch year. Seven nestlings from four nests were banded; six of these nestlings from three nests were known to have died before fledging, and the fate of the seventh nestling was unknown. Two unbanded nestlings fledged from one nest.

In addition to resident adults, two willow flycatchers were detected for which residency could not be determined (table 3-3). Field personnel captured and color banded both adults.

## River Ranch, Nevada

Two resident, adult flycatchers were detected from one territory at RIRA (table 3-3). The territory consisted of breeding individuals. Field personnel recaptured one adult flycatcher and resighted and identified the other resident adult. One of the adult flycatchers identified in RIRA in 2016 was identified for the first time since its hatch year. One nestling was banded and confirmed as fledging.

In addition to resident adults, two flycatchers were detected for which residency could not be determined (table 3-3). Both of these individuals were known to have held a territory elsewhere in the valley but were each only detected for 1 to 3 days in RIRA. Field personnel recaptured one of the adults and resighted and identified the other adult.

## Pahranagat, Nevada

Twenty-three resident, adult flycatchers were detected from 17 territories at PAHR (table 3-3). Of the 17 territories recorded at PAHR, 10 consisted of breeding pairs, and 7 consisted of unpaired males. One male occupied two different territories, one in Pahranagat MAPS and a second one in Pahranagat North. Three males were each polygynous with two females. Field personnel captured and color banded four new adults and recaptured five adult flycatchers. An additional 14 adults were resighted and identified. Of the adults identified in 2015, two were identified for the first time since their hatch year. Twenty-one nestlings were banded from seven nests; all but two of these nestlings were confirmed as fledging. Four unbanded fledglings from one additional nest were resighted; three of these fledglings were captured and banded.

Table 3-3.—Details of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site | Date banded[2] | Federal band #[2] | Color combination[3] | Age[4] | Sex[5] | Territory or location[6] | Observation status[7] |
|---|---|---|---|---|---|---|---|---|
| KEPI | Frenchy Lake | June 30, 2015 | 2660-23084 | BO(M):VI | SY | F | 56 | RS |
| | | July 4, 2015 | 2660-23235 | DG(M):VI | SY | M | 56 | RS |
| | | July 31, 2016 | 2540-58398 | OBO(M):TQ | L | U | 56 | N; died |
| | | July 13, 2014 | 2660-23048 | VI:KYK(M) | 3Y | M | F24 | RS; detected May 30–June 2; detected June 8–July 18 at T25 in Patch 01; |
| | Patch 00 | July 17, 2013 | 2540-58281 | VDV(M):TQ | A5Y | F | 06 | RS |
| | | June 4, 2014 | 9999-99999[8] | YG(M):UB | A4Y | M | 06 | RS |
| | | July 17, 2016 | 2660-23269 | DRD(M):VI | L | U | 06 | N; not confirmed as fledged |
| | Patch 01 | July 13, 2014 | 2660-23048 | VI:KYK(M) | 3Y | M | T25 | RS; detected June 8–July 18; detected May 30–June 2 at F24 in Frenchy Lake |
| | Patch 02 | July 2, 2009 | 2370-40024 | PU:BV(M) | 8Y | M | T07 | RS; detected May 19–July 23 |
| | Patch 03 | July 1, 2015 | 2660-23138 | ODO(M):VI | SY | F | 12 | RS |
| | | July 1, 2014 | 2660-23044 | VI:KB(M) | 3Y | M | 12 | RS |
| | Patch 04 | July 13, 2013 | 2540-58270 | TQ:WGW(M) | 5Y | F | 22 | RS |
| | | INA | INA | Banded | AHY | M | 22 | RS; displaced by RGR(M):TQ; suspected to be from a nearby territory; not counted as a separate individual in the study area total |
| | | July 3, 2014 | 2540-58332 | RGR(M):TQ | 3Y | M | 22 | RS; displaced a different banded male; detected May 26–30 at F21 in RIRA West Side; detected July 19–21 at F02 in RIRA East Side; R July 26 at F31 in PAHR Pahranagat North |
| | | July 14, 2016 | 2590-53206 | EY:DW(M) | L | U | 22 | N; died |
| | | July 14, 2016 | 2660-27123 | YR(M):VI | L | U | 22 | N; died |
| | Patch 04.5 | May 26, 2016 | 2540-58382 | BYB(M):TQ | AHY | M | F08 | N; detected May 26 |
| | Patch 05 | May 30, 2016 | 2540-58384 | TQ:YOY(M) | AHY | U | F10 | N; detected May 30 |

Table 3-3.—Details of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site | Date banded[2] | Federal band #[2] | Color combination[3] | Age[4] | Sex[5] | Territory or location[6] | Observation status[7] |
|---|---|---|---|---|---|---|---|---|
| KEPI (cont.) | Patch 06 | July 6, 2015 | 2660-23239 | VI:BYB(M) | SY | F | 21 | RS; R July 20 at F30 in PAHR Pahranagat North |
| | | June 8, 2010 | 2430-61088 | XX:BKB(M) | A8Y | M | 21 | RS |
| | Patch 07 | July 5, 2011 | 2590-53121 | XX:WRW(M) | A7Y | F | 05 | RS |
| | | June 29, 2015 | 2660-23134 | VI:YD(M) | 3Y | M | 05 | RS |
| | Patch 09 | June 30, 2010 | 2540-58239 | RD(M):TQ | 7Y | M | T04 | R July 25; detected May 16–July 27 |
| | Patch 10 | July 6, 2011 | 2540-58177 | TQ:KRK(M) | A7Y | F | 03 | RS |
| | | July 8, 2011 | 2590-53101 | XX:DOD(M) | 6Y | M | 03, 27 | RS |
| | | N/A | N/A | UB:UB | AHY | F | 27 | RS |
| | | N/A | N/A | UB:UB | HY | U | 27 | RS |
| | | N/A | N/A | UB:UB | HY | U | 27 | RS |
| | Patch 11 | June 22, 2014 | 2660-23067 | VI:WKW(M) | A4Y | M | T02 | RS; detected May 16–July 27 |
| | Patch 12 | June 29, 2014 | 2660-23038 | VI:BG(M) | 3Y | F | 01 | R July 20 |
| | | June 13, 2011 | 2540-58245 | TQ:KYK(M) | 7Y | M | 01, 26 | RS |
| | | June 28, 2016 | 2540-58388 | TQ:BRB(M) | L | U | 01 | N; died |
| | | June 28, 2016 | 2660-23120 | VI:DB(M) | L | U | 01 | N; died |
| | | June 28, 2016 | 2590-53203 | EY:RG(M) | L | U | 01 | N; died |
| | | July 1, 2012 | 2540-58320 | KO(M):TQ | 5Y | F | 26 | RS |
| RIRA | East Side | July 1, 2014 | 2660-23045[9] | No foot:VW(M)[10] | 3Y | F | 01 | R July 28 |
| | | July 6, 2015 | 2660-23238 | OB(M):VI | SY | M | 01 | RS; R Aug 2 at F34 in PAHR Pahranagat North |
| | | Aug 5, 2016 | 2660-23154 | VI:ROR(M) | L | U | 01 | N |

Table 3-3.—Details of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site | Date banded[2] | Federal band #[2] | Color combination[3] | Age[4] | Sex[5] | Territory or location[6] | Observation status[7] |
|---|---|---|---|---|---|---|---|---|
| RIRA (cont.) | East Side (cont.) | July 3, 2014 | 2540-58332 | RGR(M):TQ | 3Y | M | F02 | RS; detected July 19–21; detected May 26–30 at F21 in RIRA West Side; breeding June 8 – July 14 at 22 in KEPI Patch 04; R July 26 at F31 in PAHR Pahranagat North |
| | | June 2, 2015 | 2660-23133 | OK(M):VI | 3Y | M | F03 | R July 21; detected May 15–July 6 at T23 in PAHR Pahranagat MAPS |
| | West Side | July 3, 2014 | 2540-58332 | RGR(M):TQ | 3Y | M | F21 | RS; detected May 26–30; breeding June 8–July 14 at 22 in KEPI Patch 04; detected July 19–21 at F02 in RIRA East Side; R July 26 at F31 in PAHR Pahranagat North |
| PAHR | Pahranagat North | July 17, 2012 | 2430-61267 | ROR(M):XX | 6Y | F | 01 | RS |
| | | July 24, 2008 | 2430-61083 | XX:YR(M) | 10Y | M | 01, 24 | RS |
| | | July 21, 2016 | 2540-58366 | BRB(M):TQ | L | U | 01 | N |
| | | July 20, 2013 | 2660-23042 | VI:YB(M) | 4Y | F | 02 | RS |
| | | July 7, 2011 | 2540-58179 | GK(M):TQ | 6Y | M | 02, 10 | R July 8 |
| | | July 20, 2016 | 2590-53222 | KD(M):EY | L | U | 02 | N |
| | | July 20, 2016 | 2660-23152 | GV(M):VI | L | U | 02 | N |
| | | July 20, 2016 | 2660-23153 | VI:WD(M) | L | U | 02 | N |
| | | July 5, 2014 | 2660-23077 | WYW(M):VI | 3Y | F | 03 | RS |
| | | June 21, 2010 | 2370-40088 | PU:VG(M) | 8Y | M | 03, 09 | RS |
| | | July 3, 2016 | 2540-58354 | TQ:WMW(M) | L | U | 03 | N |
| | | July 3, 2016 | 2660-23264 | VI:DGD(M) | L | U | 03 | N |
| | | July 3, 2016 | 2660-23266 | BRB(M):VI | L | U | 03 | N |
| | | July 30, 2010 | 2540-58238 | TQ:GOG(M) | 7Y | F | 04 | RS |
| | | July13, 2013 | 2660-23031 | VI:YR(M) | 4Y | M | 04 | RS |
| | | July 20, 2016 | 2590-53220 | BV(M):EY | L | U | 04 | N |

Table 3-3.—Details of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site | Date banded[2] | Federal band #[2] | Color combination[3] | Age[4] | Sex[5] | Territory or location[6] | Observation status[7] |
|---|---|---|---|---|---|---|---|---|
| PAHR (cont.) | Pahranagat North (cont.) | July 20, 2016 | 2660-23150 | VI:DY(M) | L | U | 04 | N |
| | | July 20, 2016 | 2540-58337 | TQ:RBR(M) | L | U | 04 | N |
| | | July 19, 2014 | 2540-58361 | TQ:GRG(M) | 3Y | F | 06 | RS |
| | | July 21, 2010 | 2540-58201[9] | No foot:BO(M) | 7Y | M | 06 | R July 14 and 26 |
| | | July 20, 2016 | 2660-23151 | VI:KV(M) | HY | U | 06 | N |
| | | July 25, 2016 | 2590-53223 | YG(M):EY | HY | U | 06 | N |
| | | July 19, 2016 | 2590-53207 | EY:KGK(M) | HY | U | 06 | N; R July 21 |
| | | N/A | N/A | UB:UB | HY | U | 06 | RS |
| | | July 31, 2012 | 2540-58269 | KVK(M):TQ | A6Y | F | 09 | RS |
| | | July 17, 2016 | 2590-53275 | EY:BWB(M) | SY | F | 10 | N |
| | | July 17, 2016 | 2540-58397 | TQ:BGB(M) | L | U | 10 | N |
| | | July 17, 2016 | 2660-23267 | VI:WV(M) | L | U | 10 | N |
| | | July 17, 2016 | 2660-23268 | YD(M):VI | L | U | 10 | N |
| | | July 3, 2011 | 2430-61220 | RGR(M):XX | 6Y | F | 24 | RS |
| | | July 19, 2016 | 2660-23124 | VI:YW(M) | L | U | 24 | N; suspected to have died |
| | | July 19, 2016 | 2590-53209 | KR(M):EY | L | U | 24 | N |
| | | July 19, 2016 | 2660-23125 | OWO(M):VI | L | U | 24 | N |
| | | July 19, 2016 | 2540-58315 | TQ:BYB(M) | L | U | 24 | N; not confirmed as fledged |
| | | June 15, 2016 | 2590-53201 | EY:YKY(M) | AHY | M | T08 | N; detected on territory June 7–12 July; R July 25 ≈100 m away |
| | | July 8, 2010 | 2540-58157 | OY(M):TQ | 7Y | M | T26 | RS; detected July 10–19; detected May 15 at F21 in West; detected May 18–July 6 at T05 in Pahranagat MAPS |
| | | June 21, 2015 | 2660-23187 | KOK(M):VI | SY | M | T28 | R July 12 and 20; detected June 27–July 20 |
| | | July 26, 2016 | 2660-23127 | VI:BWB(M) | SY | U | T33 | N; R Aug 2; no detections other than captures |

Table 3-3.—Details of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site | Date banded[2] | Federal band #[2] | Color combination[3] | Age[4] | Sex[5] | Territory or location[6] | Observation status[7] |
|---|---|---|---|---|---|---|---|---|
| PAHR (cont.) | Pahranagat North (cont.) | July 6, 2015 | 2660-23239 | VI:BYB(M) | SY | F | F30 | R July 20; breeding June 6–July 11 at 21 in KEPI Patch 06 |
| | | July 3, 2014 | 2540-58332 | RGR(M):TQ | 3Y | M | F31 | R July 26; detected May 26–30 at F21 in RIRA West Side; breeding June 8–July 14 at 22 in KEPI Patch 04; detected July 19–21 at F02 in RIRA East Side |
| | | July 21, 2015 | 2540-58381 | WBW(M):TQ | SY | U | F32 | R July 26; detected July 25–26 |
| | | July 6, 2015 | 2660-23238 | OB(M):VI | SY | M | F34 | R Aug 2; breeding June 10–July 13 at 01 in RIRA East Side |
| | | Aug 2, 2016 | 2590-53208 | EY:VV(M) | AHY | F | F35 | N; not detected before or after capture |
| | Pahranagat West | July 28, 2014 | 2660-23053 | VI:RGR(M) | A4Y | F | 07 | RS |
| | | July 16, 2014 | 2540-58311 | DOD(M):TQ | 3Y | M | 07 | RS |
| | | July 14, 2016 | 2590-53204 | DD(M):EY | L | U | 07 | N |
| | | July 14, 2016 | 2590-23205 | EY:BK(M) | L | U | 07 | N |
| | | July 14, 2016 | 2660-23122 | VI:RV(M) | L | U | 07 | N |
| | | July 14, 2016 | 2660-23121 | GWG(M):VI | L | U | 07 | N; R July 26 |
| | | July 8, 2010 | 2540-58157 | OY(M):TQ | 7Y | M | F21 | RS; detected May 15; detected May 18–July 6 in T05 in MAPS; detected July 10–19 at T26 in North |
| | Pahranagat MAPS | July 4, 2012 | 2430-61298[9] | UB:WB(M)[11] | 6Y | F | 22 | R May 29 |
| | | July 3, 2013 | 2540-58250 | KRK(M):TQ | 4Y | M | 22 | R May 29 |
| | | June 2, 2015 | 2660-23133 | OK(M):VI | 3Y | M | T23 | RS; detected May 15–July 6; R July 21 at F03 in RIRA East Side |
| | | July 8, 2010 | 2540-58157 | OY(M):TQ | 7Y | M | T05 | RS; detected May 18–July 6; detected May 15 at F21 in West; detected July 10–19 at T26 in Pahranagat North |
| | | June 29, 2016 | 2590-53170 | XX:ODO(M) | AHY | M | T11 | N; detected June 29 – July 12 |

Table 3-3.—Details of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site | Date banded[2] | Federal band #[2] | Color combination[3] | Age[4] | Sex[5] | Territory or location[6] | Observation status[7] |
|---|---|---|---|---|---|---|---|---|
| MVWA | Rock Springs Canyon | Aug 6, 2015 | 2660-23145 | DV(M):VI | SY | F | 23 | R July 5 |
| | | July 5, 2016 | 2540-58314 | OWO(M):TQ | AHY | M | 23 | N |
| | | July 27, 2016 | 2660-23128 | VGV(M):VI | L | U | 23 | N |
| | | July 27, 2016 | 2590-53210 | YR(M):EY | L | U | 23 | N |
| | Dog Leg | INA | INA | Undetermined | AHY | F | 01 | |
| | | July 2, 2015 | 2660-23103 | VI:GY(M) | A3Y | M | 01, 02 | RS |
| | | June 30, 2014 | 2540-58140 | TQ:DWD(M) | A4Y | F | 02 | RS |
| | | N/A | N/A | UB:UB | HY | U | 02 | RS |
| | | N/A | N/A | UB:UB | HY | U | 02 | RS |
| | | N/A | N/A | UB:UB | HY | U | 02 | RS |
| | | N/A | N/A | UB:UB | L | U | 02 | Not confirmed as fledged |
| | | June 30, 2014 | 2660-23039 | RB(M):VI | 3Y | F | 22 | RS |
| | | July 24, 2015 | 2660-23114 | VI:VY(M) | 3Y | M[12] | 22 | RS |
| | | May 18, 2016 | 2540-58370 | BGB(M):TQ | AHY | M | F21 | N; not detected after capture |
| MUDD | Overton WMA Pond | N/A | N/A | UB:UB | AHY | U | F01 | RS; detected May 17 |
| | | N/A | N/A | UB:UB | AHY | U | F03 | RS; detected May 17 |
| | | N/A | N/A | UB:UB | AHY | U | F05 | RS; detected May 28 |
| | Overton WMA | July 26, 2015 | 2540-58336 | WYW(M):TQ | 3Y | F | 02 | RS |
| | | June 6, 2013 | 2660-23017 | VI:DYD(M) | 5Y | M | 02 | RS |
| | | July 26, 2016 | 2660-23126 | KYK(M):VI | SY | F | 04 | N |
| | | July 15, 2016 | 2590-53219 | EY:BG(M) | SY | M | 04 | N |
| | | June 21, 2016 | 2590-53202 | BG(M):EY | AHY | M | F21 | N; detected June 21–25 |
| WMSP | Muddy Stringer 01 | May 20, 2008 | 2540-58234 | KD(M):TQ | A10Y | M | T21 | RS; detected May 24–Aug 2 |
| | | INA | INA | Undetermined | AHY | U | F01 | Detected July 26 |

Table 3-3.—Details of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site | Date banded[2] | Federal band #[2] | Color combination[3] | Age[4] | Sex[5] | Territory or location[6] | Observation status[7] |
|---|---|---|---|---|---|---|---|---|
| TOPO | Swine Paradise | June 27, 2015 | 2660-23211 | GY(M):VI | A3Y | F | 51 | R May 17 |
| | | N/A | N/A | UB:UB | AHY | M | 51, 59, 61 | RS |
| | | INA | INA | Banded | AHY | F | 59 | RS |
| | | INA | INA | Undetermined | AHY | F | 61 | |
| | | N/A | N/A | UB:UB | AHY | M | T80 | RS; detected May 13–24 |
| | | INA | INA | Banded | AHY | U | F64 | Detected July 29 |
| | Platform | N/A | N/A | UB:UB | AHY | M | T70 | RS; detected June 12–20 |
| | 250M | INA | INA | Undetermined | AHY | U | F79 | Detected May 16 |
| | Hell Bird | N/A | N/A | UB:UB | AHY | M | F65 | RS; detected July 25 |
| | Glory Hole | INA | INA | Undetermined | AHY | U | F41 | Detected May 15 |
| | | INA | INA | Undetermined | AHY | U | F42 | Detected May 15 |
| | | INA | INA | Undetermined | AHY | U | F43 | Detected May 25 |
| | | N/A | N/A | UB:UB | AHY | U | F63 | RS; detected July 14 |
| | Farm Ditch Road | N/A | N/A | UB:UB | AHY | U | F19 | RS; detected May 16 |
| | CPhase 05 | N/A | N/A | UB:UB | AHY | U | F35 | RS; detected June 28 |
| BIWI | Coyote Crossing | N/A | N/A | UB:UB | AHY | M | T12 | RS; detected May 25–June 9 |
| | Bill Willow | July 21, 2016 | 2590-53277 | EY:DYD(M) | SY | F | 15 | N |
| | | N/A | N/A | UB:UB | AHY | M | 15, 83 | RS |
| | | July 31, 2016 | 2660-23196 | DYD(M):VI | L | U | 15 | N |
| | | July 31, 2016 | 2590-53243 | RWR(M):EY | L | U | 15 | N |
| | | N/A | N/A | UB:UB | AHY | F | 42 | RS |
| | | N/A | N/A | UB:UB | AHY | M | 42 | RS |
| | | Aug 4, 2016 | 2590-53256 | DR(M):EY | L | U | 42 | N |

Table 3-3.—Details of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site | Date banded[2] | Federal band #[2] | Color combination[3] | Age[4] | Sex[5] | Territory or location[6] | Observation status[7] |
|---|---|---|---|---|---|---|---|---|
| BIWI (cont.) | Bill Willow (cont.) | Aug 4, 2016 | 2660-23252 | VI:BKB(M) | L | U | 42 | N |
| | | Aug 4, 2016 | 2660-23253 | RBR(M):VI | L | U | 42 | N |
| | | June 5, 2014 | 2540-58362 | TQ:YWY(M) | A4Y | F | 83 | RS; breeding through June 13 at 33 in ALAM Middle Earth 02 |
| | | July 17, 2016 | 2590-53239 | EY:WGW(M) | L | U | 83 | N; not confirmed as fledged |
| | | July 17, 2016 | 2660-23172 | BKB(M):VI | L | U | 83 | N |
| | | July 17, 2016 | 2590-53238 | KG(M):EY | L | U | 83 | N; not confirmed as fledged |
| | | July 22, 2015 | 2660-23218 | YO(M):VI | A3Y | M | F10 | RS; detected July 28; detected May 14 – June 19 at T21 in Site 08 |
| | Wispy Willow | July 28, 2015 | 2660-23193 | VRV(M):VI | 3Y | F | 20 | RS |
| | | N/A | N/A | UB:UB | AHY | M | 20 | RS |
| | | July 17, 2014 | 2540-58356 | DGD(M):TQ | 4Y | F | 41 | RS |
| | | INA | INA | Undetermined | AHY | M | 41 | |
| | | July 17, 2016 | 2590-53237 | EY:DK(M) | L | U | 41 | N |
| | | June 22, 2016 | 2660-23246 | VI:DV(M) | SY | M | T33 | N; detected June 15–27 |
| | | INA | INA | Undetermined | AHY | U | F55 | Detected July 15 |
| | Site 01 | June 15, 2016 | 2540-58389 | TQ:WBW(M) | SY | M | T82 | N; detected June 2–23 |
| | | INA | INA | Undetermined | AHY | U | F32 | Detected May 25–26 |
| | | INA | INA | Undetermined | AHY | U | F61 | Detected May 17 |
| | | INA | INA | Undetermined | AHY | U | F62 | Detected May 26 |
| | Burn Edge | INA | INA | Undetermined | AHY | U | F53 | Detected June 8 |
| | | INA | INA | Undetermined | AHY | U | F57 | Detected June 8 |
| | | N/A | N/A | UB:UB | AHY | U | F60 | RS; detected June 8 |

Table 3-3.—Details of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site | Date banded[2] | Federal band #[2] | Color combination[3] | Age[4] | Sex[5] | Territory or location[6] | Observation status[7] |
|---|---|---|---|---|---|---|---|---|
| BIWI (cont.) | Site 03 | INA | INA | Undetermined | AHY | U | F37 | Detected June 9 |
| | | INA | INA | Undetermined | AHY | U | F38 | Detected June 9 |
| | | INA | INA | Undetermined | AHY | U | F39 | Detected June 9 |
| | Beaver Pond | N/A | N/A | UB:UB | AHY | U | F02 | RS; detected June 10 |
| | | N/A | N/A | UB:UB | AHY | U | F68 | RS; detected June 10 |
| | | N/A | N/A | UB:UB | AHY | U | F69 | RS; detected June 10 |
| | Site 08 | July 22, 2015 | 2660-23218 | YO(M):VI | A3Y | M | T21 | RS; detected May 14–June 19; detected July 28 at F10 in Bill Willow |
| | | INA | INA | Undetermined | AHY | U | F70 | Detected June 10 |
| | | INA | INA | Undetermined | AHY | U | F84 | Detected June 23 |
| ALAM | South Camp | N/A | N/A | UB:UB | AHY | F | 50 | RS |
| | | July 18, 2016 | 2590-53240 | EY:GR(M) | SY | M | 50 | N |
| | Over the Edge | N/A | N/A | UB:UB | AHY | F | 13 | RS |
| | | INA | INA | Banded | AHY | M | 13 | RS |
| | | N/A | N/A | UB:UB | AHY | F | 48 | RS |
| | | INA | INA | Undetermined | AHY | M | 48 | |
| | | N/A | N/A | UB:UB | AHY | M | F52 | RS; detected May 31 |
| | Sidebar 01 | July 8, 2016 | 2540-58396 | BWB(M):TQ | AHY | F | 62 | N; female paired with two consecutive males |
| | | May 26, 2016 | 2660-23272 | VI:OKO(M) | AHY | M | 62 | N |
| | | N/A | N/A | UB:UB | AHY | M | 62 | RS; 2nd male, detected starting June 24 |
| | | July 8, 2016 | 2540-58395 | TQ:YBY(M) | L | U | 62 | N |
| | | INA | INA | Banded | AHY | M | T53 | RS; detected June 1–18 |

Table 3-3.—Details of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site | Date banded[2] | Federal band #[2] | Color combination[3] | Age[4] | Sex[5] | Territory or location[6] | Observation status[7] |
|---|---|---|---|---|---|---|---|---|
| ALAM (cont.) | Edgewater 01 | N/A | N/A | UB:UB | AHY | F | 47 | RS |
| | | N/A | N/A | UB:UB | AHY | M | 47 | RS |
| | | N/A | N/A | UB:UB | AHY | F | 81 | RS |
| | | May 26, 2016 | 2590-53276 | EY:GW(M) | AHY | M | 81 | N |
| | Camp 01 | N/A | N/A | UB:UB | AHY | F | 26 | RS |
| | | July 6, 2016 | 2660-23248 | RV(M):VI | AHY | M | 26 | N |
| | Camp 04 | June 20, 2015 | 2540-58346 | VGV(M):TQ | SY | F | 28 | RS |
| | | June 14, 2015 | 2540-58355 | TQ:KW(M) | SY | M | 28, 68 | R July 12 |
| | | July 12, 2016 | 2590-53236 | EY:BV(M) | SY | F | 68 | N |
| | | July 14, 2016 | 2660-23171 | VI:RBR(M) | L | U | 68 | N |
| | | N/A | N/A | UB:UB | AHY | U | F15 | RS; detected July 21 |
| | Middle Earth 01 | N/A | N/A | UB:UB | AHY | F | 31 | RS |
| | | May 12, 2016 | 2660-23119 | VI:WR(M) | AHY | M | 31 | N |
| | Middle Earth 02 | N/A | N/A | UB:UB | AHY | F | 32 | RS |
| | | N/A | N/A | UB:UB | AHY | M | 32, 34 | RS |
| | | June 20, 2016 | 2540-58390 | TQ:MY(M) | L | U | 32 | N |
| | | June 5, 2014 | 2540-58362 | TQ:YWY(M) | A4Y | F | 33 | RS; breeding at 83A in BIWI Bill Willow starting June 17 |
| | | N/A | N/A | UB:UB | AHY | M | 33, 72 | RS |
| | | INA | INA | Undetermined | AHY | F | 34 | |
| | | July 20, 2016 | 2540-58400 | TQ:DG(M) | SY | F | 35 | N |
| | | N/A | N/A | UB:UB | AHY | M | 35, 42 | RS |
| | | July 25, 2016 | 2660-23251 | YB(M):VI | L | U | 35 | N |
| | | INA | INA | Undetermined | AHY | F | 37 | |

Table 3-3.—Details of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site | Date banded[2] | Federal band #[2] | Color combination[3] | Age[4] | Sex[5] | Territory or location[6] | Observation status[7] |
|---|---|---|---|---|---|---|---|---|
| ALAM (cont.) | Middle Earth 02 (cont.) | May 13, 2015 | 2660-23174 | VI:DW(M) | A3Y | M | 37, 51 | RS |
| | | N/A | N/A | UB:UB | HY | U | 37 | RS |
| | | N/A | N/A | UB:UB | AHY | F | 42 | RS |
| | | N/A | N/A | UB:UB | HY | U | 42 | RS |
| | | N/A | N/A | UB:UB | HY | U | 42 | RS |
| | | INA | INA | Undetermined | AHY | F | 43 | |
| | | N/A | N/A | UB:UB | AHY | M | 43 | RS |
| | | June 23, 2016 | 2540-58393 | TQ:MB(M) | L | U | 43 | N |
| | | June 23, 2016 | 2660-23247 | VI:BGB(M) | L | U | 43 | N |
| | | June 23, 2016 | 2590-53254 | BW(M):EY | L | U | 43 | N |
| | | N/A | N/A | UB:UB | AHY | F | 51 | RS |
| | | N/A | N/A | UB:UB | HY | U | 51 | RS |
| | | June 14, 2015 | 2660-23204 | VI:GB(M) | SY | F | 71 | RS |
| | | July 20, 2016 | 2590-53241 | WD(M):EY | AHY | M | 71 | N |
| | | July 28, 2016 | 2590-53242 | BY(M):EY | L | U | 71 | N |
| | | July 28, 2016 | 2660-23173 | VI:WOW(M) | L | U | 71 | N |
| | | INA | INA | Undetermined | AHY | F | 72 | |
| | Burro Wash 01 | N/A | N/A | UB:UB | AHY | F | 23 | RS |
| | | N/A | N/A | UB:UB | AHY | M | 23 | RS |
| | | July 5, 2016 | 2540-58399 | RBR(M):TQ | SY | F | 75 | N |
| | | N/A | N/A | UB:UB | AHY | M | 75 | RS |
| | | INA | INA | Undetermined | AHY | M | T76 | Detected May 26–June 16 |
| | | INA | INA | Undetermined | AHY | M | F17 | Detected June 28 |

Table 3-3.—Details of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site | Date banded[2] | Federal band #[2] | Color combination[3] | Age[4] | Sex[5] | Territory or location[6] | Observation status[7] |
|---|---|---|---|---|---|---|---|---|
| ALAM (cont.) | Burro Wash 02 | INA | INA | Banded | AHY | F | 24 | RS |
| | | N/A | N/A | UB:UB | AHY | M | 24 | RS |
| | | N/A | N/A | UB:UB | HY | U | 24 | RS |
| | | N/A | N/A | UB:UB | HY | U | 24 | RS |
| | | N/A | N/A | UB:UB | L | U | 24 | Not confirmed as fledged |
| | | INA | INA | Banded | AHY | U | 79 | RS |
| | | N/A | N/A | UB:UB | AHY | U | 79 | RS |
| | | N/A | N/A | UB:UB | HY | U | 79 | RS |
| | | N/A | N/A | UB:UB | AHY | M | T14 | RS; detected July 9–21 |
| | | July 13, 2016 | 2540-58392 | VMV(M):TQ | SY | U | F20 | N; detected July 13 |
| | | July 13, 2016 | 2660-23170 | VI:BRB(M) | SY | M | F27 | N; detected July 11-17 |
| | | June 28, 2016 | 2540-58391 | MWM(M):TQ | SY | M | F29 | RS; detected July 7; N June 28 at F84 in Santa Maria North 01 |
| | Motherlode 01 | N/A | N/A | UB:UB | AHY | F | 02 | RS |
| | | June 6, 2014 | 2660-23066 | VI:VR(M) | A4Y | M | 02 | RS |
| | | N/A | N/A | UB:UB | HY | U | 02 | RS |
| | | N/A | N/A | UB:UB | HY | U | 02 | RS |
| | | N/A | N/A | UB:UB | HY | U | 02 | RS |
| | | INA | INA | Undetermined | AHY | F | 25 | |
| | | N/A | N/A | UB:UB | AHY | M | 25, 83 | RS |
| | | N/A | N/A | UB:UB | AHY | F | 40 | RS |
| | | May 24, 2015 | 2660-23177 | BG(M):VI | A3Y | M | 40, 41 | RS |
| | | May 22, 2015 | 2660-23176 | VI:BR(M) | A3Y | F | 41 | RS |
| | | N/A | N/A | UB:UB | HY | U | 41 | RS |

Table 3-3.—Details of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site | Date banded[2] | Federal band #[2] | Color combination[3] | Age[4] | Sex[5] | Territory or location[6] | Observation status[7] |
|---|---|---|---|---|---|---|---|---|
| ALAM (cont.) | Motherlode 02 | N/A | N/A | UB:UB | HY | U | 41 | RS |
| | | N/A | N/A | UB:UB | AHY | F | 61 | RS |
| | | June 6, 2014 | 2540-58329 | TQ:RDR(M) | A4Y | M | 61 | RS |
| | | N/A | N/A | UB:UB | HY | U | 61 | RS |
| | | N/A | N/A | UB:UB | HY | U | 61 | RS |
| | | June 4, 2014 | 2660-23063 | GR(M):VI | A4Y | F | 83 | RS |
| | | N/A | N/A | UB:UB | HY | U | 83 | RS |
| | | N/A | N/A | UB:UB | HY | U | 83 | RS |
| | | N/A | N/A | UB:UB | HY | U | 83 | RS |
| | | INA | INA | Banded | AHY | M | T74 | RS; detected May 17–June 18 |
| | | INA | INA | Banded | AHY | U | F58 | RS; detected July 13 |
| | | N/A | N/A | UB:UB | AHY | F | 22 | RS |
| | | N/A | N/A | UB:UB | AHY | M | 22, 77 | RS |
| | | N/A | N/A | UB:UB | AHY | F | 77 | RS |
| | | N/A | N/A | UB:UB | AHY | M | T73 | RS; detected June 9–26 |
| | Motherlode 03 | INA | INA | Undetermined | AHY | F | 64 | |
| | | N/A | N/A | UB:UB | AHY | M | 64 | RS |
| | | N/A | N/A | UB:UB | AHY | M | T63 | RS; detected May 18–June 15 |
| | Santa Maria North 01 | N/A | N/A | UB:UB | AHY | F | 44 | RS |
| | | July 5, 2016 | 2540-58394 | MK(M):TQ | AHY | M | 44 | N |
| | | July 23, 2016 | 2660-23250 | BGB(M):VI | L | U | 44 | N; not confirmed as fledged |
| | | July 23, 2016 | 2660-23249 | VI:OBO(M) | L | U | 44 | N; not confirmed as fledged |
| | | July 23, 2016 | 2590-53255 | EY:BD(M) | L | U | 44 | N; not confirmed as fledged |

Table 3-3.—Details of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site | Date banded[2] | Federal band #[2] | Color combination[3] | Age[4] | Sex[5] | Territory or location[6] | Observation status[7] |
|---|---|---|---|---|---|---|---|---|
| ALAM (cont.) | Santa Maria North 01 (cont.) | N/A | N/A | UB:UB | AHY | F | 45 | RS |
| | | N/A | N/A | UB:UB | AHY | M | 45 | RS |
| | | N/A | N/A | UB:UB | HY | U | 45 | RS |
| | | N/A | N/A | UB:UB | HY | U | 45 | RS |
| | | N/A | N/A | UB:UB | HY | U | 45 | RS |
| | | N/A | N/A | UB:UB | AHY | F | 46 | RS |
| | | June 4, 2014 | 2540-58317 | TQ:VYV(M) | A4Y | M | 46 | RS |
| | | N/A | N/A | UB:UB | HY | U | 46 | RS |
| | | N/A | N/A | UB:UB | HY | U | 46 | RS |
| | | N/A | N/A | UB:UB | HY | U | 46 | RS |
| | | N/A | N/A | UB:UB | AHY | F | 66 | RS |
| | | N/A | N/A | UB:UB | AHY | M | 66 | RS |
| | | N/A | N/A | UB:UB | HY | U | 66 | RS |
| | | N/A | N/A | UB:UB | HY | U | 66 | RS |
| | | N/A | N/A | UB:UB | L | U | 66 | Not confirmed as fledged |
| | | INA | INA | Undetermined | AHY | F | 67 | |
| | | N/A | N/A | UB:UB | AHY | M | 67 | RS |
| | | N/A | N/A | UB:UB | HY | U | 67 | RS |
| | | N/A | N/A | UB:UB | HY | U | 67 | RS |
| | | June 28, 2016 | 2540-58391 | MWM(M):TQ | SY | M | F84 | N; detected June 28; detected July 7 at F29 in Burro Wash 02 |
| | | INA | INA | Banded | AHY | U | F85 | RS; detected July 19 |

Table 3-3.—Details of southwestern willow flycatchers and willow flycatchers detected during the 2016 breeding season*

| Study area[1] | Survey site | Date banded[2] | Federal band #[2] | Color combination[3] | Age[4] | Sex[5] | Territory or location[6] | Observation status[7] |
|---|---|---|---|---|---|---|---|---|
| PVER[13] | Phase 02 | June 14, 2016 | 2590-53272 | RW(M):EY | SY | M | T21 | N; detected June 5–14 |

* Only study areas where resident flycatchers were detected in 2016 are included in the table.

[1] KEPI = Key Pittman, RIRA = River Ranch, PAHR = Pahranagat, MVWA = Meadow Valley Wash, MUDD = Muddy River, WMSP = Warm Springs, TOPO = Topock Marsh, BIWI = Bill Williams, ALAM = Alamo Lake, and PVER = Palo Verde Ecological Reserve.
[2] INA = information not available, and N/A = not applicable.
[3] **Color-band codes**: B = light blue, banded = bird was banded but combination could not be determined, D = dark blue, EY = electric yellow Federal band, G = green, K = black, M = mulberry, (M) = metal pinstriped band, O = orange, PU = pumpkin Federal band, R = red, TQ = turquoise Federal band, UB = unbanded, undetermined = presence of bands could not be determined, V = violet, VI = violet Federal band, W = white, XX = standard silver Federal band, and Y = yellow. Color combinations are read as the bird's left leg and right leg, top to bottom; two or three letters designate every band; color-band designations for right and left legs are separated with a colon.
[4] **Age in 2016**: L = nestling, HY = hatch year, SY = 2 years, AHY = 2 years or older, 3Y = 3 years, A3Y = 3 years or older, 4Y = 4 years, A4Y = 4 years or older, etc.
[5] **Sex codes**: F = female, M = male, and U = unknown.
[6] **Territory or location code**: A number without an alpha code indicates a flycatcher pair, a number indicates a unique location, F = individual detected for less than 7 days, and T = territorial individual detected for at least 7 days.
[7] **Observation status codes**: N = new capture, R = recapture followed by date recaptured, and RS = resight. Banded nestlings are confirmed to have fledged unless noted otherwise.
[8] Captured with pre-existing leg injury. No Federal band applied. Band number tracked internally as 9999-99999.
[9] Original Federal band number.
[10] Captured with a leg injury and rebanded. Original color combination DVD(M):VI.
[11] Captured with a leg injury and rebanded. Original color combination KGK(M):XX.
[12] This individual incorrectly sexed as female in 2015 based on wing chord measurement of 65 mm.
[13] For this study area, only flycatchers that were resident or singing insistently are included. An additional 15 unbanded flycatchers and 23 flycatchers with undetermined band status were detected at the PVER study area between May 2 and June 14. None of these individuals responded strongly to broadcast or engaged in extensive, unsolicited song and were likely migrants.

In addition to resident flycatchers, three flycatchers known to have held a territory elsewhere in the Pahranagat Valley, one flycatcher detected for the first time since it was banded as a nestling, and one willow flycatcher of unknown origin were each detected for 1 or 2 days in late July or early August. Field personnel captured and color banded the willow flycatcher and recaptured the four adult flycatchers.

## Meadow Valley Wash, Nevada

Seven resident, adult flycatchers were detected from four territories at MVWA (see table 3-3). All four territories consisted of breeding individuals, and one breeding male was polygynous with two females. Field personnel captured and color banded one new adult flycatcher and recaptured one adult flycatcher that was identified for the first time since its hatch year. Four other adults were resighted and identified. The band status of one adult could not be determined. Two nestlings from one nest were banded, and three unbanded nestlings fledged from another nest.

In addition to resident adults, one willow flycatcher was detected for which residency could not be confirmed (see table 3-3). Field personnel captured and color banded this individual.

## Muddy River, Nevada

Four resident, adult flycatchers were detected from two territories at MUDD (see table 3-3). Both territories consisted of breeding pairs. Field personnel captured two new adult flycatchers and resighted and identified two adult flycatchers.

In addition to resident adults, four willow flycatchers were detected for which residency could not be confirmed (see table 3-3). Field personnel captured and color banded one of the willow flycatchers. Three willow flycatchers remained unbanded.

## Warm Springs, Nevada

One resident, unpaired male flycatcher from one territory was detected at WMSP (see table 3-3). This adult was resighted and identified.

## Topock Marsh, Arizona

Six resident, adult flycatchers were detected from five territories at TOPO (see table 3-3). Three of the territories recorded at TOPO consisted of breeding pairs, and two consisted of unpaired males. One male was polygynous with three females. Field personnel recaptured and identified one adult flycatcher. One

additional adult was known to be banded, but its band combination could not be confirmed. Three adults remained unbanded, and the band status of one individual could not be determined.

In addition to resident adults, one banded flycatcher for which residency could not be determined was detected. The band combination for this individual could not be confirmed. Eight willow flycatchers that were not determined to be resident at the study area were also detected (see table 3-3). Four of the adult willow flycatcher remained unbanded, and the band status of another four individuals could not be determined.

## Bill Williams, Arizona

Thirteen resident, adult flycatchers were detected from nine territories at BIWI. Five of the territories consisted of breeding individuals, and four consisted of unpaired males. One male was polygynous with two females. Field personnel captured and color banded three new adult flycatchers. Four additional adults were resighted and identified. Five adults remained unbanded, and band status could not be determined for one adult. Nine nestlings from four nests were banded; seven of these nestlings were confirmed as fledging.

In addition to resident adults, 15 individuals were detected for which residency could not be confirmed (see table 3-3). Four adults remained unbanded, and band status could not be determined for 11 adults.

## Alamo Lake, Arizona

Seventy-five resident, adult flycatchers were detected from 44 territories at ALAM (see table 3-3). Of the 44 territories recorded at ALAM, 36 consisted of breeding pairs, 2 consisted of pairs for which no nest could be found, and 6 consisted of an unpaired male. Eight males were each polygynous with two females. Field personnel captured and color banded 11 new adult flycatchers and recaptured 1 previously banded flycatcher. Ten adults were resighted and identified, and five additional adults were known to be banded, but their band combinations could not be confirmed. Thirty-nine adults remained unbanded, and band status could not be determined for nine adults. Twelve nestlings from 7 nests were banded, and 27 unbanded fledglings from 13 additional nests were resighted.

In addition to adults that were resident on a territory, three flycatchers that were identified to subspecies were detected. Two were known to be banded, but their band combinations could not be confirmed; the other was newly captured in one site and then resighted over 1 week later at a different site. Five additional willow flycatchers for which residency was not confirmed were detected (see table 3-3). Field personnel captured and color banded two of these adults; two adults

remained unbanded; and band status could not be determined for one adult. The total number of individuals detected at ALAM may be an over-estimate due to within-season movement that went undetected.

### Palo Verde Ecological Reserve, California

One resident, adult male flycatcher was detected, and field personnel captured and color banded it.

An additional 38 adult willow flycatchers were detected for which residency could not be confirmed. These 38 willow flycatchers were detected between May 22 and June 14, responded weakly to broadcasts, and were likely migrants. Fifteen adults remained unbanded, and band status could not be determined for 23 adults.

## Non-Monitoring Sites

These study areas were monitored by other agencies, and here only banded flycatchers that were captured or resighted are reported. Unbanded individuals or those with unknown band status are not included.

### St. George, Utah

Personnel from the Utah Division of Wildlife Resources resighted and identified five adult flycatchers and resighted an additional two banded flycatchers that could not be definitively identified (table 3-4). Of the five identified adults, one was identified for the first time since its hatch year.

### Mesquite, Nevada

Personnel from the NDOW captured and banded two adult flycatchers and resighted and identified one additional adult (see table 3-4). Four adults were resighted as being banded, but their identities could not be confirmed.

### Mormon Mesa, Nevada

Personnel from the NDOW captured and banded one adult flycatcher and resighted and identified another adult flycatcher. Two additional adult flycatchers were resighted as being banded but could not be definitively identified (see table 3-4).

Table 3-4.—Banded southwestern willow flycatchers detected at non-monitoring sites, 2016

| Study area[1] | Survey site | Date banded | Federal band # | Color combination[3] | Age[4] | Sex[5] | Observation status[6] |
|---|---|---|---|---|---|---|---|
| STGE | Y-Drain | July 22, 2013 | 2540-58124 | TQ:DGD(M) | 4Y | F | RS |
| | | INA | INA | Banded | AHY | M | RS |
| | Seegmiller Marsh | July 17, 2013 | 2660-23007 | RG(M):VI | 4Y | M | RS |
| | | July 9, 2010 | 2540-58160 | DD(M):TQ | 7Y | M | RS |
| | | INA | INA | Banded | AHY | M | RS |
| | | July 17, 2013 | 2660-23010 | VI:KVK(M) | 4Y | F | RS |
| | Riverside Marsh | July 7, 2015 | 2660-23241 | VY(M):VI | SY | F | RS |
| MESQ | Mesquite West | June 29, 2013 | 2590-53177 | OWO(M):XX | A5Y | M | RS |
| | | June 17, 2016 | 2660-23274 | OW(M):VI | SY | M | N |
| | | INA | INA | Banded | AHY | F | RS |
| | Electric Avenue Pond | May 27, 2016 | 2590-53273 | EY:KG(M) | AHY | M | N |
| | | INA | INA | Banded | AHY | F | RS |
| | | INA | INA | Banded | AHY | M | RS |
| | | INA | INA | Banded | AHY | M | RS |
| MOME | Virgin River 01 South | May 28, 2012 | 2430-61282 | XX:YGY(M) | A6Y | M | RS |
| | | June 16, 2016 | 2660-23273 | GKG(M):VI | AHY | M | N |
| | | INA | INA | Banded | AHY | M | RS |
| | | INA | INA | Banded | AHY | U | RS |

[1] STGE = St. George, MESQ = Mesquite, and MOME = Mormon Mesa.
[2] INA = information not available.
[3] **Color-band codes**: banded = bird was banded but combination could not be determined D = dark blue, EY = electric yellow Federal band, G = green, K = black, (M) = metal pinstriped band, O = orange, R = red, TQ = turquoise Federal band, V = violet, VI = violet Federal band, W = white, XX = standard silver Federal band, and Y = yellow. Color combinations are read as the bird's left leg and right leg, top to bottom; two or three letters designate every band; color-band designations for right and left legs are separated with a colon.
[4] **Age in 2016**: AHY = 2 years or older, SY = second year, 4Y = 4 years, A4Y = 4 years or older, etc.
[5] **Sex codes**: F = female, M = male, and U = unknown.
[6] **Observation status codes**: N = new capture, and RS = resight.

## Adult Between-Year Return and Dispersal

In 2015, 88 adult, resident flycatchers were individually identified at study areas that were monitored by SWCA in both 2015 and 2016. Of these 88 flycatchers, 49 (56%) were detected in 2016, with 3 (6%) of the 49 being initially detected at a different study area than where they were resident in 2015. Of all the adult flycatchers identified in 2016, five were detected at a different study area than where they were last detected in a previous year (table 3-6). The median dispersal distance for all returning adult flycatchers exhibiting between-year movements in 2016 was 12.1 km (minimum = 9.1 km, maximum = 32.2 km).

Table 3-5.—Resident adult southwestern willow flycatcher annual return from 2015 to 2016

| Study area | # identified in 2015 | # of 2015 birds detected in 2016 | % return | % return to same study area |
|---|---|---|---|---|
| Key Pittman | 22 | 14 | 64 | 93 |
| River Ranch | 5 | 4 | 80 | 50 |
| Pahranagat | 21 | 15 | 71 | 100 |
| Meadow Valley Wash | 5 | 3 | 60 | 100 |
| Muddy River | 3 | 2 | 67 | 100 |
| Warm Springs | 2 | 1 | 50 | 100 |
| Topock Marsh | 8 | 1 | 12 | 100 |
| Bill Williams | 7 | 3 | 43 | 100 |
| Alamo Lake | 14 | 6 | 43 | 100 |
| Palo Verde Ecological Reserve | 1 | 0 | 0 | – |
| **Total** | **88** | **49** | **56** | **94** |

## Juvenile Between-Year Return and Dispersal

In 2015, 75 nestlings and 1 fledgling were banded at all study areas monitored by SWCA. Five of the nestlings were known or suspected to have died before fledging. Of the 71 remaining juveniles, 11 (15%) were identified in 2016 (table 3-7). Of the 11 returning nestlings identified in 2016, 5 (45%) dispersed away from their natal study area. The median dispersal distance for all returning juvenile flycatchers in 2016 was 1.3 km (minimum = 0.4 km, maximum = 364.6 km).

Table 3-6.—Adult southwestern willow flycatcher between-year movements for all individuals identified in a previous year and recaptured or resighted at a different study area in 2016

| Study area/survey site/year detected[1] | Study area/survey site detected 2016[1] | Distance moved (km) | Federal band # | Color combination[2] | Sex[3] |
|---|---|---|---|---|---|
| RIRA/East Side/2015 | KEPI/Frenchy Lake | 9.1 | 2660-23048 | VI:KYK(M) | M |
| RIRA/West Side/2015 | KEPI/Patch 03 | 11.4 | 2660-23044 | VI:KB(M) | M |
| RIRA/Smalls/2015 | KEPI/Patch 07 | 12.1 | 2660-23134 | VI:YD(M) | M |
| KEPI/Patch 00/2015 | PAHR/Pahranagat North | 29.4 | 2660-23077 | WYW(M):VI | F |
| KEPI/Patch 06/2015 | PAHR/Pahranagat MAPS | 32.2 | 2660-23133 | OK(M):VI | M |

[1] KEPI = Key Pittman, PAHR = Pahranagat, and RIRA = River Ranch.
[2] **Color-band codes**: B = light blue, D = dark blue, K = black, (M) = metal pinstriped band, O = orange, VI = violet Federal band, W = white, and Y = yellow. Color combinations are read as the bird's left leg and right leg, top to bottom; two letters designate every band; color-band designations for right and left legs are separated with a colon.
[3] **Sex codes**: F = female, and M = male.

Table 3-7.—Juvenile southwestern willow flycatchers banded as hatch year birds in a prior year and identified as adults for the first time in 2016

| Study area/ survey site banded[1] | Year hatched | Study area/ survey site detected 2016[1] | Distance moved (km) | Federal band # | Color combination[2] | Sex[3] |
|---|---|---|---|---|---|---|
| KEPI/Patch 12 | 2015 | KEPI/Patch 06 | 0.4 | 2660-23239 | VI:BYB(M) | F |
| KEPI/Patch 10 | 2015 | KEPI/Patch 03 | 0.6 | 2660-23138 | ODO(M):VI | F |
| ALAM/Motherlode 01 | 2015 | ALAM/Middle Earth 02 | 0.6 | 2660-23204 | VI:GB(M) | F |
| ALAM/Middle Earth 01 | 2015 | ALAM/Camp 04 | 0.9 | 2540-58346 | VGV(M):TQ | F |
| ALAM/Motherlode 01 | 2015 | ALAM/Camp 04 | 1.0 | 2540-58355 | TQ:KW(M) | M |
| MVWA/Dog Leg | 2015 | MVWA/Rock Springs Canyon | 1.3 | 2660-23145 | DV(M):VI | F |
| KEPI/Patch 12 | 2015 | RIRA/East Side | 12.2 | 2660-23238 | OB(M):VI | M |
| RIRA/West Side | 2015 | PAHR/Pahranagat North | 18.2 | 2540-58381 | WBW(M):TQ | U |
| PAHR/Pahranagat North | 2015 | KEPI/Frenchy Lake | 27.1 | 2660-23084 | BO(M):VI | F |
| PAHR/Pahranagat North | 2015 | KEPI/Frenchy Lake | 27.1 | 2660-23235 | DG(M):VI | M |
| ALAM/Middle Earth 02 | 2015 | PAHR/Pahranagat North | 364.6 | 2660-23187 | KOK(M):VI | M |

[1] ALAM = Alamo Lake, KEPI = Key Pittman, MVWA = Meadow Valley Wash, PAHR = Pahranagat, and RIRA = River Ranch.
[2] **Color-band codes**: B = light blue, D = dark blue, G = green, K = black, (M) = metal pinstriped band, O = orange, TQ = turquoise Federal band, V = violet, VI = violet Federal band, W = white, and Y = yellow. Color combinations are read as the bird's left leg and right leg, top to bottom; two or three letters designate every band; color-band designations for right and left legs are separated with a colon.
[3] **Sex codes**: F = female, M = male, and U = unknown.

## Within-Year, Between-Study Area Movements

Field personnel detected within-year, between-study area movements from five flycatchers in 2016 (table 3-8). One female flycatcher was recaptured in PAHR Pahranagat North after breeding in KEPI Patch 06, and another female had one breeding attempt at ALAM Middle Earth 02 and a second breeding attempt at BIWI Bill Willow. One unpaired male flycatcher held a territory at PAHR Pahranagat MAPS and was then recaptured at RIRA East Side. A second male held a breeding territory in RIRA East Side and was later recaptured in PAHR Pahranagat North. A third male had several within-season movements, being detected initially at RIRA West Side, then holding a breeding territory at KEPI Patch 04, and then being detected at RIRA East Side and recaptured at PAHR Pahranagat North.

Table 3-8.—Adult flycatcher within-year movements for all individuals identified at two different study areas in 2016

| Start study area/ survey site[1] | End study area/ survey site[1] | Distance moved (km) | Federal band # | Color combination[2] | Sex[3] |
|---|---|---|---|---|---|
| RIRA/East Side | PAHR/Pahranagat North | 18.1 | 2660-23238 | OB(M):VI | M |
| PAHR/Pahranagat MAPS | RIRA/East Side | 20.7 | 2660-23133 | OK(M):VI | M |
| KEPI/Patch 06 | PAHR/Pahranagat North | 30.1 | 2660-23239 | VI:BYB(M) | F |
| RIRA/West Side | PAHR/Pahranagat North | 41.1[4] | 2540-58332 | RGR(M):TQ | M |
| ALAM/Middle Earth 02 | BIWI/Bill Willow | 48.8 | 2540-28362 | TQ:YWY(M) | F |

[1] ALAM = Alamo Lake, BIWI = Bill Williams, KEPI = Key Pittman, PAHR = Pahranagat, and RIRA = River Ranch.
[2] **Color-band codes**: B = light blue, G = green, K = black, (M) = metal pinstriped band, O = orange, R = red, TQ = turquoise Federal band, VI = violet Federal band, W = white, and Y = yellow. Color combinations are read as the bird's left leg and right leg, top to bottom; two letters designate every band; color-band designations for right and left legs are separated with a colon.
[3] **Sex codes**: F = female, and M = male.
[4] This individual moved from RIRA to KEPI to RIRA to PAHR. The distance moved is the cumulative distance.

# DISCUSSION

## Color-Banding Effort

The proportion of all detected adults that were known to be banded varied widely among study areas, ranging from 3% at PVER to 100% at RIRA and PAHR. These percentages include non-resident willow flycatchers, which are typically detected only once and do not exhibit territorial behaviors, making them difficult to capture. Consequently, almost all non-resident individuals are unbanded or have an undetermined band status, and study areas such as PVER that had a low proportion of resident adults (3%) also had low proportions of banded adults

(3%). Over the years, higher numbers of non-resident individuals have been typically detected in study areas along the main stem of the LCR, such as TOPO and BIWI, than at the other study areas, with the lowest number of non-resident willow flycatchers being detected at PAHR and KEPI. The majority of these detections occur prior to the middle of June, suggesting that these individuals are migrants. Lowland riparian areas throughout the desert Southwest are heavily used by many migrant birds (Skagen et al. 2005), and the LCR likely provides a major migratory pathway. It is therefore not surprising that a higher number of migrant willow flycatchers would be detected at study areas on or near the main stem of the river.

The proportion of resident adult flycatchers that were known to be banded also varied among study areas, ranging from 33% at TOPO to 100% at RIRA, PAHR, MUDD, and WMSP. Differences among study areas in the percentage of resident flycatchers that are banded are typically related to vegetation density and structure, which affect the ability of field personnel to capture flycatchers, and are also related to the number of adult and juvenile flycatchers banded in previous years. In the Nevada study areas (KEPI, RIRA, PAHR, MVWA, MUDD, and WMSP), the proportion of resident adults that were banded by the end of the season was high, ranging from 86 to 100%. All but one adult resident flycatcher and one fledgling flycatcher at these study areas were banded by the end of the prior field season, so the 2016 field season started with a high proportion of flycatchers already banded. These study areas also generally have vegetation structure that is conducive to capture. At TOPO and BIWI, where the proportion of banded resident adults was 33 and 54%, respectively, a lower proportion of flycatchers had been previously banded (≈65% of adults and 43% of fledglings in 2015), and dense vegetation limits captures of unbanded adults. At ALAM, vegetation structure is generally more conducive to capture than at TOPO and BIWI, but only 30% of resident adults and 40% of fledglings were banded in 2015. ALAM thus started the 2016 season with a low proportion of banded flycatchers. The ALAM study area was new to this project in 2014, and the entire population at ALAM was unmarked at the beginning of the 2014 breeding season. ALAM also had the highest number of resident flycatchers of any of the study areas in 2014–16, and the amount of field effort available to band adult and juvenile flycatchers was insufficient to band a majority of the population in any year. The low proportion of banded adults coupled with several likely mid-season movements at Alamo Lake likely resulted in an overestimation in the number of flycatchers in the study area (see chapter 2).

## Adult and Juvenile Between-Year Dispersal

Adult and juvenile dispersal data for the 2016 field season show overall high site fidelity exhibited by adult flycatchers (94%) and lower natal site fidelity exhibited by juveniles (55%), with juveniles dispersing among study areas. These dispersal

data are consistent with the patterns observed at all study areas from 1998 to 2016, over which period 90% of adult returns were to the same study area, while only 51% of all juvenile returns were to the natal study area (McLeod and Pellegrini 2013, 2014, 2015, 2016). These dispersal data are also consistent with range-wide data (Paxton et al. 2007), which show adult flycatchers exhibiting high site fidelity to breeding areas. Juvenile dispersal within the southern Nevada/LCR population(s) is largely limited to this region, and while reciprocal juvenile movements among geographically isolated flycatcher populations of the greater Southwest do occur, they are rare. Only three instances of flycatcher immigration from sites outside the southern Nevada/LCR region have been recorded since 1997 (McKernan and Braden, unpublished data; McLeod et al. 2008), with two males originally banded as nestlings in 2003 at Roosevelt Lake recaptured in 2005 at MUDD and TOPO and one male banded as a nestling in 1999 at Roosevelt Lake recaptured in 2002 in Grand Canyon. Banding and resighting efforts in 1996–2005 at both Roosevelt Lake and the San Pedro River were intensive, with an average of 74% of the detected flycatchers being banded in a given year (Paxton et al. 2007). Although movements of this magnitude are infrequent, other instances of dispersal distances greater than 140 km have been reported for the flycatcher (Paxton et al. 2007) and have been noted within the southern Nevada/LCR population (McLeod and Pellegrini 2013, 2014, 2015, 2016). Banding studies at Roosevelt Lake and along the San Pedro River were discontinued after 2005, so immigration of juveniles produced in those areas after 2005 would have gone undetected. The observed dispersal patterns fit well with the tenets of contemporary metapopulation theory (Hanski and Simberloff 1997), suggesting the southern Nevada/LCR population may be a panmictic subpopulation of a greater metapopulation. Occasional juvenile dispersal between subpopulations is likely an important population variable in terms of gene flow, with movements contributing to an understanding of the observed patterns of high genetic diversity within, and low genetic isolation among, flycatcher populations (Busch et al. 2000).

Dispersal by juveniles or adults is required for the colonization of new breeding sites, and long-distance movements are required for colonization of sites in Reclamation's conservation areas south of Parker Dam. For the second time since surveys began in 2008 at conservation areas south of Parker Dam, a resident, territorial male flycatcher was detected at one of the conservation areas. This individual was detected over a 9-day period in the first half of June at PVER Phase 02 site; no other flycatchers were detected in the vicinity during that period, and the bird appeared to be unpaired. This bird was unbanded when it arrived, and its origin is unknown. It was captured and banded; it had several retained feathers and was thus aged as a second-year bird. It was not detected, either at PVER or at any other study area, after June 14. The likelihood of this individual returning to the PVER study area in a future year is unknown, but given that site fidelity is strongly linked to successful reproduction (McLeod and Pellegrini 2013) and this individual was not paired, it is not expected to return to the same location.

The known breeding sites that are closest to the conservation areas south of Parker Dam, and thus the most likely to be sources for flycatchers that colonize these areas, are at BIWI, TOPO, and ALAM; each is approximately 75–230 km from the conservation areas and within the range of dispersal distances (0.02–364.6 km for juveniles, 0.001–258.6 km for adults) recorded within the southern Nevada/LCR population (McLeod and Pellegrini 2013; this report). Given the observed patterns of adult and juvenile dispersal, returning juveniles from these breeding sites are more likely than returning adults to colonize new areas, and the likelihood of future colonization of the conservation areas is thus linked to flycatcher productivity at established breeding sites. Observations of returning juveniles from 2008 to 2016 indicate that 99% of returning juveniles are detected by the time they are 3 years old. For the coming breeding season (2017), the likely pool of returning juveniles would be drawn from all nestlings not known or suspected to have died before fledging in 2015 and 2016 at TOPO (1 nestling), BIWI (20 nestlings), and ALAM (96 nestlings). After accounting for typical annual survival at TOPO and BIWI (13–34% for juveniles, 46% for adults) (McLeod and Pellegrini 2013), the number of returning juveniles from 2015 and 2016 available for dispersal and colonization in 2017 would be around 20 individuals, with ALAM being the most likely source. In 2016, a dispersing ALAM juvenile was recaptured in PAHR, 364.6 km away from its natal area. This is the second confirmed dispersing juvenile from ALAM, with the first dispersing from ALAM to BIWI in 2015. Given that only 40 and 25% of confirmed fledglings at ALAM were banded in 2015 and 2016, respectively, detecting and recording all dispersal events is not possible.

It is also possible, though less likely, that the conservation areas could be colonized by individuals from more distant breeding areas, such as those along the Muddy and Virgin Rivers (300–350 km from the PVER). Although such long-distance movements are relatively infrequent, multiple instances of adult and juvenile dispersal between the Virgin River, TOPO, and BIWI have been documented in recent years (McLeod and Pellegrini 2013, 2014, 2015). The likelihood of an individual from the Virgin or Muddy Rivers colonizing the conservation areas is limited, however, by low productivity on the Virgin and Muddy Rivers in recent years (McLeod and Pellegrini 2015, 2016; this document; NDOW, unpublished data), and flycatcher breeding areas at Roosevelt Lake (300–330 km from the PVER) might provide a more likely population source.

## Within-Year, Between-Study-Area Movement

In 2016, five flycatchers were detected moving between study areas within the breeding season, with one individual moving three times. This number of movements (7) ties with the previous high number recorded in 2011 (2003–15 range = 0–7; median = 2). Four of the within-year, between-study-area movements consisted of individuals detected briefly as a non-territorial adult

in a second study area near the end of the breeding season after breeding or defending a territory elsewhere. Of the 28 within-year, between-study-area movements detected in 2003–15, 12 (43%) were of individuals detected as non-territorial adults at the end of the breeding season after breeding or defending a territory elsewhere. Of these 12 individuals, 9 returned in a subsequent year, and 7 of the 9 (78%) returned to the same survey site where they were last detected. These individuals were likely prospecting for potential breeding sites – a life history trait that may benefit the flycatcher given the ephemeral, dynamic nature of riparian habitats (i.e., riparian vegetation and hydrology changing from one year to the next). Six of the seven movements detected in 2016 occurred at study areas in the Pahranagat Valley. Several of these movements were detected through late-season passive netting efforts. The amount of time field personnel spend passive netting is quite variable year to year; the high number of movements detected in 2016 may be a reflection of the amount of passive netting effort rather than an actual increase in movements.

## Adult and Juvenile Survivorship

Annual survivorship is defined as the number of individuals that survive from one year to the next, and accurate estimates depend on year-to-year detection of uniquely marked birds. Fifty-six percent of the adult, resident flycatchers identified in 2015 were detected again in 2016, while of the 71 juveniles banded in monitored sites in 2015 and not known or suspected to have died before fledging, only 11 (15%) were identified in 2016. Thus, minimum estimated adult and juvenile survival from 2015 to 2016 at all monitored sites was 56 and 15%, respectively. These estimates are similar to those recorded in previous years (median adult annual survivorship in 2004–15 = 55% [range = 39–74%]; median juvenile annual survivorship in 2009–15 = 22% [range = 13–29%]). The annual adult survivorship estimates at TOPO (12%), BIWI (43%), and ALAM (43%) were below the overall 2016 annual return rate of 56%. Both TOPO and BIWI had small starting sample sizes (eight and seven individuals, respectively), and survivorship estimates would thus be strongly affected by the fate of one or two individuals. At TOPO, a combination of poor reproductive success with a reduction in the amount of available habitat could have resulted in emigration or in flycatchers being present in the study area but not actively defending a territory and thus being difficult to detect. At Alamo Lake, personnel were unable to devote the amount of field effort necessary to identify all individuals, and of the 75 resident adults detected in 2016, 5 were known to be banded but were not identified to individual, and the band status of 9 adults remained undetermined at the end of the season. Thus, the survival estimate for Alamo Lake in 2016 is likely below the actual rate of survival. These simple annual percent survivorship calculations assume that all living flycatchers are detected in a given year, and individuals not detected are assumed to have died, unless detected elsewhere. To

provide more robust estimates of annual survival, demographic data acquired from 2013 to 2017 will be combined with data collected during 1997–2012. Survival and detection probabilities will be estimated using program MARK (White and Burnham 1999) and presented in a summary report in 2017.

# Chapter 4 – Nest Monitoring

## INTRODUCTION

Documentation of nest success and productivity is critical to understanding local population status and demographic patterns of the flycatcher. In 2016, at all sites where flycatcher breeding activity was suspected, SWCA personnel conducted intensive nest searches and nest monitoring. Specific objectives of nest monitoring included identifying breeding individuals (see chapter 3), calculating nest success and failure, documenting causes of nest failure (e.g., abandonment, desertion, depredation, and brood parasitism), and calculating nest productivity. Nest monitoring results from 2016 were compared with those at the study areas from 1996 to 2015 (Braden and McKernan, unpublished data; McLeod et al. 2008; McLeod and Pellegrini 2013, 2014, 2015, 2016). Although aspects of willow flycatcher breeding ecology can vary widely across the species' broad geographical and elevational ranges (Whitfield et al. 2003), SWCA compared monitoring results with range-wide data to identify specific variables that may contribute to the characterization of flycatcher breeding ecology throughout the LCR and its tributaries.

## METHODS

Upon confirming or suspecting a pair of flycatchers was present, field personnel conducted intensive nest searches following the methods of Rourke et al. (1999). Nest monitoring followed a modification of the methods described by Rourke et al. (1999) and the Breeding Biology Research and Monitoring Database (BBIRD) protocol by Martin et al. (1997).

Nests were located primarily by observing adult flycatchers return to a nest or by systematically searching suspected nest sites. Nests were typically monitored every 2 to 4 days after nest building was complete and incubation was confirmed. Nests at Alamo Lake were monitored less frequently, sometimes with 6 or more days between visits. During incubation and after hatching, nest contents were observed directly whenever possible using a telescoping mirror pole to determine nest contents and transition dates. Nest monitoring during nest building and egg-laying stages was limited to reduce the chance of abandonment during these periods. To reduce the risk of premature fledging of young (Rourke et al. 1999), nests were observed from a distance, using binoculars, once nestlings were 8 days of age. If no activity was observed at a previously occupied nest, the nest was checked directly to determine nest contents and

condition. If no activity was observed at a nest close to or on the estimated fledge date, field personnel conducted a systematic search of the area to locate possible fledglings.

Per instructions from Reclamation biologists, a flycatcher nest was considered successful only if fledglings were observed near the nest or in surrounding areas. The number of young fledged from each nest was counted as the number of fledglings actually observed. This method of determining success produces a conservative estimate of both nest success rate and number of fledges and differs from methods recommended by some nest monitoring protocols (e.g., Martin et al. 1997; Rourke et al. 1999), which consider a nest as successful if chicks are observed in the nest within 2 days of the estimated fledge date.

A nest was considered to have failed if (1) the nest was abandoned prior to egg laying (abandoned), (2) the nest was deserted with flycatcher eggs or young remaining (deserted), (3) the nest was found empty or destroyed more than 2 days prior to the estimated fledge date (depredated), (4) nestlings died in the nest despite being tended by the adults (nestlings died in nest), or (5) the entire clutch was incubated for an excess of 20 days (infertile/addled). For nests containing flycatcher eggs, parasitism was considered the cause of nest failure if (1) cowbird young outlived any flycatcher eggs or young or (2) the disappearance of all flycatcher eggs coincided with the appearance of cowbird eggs.

For each nest check, field personnel recorded the date and time of the visit, monitoring method (observation via binoculars or mirror pole), nesting stage, nest contents, and number and behavior of adults and/or fledges present. These data were recorded in a field journal and then entered in TerraSync 5.70 on a computer at the end of the field day. Flycatcher nest success was calculated using both apparent nesting success (number of successful nests/total number of nests containing at least one flycatcher egg) and the Mayfield method (Mayfield 1961, 1975), which calculates daily nest survival to account for nests that failed before they were found. To calculate transition dates, SWCA assumed that one egg was laid per day, and incubation was considered to start the day the last egg was laid (per Martin et al. 1997). The nestling period was considered to start the day the first egg hatched and end the day the first nestling fledged. If exact transition dates or dates of depredation events were unknown, the transition date was estimated as halfway between observations. For nests for which fate was unknown, the last known date of activity was used to determine the number of observation days. To calculate Mayfield survival probabilities (MSPs), SWCA used the average length of each nest stage (2.17, 12.90, and 13.71 days for laying, incubation, and nestling stages, respectively) as observed in this study in 2003–16 for nests with known transition dates. Nest productivity was calculated as the number of young fledged per nesting attempt that produced at least one flycatcher

egg and had a known outcome. Fecundity was calculated as number of young produced per female over the breeding season. Parasitism rates were calculated as the percentage of nests with known contents that included at least one flycatcher egg and one cowbird egg.

SWCA personnel attempted to addle cowbird eggs in easily accessible flycatcher nests at study areas in Nevada. If the nest was accessible without a ladder, the cowbird egg was addled as soon as it was discovered. If a ladder was required, the cowbird egg was addled on the next regularly scheduled nest visit. Cowbird eggs were addled only if a direct view of the nest contents could be obtained from a secure location either on the ground or on a ladder. Field personnel carefully removed the cowbird egg from the nest and placed it in a padded film canister. Field personnel then shook the canister vigorously for about 1 minute, incorporating sharp, jerky movements, and returned the egg to the nest. The cowbird egg was not permanently removed from the nest so as not to mimic a partial depredation event, which might result in nest desertion. If a nest was found with a cowbird nestling already in the nest, or if a shaken cowbird egg still hatched, the cowbird nestling was removed from the nest.

All field personnel practiced egg addling with several button quail (*Coturnix chinensis*) eggs at the start of the field season to determine how vigorously they could shake an egg without breaking it. Button quail eggs are slightly larger than cowbird eggs (19 x 25 mm versus 16 x 21 mm) but provide a reasonable and easily available substitute. Shaken eggs were carefully opened to determine whether any damage to the internal structure of the egg was apparent. Field personnel varied in their ability to shake an egg to the point of causing internal damage without breaking the shell.

At study areas in Arizona, SWCA field personnel replaced cowbird eggs with artificial cowbird eggs in easily accessible flycatcher nests. Three-dimensional printed cowbird eggs were obtained from Shapeways (http://www.shapeways.com/shops/VN, per Igic et al. 2015) and painted with BEHR PREMIUM PLUS ULTRA ® interior paint to resemble cowbird eggs (figure 4-1).

Summary statistics were calculated using IBM ® SPSS ® v. 22.0. One-sided confidence intervals around differences in proportions followed Agresti and Caffo 2000 (formula provided by Reclamation staff).

**Figure 4-1.—Artificial cowbird eggs used to replace cowbird eggs in easily accessible southwestern willow flycatcher nests at study areas in Arizona.**

# RESULTS

## Nest Monitoring

One hundred one flycatcher nesting attempts were documented at KEPI, RIRA, PAHR, MWWA, MUDD, TOPO, BIWI, and ALAM; 91 of these nests were known to contain flycatcher eggs and were used in calculating nest success and productivity. Thirty-five (39%) nests were successful and fledged young, 54 (59%) failed, and 2 (2%) had an unknown fate. Nest success ranged from 0% at TOPO and MUDD to 57% at BIWI (table 4-1). For a comparison of apparent nest success at all monitoring sites from 1997 to 2016, see table 4-2.

Sixty-six nesting females were followed through all of their nesting attempts; one of these females nested at both ALAM and BIWI. Of the 66 females, 61 were known to have produced at least 1 egg. Of the 66 females, 40 had 1 nesting attempt, 20 had 2 nesting attempts, and 6 had 3 nesting attempts. All of the 26 females with multiple nesting attempts renested after failed nests. Three additional females at ALAM were found feeding fledglings, but the nests were never located. An additional three females were detected at ALAM, but no nests for these females were found.

Table 4-1.—Summary of southwestern willow flycatcher nest monitoring results at all study areas, 2016

| Study area[1] | Survey site | Pairs | Nests | Nests with 1+ WE[2] | Successful nests[3] | Failed nests[3] | Nests with unknown fate | Parasitized nests[4] |
|---|---|---|---|---|---|---|---|---|
| KEPI | Frenchy Lake | 1 | 2 | 2 | 0 | 2 (100) | 0 | 0 |
| | Patch 00 | 1 | 2 | 2 | 0 | 1 (50) | 1 (50) | 2 (100) |
| | Patch 03 | 1 | 3 | 3 | 0 | 3 (100) | 0 | 0 |
| | Patch 04 | 1 | 2 | 2 | 0 | 2 (100) | 0 | 0 |
| | Patch 06 | 1 | 2 | 2 | 0 | 2 (100) | 0 | 1 (50) |
| | Patch 07 | 1 | 2 | 2 | 0 | 2 (100) | 0 | 0 |
| | Patch 10 | 2 | 3 | 3 | 1 (33) | 2 (67) | 0 | 0 |
| | Patch 12 | 2 | 3 | 3 | 0 | 3 (100) | 0 | 0 |
| | **Total** | *10* | *19* | *19* | *1 (5)* | *17 (90)* | *1 (5)* | *3 (16)* |
| RIRA | East Side | 1 | 3 | 3 | 1 (33) | 2 (67) | 0 | 0 |
| | **Total** | *1* | *3* | *3* | *1 (33)* | *2 (67)* | *0* | *0* |
| PAHR | Pahranagat North | 8 | 14 | 12 | 7 (58) | 5 (42) | 0 | 0 |
| | Pahranagat West | 1 | 2 | 2 | 1 (50) | 1 (50) | 0 | 0 |
| | Pahranagat MAPS | 1 | 3 | 3 | 0 | 3 (100) | 0 | 1 (33) |
| | **Total** | *10* | *19* | *17* | *8 (47)* | *9 (53)* | *0* | *1 (6)* |
| MVWA | Rock Springs Canyon | 1 | 1 | 1 | 1 (100) | 0 | 0 | 0 |
| | Dog Leg | 3 | 3 | 3 | 1 (33) | 2 (67) | 0 | 0 |
| | **Total** | *4* | *4* | *4* | *2 (50)* | *2 (50)* | *0* | *0* |
| MUDD | Overton WMA | 2 | 2 | 2 | 0 | 2 (100) | 0 | 0 |
| | **Total** | *2* | *2* | *2* | *0* | *2 (100)* | *0* | *0* |
| TOPO | Swine Paradise | 3 | 6 | 3 | 0 | 3 (100) | 0 | 1 (50) |
| | **Total** | *3* | *6* | *3* | *0* | *3 (100)* | *0* | *1 (50)* |
| BIWI | Bill Willow | 3 | 4 | 3 | 3 (100) | 0 | 0 | 0 |
| | Wispy Willow | 2 | 4 | 4 | 1 (25) | 3 (75) | 0 | 1 (33) |
| | **Total** | *5* | *8* | *7* | *4 (57)* | *3 (43)* | *0* | *1 (17)* |
| ALAM | South Camp | 1 | 1 | 1 | 0 | 1 (100) | 0 | 0 |
| | Over the Edge | 2 | 2 | 2 | 0 | 2 (100) | 0 | 1 (50) |
| | Sidebar 01 | 1 | 1 | 1 | 1 (100) | 0 | 0 | 0 |
| | Edgewater 01 | 2 | 2 | 1 | 0 | 1 (100) | 0 | 0 |
| | Camp 01 | 1 | 1 | 1 | 0 | 1 (100) | 0 | 1 (100) |
| | Camp 04 | 2 | 2 | 2 | 1 (50) | 1 (50) | 0 | 0 |
| | Middle Earth 01 | 1 | 0 | 0 | – | – | – | – |
| | Middle Earth 02 | 10 | 12 | 11 | 7 (64) | 4 (36) | 0 | 0 |
| | Burro Wash 01 | 2 | 3 | 3 | 0 | 3 (100) | 0 | 0 |
| | Burro Wash 02 | 2 | 2 | 2 | 2 (100) | 0 | 0 | 0 |
| | Motherlode 01 | 6 | 7 | 6 | 4 (67) | 2 (33) | 0 | 0 |
| | Motherlode 02 | 2 | 2 | 1 | 0 | 1 (100) | 0 | 0 |
| | Motherlode 03 | 1 | 0 | 0 | -- | -- | -- | -- |
| | Santa Maria North 01 | 5 | 5 | 5 | 4 (80) | 0 | 1 (20) | 0 |
| | **Total** | *38* | *40* | *36* | *19 (53)* | *16 (44)* | *1 (3)* | *2 (8)* |
| | **Overall total** | **73** | **101** | **91** | **54 (59)** | **35 (39)** | **2 (2)** | **8 (11)** |

[1] KEPI = Key Pittman, RIRA = River Ranch, PAHR = Pahranagat, MVWA = Meadow Valley Wash, MUDD = Muddy River, TOPO = Topock Marsh, BIWI = Bill Williams, and ALAM = Alamo Lake.
[2] WE = willow flycatcher egg.
[3] Only nests with at least one flycatcher egg were used in tallies and percentage calculations. Percentages are given in parentheses.
[4] Parasitized nests include all nests that contained at least one flycatcher egg and one cowbird egg regardless of nest fate. Percentages in parentheses include only nests with at least one flycatcher egg and for which parasitism status could be determined.

Table 4-2.—Southwestern willow flycatcher percent apparent nest success recorded at all study areas, 1996–2016*

| Year | Study area[1] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | KEPI[2] | RIRA[2] | PAHR | MVWA | MUDD | WMSP | TOPO | BIWI | ALAM[2] |
| 1996 | – | – | Nm | Nm | Nm | Nm | Nc | Nm | – |
| 1997 | – | – | Nm | Nm | Nc | Nm | Nc | Nd | – |
| 1998 | – | – | 47 (19) | 0 (2) | Nm | Nm | 53 (15) | Nd | – |
| 1999 | – | – | 60 (15) | Nd | Nm | Nm | 38 (16) | 100 (1) | – |
| 2000 | – | – | 63 (16) | Nd | 100 (1) | Nm | 36 (11) | 100 (1) | – |
| 2001 | – | – | 50 (18) | Nd | Nc | Nm | 36 (14) | 50 (4) | – |
| 2002 | – | – | 33 (12) | Nm | Nd | Nm | 50 (6) | 78 (9) | – |
| 2003 | – | – | 91 (11) | Nd | Nd | Nm | 78 (9) | 100 (2) | – |
| 2004 | – | – | 76 (17) | Nm | Nd | Nm | 45 (38) | Nd | – |
| 2005 | – | – | 58 (19) | Nm | 38 (8) | Nm | 24 (34) | 100 (2) | – |
| 2006 | – | – | 60 (15) | Nm | 44 (9) | Nm | 23 (17)[4] | 20 (5) | – |
| 2007 | – | – | 67 (12) | Nm | 0 (6) | Nm | 75 (8) | 25 (8) | Nm |
| 2008 | – | – | 80 (10) | Nm | 25 (8) | Nm | 13 (8)[3] | 40 (5)[3] | Nm |
| 2009 | – | – | 47 (17)[3] | Nm | 0 (8) | Nm | 50 (2) | 33 (6) | Nm |
| 2010 | 50 (30) | – | 59 (17) | Nm | 100 (3) | 0 (3) | 50 (2) | 18 (11) | Nm |
| 2011 | 45 (31) | 0 (4) | 100 (7) | Nm | 0 (5)[3] | 100 (1) | 0 (1) | 40 (5) | Nm |
| 2012 | 41 (27) | Nd | 71 (14) | Nm | 25 (4) | 0 (2) | Nd | 0 (2) | Nm |
| 2013 | 35 (23)[5] | 0 (2) | 86 (7) | Nm | 25 (4) | Nd | 0 (2) | Nd | Nm |
| 2014 | 44 (18)[6] | Nd | 65 (17) | 100 (2) | 20 (5)[8] | Nd | 100 (3) | 50 (4) | 25 (24)[7] |
| 2015 | 11 (18) | 50 (4) | 89 (9) | 100 (4) | 50 (2)[3] | 100 (1) | 20 (5) | 50 (8)[3] | 62 (34)[8] |
| 2016 | 5 (19)[3] | 33 (3) | 47 (17) | 50 (4) | 0 (2) | Nd | 0 (3) | 57 (7) | 53 (36)[3] |

* Data from 1997 to 2002 are from Braden and McKernan (unpublished data); these numbers have been verified with the raw data and may differ from those presented in earlier annual reports. Data from 2003 to 2007 are from McLeod et al. 2008; data from 2008 to 2012 are from McLeod and Pellegrini 2013; and data from 2013, 2014, and 2015 are from McLeod and Pellegrini 2014, 2015, and 2016, respectively. The total number of nests containing at least one flycatcher egg is indicated in parentheses. Nc = breeding confirmed, nest success not calculated; Nd = study area surveyed, no breeding documented; and Nm = not monitored.

[1] KEPI = Key Pittman, RIRA = River Ranch, PAHR = Pahranagat, MVWA = Meadow Valley Wash, MUDD = Muddy River, WMSP = Warm Springs, TOPO = Topock Marsh, BIWI = Bill Williams, and ALAM = Alamo Lake.
[2] Data are included only for years when monitoring was completed by SWCA.
[3] Fate of one nest was unknown.
[4] An additional three nests (18%) were suspected to have fledged, but fledglings were not visually confirmed.
[5] One additional nest (4%) was suspected to have fledged, but fledglings were not visually confirmed.
[6] Fate of three nests was unknown.
[7] Fate of four nests was unknown.
[8] Fate of two nests was unknown.

## Nest Failure

Depredation was the major cause of nest failure for all study areas combined, accounting for 59% (38 of 64) of all failed nests (table 4-3) and 70% (38 of 54) of nests that failed after flycatcher eggs were laid. Ten nests (16%) were abandoned before flycatcher eggs were laid; two of these nests had been parasitized by cowbirds. Parasitism caused failure at 1 (2%) of the 54 nests that failed after flycatcher eggs were laid. Of all 64 failed nests, 13 (20%) were deserted, and 1 nest (2%) failed when a branch fell on it. The cause of failure was unknown at one nest that had already failed by the time it was found.

Table 4-3.—Summary of causes of southwestern willow flycatcher nest failure at all study areas, 2016*

| Study area[1] | Total # nests | All failed nests | Abandoned | Parasitized | Deserted | Depredated | Tree fell | Cause of failure unknown |
|---|---|---|---|---|---|---|---|---|
| KEPI | 19 | 17 | 0 | 0 | 2 (12) | 15 (88) | 0 | 0 |
| RIRA | 3 | 2 | 0 | 0 | 1 (50) | 1 (50) | 0 | 0 |
| PAHR | 19 | 11 | 2 (18) | 0 | 1 (9) | 7 (64) | 1 (9) | 0 |
| MVWA | 4 | 2 | 0 | 0 | 1 (50) | 1 (50) | 0 | 0 |
| MUDD | 2 | 2 | 0 | 0 | 1 (50) | 1 (50) | 0 | 0 |
| TOPO | 6 | 6 | 3 (50) | 0 | 1 (17) | 1 (17) | 0 | 1 (17) |
| BIWI | 8 | 4 | 1 (25) | 0 | 1 (25) | 2 (50) | 0 | 0 |
| ALAM | 40 | 20 | 4 (20) | 1 (5) | 5 (25) | 10 (50) | 0 | 0 |
| **Total** | **101** | **64** | **10 (16)** | **1 (2)** | **13 (20)** | **38 (59)** | **1 (2)** | **1 (2)** |

* All nesting attempts (those with and without flycatcher eggs) are included. Percentage of failed nests is shown in parentheses for each cause of failure. Abandoned = no flycatcher eggs were laid; deserted = deserted with eggs or young remaining in the nest; depredated = nest empty or destroyed 2 days or more before anticipated fledge date; and parasitized = cowbird young outlived any flycatcher young or appearance of cowbird egg(s) coincided with disappearance of all flycatcher eggs.

[1] KEPI = Key Pittman, RIRA = River Ranch, PAHR = Pahranagat, MVWA = Meadow Valley Wash, MUDD = Muddy River, WMSP = Warm Springs, TOPO = Topock Marsh, BIWI = Bill Williams, and ALAM = Alamo Lake.

## Brood Parasitism

Eight of 76 nests (11%) with flycatcher eggs and known parasitism status were brood parasitized by cowbirds, and 2 additional nests without flycatcher eggs were abandoned with a cowbird egg (table 4-4). Brood parasitism ranged from 0 to 50% and was highest at TOPO (see table 4-1). For nests containing flycatcher eggs, parasitism likely contributed to the failure of three nests that were deserted shortly after being parasitized, and one nest failed when the appearance

Table 4-4.—Fates of southwestern willow flycatcher nests parasitized by brown-headed cowbirds at all study areas, 2016*

| Study area[1] | Nest ID code | Outcome[2] |
|---|---|---|
| KEPI | 06A | Parasitized during laying; CE addled. Depredated during incubation. |
| | 06B | Parasitized during incubation; CE not addled and not incubated long enough to hatch. Final fate of WNs unknown. |
| | 21B | Deserted during laying with two WE and one CE immediately after parasitism event. |
| PAHR | 22C | Parasitized during laying; CE addled and did not hatch. Deserted after 14 days incubation. |
| TOPO | 51C | Deserted during incubation immediately after parasitism event. |
| | 59B | Abandoned with one CE. |
| BIWI | 20A | Deserted during laying with one WE and one CE immediately after parasitism event. |
| | 42A | Abandoned with one CE. |
| ALAM | 26A | CE replaced with fake CE. Deserted with one WE and fake CE 4 days later. |
| | 48A | Parasitized during incubation; WE disappeared when CE appeared. |

* All nesting attempts are included.

[1] KEPI = Key Pittman, PAHR = Pahranagat, TOPO = Topock Marsh, BIWI = Bill Williams, and ALAM = Alamo Lake.
[2] WE = flycatcher egg(s), CE = cowbird egg(s), and WN = flycatcher nestling(s).

of the cowbird egg coincided with the disappearance of the only flycatcher egg. Of the four remaining parasitized nests, two were deserted many days after the parasitism event, one was depredated, and one had an unknown fate. In 2016, 24 of 67 (59.4%) unparasitized nests were successful, whereas zero of seven (0%) parasitized nests were successful (one-sided Fisher's exact test, $P = 0.056$; difference in proportions = 0.36, 95% lower bound = 0.05).

## Cowbird Egg Addling and Replacement

Of the eight parasitized flycatcher nests that also contained flycatcher eggs, only four were not deserted immediately after the parasitism event. Field personnel attempted to addle cowbird eggs at two of these four nests. One of these two nests was incubated for over 10 days after the parasitism event, but the cowbird egg did not hatch. The second nest with an addled cowbird egg was depredated a few days after addling, and the cowbird egg therefore did not hatch. Field personnel replaced the cowbird egg with a fake cowbird egg at a third nest.

The cowbird egg was not addled at the fourth nest because the parasitism event took place during incubation and it was unlikely the cowbird egg would have been incubated long enough to hatch; this un-addled cowbird egg did not hatch.

## Mayfield Nest Success and Nest Productivity

MSP ranged from 0.119 at MWWA to 0.496 at BIWI and was 0.324 for all study areas combined (table 4-5). MSP could not be calculated for MUDD and TOPO because no nests progressed to the nestling phase. At all sites, 74 nestlings were confirmed to have fledged from 89 nests of known outcome (mean number of fledglings/nest = 0.83, standard error [SE] = 0.13). Fecundity across study areas ranged from 0.00 to 2.30 young/female and averaged 1.06 (SE = 0.15) (table 4-6).

# DISCUSSION

## Number of Breeding Flycatchers

In 2016, breeding was documented in eight study areas (KEPI, RIRA, PAHR, MVWA, MUDD, TOPO, BIWI, and ALAM). Breeding has been documented in each of these study areas in previous years (McLeod and Pellegrini 2013, 2014, 2015, 2016). Fewer flycatcher pairs (10) were detected at KEPI in 2016 than in any of the other 6 years the study area has been intensively monitored (figure 4-2). This is the second consecutive year in which the number of pairs has declined, and the decline has been concurrent with declines in nest success and fecundity (see below) at this study area. Poor nest success likely contributes to the declining number of pairs; reproductive failure means that flycatchers are less likely to return to the same breeding site in the following year (McLeod and Pellegrini 2013), and fewer fledglings means fewer young flycatchers are available to recruit into the population. Annual fluctuations appear to be the norm at PAHR, where 10 pairs were detected in 2016 (range in 2003–15 = 6–15 pairs, median = 10 pairs; figure 4-2).

The number of flycatcher pairs recorded at MUDD continued to be low, with only two pairs recorded for the second consecutive year (figure 4-2). A breeding pair was detected in the southern end of the Overton WMA survey site for the first time since 2013. The nest was placed directly over the water along a noisy section of the stream, which made flycatcher vocalizations hard to detect. All flycatcher nests at MUDD have been placed directly over the river in recent years. This is likely a response to declining habitat quality; the southern portion of the breeding site was dry in 2012–15, resulting in reduced canopy closure, and the entire area has been affected by tamarisk beetles, which have been defoliating tamarisk annually since 2012 (see chapter 2).

Table 4-5.—Daily survival rates and MSPs for southwestern willow flycatcher nest stages at all study areas, 2016

| Study area[1] | Nest stage[2] | Nest losses/ observation days | Daily survival rate | MSP[3] |
|---|---|---|---|---|
| KEPI | 1 | 2/42 | 0.952 | 0.900 |
| | 2 | 5/182 | 0.973 | 0.698 |
| | 3 | 10/92 | 0.891 | 0.206 |
| | All stages | | | 0.130 |
| RIRA | 1 | 0/2 | 1.000 | 1.000 |
| | 2 | 2/17 | 0.882 | 0.199 |
| | 3 | 0/14.5 | 1.000 | 1.000 |
| | All stages | | | 0.199 |
| PAHR | 1 | 1/33 | 0.970 | 0.936 |
| | 2 | 6/169 | 0.964 | 0.627 |
| | 3 | 2/121 | 0.983 | 0.796 |
| | All stages | | | 0.467 |
| MVWA | 1 | 1/2 | 0.500 | 0.223 |
| | 2 | 1/21 | 0.952 | 0.533 |
| | 3 | 0/18.5 | 1.000 | 1.000 |
| | All stages | | | 0.119 |
| MUDD | 1 | 0/2 | 1.000 | 1.000 |
| | 2 | 2/28.5 | 0.930 | 0.391 |
| | 3 | 0/0 | – | – |
| | All stages | | | N/A[4] |
| TOPO | 1 | 1/4 | 0.750 | 0.536 |
| | 2 | 2/6 | 0.667 | 0.005 |
| | 3 | 0/0 | – | – |
| | All stages | | | N/A[4] |
| BIWI | 1 | 1/10 | 0.900 | 0.796 |
| | 2 | 1/54 | 0.981 | 0.786 |
| | 3 | 1/59.5 | 0.983 | 0.793 |
| | All stages | | | 0.496 |
| ALAM | 1 | 0/23 | 1.000 | 1.000 |
| | 2 | 10/296.5 | 0.966 | 0.642 |
| | 3 | 6/205 | 0.971 | 0.665 |
| | All stages | | | 0.427 |
| **Total** | **1** | **6/118** | **0.949** | **0.893** |
| | **2** | **29/774** | **0.963** | **0.611** |
| | **3** | **19/510.5** | **0.963** | **0.595** |
| | **All stages** | | | **0.324** |

[1] KEPI = Key Pittman, RIRA = River Ranch, PAHR = Pahranagat, MVWA = Meadow Valley Wash, MUDD = Muddy River, TOPO = Topock Marsh, BIWI = Bill Williams, and ALAM = Alamo Lake
[2] 1 = egg laying, 2 = incubation, and 3 = nestling.
[3] MSP was calculated using 2.17-day egg laying, 12.90-day incubation, and 13.71-day nestling stages.
[4] MSP cannot be calculated for all stages because of lack of data.

Table 4-6.—Southwestern willow flycatcher nest productivity (young fledged per nest) and fecundity (young fledged per female) at all study areas, 2016*

| Study area[1] | # young fledged | # nests with known outcome | Productivity mean (SE) | # females with known outcome | Fecundity mean (SE) |
|---|---|---|---|---|---|
| KEPI | 2 | 18 | 0.11 (0.11) | 9 | 0.22 (0.22) |
| RIRA | 1 | 3 | 0.33 (0.33) | 1 | 1.00 |
| PAHR | 23 | 17 | 1.35 (0.39) | 10 | 2.30 (0.47) |
| MVWA | 5 | 4 | 1.25 (0.75) | 4 | 1.25 (0.75) |
| MUDD | 0 | 2 | 0.00 | 2 | 0.00 |
| TOPO | 0 | 3 | 0.00 | 3 | 0.00 |
| BIWI | 7 | 7 | 1.00 (0.44) | 5 | 1.40 (0.51) |
| ALAM | 36 | 35 | 1.03 (0.19) | 37 | 0.97 (0.18) |
| **Total** | **74** | **89** | **0.83 (0.13)** | **70[2]** | **1.06 (0.15)** |

* Productivity calculations include nests that contained flycatcher eggs and had a known outcome. Fecundity calculations include all females for which nest outcomes were known.

[1] KEPI = Key Pittman, RIRA = River Ranch, PAHR = Pahranagat, MVWA = Meadow Valley Wash, MUDD = Muddy River, TOPO = Topock Marsh, BIWI = Bill Williams, and ALAM = Alamo Lake.

[2] One female nested at both ALAM and BIWI and is counted only once in the total.

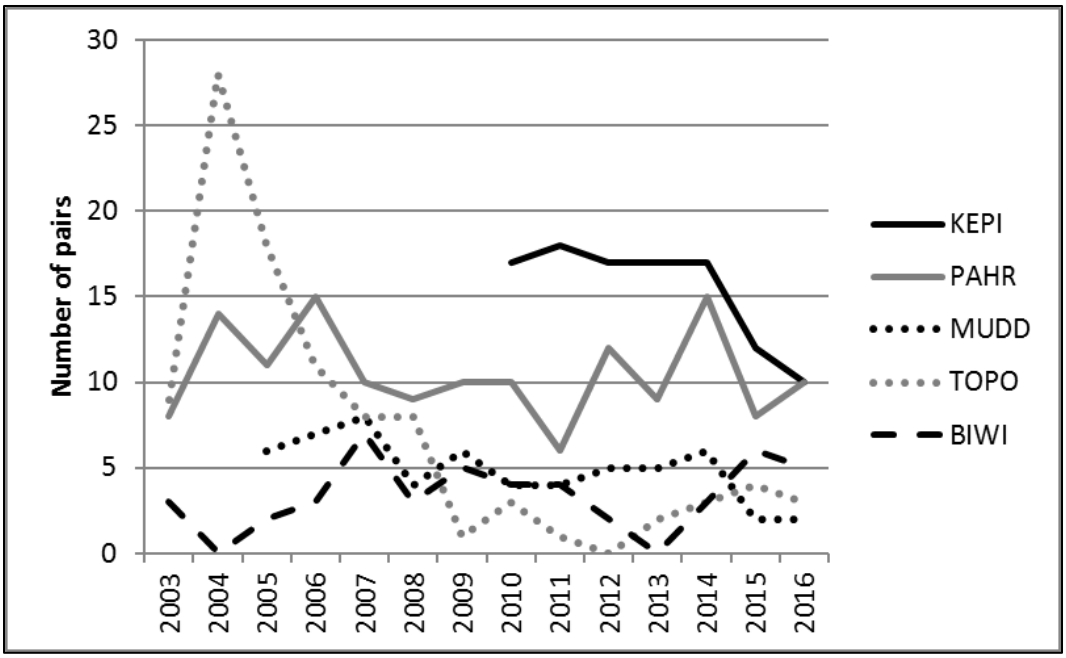



**Figure 4-2.—Number of pairs of southwestern willow flycatchers detected at Key Pittman (KEPI), Pahranagat (PAHR), Muddy River (MUDD), Topock Marsh (TOPO), and Bill Williams (BIWI) during years of intensive nest monitoring.**

The number of breeding flycatchers at TOPO continued to be low in 2016 (see figure 4-2), which is unsurprising considering that a significant portion of the study area burned at the end of the 2015 breeding season. All five pairs of breeding flycatchers detected at BIWI were found in sites near the mouth of the Bill Williams River, adjacent to an arm of Lake Havasu. Flow on the lower portion of the Bill Williams River has been 0.0 cfs since May 2015 (see chapter 2), and the pattern of flycatcher occupancy was likely affected by the lack of surface water in most portions of the study area. Given that southwestern riparian ecosystems experience dynamic change and are not ecologically static (Periman and Kelly 2000), flycatcher occupancy and nesting are likely to be affected by changes in habitat suitability, with breeding flycatchers detected at a given site in one year and not in another.

## Nest Success

Nest success alone is an incomplete measure of the production of young. Successful nests produce from one to four young, and variations in nest productivity are not reflected in nest success rates. In addition, although every failed nest attempt lowers percent nest success and MSP, success of a subsequent nesting attempt may result in the same number of young produced as if the initial nesting attempt had been successful. Thus, nest productivity (young produced per nesting attempt of known outcome) and fecundity (young produced per female with known outcome) in conjunction with nest success provide additional information on the success of a given breeding season.

In 2015 at KEPI, both fecundity and productivity declined sharply from the levels recorded in previous years, and this decline continued in 2016 (figure 4-3). In both years, the leading cause of nest failure at KEPI was depredation, with 10 of 12 depredation events in 2015 and 9 of 15 depredation events in 2016 occurring in the nestling stage (see discussion on nest failure below). Apparent nest success at PAHR was among the lowest recorded since monitoring began (see table 4-2 and figure 4-3), but fecundity was 2.3 young/female, which is the average recorded in 2003–15.

MUDD continued to show the extreme annual fluctuations in nest success and fecundity that are inherent with small sample sizes; in 2015, both nest success and fecundity were among the highest recorded since monitoring began in 2005, but no fledglings were produced in 2016 (figures 4-4 and 4-5). The long-term averages (2005–15) of nest success (25%) and fecundity (0.5 young/female) at MUDD are the lowest of the regularly occupied study areas (KEPI, PAHR, MUDD, TOPO, BIWI, and ALAM). At TOPO, nest success and fecundity were low for the second consecutive year; no fledglings were produced in 2016. TOPO also has low sample sizes, and large interannual fluctuations in productivity are expected. Nest success and fecundity at BIWI, however, were essentially unchanged from 2014 and 2015.

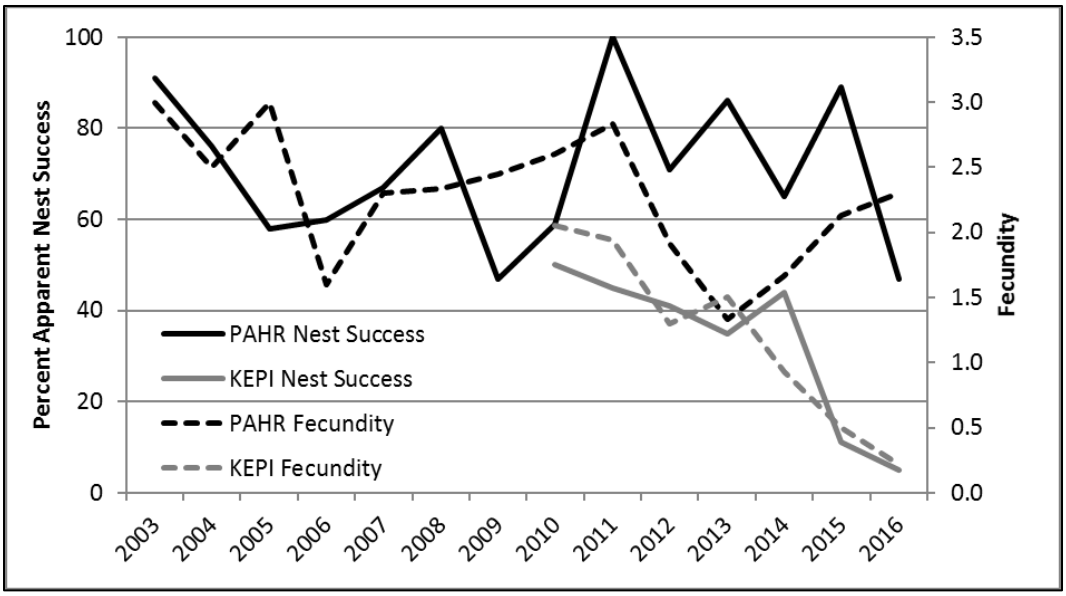



**Figure 4-3.—Annual apparent nest success and fecundity (number of young produced per adult female) at Key Pittman (KEPI) and Pahranagat (PAHR), 2003–16.**

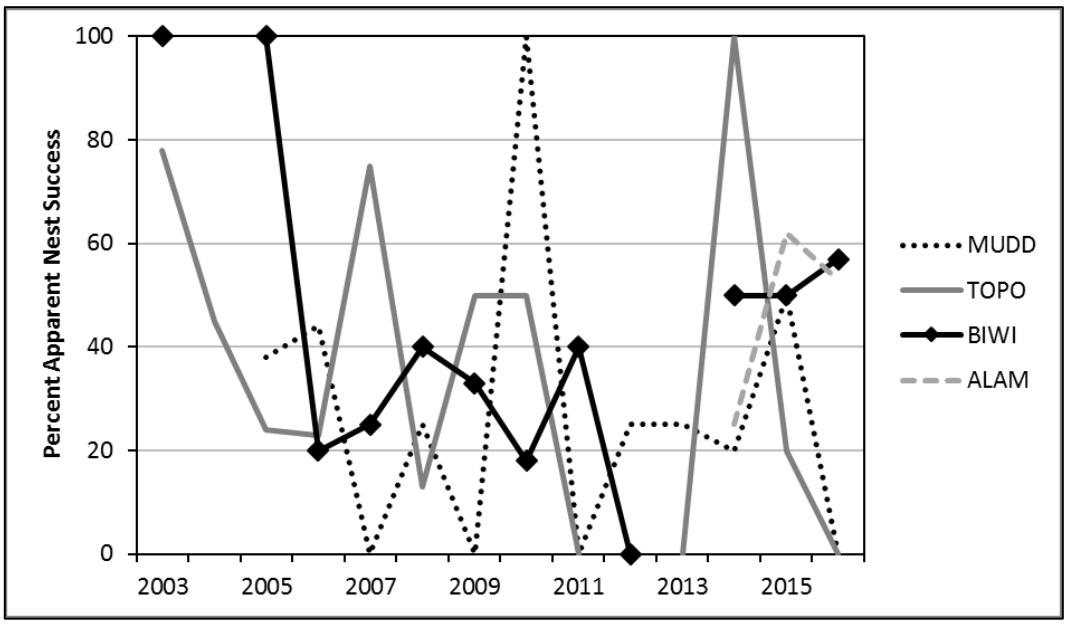



**Figure 4-4.—Annual percent apparent nest success at Muddy River (MUDD), Topock Marsh (TOPO), Bill Williams (BIWI), and Alamo Lake (ALAM), 2003–16.**

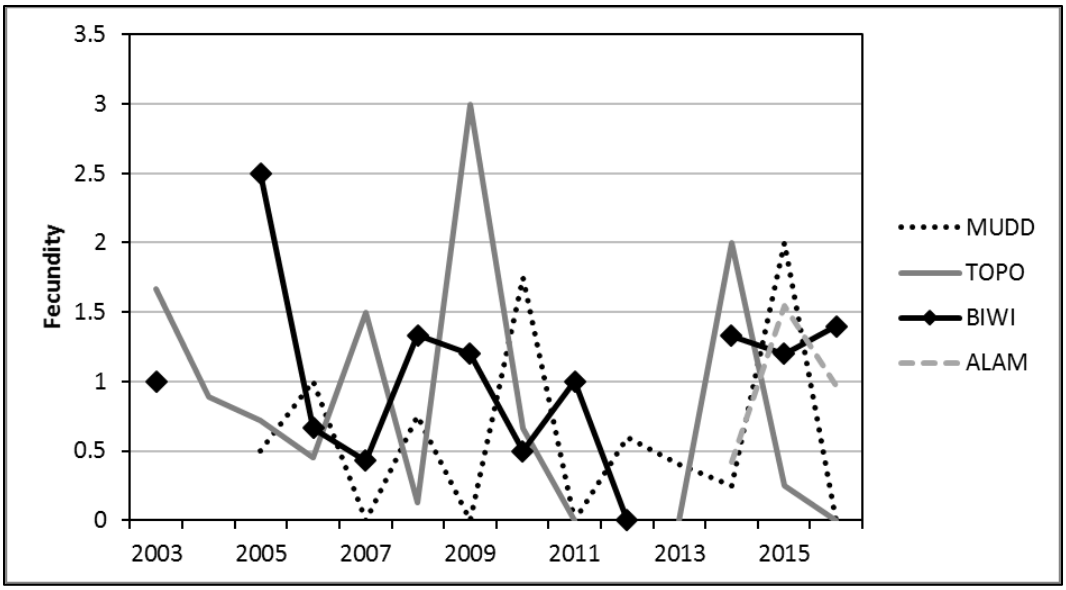



**Figure 4-5.—Annual fecundity at Muddy River (MUDD), Topock Marsh (TOPO), Bill Williams (BIWI), and Alamo Lake (ALAM), 2003–16.**

Nest success (53%) and fecundity (0.97 young/female) observed at ALAM in 2016 were intermediate between the levels observed in 2014 (25% and 0.42 young/female) and 2015 (62% and 1.55 young/female). Reproductive success at ALAM may be influenced by fluctuating habitat conditions. In 2014, soils throughout the study area were dry, median maximum daily temperatures at flycatcher nests were approximately 7–10 degrees Celsius (°C) hotter than at either BIWI or TOPO, and vapor pressure was typically 500–1,000 Pascals lower than at BIWI and TOPO (McLeod and Pellegrini 2015). In 2015, soils were damp and microclimate conditions more closely resembled those at BIWI and TOPO (McLeod and Pellegrini 2016). In 2016, soils at ALAM were again dry, but microclimate conditions were similar to those recorded in 2015 (see chapter 5).

## Nest Failure

Depredation was the leading cause of nest failure in 2016, as has been the case in previous years; this is consistent with the results reported in other studies at sites across Arizona (Graber et al. 2007; Graber and Koronkiewicz 2009; Ellis et al. 2008). The depredation rate was highest at KEPI, where depredation accounted for 88% of all failed nests. Nine of the 15 depredation events (60%) at KEPI occurred during the nestling phase; this is consistent with the trend observed over the last several years, with a high proportion of nests that were depredated at KEPI having failed during the nestling stage. In comparison, 34% of depredated nests failed during the nestling phase across the other study areas in 2003–15 (SWCA, unpublished data). Likely predators of nestling flycatchers at KEPI in recent years include a pair of Cooper's hawks (*Accipiter cooperii*), which have nested at

KEPI annually since 2013. Cooper's hawks may also reduce the fledgling survival rate in addition to depredating nestlings. Cooper's hawks were the primary nest predator documented in a nest camera study in central Arizona (Ellis et al. 2008). This study also determined that several nests were depredated late in the nesting cycle and would have been erroneously considered successful if traditional methods of determining nest success (nestlings present within 2 days of fledge date) were used. For open-cup nesting passerines, nest depredation rates can vary year to year, and sometimes substantially, with depredation of eggs and young ultimately linked to landscape characteristics and fluctuations in predator densities, abundance, and richness (Howlett and Stutchbury 1996; Robinson 1992; Wiens 1989). If productivity at KEPI continues to be low, with depredation during the nestling phase being a primary cause of nest failure, inspection of the Cooper's hawk nest and plucking posts to search for flycatcher remains and leg bands might provide evidence to implicate Cooper's hawks as predators of flycatcher nestlings.

## Brood Parasitism

The overall parasitism rate observed in 2016 (11%) was slightly higher than those reported at other monitored sites across Arizona in 1996–2006, which were less than 10% at most sites in most years (Ellis et al. 2008; Graber et al. 2007), and was essentially equal to that recorded in 2015 (12%). These rates are the lowest recorded in this study since monitoring began in 1997 (median 1997–2014 = 18.7%, range = 14.8–35.7%). The relatively low parasitism rates observed in 2015–16 probably do not indicate a change in the abundance or activities of cowbirds but rather reflect shifts in which study areas were monitored and the relative abundance of flycatchers at each area. The Mesquite study area on the Virgin River was not monitored in 2015–16; this study area typically had high parasitism rates, averaging 41.4% in 1997–2012. There were only two flycatcher nests annually in 2015 and 2016 at MUDD, which also typically had a very high parasitism rate, averaging 43.0% in 2005–14, while ALAM, which had a low parasitism rate (6.3–10.7% in 2014–16), accounted for over a third of all flycatcher nests with known parasitism status in 2015–16.

Only one instance of nest failure in 2016 was directly attributed to cowbirds (i.e., cowbird young outlived any flycatcher eggs or young, or the disappearance of all flycatcher eggs coincided with the appearance of cowbird eggs). However, cowbirds can influence flycatcher productivity in other ways. Cowbirds often eject a host egg during the parasitism event, reducing the host clutch size. Female cowbirds are known to physically attack willow flycatcher nestlings (Woodward and Stoleson 2002), remove single eggs, and occasionally destroy entire broods after laying is complete or after hatching (Lowther 1993). In addition, cowbirds were photographed removing eggs from artificial nests during a camera study completed in 2008–10 by Northern Arizona University at sites along the LCR and

in southern Nevada, and cowbirds were documented on video depredating flycatcher nests during both the incubation and nestling phases (Theimer et al. 2011). In the Virgin Valley, only cowbirds were documented depredating flycatcher nests. The Northern Arizona University camera study documented other avian predators at both artificial and flycatcher nests in other areas, with diversity of predators correlated to the diversity of the local avian community. While it is possible that other species, such as yellow-breasted chats (*Icteria virens*), are also responsible for some depredation events, it is likely that many depredation events on eggs and nestlings are attributable to cowbirds.

Parasitism does not invariably cause nest failure, but the success rate (15%) for parasitized nests at all study areas in 2003–16 was one-third that of unparasitized nests (49%; one-sided Fisher's exact test, $P < 0.001$). Similar results were recorded for willow flycatchers in Oregon, with parasitism resulting in a 50% decrease in success rates compared to unparasitized nests (Sedgwick and Iko 1999) and at other sites in Arizona, where in 1996–2005, 20% of parasitized nests fledged flycatcher young versus 57% of unparasitized nests (Ellis et al. 2008). Parasitized nests that did succeed in fledging flycatcher young at all study areas in 2003–16 produced on average fewer young (1.3 young/nest) than did unparasitized nests (2.2 young/nest; $F_{1,364} = 24.86$, $P < 0.001$). In addition to the female cowbird ejecting eggs during the parasitism event, cowbird young also cause interspecific nestling competition, as evidenced by the presence of severely underdeveloped nestlings in some parasitized nests. For all nests monitored from 2003 to 2016, 40% of nests that fledged a cowbird also fledged flycatcher young. This is a higher rate of success than that observed in flycatchers at Kern River, California (9%) (Whitfield and Sogge 1999), but comparable to that observed at other Arizona sites (40%) (Ellis et al. 2008).

Repeated parasitism events over a female flycatcher's lifetime can reduce lifetime productivity (McLeod and Pellegrini 2013). In addition, flycatchers that fledge late in the season have been shown to have a lower survival rate than those that fledge early in the season (McLeod and Pellegrini 2013; Paxton et al. 2007), suggesting additional hidden effects of parasitism and subsequent renesting on flycatcher demography. Across all study areas and all years through 2012, female flycatchers that were parasitized at least once during the season and still produced a successful nest had fledge dates that were, on average, 10 days later than successful females who were not parasitized. This 10-day delay corresponds to a reduced juvenile survival probability of approximately 6% (McLeod and Pellegrini 2013).

## Cowbird Egg Addling and Replacement

Prior to 2016, the hatch rate of cowbird eggs that were incubated for a minimum of 10 days and that were not addled was 67% (36 of 54 eggs) across all years and

study areas. In contrast, only 26% (5 of 19 eggs) of the cowbird eggs that were shaken hatched after a minimum of 10 days of incubation, and it was apparent that addling cowbird eggs significantly reduced the cowbird hatch rate (Pearson chi-square = 18.1, $P < 0.001$; difference in proportions = 0.40, 95% lower bound = 0.15). In 2016, only one cowbird egg was addled, and it did not hatch. Replacing cowbird eggs with artificial eggs eliminates the possibility of cowbird eggs hatching, and field personnel replaced one cowbird egg with a fake egg. Although this nest was ultimately deserted, the female flycatcher continued to incubate the nest for several days after the egg was replaced, and it is unlikely that egg replacement caused nest failure. Continuing to replace cowbird eggs with artificial eggs in the future is a viable option.

# Chapter 5 – Nest Site Characteristics

## INTRODUCTION

It is apparent that flycatchers along the LCR and its tributaries typically select territories and nest sites that are in close proximity to surface water (McLeod and Pellegrini 2013). This preference for surface water has been demonstrated with flycatcher populations in the Cliff-Gila Valley (Stoleson and Finch 2003) and along the Gila and San Pedro Rivers (Paradzick 2005). Paradzick and Woodward (2003) also found that the majority of occupied sites in Arizona from 1993 to 2000 were less than 50 m from water. Despite the general knowledge that flycatchers are drawn to surface water, relatively few data are available regarding the persistence of water at occupied areas throughout the breeding season, though Whitfield and Enos (1996) noted that most breeding areas dried up before young fledged. To broaden the understanding of the patterns of inundation throughout the breeding season, surface water conditions were documented periodically throughout the nesting cycle for each flycatcher nest. General information on each nest was gathered, such as nesting substrate and percentage of the vegetation around the nest that consisted of tamarisk. This percentage estimate provides a qualitative assessment of the potential impact of tamarisk defoliation on each nesting attempt. In addition, temperature and humidity were measured via data loggers at nests that progressed to the incubation phase at TOPO, BIWI, and ALAM. These data will add to the database describing conditions in occupied flycatcher territories and also provide measures of temperature and humidity with which data collected concurrently at conservation areas can be compared.

## METHODS

### Surface Hydrology

Surface hydrology was described near all active nests two to three times during the life of each nest. Descriptions included conditions of soil moisture at the nest (inundated, saturated, damp, or dry), depth of water at the nest (if any, to the nearest centimeter or nearest 5 cm if > 5 cm), distance from the nest to wet soils (inundated or saturated soil, to the nearest meter), and the percent of the area within 20 and 50 m of the nest that contained wet soils (to the nearest 5%). As described in chapter 2, soil moisture categories were qualitatively determined as follows: inundated soils were those that had water visible on the surface; soils were considered saturated if compression of the soil (e.g., by stepping on it) caused water to be expressed; soils were considered dry if squeezing a handful of soil did not result in the soil sticking together; and damp soils were any that did not have surface water and did not meet the criteria for either saturated or dry (i.e., compressing a handful of soil caused the soil to stick together, but no water

was expressed). Estimates of distance to wet soils were determined by one of three methods: (1) a visual estimate in the field (if wet soils were visible from the nest), (2) using a Global Positioning System (GPS) unit in the field (finding the nearest wet soil, recording the GPS location, and setting the GPS unit to navigate back to the nest, thus displaying distance from wet soils back to the nest), or (3) by measuring on a georeferenced aerial photograph (either on a hard-copy aerial photo or by using the measuring tool in Google Earth or Pathfinder). The percentages of the area within 20 and 50 m of the nest that contained wet soils were estimated either visually in the field or, more often, by using on-the-ground knowledge of surface hydrology coupled with an aerial photograph to help with visualizing the area encompassed within a 20- or 50-m-radius circle around the nest. These data were scheduled to be collected when the nest was found, at the nest check before the estimated hatch day (or, if estimated hatch day was unknown, the nest check when nestlings were first detected), and again at fledge or failure. If a nest failed during laying or incubation or was found with nestlings, only two measurements of surface hydrology were collected.

At Muddy River, wet soils have been confined to the river channel itself in recent years, and the linear distribution of these soils seems to lead observers to overestimate the percentage of wet soils in the vicinity of the nest. A shapefile of the river channel was generated using aerial imagery in ESRI® ArcMap v. 10.2. These shapefiles were overlain with 20- and 50-m buffers around each nest location. The areas where the two layers intersected were extracted, and the percentage of each buffer that intersected the water mapping shapefile was calculated. Field estimates were compared with the water mapping estimates, and in instances in which the difference between the two was more than 10%, the water mapping estimate was selected for inclusion in the final dataset.

## Vegetation

At each nest, the species of tree or shrub in which the nest was placed (nest substrate) was recorded as well as a visual estimate of the percentage of vegetation volume that consisted of tamarisk within 2 and 5 m of the nest. These two distances were chosen to try to assess, in the event of defoliation by tamarisk beetles, whether the level of defoliation in the immediate vicinity of the nest (2 m) or in the more general vicinity (5 m) had a greater influence on nest success and microclimate. It is typically not possible to see more than 5 m, so the percentage of tamarisk was not estimated at distances > 5 m. One of the following vegetation types was also assigned to each nest based on the foliage volume of the plant species present within 5 m of the nest:

TAMSPP = > 75% tamarisk

SALGOO = > 75% Goodding's willow

SALEXI = > 75% coyote willow

POPFRE = > 75% cottonwood
TAMSPP_SALEXI = tamarisk and coyote willow mix, neither > 75%
SALGOO_POPFRE = Goodding's willow and cottonwood mix, neither > 75%
TAMSPP_SALGOO = tamarisk with emergent Goodding's willow
SALGOO_TAMSPP = Goodding's willow overstory with tamarisk understory
OTHER = a vegetation type that does not fit one of the above descriptions

## Temperature and Humidity

A Hygrochron iButton (Maxim Integrated, San Jose, California) was deployed at each flycatcher nest that was confirmed to be in the incubation phase at TOPO, BIWI, and ALAM. The iButton was mounted on a key fob and hung in an inconspicuous location, no higher than 2 m above the ground but below nest height, and within 2 m horizontal distance of the nest. The loggers recorded temperature and relative humidity every 30 minutes and remained in place until the end of the breeding season.

## Statistical Analyses

Temperature and humidity data were truncated to the midnight after the logger was deployed and the midnight before the logger was removed so that only full 24-hour periods were represented. Temperature (T, °C) and relative humidity (RH) were converted to vapor pressure[1] (VP, Pascals) as follows:

$$VP = RH*(610.7*10^{((7.5*T)/(237.3+T))})/100$$

The following temperature and humidity variables were calculated for each logger:

Maximum daily temperature
Minimum nocturnal temperature
Daily temperature range (diurnal maximum minus nocturnal minimum)
Mean diurnal vapor pressure
Mean nocturnal vapor pressure

Times from 0530 to 2000 hours were assigned as day and all others as night. Each variable was summarized over 2-week periods by study area and by vegetation type within each study area. The SE for each 2-week period for each variable was calculated using each daily measurement from each logger as an

[1] Vapor pressure, unlike relative humidity, is not influenced by ambient temperature and may be a more biologically meaningful measure of water content of the air (e.g., the relative vapor pressure inside and outside an egg determines whether the egg loses moisture).

independent observation. Daily summary data were not always normally distributed, and median data are presented in graphs showing daily summary data. Analyses of temperature and humidity and a summary of vegetation data were completed in IBM ® SPSS ® v. 22.0.

# RESULTS

## Surface Hydrology

Soil moisture conditions were described up to 4 times during the season at 98 flycatcher nests in 8 study areas: KEPI (19 nests), RIRA (3 nests), PAHR (19 nests), MVWA (4 nests), MUDD (2 nests), TOPO (6 nests), BIWI (8 nests), and ALAM (37 nests). Although the intention was to record these data up to three times, soil moisture data were collected four times at two nests when estimates were recorded on two different days for the same nest stage. When this occurred, the estimate further from the transition date was removed from the dataset. Soil moisture conditions were described at 94 of the 98 nests within 1 week of the nest being found; 58 were found during building, 8 during laying, 20 during incubation, 6 with nestlings, and 2 after they had been deserted.

All measures of surface hydrology at KEPI showed a gradual drying trend through the breeding season (figure 5-1). Water in Nesbitt Lake declined gradually from unusually high levels in May, and there were no noticeable daily fluctuations in lake levels during the breeding season (see chapter 2); thus, no nest was more than 9 m from wet soils at any point in the nesting cycle. Of the 50 estimates of soil condition at nests in KEPI, 33 (66%) were of saturated or inundated soils, 16 (32%) were of damp soils, and 1 (2%) noted dry soils. RIRA showed a more pronounced drying trend, with the distance to wet soils increasing from a few meters in June to over 200 m in late July (figure 5-1). This pattern is consistent with field personnel observations that the RIRA study area was very wet until irrigation was turned off for 2–3 weeks starting in mid-June (see chapter 2). Of the seven estimates of soil conditions at nests at RIRA, two (29%) were of damp soils, and five (71%) were of dry soils. At PAHR, a slight drying trend was observed through the season in all measures of surface hydrology, though the distance to wet soils was less than 10 m throughout the life of the nest at all but 1 of the 19 nests (figure 5-2). This drying trend is consistent with the declining water levels measured in Upper Pahranagat Lake over the breeding season (see figures 2-4 and 2-5). Of the 48 estimates of soil conditions at nests at PAHR, 39 (81%) were of saturated or inundated soils, 8 (17%) were of damp soils, and 1 (2%) was of dry soils. Surface hydrology conditions at MVWA showed no obvious change through the season. Most nests were over dry or damp soils, and distance to wet soils was < 15 m when measurements were recorded at all nests (figure 5-2).

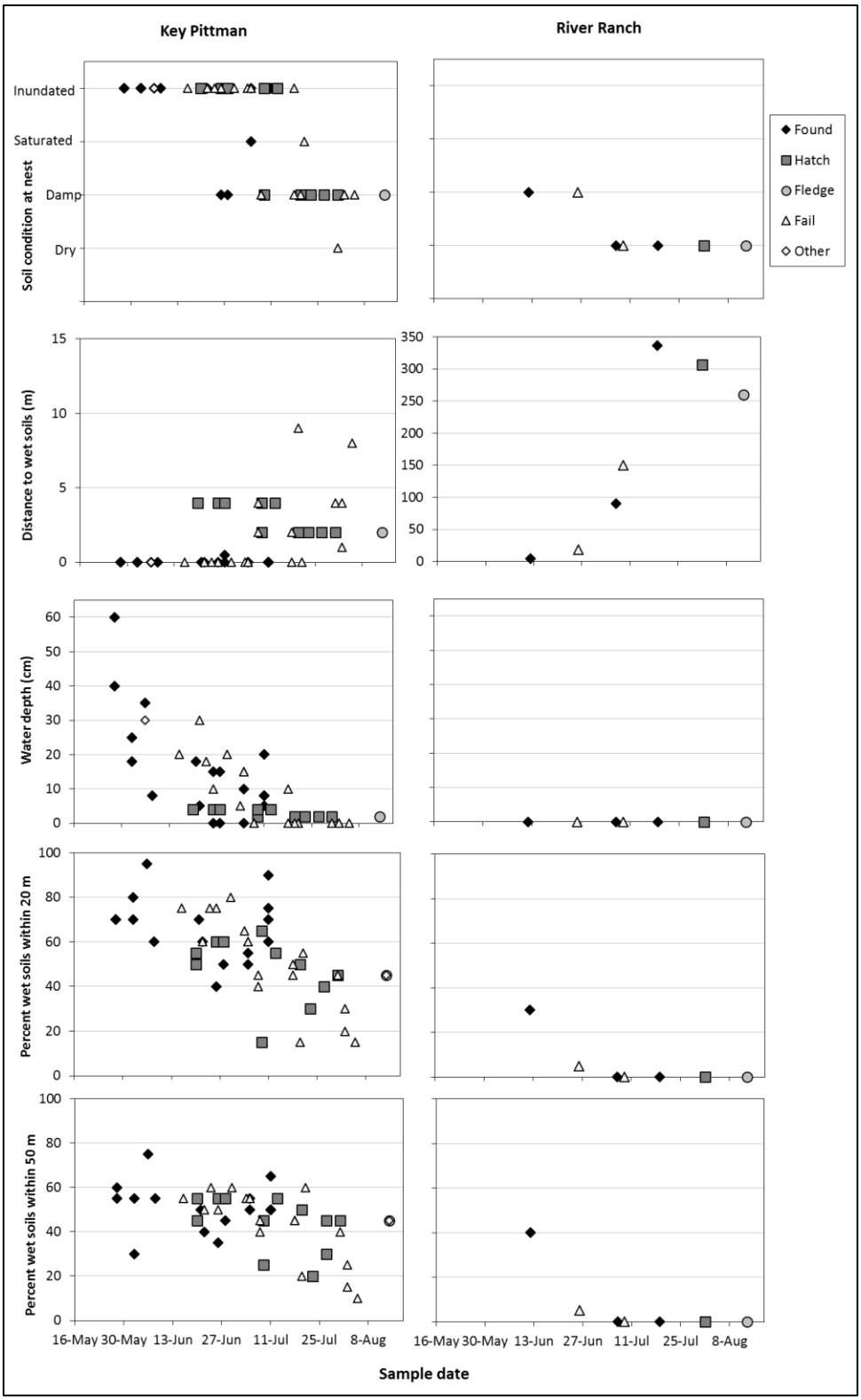



**Figure 5-1.—Soil moisture characteristics at southwestern willow flycatcher nests at Key Pittman (n = 19) and River Ranch (n = 3), 2016.**

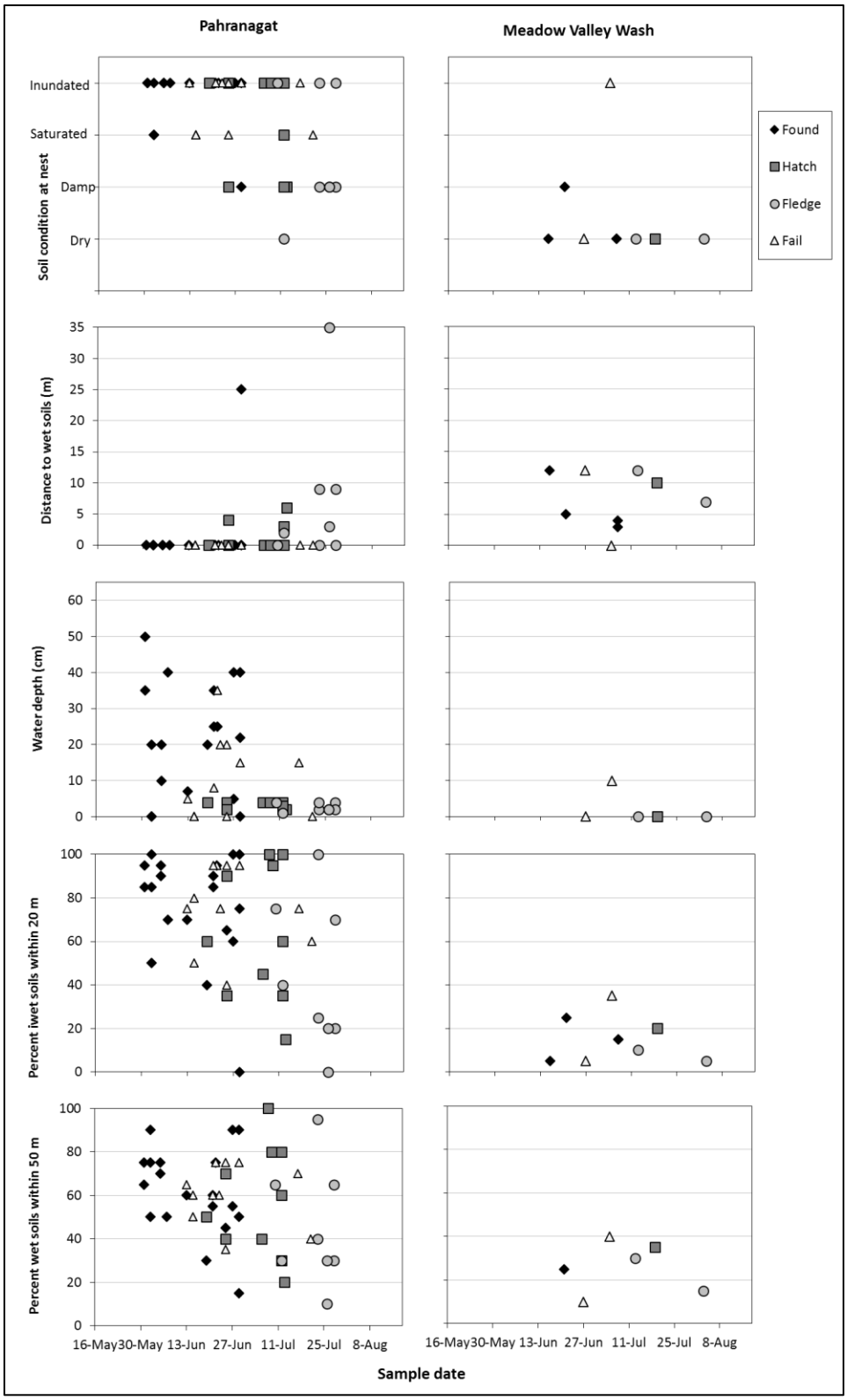



**Figure 5-2.—Soil moisture characteristics at southwestern willow flycatcher nests at Pahranagat (n = 19) and Meadow Valley Wash (n = 4), 2016.**

At MUDD, all field observations resulted in an over-estimate of wet soil extent, though some observers were able to estimate wet soil extent to within 10% of the water mapping values. Of the eight estimates, six (75%) were generated from water mapping. Areal extent of water did not change through the season at MUDD, as all surface water and saturated soils were contained in the narrow river channel (see chapter 2). Consequently, even though both nests at MUDD were located over surface water throughout the season, the extent of wet soils in the vicinity of each nest was small (figure 5-3). Depth of surface water below each nest varied in accordance with river depth (figure 5-3).

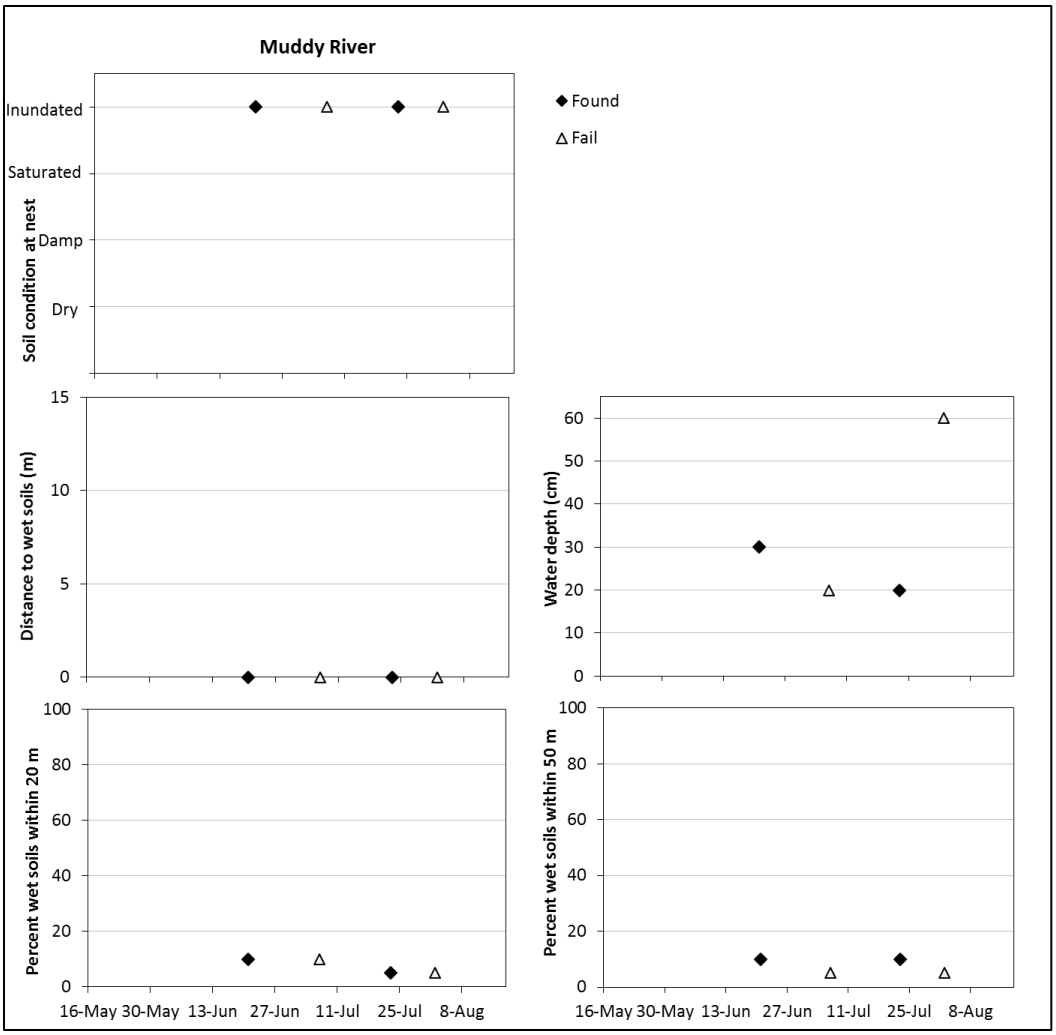



**Figure 5-3.—Soil moisture characteristics at southwestern willow flycatcher nests at Muddy River (n = 2), 2016.**

At TOPO, only one nest was located over wet soils, but distance to wet soils never exceeded 30 m (figure 5-4). No seasonal trends in surface hydrology were apparent in the data (figure 5-4), although marsh levels declined gradually over the breeding season (see figure 2–6). Of the 11 estimates of soil condition at TOPO, 1 (9%) was of inundated soils, 2 (18%) were of saturated soils, and 8 (73%) were of dry soils. No seasonal trends in surface hydrology were apparent at BIWI (figure 5-4). All nests at BIWI were in sites where water levels depend on the level of Lake Havasu, which fluctuated but showed no trend during the summer months (see figure 2-7). ALAM was the driest study area with breeding flycatchers in 2016, with only 2 of the 92 estimates (2%) noting damp soils beneath nests and all other estimates noting dry soils. Soil conditions did not fluctuate between estimates aside from temporarily damp soils caused by overnight rain (see chapter 2). Distance to known standing water varied from 22 m to 1.6 km. The median distance to water for all nests was 908 m and did not vary through the breeding season. Because of the extremely dry conditions in this study area, the data are not presented graphically.

## Vegetation

Vegetation characteristics were recorded at 98 flycatcher nests (19 at KEPI, 3 at RIRA, 19 at PAHR, 4 at MVWA, 2 at MUDD, 6 at TOPO, 8 at BIWI, and 37 at ALAM; table 5-1). Nests were built in coyote willows (26%), Goodding's willows (35%), cottonwoods (4%), tamarisk (33%), velvet ash (1%), Indian hemp (1%), and downed branches (1%). No tamarisk foliage was present within 5 m of any nest at RIRA or PAHR. Tamarisk foliage was present to some extent within 5 m of each nest location at MUDD (range = 70–80%), TOPO (range = 50–100%), and BIWI (100%). Tamarisk foliage was present within 5 m of only 1 of the 19 nests at KEPI, while at MVWA, tamarisk foliage was present within 5 m of 3 of the 4 nests (range = 10–35%). At ALAM, tamarisk foliage was present within 5 m of 30 of the 37 nests (range = 5–95%). Of the study areas with tamarisk present in the vicinity of a nest location, KEPI, MVWA, and ALAM had low median percentages of tamarisk within 5 m of flycatcher nests (0, 12.5, and 15%, respectively) while MUDD, TOPO, and BIWI had higher percentages of tamarisk within 5 m of nests (75, 80, and 100%, respectively; see table 5-1).

## Temperature and Humidity

An iButton was deployed at 1 nest at TOPO, 7 nests at BIWI, and 30 nests at ALAM. The loggers were deployed between late May and mid-July and remained in place until early August. One data logger at BIWI did not launch; all other data loggers functioned properly. Nests where loggers were deployed

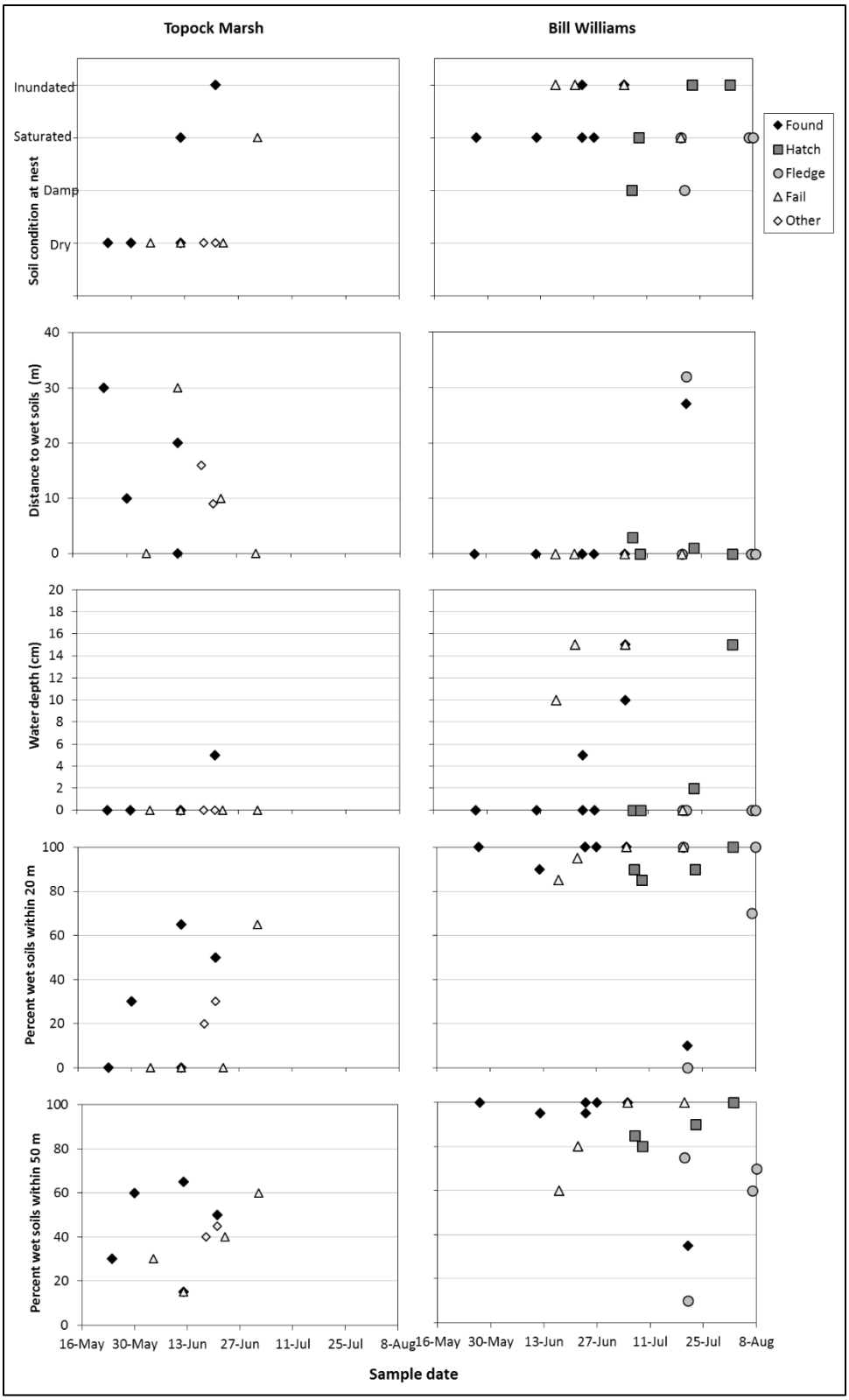



**Figure 5-4.—Soil moisture characteristics at southwestern willow flycatcher nests at Topock Marsh (n = 6) and Bill Williams (n = 8), 2016.**

Table 5-1.—Tally of nests by nest substrate and percentage of tamarisk at southwestern willow flycatcher nests by vegetation type in all study areas, 2016

| Study area[1] | Vegetation type[2] | Nest substrate | | | | | % TAMSPP within 2 m | | % TAMSPP within 5 m | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | SALEXI | SALGOO | POPFRE | TAMSPP | OTHER | Median (25th–75th percentile) | Mean (SE) | Median (25th–75th percentile) | Mean (SE) |
| KEPI | SALEXI (n = 17) | 17 | 0 | 0 | 0 | 0 | 0.0 (0.0–0.0) | 0.0 (0.0) | 0.0 (0.0–0.0) | 0.0 (0.0) |
| | OTHER[3] (n = 2) | 2 | 0 | 0 | 0 | 0 | 10.0 (0.0–20.0) | 10.0 (10.0) | 10.0 (0.0–20.0) | 10.0 (10.0) |
| | **Total** | **19** | **0** | **0** | **0** | **0** | **0.0 (0.0–0.0)** | **1.1 (1.1)** | **0.0 (0.0–0.0)** | **1.1 (1.1)** |
| RIRA | SALEXI (n = 3) | 3 | 0 | 0 | 0 | 0 | 0.0 (0.0–0.0) | 0.0 (0.0) | 0.0 (0.0–0.0) | 0.0 (0.0) |
| | **Total** | **3** | **0** | **0** | **0** | **0** | **0.0 (0.0–0.0)** | **0.0 (0.0)** | **0.0 (0.0–0.0)** | **0.0 (0.0)** |
| PAHR | POPFRE (n = 5) | 0 | 0 | 4 | 0 | 1[4] | 0.0 (0.0–0.0) | 0.0 (0.0) | 0.0 (0.0–0.0) | 0.0 (0.0) |
| | SALGOO (n = 14) | 0 | 13 | 0 | 0 | 1[5] | 0.0 (0.0–0.0) | 0.0 (0.0) | 0.0 (0.0–0.0) | 0.0 (0.0) |
| | **Total** | **0** | **13** | **4** | **0** | **2** | **0.0 (0.0–0.0)** | **0.0 (0.0)** | **0.0 (0.0–0.0)** | **0.0 (0.0)** |
| MVWA | POPFRE (n = 1) | 1 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | SALEXI (n = 1) | 1 | 0 | 0 | 0 | 0 | 10.0 | 10.0 | 10.0 | 10.0 |
| | OTHER[6] (n = 2) | 0 | 0 | 0 | 1 | 1[7] | 40.0 (35.0–45.0) | 40.0 (5.0) | 25.0 (15.0–35.0) | 25.0 (10.0) |
| | **Total** | **2** | **0** | **0** | **1** | **1** | **22.5 (5.0–40.0)** | **22.5 (10.5)** | **12.5 (5.0–25.0)** | **15.0 (7.4)** |
| MUDD | TAMSPP (n = 1) | 0 | 0 | 0 | 1 | 0 | 70.0 | 70.0 | 80.0 | 80.0 |
| | TAMSPP_SALEXI (n = 1) | 1 | 0 | 0 | 0 | 0 | 50.0 | 50.0 | 70.0 | 70.0 |
| | **Total** | **1** | **0** | **0** | **1** | **0** | **60.0 (50.0–70.0)** | **60.0 (10.0)** | **75.0 (70.0–80.0)** | **75.0 (5.0)** |

Table 5-1.—Tally of nests by nest substrate and percentage of tamarisk at southwestern willow flycatcher nests by vegetation type in all study areas, 2016

| Study area[1] | Vegetation type[2] | Nest substrate | | | | | % TAMSPP within 2 m | | % TAMSPP within 5 m | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | SALEXI | SALGOO | POPFRE | TAMSPP | OTHER | Median (25th–75th percentile) | Mean (SE) | Median (25th–75th percentile) | Mean (SE) |
| TOPO | TAMSPP (n = 5) | 0 | 0 | 0 | 5 | 0 | 100.0 (100.0–100.0) | 100.0 (0.0) | 80.0 (80.0–100.0) | 87.0 (5.0) |
| | TAMSPP_SALGOO (n = 1) | 0 | 0 | 0 | 1 | 0 | 80.0 | 80.0 | 50.0 | 50.0 |
| | **Total** | **0** | **0** | **0** | **6** | **0** | **100.0 (100.0-100.0)** | **96.7 (3.3)** | **80.0 (75.0-100.0)** | **80.8 (7.6)** |
| BIWI | TAMSPP (n = 8) | 0 | 0 | 0 | 8 | 0 | 100.0 (100.0-100.0) | 100.0 (0.0) | 100.0 (100.0-100.0) | 100.0 (0.0) |
| | **Total** | **0** | **0** | **0** | **8** | **0** | **100.0 (100.0–100.0)** | **100.0 (0.0)** | **100.0 (100.0–100.0)** | **100.0 (0.0)** |
| ALAM | SALGOO (n = 18) | 0 | 18 | 0 | 0 | 0 | 5.0 (0.0-5.0) | 3.9 (1.0) | 5.0 (0.0-10.0) | 5.3 (1.4) |
| | SALGOO_TAMSPP (n = 12) | 0 | 2 | 0 | 10 | 0 | 65.0 (30.0-82.5) | 57.9 (9.0) | 60.0 (30.0-70.0) | 53.8 (7.0) |
| | TAMSPP (n = 4) | 0 | 0 | 0 | 4 | 0 | 97.5 (95.0-100.0) | 97.5 (1.4) | 92.5 (85.0-95.0) | 90.0 (3.5) |
| | TAMSPP_SALGOO (n = 2) | 0 | 0 | 0 | 2 | 0 | 90.0 (80.0-100.0) | 90.0 (10.0) | 70.0 (65.0-75.0) | 70.0 (5.0) |
| | OTHER[8] (n = 1) | 0 | 1 | 0 | 0 | 0 | 60.0 | 60.0 | 40.0 | 40.0 |
| | **Total** | **0** | **21** | **0** | **16** | **0** | **10.0 (5.0-80.0)** | **37.7 (6.5)** | **15.0 (5.0-65.0)** | **34.6 (5.6)** |

[1] KEPI = Key Pittman, RIRA = River Ranch, PAHR = Pahranagat, MVWA = Meadow Valley Wash, MUDD = Muddy River, WMSP = Warm Springs, TOPO = Topock Marsh, BIWI = Bill Williams, and ALAM = Alamo Lake.

[2] POPFRE = > 75% cottonwood; SALEXI = > 75% coyote willow; SALGOO = > 75% Goodding's willow; SALGOO_POPFRE = Goodding's willow and cottonwood mix, neither > 75%; SALGOO_TAMSPP = Goodding's willow overstory with tamarisk understory; TAMSPP = > 75% tamarisk; TAMSPP_SALEXI = tamarisk and coyote willow mix, neither > 75%; TAMSPP_SALGOO = tamarisk with emergent Goodding's willow; and OTHER = a vegetation type that does not fit one of the above descriptions.

[3] Mix of coyote willow, cottonwood, and tamarisk.

[4] Downed, leafless branch.

[5] Indian hemp.

[6] Velvet ash overstory with tamarisk understory.

[7] Velvet ash.

[8] Mix of cottonwood, Goodding's willow, and tamarisk.

were located in four different vegetation types (see "Vegetation" in the "Methods" section above). At TOPO and BIWI, all nests where loggers were deployed were in TAMSPP. At ALAM, 17 nests were in SALGOO, 8 were in SALGOO_TAMSPP, 4 were in TAMSPP, and 1 was in TAMSPP_SALGOO. Microclimate data were recorded at only one nest at TOPO, and the low sample size precludes drawing meaningful comparisons between TOPO and other study areas. Mean and median maximum daily temperatures at nests at ALAM were generally 3–4 °C higher than at nests at BIWI (attachment 9; figures 5-5 and 5-6), while minimum temperatures were less variable between study areas, typically being 1–2 °C higher at BIWI than at ALAM (see attachment 9; figures 5-7 and 5-8). Because high temperatures were higher and low temperatures were lower at ALAM versus BIWI, daily temperature ranges were also greater at ALAM than at BIWI (see attachment 9; figures 5-9 and 5-10). Both diurnal and nocturnal vapor pressure were lower at ALAM than at BIWI (see attachment 9; figures 5-11 to 5-14).

Maximum daily temperatures in SALGOO at ALAM were cooler and varied less among nests than in other vegetation types at ALAM (see attachment 9; figures 5-5 and 5-6). Minimum daily temperatures and vapor pressure did not differ among vegetation types at ALAM.

# DISCUSSION

## Surface Hydrology

Surface soil moisture conditions did not fluctuate from day to day at any of the study areas where flycatcher nests were found; therefore, surface soil moisture conditions that were recorded within a week of a nest being found in the building stage closely represent the conditions present when the nest location was selected by the flycatcher. This was the case for 58 of 94 nests in all study areas. Hydrological conditions near nests remained constant through the season at both ALAM and MUDD (see chapter 2), and surface soil moisture conditions described at these study areas for nests after they were found (20 nests at ALAM, 1 nest at MUDD) are thus representative of the conditions that were present when the nest site was selected. Of these 79 nests where surface soil moisture conditions were known at the time the nest site was selected, 40 (51%) were built within 5 m of standing water or saturated soil, and an additional 5 nests (6%) were within 30 m of water. All 34 nests that were not within 30 m of wet soils were at ALAM, where the vast majority of suitable riparian vegetation was much greater than 30 m from wet soils.

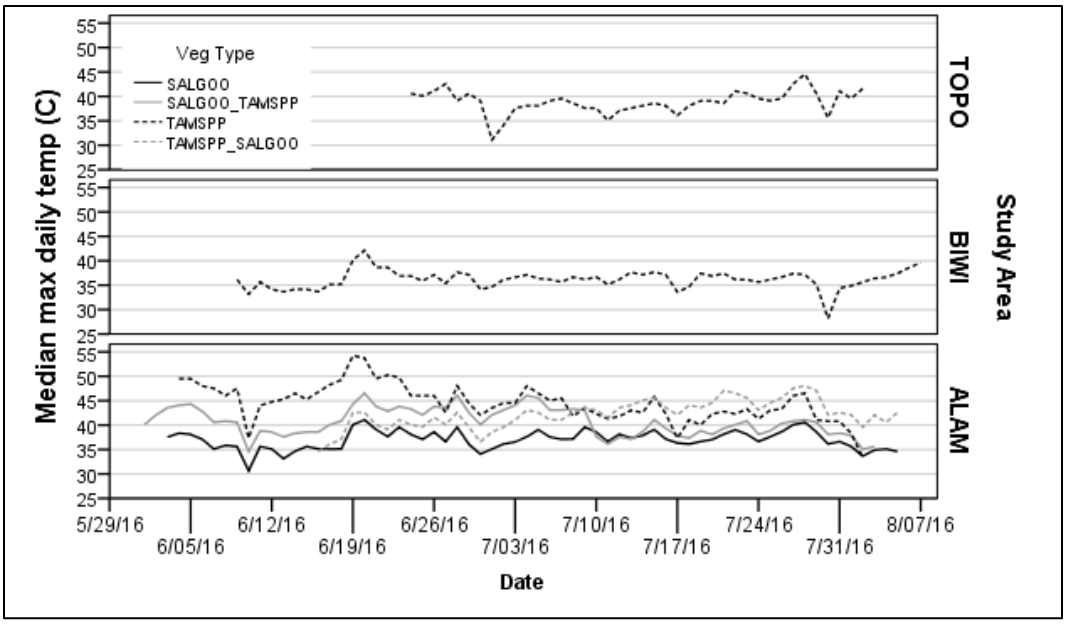



**Figure 5-5.—Median maximum daily temperature by vegetation type at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016.**
Topock Marsh (TOPO; TAMSPP = > 75% tamarisk, n = 1), Bill Williams (BIWI; n = 6), and Alamo Lake (ALAM; SALGOO = > 75% Goodding's willow, n = 17; SALGOO_TAMSPP = Goodding's willow overstory with tamarisk understory, n = 8; TAMSPP, n = 4; and TAMSPP_SALGOO = tamarisk with emergent Goodding's willow, n = 1).

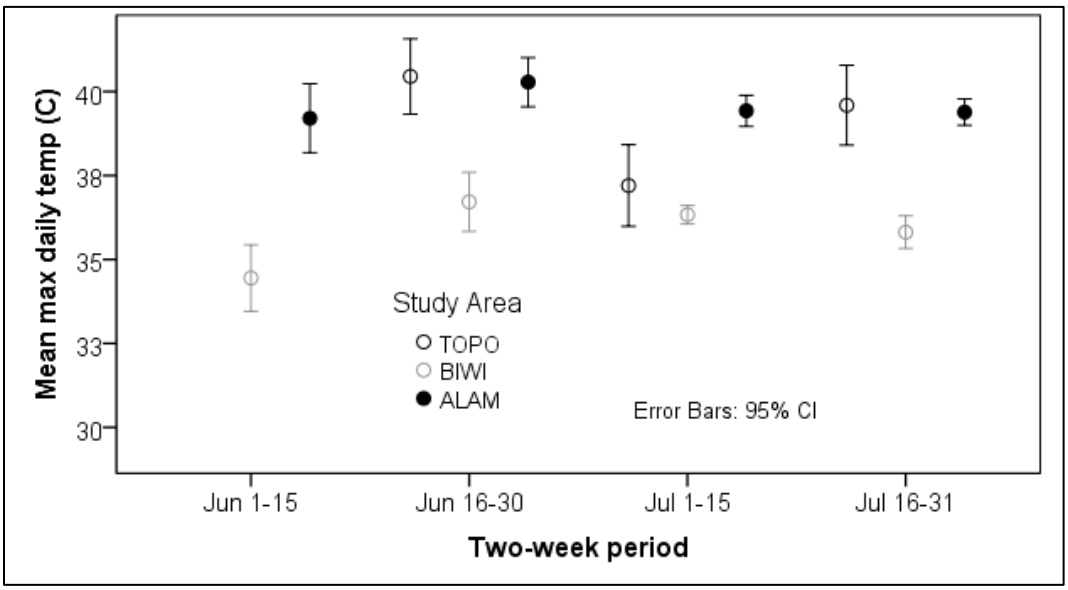



**Figure 5-6.—Mean maximum daily temperature and 95% confidence intervals over 2-week periods by study area at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016.**
Topock Marsh (TOPO, n = 1), Bill Williams (BIWI, n = 6), and Alamo Lake (ALAM, n = 30).

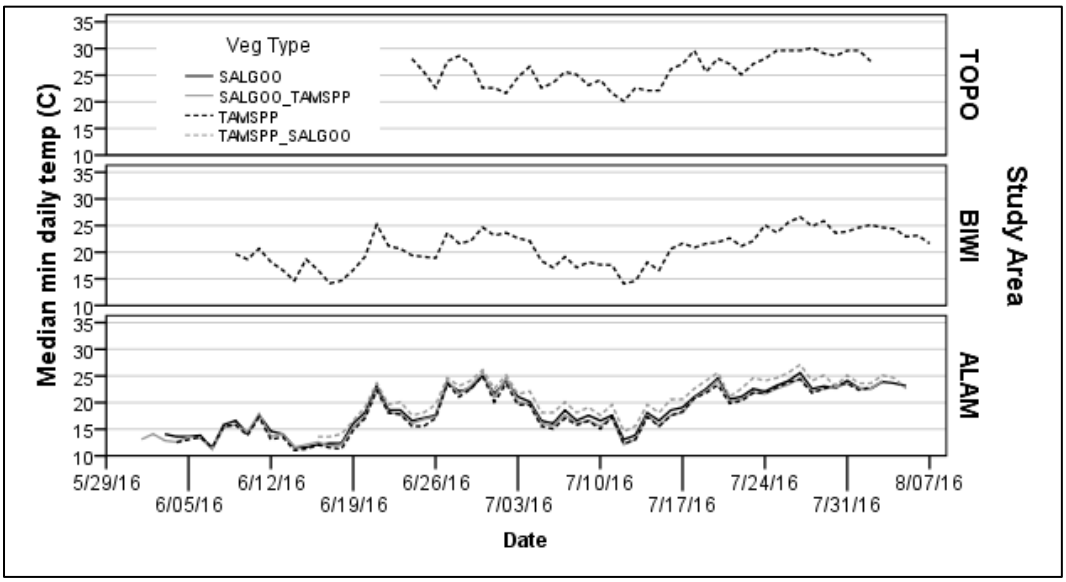



**Figure 5-7.—Median minimum daily temperature by vegetation type at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016.**
Topock Marsh (TOPO; TAMSPP = > 75% tamarisk, n = 1), Bill Williams (BIWI; n = 6), and Alamo Lake (ALAM; SALGOO = > 75% Goodding's willow, n = 17; SALGOO_TAMSPP = Goodding's willow overstory with tamarisk understory, n = 8; TAMSPP, n = 4; and TAMSPP_SALGOO = tamarisk with emergent Goodding's willow, n = 1).

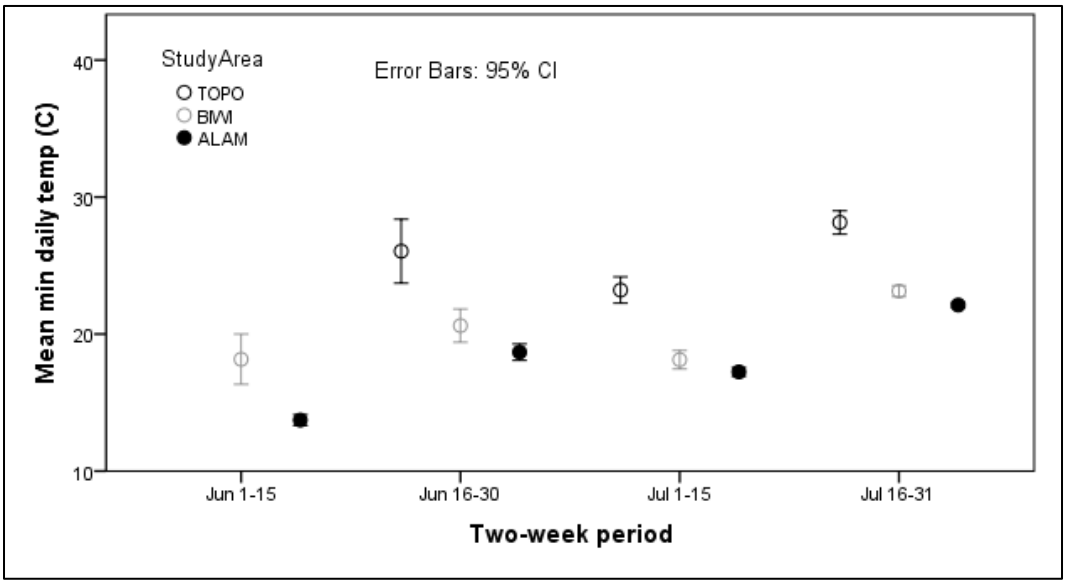



**Figure 5-8.—Mean minimum daily temperature and 95% confidence intervals over 2-week periods by study area at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016.**
Topock Marsh (TOPO, n = 1), Bill Williams (BIWI, n = 6), and Alamo Lake (ALAM, n = 30).

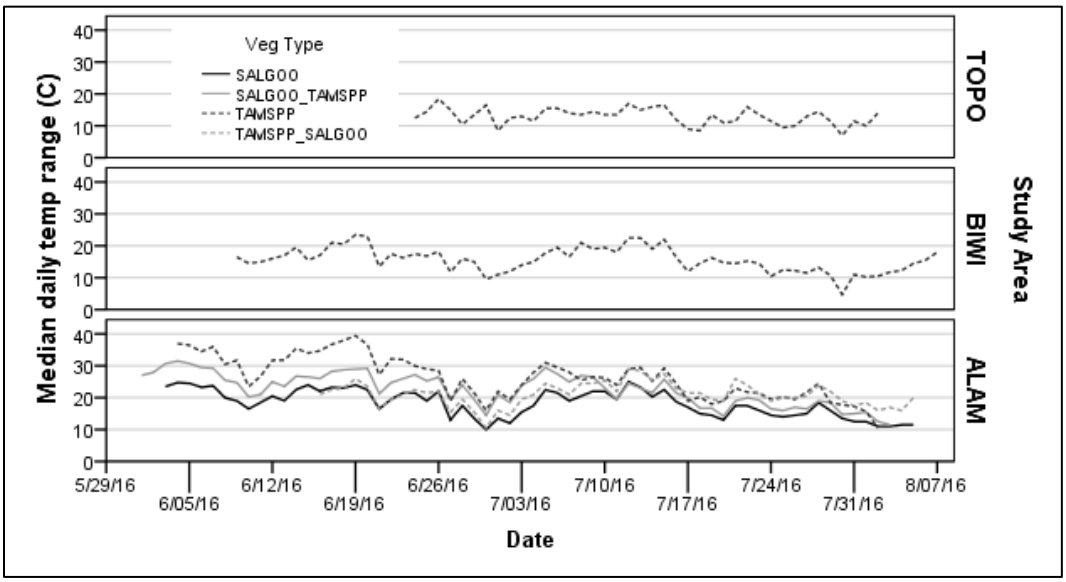



**Figure 5-9.—Median daily temperature range by vegetation type at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016.**
Topock Marsh (TOPO; TAMSPP = > 75% tamarisk, n = 1), Bill Williams (BIWI; n = 6), and Alamo Lake (ALAM; SALGOO = > 75% Goodding's willow, n = 17; SALGOO_TAMSPP = Goodding's willow overstory with tamarisk understory, n = 8; TAMSPP, n = 4; and TAMSPP_SALGOO = tamarisk with emergent Goodding's willow, n = 1).

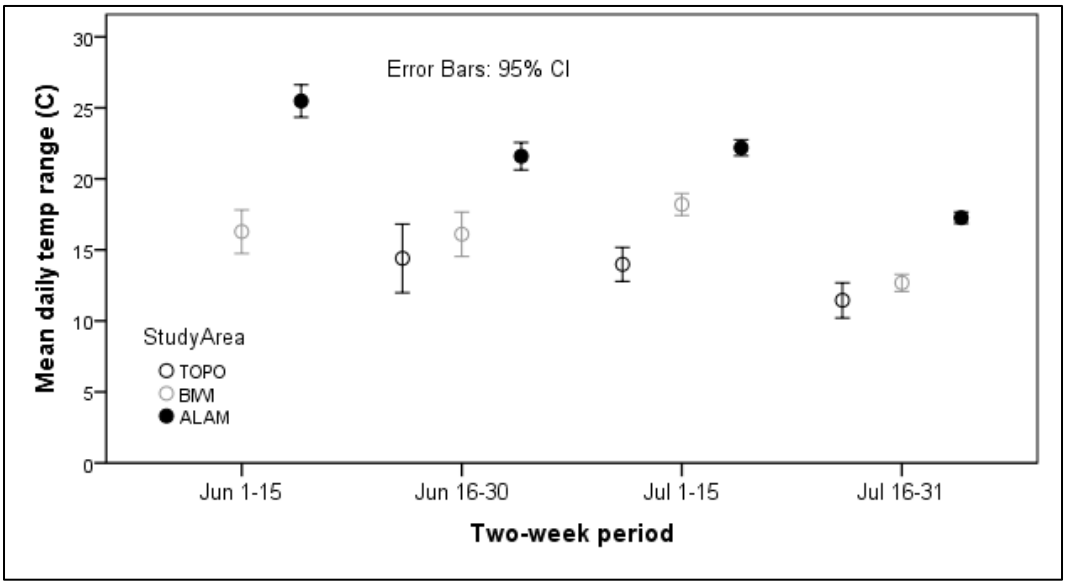



**Figure 5-10.—Mean daily temperature range and 95% confidence intervals over 2-week periods by study area at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016.**
Topock Marsh (TOPO, n = 1), Bill Williams (BIWI, n = 6), and Alamo Lake (ALAM, n = 30).

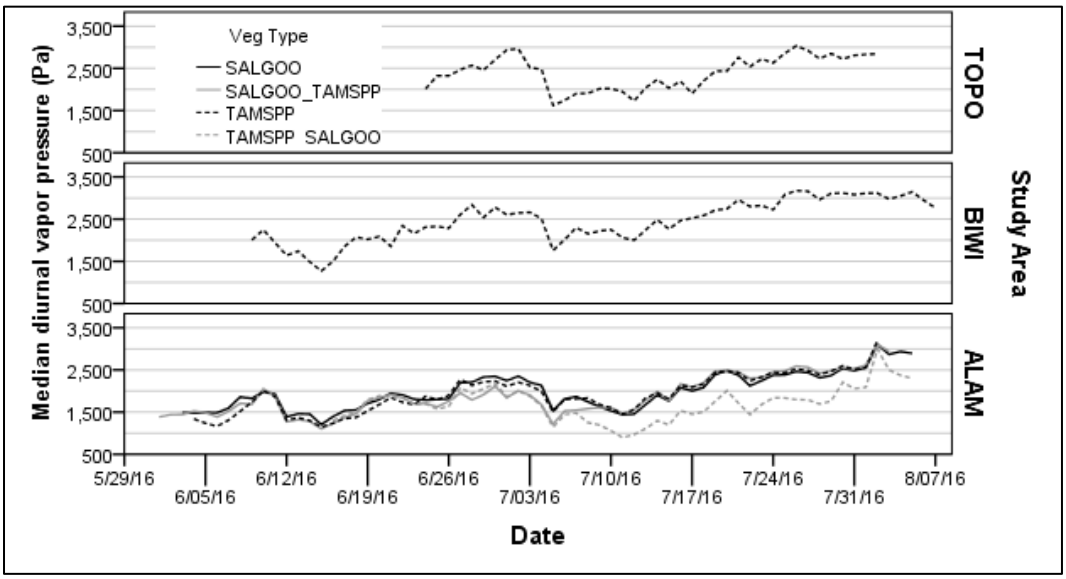



**Figure 5-11.—Median diurnal vapor pressure by vegetation type at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016.**
Topock Marsh (TOPO; TAMSPP = > 75% tamarisk, n = 1), Bill Williams (BIWI; TAMSPP, n = 6), and Alamo Lake (ALAM; SALGOO = > 75% Goodding's willow, n = 17; SALGOO_TAMSPP = Goodding's willow overstory with tamarisk understory, n = 8; TAMSPP, n = 4; and TAMSPP_SALGOO = tamarisk with emergent Goodding's willow, n = 1).

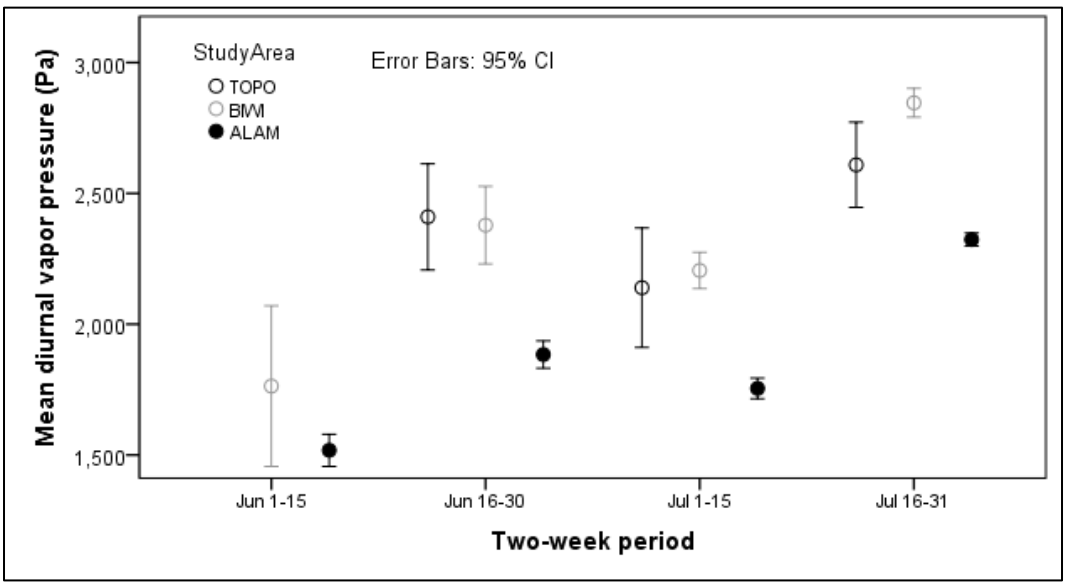



**Figure 5-12.—Mean diurnal vapor pressure and 95% confidence intervals over 2-week periods by study area at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016.**
Topock Marsh (TOPO, n = 1), Bill Williams (BIWI, n = 6), and Alamo Lake (ALAM, n = 30).

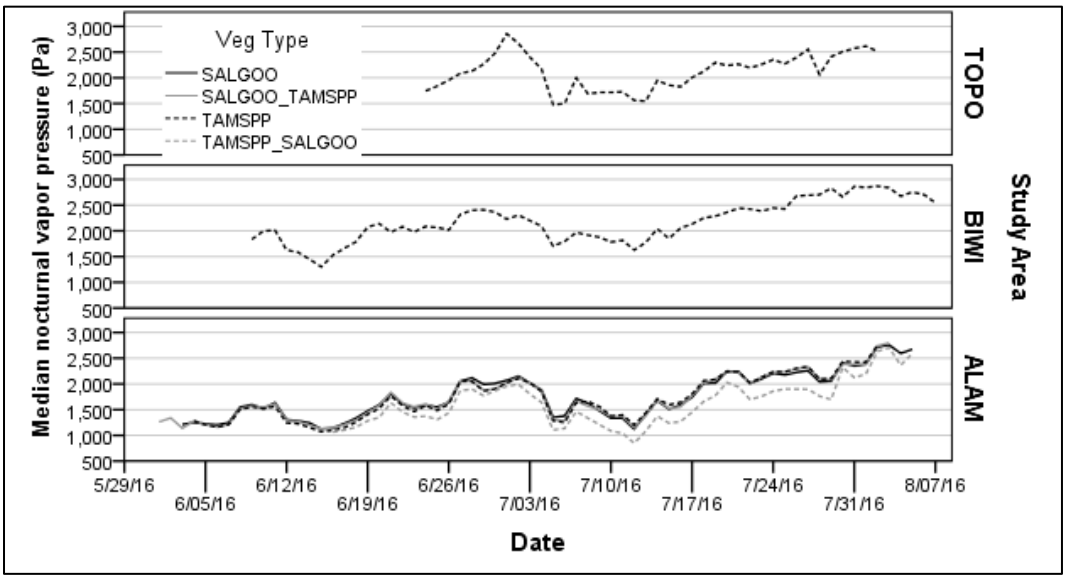



**Figure 5-13.—Median nocturnal vapor pressure by vegetation type at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016.**
Topock Marsh (TOPO; TAMSPP = > 75% tamarisk, n = 1), Bill Williams (BIWI; TAMSPP, n = 6), and Alamo Lake (ALAM; SALGOO = > 75% Goodding's willow, n = 17; SALGOO_TAMSPP = Goodding's willow overstory with tamarisk understory, n = 8; TAMSPP, n = 4; and TAMSPP_SALGOO = tamarisk with emergent Goodding's willow, n = 1).

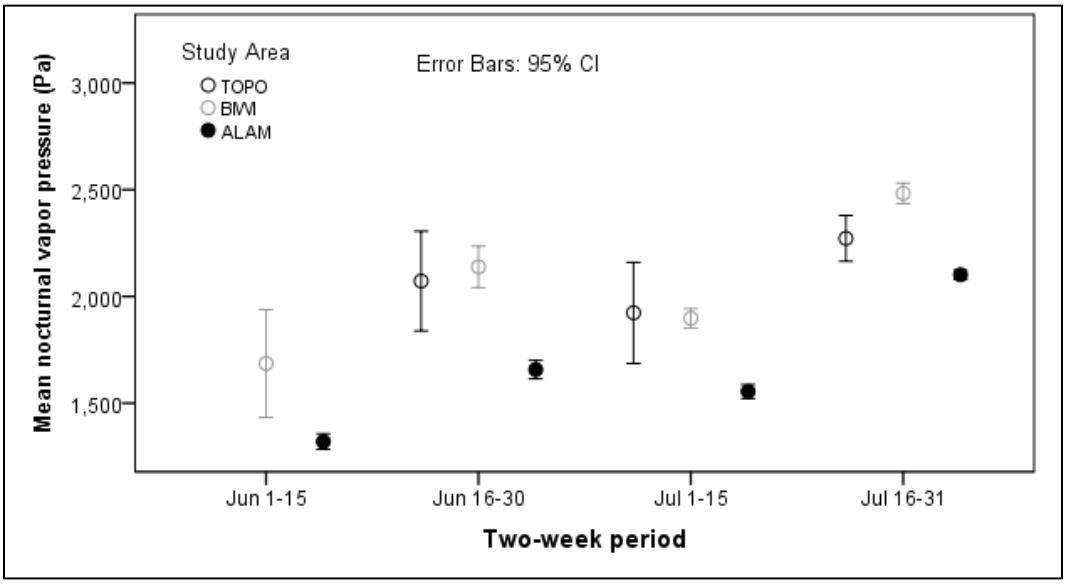



**Figure 5-14.—Mean nocturnal vapor pressure and 95% confidence intervals over 2-week periods by study area at southwestern willow flycatcher nests at Topock Marsh, Bill Williams, and Alamo Lake, 2016.**
Topock Marsh (TOPO, n = 1), Bill Williams (BIWI, n = 6), and Alamo Lake (ALAM, n = 30).

Flycatchers are known for their propensity to nest near surface water (McLeod and Pellegrini 2013; Sogge and Marshall 2000; Sogge et al. 2010), which affects vegetation density, food availability (Iwata et al. 2003; Peterson et al. 2015), and microclimate (McLeod and Pellegrini 2013). Hydrological conditions can vary dramatically between years, particularly at sites influenced by reservoir levels (Sogge and Marshall 2000). This has been evident at ALAM, where many of the currently occupied nesting areas were under water as recently as 2011. The drop in lake levels over the last several years (figure 5-15) has resulted in the growth of large areas of habitat with suitable vegetation structure on exposed sediment (see chapter 2). This is common in reservoir systems (e.g., Roosevelt Lake, Arizona; and Elephant Butte Reservoir, New Mexico), and flycatchers appear to prefer the younger habitat and will colonize it rapidly if it is near an established population (Paxton et al. 2007). The last 3 years of monitoring at ALAM have shown flycatchers moving into new sites (e.g., Edgewater, Over the Edge, and South Camp) that developed as new portions of the lakebed were exposed. Over the same period, flycatchers abandoned older sites (e.g., Motherlode 03 and Motherlode 04) where vegetation declined in vigor as the water table dropped. The continued decline of water levels at Alamo Lake has left even the new sites far from surface water, and flycatchers at ALAM either have had to nest at a distance from water or leave the study area entirely to search for nesting sites elsewhere.

Dry soils and a hot, dry microclimate may have contributed to the low nest success observed in ALAM in 2014 (McLeod and Pellegrini 2015). Lake levels were higher in 2015 than in 2014, and surface soil moisture at nests was correspondingly higher, with damp soils noted in approximately one-third of the estimates of soil condition. Lake levels in 2016 were lower than in 2014, and soils beneath nests were once again predominantly dry. Despite this, microclimate at nests was similar to what was recorded in 2015 (see discussion below). Fecundity recorded in 2016 (0.97 young/female) was intermediate between that recorded in 2014 (0.42 young/female) and 2015 (1.55 young/female). Given an estimated annual adult survival rate of ≈60% and juvenile survival of ≈35% (McLeod et al. 2008; Paxton et al. 2007), none of these fecundity rates are sufficient for a self-sustaining population. Other studies (Moore and Ahlers 2008) have shown that dry soils can be associated with lower productivity. The presence of nesting flycatchers at ALAM in habitats that are at a distance from surface water demonstrates that flycatchers can nest in areas that do not meet the generally accepted criteria for high quality habitat but should not be construed as evidence that moist soils are unimportant for flycatcher occupancy and successful breeding.

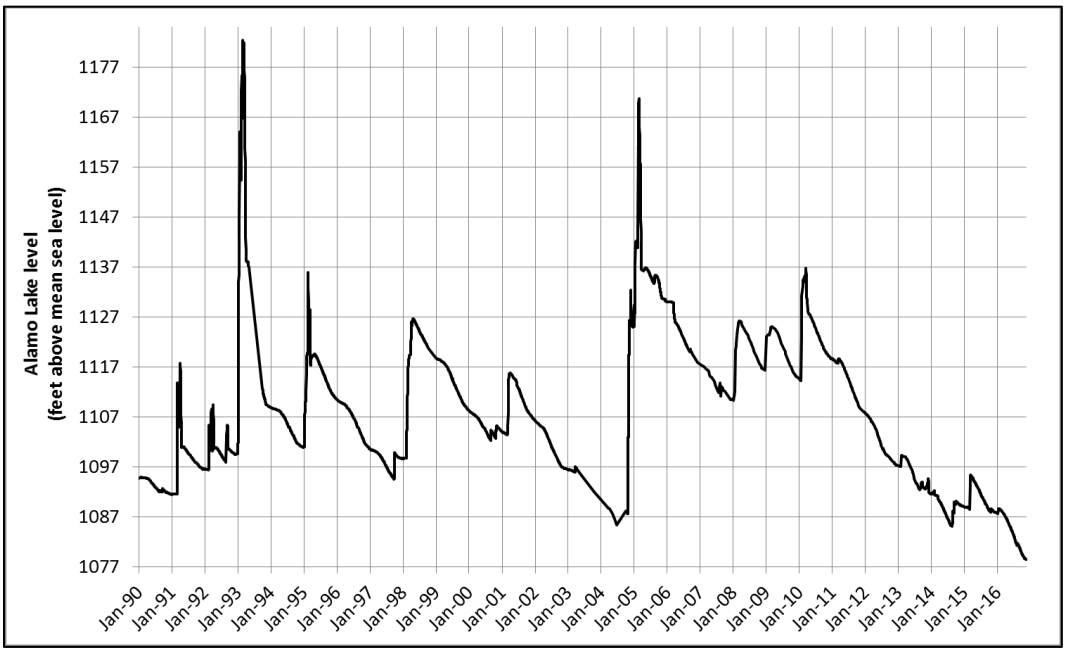



**Figure 5-15.—Alamo Lake level (feet above mean sea level), 1990–2016.**

Surface soil moisture conditions at flycatcher breeding sites can vary within as well as between years. In some locations, wet soils may be present only in the early part of the breeding season (USFWS 2002). A decline in wet soils through the breeding season was observed at several study areas (KEPI, PAHR, MUDD, TOPO, and BIWI) in earlier years of the study (McLeod and Pellegrini 2013, 2014, 2015, 2016), and these declines were again observed in 2016 at PAHR and KEPI. No seasonal decline has been observed in recent years at MUDD because all surface water has been confined to the main river channel in 2013–16. At both TOPO and BIWI, all flycatcher nests in 2016 were in portions of the study areas that do not experience strong seasonal declines in proximity to water. All nests at TOPO in 2016 were in Swine Paradise, adjacent to the relatively deep water of Topock Marsh, and the decline in marsh elevation throughout the flycatcher breeding season (see figure 2-8) had little effect on the proximity of nests to wet soils, whereas some nests in previous years were found at sites that are inundated only when marsh levels are high. At BIWI, all nests in 2016 were in sites where water levels are controlled by the level of Lake Havasu, which fluctuates but shows no unidirectional trend during the flycatcher breeding season. In previous years, some nests were in sites where the proximity of water is influenced by flow in the Bill Williams River, which does typically decline over the flycatcher breeding season (see figure 2-12).

## Vegetation

Overall, tamarisk was present near 50% of the nests monitored in 2016, though the percentage of the vegetation that consisted of tamarisk ranged from 5 to 100%. The majority (65%) of nests with tamarisk present in the vicinity were located in tamarisk trees, which is likely because tamarisk tends to have a branching structure suitable for nest placement. While the purpose of quantifying the amount of tamarisk in the vicinity of each nest is to determine the potential impact of defoliation, defoliation around flycatcher nests was noted only at MUDD in 2016. Only two nests were found at MUDD, and they both failed; it is therefore impossible to determine a threshold percentage of tamarisk foliage at which adverse effects on nest success might occur during a defoliation event. Tamarisk beetles were detected at both BIWI and TOPO in 2016, although no defoliation occurred during the breeding season in the immediate vicinity of flycatcher nests. More extensive defoliation will likely be observed at these study areas in 2017 and may affect breeding flycatchers.

## Temperature and Humidity

In 2014, SWCA noted that nests at ALAM had markedly lower vapor pressures and markedly higher maximum daily temperatures and daily temperature ranges than nests at either TOPO or BIWI. SWCA also speculated that microclimate variables at Alamo Lake might resemble those in the other study areas if wet soils had been present in flycatcher territories. Soils at ALAM in 2015 were moister than they had been in 2014, though they were still the driest observed in any study area. The maximum daily temperature and humidity at nests at ALAM differed less from conditions at TOPO and BIWI in 2015, when some damp soils were present at Alamo Lake, than they did in 2014, when soils were very dry. Soils at ALAM were once again very dry in 2016. The difference in humidity between ALAM and BIWI was greater than what was observed in 2015 but still less than what was observed in 2014, while the difference in temperature in 2016 was similar to what it had been in 2015 (figures 5-16 and 5-17). It is unclear why the microclimate at ALAM in 2016 did not more closely resemble that measured in 2014, since surface soil moisture characteristics were very similar between those years.

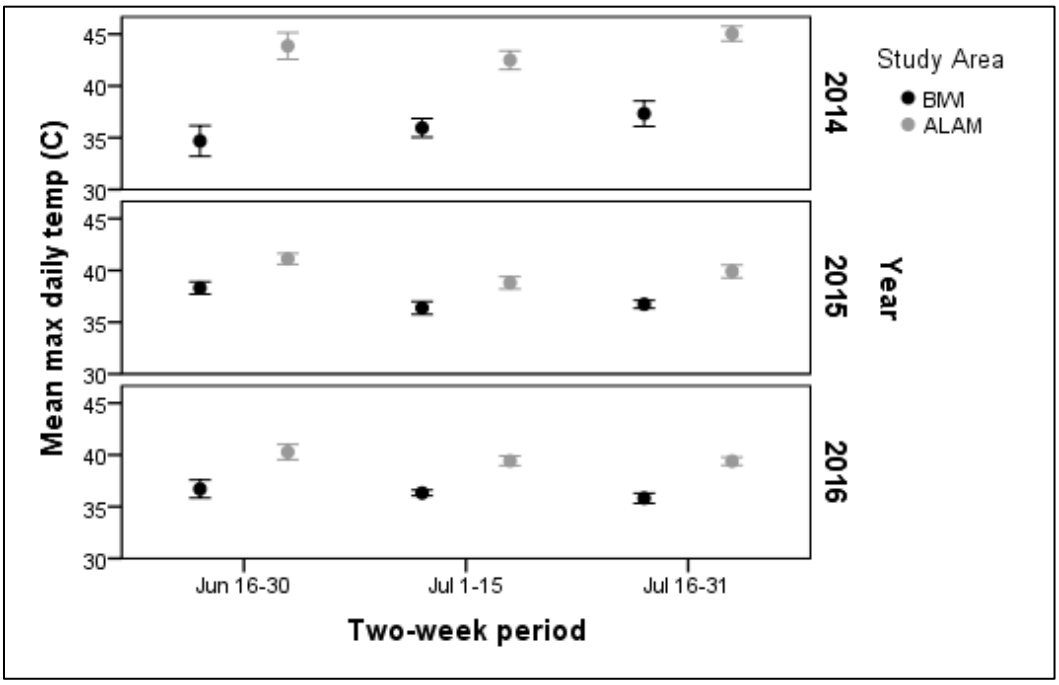



**Figure 5-16.—Mean maximum daily temperatures and 95% confidence intervals at southwestern willow flycatcher nests at Bill Williams (BIWI) and Alamo Lake (ALAM), 2014–16.**

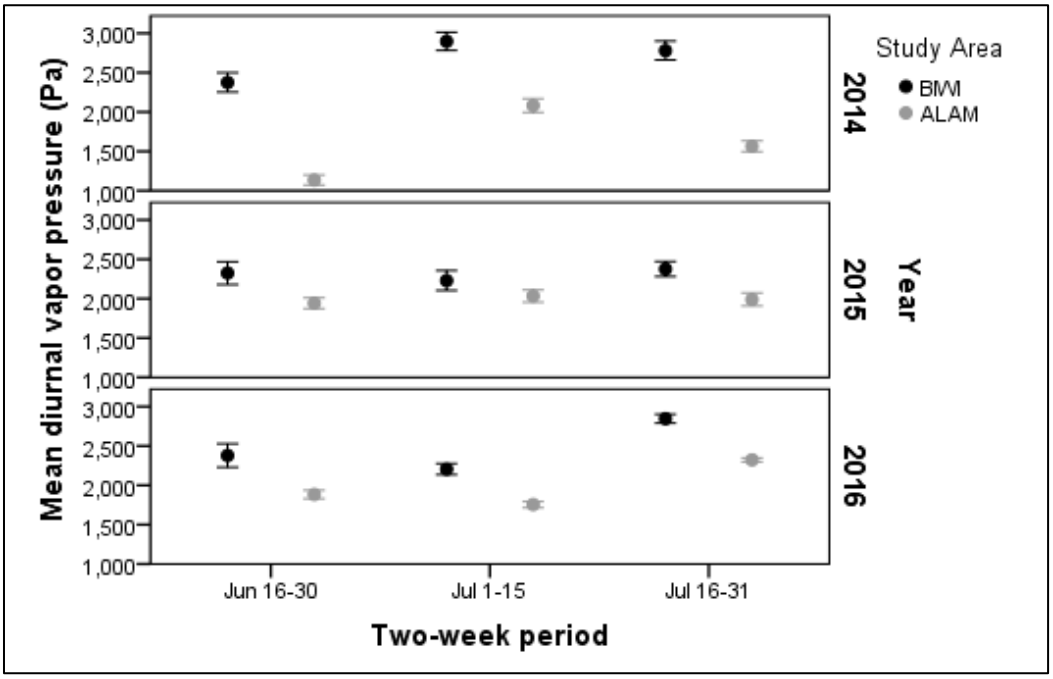



**Figure 5-17.—Mean diurnal vapor pressures and 95% confidence intervals at southwestern willow flycatcher nests at Bill Williams (BIWI) and Alamo Lake (ALAM), 2014–16.**

# Chapter 6 – Discussion Summary

For ease of reference, this chapter summarizes all study design discussions from previous chapters.

## BROADCAST SURVEYS AND SITE ASSESSMENT

The habitat conditions at the following sites were assessed and may warrant having the survey area adjusted and/or the frequency of surveys changed if monitoring is continued within those portions of the LCR system in future years.

Most of the northern arm of WMSP Muddy Stringer 01 is unsuitable for southwestern willow flycatcher breeding habitat, lacking any type of closed canopy or understory. The small coyote willow patch at the northern end of the site could develop into suitable habitat if it increased in height, areal extent, and density. Surveys at this site could be discontinued until habitat improves.

Lost Lake in TOPO was not surveyed in 2016 due to poor habitat quality following a fire earlier in the year. Suitable vegetation and hydrology components still exist but are now too limited in areal extent. Habitat at this site may regenerate sufficiently to be considered suitable again. Surveys at this site could be discontinued until habitat improves.

Last Gasp, Guinness, Beaver Pond North, and Beaver Pond at BIWI are currently on a triennial survey schedule. Suitable vegetation structure at these sites is limited but could increase if the areal extent of surface water increased. Breeding flycatchers were discovered in 2015 adjacent to the original extent of Site 08. Based on the current habitat condition, surveys in the original extent of Site 08 could continue as periodic, while annual surveys could be completed in the area that was occupied in 2015 and 2016. Further exploration of the area between Site 08 and Upstream from Site 08 could be conducted. Surveys at Black Rail were discontinued in 2016 due to a lack of surface water and suitable canopy closure; this site could be visited again in future years to determine if surface soil moisture conditions and vegetation structure have improved. Since SWCA began monitoring Site 05 in 2003, only one resident, unpaired male flycatcher has been detected. This detection was in 2009, when surface water was much more widely distributed throughout the site. Most of Site 05 was completely dry in 2016; surveys at this site could be discontinued if habitat conditions have not improved in 2017.

Bullard Wash in ALAM was assessed for the first time in 2016. Suitable vegetation structure does exist within the site, but the areal extent of suitable habitat is unknown. Several additional sites were evaluated in ALAM in 2016,

including Prospect 01, Santa Maria South 01, and Bullard Wash North (reconnaissance site). These three sites were assessed to lack suitable vegetation structure or sufficient areal extent of available habitat and to be unlikely to improve in suitability should lake levels rise and surface soil moisture conditions improve.

# NEST PREDATORS

Depredation was the leading cause of nest failure in 2016, and the depredation rate was highest at KEPI, where depredation accounted for 88% of all failed nests. A majority (60%) of the depredation events at KEPI occurred during the nestling phase; this is consistent with the trend observed over the last several years, with a high proportion of nests that were depredated at KEPI having failed during the nestling stage. Likely predators of nestling flycatchers at KEPI in recent years include a pair of Cooper's hawks, which have nested at KEPI annually since 2013. Cooper's hawks may also reduce the fledgling survival rate in addition to depredating nestlings. Inspection of the Cooper's hawk nest and plucking posts to search for flycatcher remains and leg bands might provide evidence to verify whether Cooper's hawks are predators of flycatcher nestlings if future monitoring continues in order to determine the factors affecting nestling and fledgling survival rates at KEPI.

# COWBIRD CONTROL

Field personnel replaced one cowbird egg in a nest with a fake egg in 2016 instead of addling the cowbird egg and leaving it in the nest. Although this nest was ultimately deserted, the female flycatcher continued to incubate the nest for several days after the egg was replaced, and it is unlikely that egg replacement caused nest failure. This may be an effective alternative to egg addling and eliminates the possibility of the cowbird egg hatching if addling did not make the egg unviable.

# LITERATURE CITED

Agresti, A. and B. Caffo. 2000. Simple and effective confidence intervals for proportions and differences of proportions result from adding two successes and two failures. The American Statistician 54:280–288.

Ahlering, M.A, D.H. Johnson, and J. Faaborg. 2006. Conspecific attraction in a grassland bird, the Baird's sparrow. Journal of Field Ornithology 77:365–371.

Blood, D. 2017. SWCA Environmental Consultants, Flagstaff, Arizona, personal communication.

Bloodworth, B. 2014. Tamarisk Coalition, Grand Junction, Colorado, personal communication.

Braden, G.T. and R.L. McKernan. 2006. Status, Distribution, Life-History, and Habitat Affinities of the Southwestern Willow Flycatcher Along the Lower Colorado River, Year 7 – 2002: Final Report – Revised. Final report submitted to the Bureau of Reclamation, Boulder City, Nevada, by San Bernardino County Museum, Redlands, California. 82 p.

Brown, B.T., S.W. Carothers, and R.R. Johnson. 1987. Grand Canyon Birds. The University of Arizona Press, Tucson. 302 p.

Busch, J.D., M.P. Miller, E.H. Paxton, M.K. Sogge, and P. Keim. 2000. Genetic variation in the endangered southwestern willow flycatcher. The Auk 117:586–595.

Dudley, T. 2012. University of California, Santa Barbara, personal communication.

_____. 2014. University of California, Santa Barbara, personal communication.

_____. 2015. University of California, Santa Barbara, personal communication.

Durst, S.L., M.K. Sogge, H.C. English, S.O. Williams, B.E. Kus, and S.J. Sferra. 2006. Southwestern Willow Flycatcher Breeding Site and Territory Summary – 2005. U.S. Geological Survey Southwest Biological Science Center report to the Bureau of Reclamation.

Ellis, L.A., D.M. Weddle, S.D. Stump, H.C. English, and A.E. Graber. 2008. Southwestern Willow Flycatcher Final Survey and Monitoring Report. Arizona Game and Fish Department, Research Technical Guidance Bulletin #10, Phoenix.

Finch, D.M. and J.F. Kelly. 1999. Status of management of the southwestern willow flycatcher in New Mexico. Pages 197–203 *in* D.M. Finch, J.C. Whitney, J.F. Kelly, and S.R. Loftin (editors). Rio Grande Ecosystems: Linking Land, Water, and People. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station Proceedings, RMRS-P-7.

Garrett, K. and J. Dunn. 1981. Birds of Southern California. Los Angeles Audubon Society, Los Angeles, California.

GeoSystems Analysis, Inc. 2014. Soil Moisture Monitoring Pilot Study at Palo Verde Ecological Reserve Phase 2. Report submitted to the Bureau of Reclamation, Boulder City, Nevada, by GeoSystems Analysis Inc., Tucson, Arizona. 65 p + attachments.

Gill, F.B. 1995. Ornithology, Second Edition. W.H. Freeman and Company, New York.

Graber, A.E. and T.J. Koronkiewicz. 2009. Southwestern Willow Flycatcher Surveys and Nest Monitoring Along the Gila River Between Coolidge Dam and South Butte, 2008. Final 2008 summary report submitted to the Bureau of Reclamation, Phoenix, Arizona, by SWCA Environmental Consultants, Flagstaff, Arizona. 66 p.

Graber, A.E., D.M. Weddle, H.C. English, S.D. Stump, H.E. Telle, and L.A. Ellis. 2007. Southwestern Willow Flycatcher 2006 Survey and Nest Monitoring Report. Nongame and Endangered Wildlife Program, Technical Report 249. Arizona Game and Fish Department, Phoenix.

Halterman, M., M.J. Johnson, J.A. Holmes, and S.A. Laymon. 2015. A Natural History Summary and Survey Protocol for the Western Distinct Population Segment of the Yellow-billed Cuckoo: U.S. Fish and Wildlife Techniques and Methods. 45 p.

Hanski, I.A. and D. Simberloff. 1997. The metapopulation approach, its history, conceptual domain, and application to conservation. Pages 5–26 *in* I.A. Hanski, and M.E. Gilpin (editors). Metapopulation Biology: Ecology, Genetics, and Evolution. Academic Press, San Diego, California.

Harter, L. 2016. Great Basin Bird Observatory, Lake Havasu City, Arizona, personal communication.

Hill, G.E. 1988. Age, plumage brightness, territory quality, and reproductive success in the black-headed grosbeak. The Condor 90:379–388.

Hines, C. 2017. SWCA Environmental Consultants, Flagstaff, Arizona, personal communication.

Holmes, R.T., P.P. Marra, and T.W. Sherry. 1996. Habitat-specific demography of breeding black-throated blue warblers (*Dendroica caerulescens*): implications for population dynamics. Journal of Animal Ecology 65:183–195.

Howell, N.G. and S. Webb. 1995. A Guide to the Birds of Mexico and Northern Central America. Oxford University Press, New York.

Howlett, J.S. and B.J. Stutchbury. 1996. Nest concealment and predation in hooded warblers: experimental removal of nest cover. The Auk 113:1–9.

Igic, B., V. Nunez, H.U. Voss, R. Croston, Z. Aidala, A.V. Lopez, A. Van Tatenhove, M.E. Holford, M.D. Shawkey, and M.E. Hauber. 2015. Using 3D printed eggs to examine the egg-rejection behaviour of wild birds. PeerJ 3:e965; DOI 10.7717/peerj.965.

Iwata, T., S. Nakano, and M. Murakami. 2003. Stream meanders increase insectivorous bird abundance in riparian deciduous forests. Ecography 26:325–337.

Johnson, M.J. and M.K. Sogge. 1997. Southwestern Willow Flycatcher Surveys Along Portions of the San Juan River, Utah (Montezuma Creek – Mexican Hat and Clay Hills Crossing), 1997. U.S. Geological Survey Colorado Plateau Field Station, Flagstaff, Arizona.

Kenwood, K.E. and E.H. Paxton. 2001. Survivorship and Movements of Southwestern Willow Flycatchers in Arizona – 2001. U.S. Geological Survey report to the Bureau of Reclamation, Phoenix, Arizona. 44 p.

Ketcham, S. 2016. Bureau of Land Management, Lake Havasu City, Arizona, personal communication

Klinger, C. 2013. Nevada Department of Wildlife. Las Vegas, Nevada, personal communication.

Koronkiewicz, T.J., S.N. Cardinal, M.K. Sogge, and E.H. Paxton. 2002. Survivorship and Movements of Southwestern Willow Flycatchers at Roosevelt Lake, Arizona – 2002. Report to the Bureau of Reclamation, Phoenix, Arizona. Submitted by the U.S. Geological Survey Southwest Science Center, Colorado Plateau Field Station, Flagstaff, Arizona. 43 p.

Koronkiewicz, T.J., M.A. McLeod, B.T. Brown, and S.W. Carothers. 2006a. Southwestern Willow Flycatcher Surveys, Demography, and Ecology Along the Lower Colorado River and Tributaries, 2005. Annual report submitted to the Bureau of Reclamation, Boulder City, Nevada, by SWCA Environmental Consultants, Flagstaff, Arizona. 176 p.

Koronkiewicz, T.J., M.K. Sogge, C. Van Riper III, and E.H. Paxton. 2006b. Territoriality, site fidelity, and survivorship of willow flycatchers wintering in Costa Rica. The Condor 108:558–570.

Kreiser, J. 2017. SWCA Environmental Consultants, Flagstaff, Arizona, personal communication.

Lakes Online. 2014. Alamo Lake water level http://alamo.lakesonline.com/Level.asp (accessed on November 11, 2014).

_____. 2016. Lake Havasu water level http://www.havasu.lakesonline.com/Level.asp (accessed on November 16, 2016).

Lowther, P.E. 1993. Brown-headed cowbird (*Molothrus ater*) *in* A. Poole and F. Gill (editors). The Birds of North America, No. 47. The Birds of North America, Inc., Philadelphia, Pennsylvania.

Lynn, J.C., T.J. Koronkiewicz, M.J. Whitfield, and M.K. Sogge. 2003. Willow flycatcher winter habitat in El Salvador, Costa Rica, and Panama: characteristics and threats. Pages 41–51 *in* M.K. Sogge, B.E. Kus, S.J. Sferra, and M.J. Whitfield (editors). Ecology and Conservation of the Willow Flycatcher, Studies in Avian Biology No. 26. Cooper Ornithological Society.

Marshall, R.M. and S.H. Stoleson. 2000. Threats. Pages 13–24 *in* Status, Ecology, and Conservation of the Southwestern Willow Flycatcher. U.S. Forest Service General Technical Report, RMRS-GTR-60.

Martin, T.E., C.R. Paine, C.J. Conway, W.M. Hochachka, P. Allen, and W. Jenkins. 1997. Breeding Biology Research and Monitoring Database (BBIRD) Field Protocol. Montana Cooperative Wildlife Research Unit, University of Montana, Missoula.

Mayfield, H. 1961. Nesting success calculated from exposure. Wilson Bulletin 73(3):255–261.

_____. 1975. Suggestions for calculating nest success. Wilson Bulletin 87(4):456–466.

McKernan, R.L. and G. Braden. 1998. Status, Distribution, and Habitat Affinities of the Southwestern Willow Flycatcher Along the Lower Colorado River, Year 2 – 1997. Unpublished report submitted to the Bureau of Reclamation, Boulder City, Nevada, and the U.S. Fish and Wildlife Service, Carlsbad, California, by the San Bernardino County Museum, Redlands, California. 64 p.

_____. 1999. Status, Distribution, and Habitat Affinities of the Southwestern Willow Flycatcher Along the Lower Colorado River, Year 3 – 1998. Unpublished report submitted to the Bureau of Reclamation, Boulder City, Nevada; the U.S. Fish and Wildlife Service, Carlsbad, California, and Reno, Nevada; and the Bureau of Land Management, Caliente, Nevada, by the San Bernardino County Museum, Redlands, California. 71 p.

_____. 2002. Status, Distribution, and Habitat Affinities of the Southwestern Willow Flycatcher Along the Lower Colorado River, Year 6 – 2001. Unpublished report submitted to the Bureau of Reclamation, Boulder City, Nevada, and the U.S. Fish and Wildlife Service, Carlsbad, California, and Reno, Nevada, by the San Bernardino County Museum, Redlands, California. 58 p.

McLeod, M.A. and A.R. Pellegrini. 2012. Southwestern Willow Flycatcher Surveys, Demography, and Ecology Along the Lower Colorado River and Tributaries, 2011. Annual report submitted to the Bureau of Reclamation, Boulder City, Nevada, by SWCA Environmental Consultants, Flagstaff, Arizona. 167 p.

_____. 2013. Southwestern Willow Flycatcher Surveys, Demography, and Ecology Along the Lower Colorado River and Tributaries, 2008–2012. Summary report submitted to the Bureau of Reclamation, Boulder City, Nevada, by SWCA Environmental Consultants, Flagstaff, Arizona. 341 p.

_____. 2014. Southwestern Willow Flycatcher Surveys, Demography, and Ecology Along the Lower Colorado River and Tributaries, 2013. Annual report submitted to the Bureau of Reclamation, Boulder City, Nevada, by SWCA Environmental Consultants, Flagstaff, Arizona. 143 p.

_____. 2015. Southwestern Willow Flycatcher Surveys, Demography, and Ecology Along the lower Colorado River and Tributaries, 2014. Annual report submitted to the Bureau of Reclamation, Boulder City, Nevada, by SWCA Environmental Consultants, Flagstaff, Arizona. 147 p.

_____. 2016. Southwestern Willow Flycatcher Surveys, Demography, and Ecology Along the lower Colorado River and Tributaries, 2015 Annual Report. Submitted to the Bureau of Reclamation, Boulder City, Nevada, by SWCA Environmental Consultants, Flagstaff, Arizona. 227 p.

McLeod, M.A., T.J. Koronkiewicz, B.T. Brown, W.J. Langeberg, and S.W. Carothers. 2008. Southwestern Willow Flycatcher Surveys, Demography, and Ecology Along the Lower Colorado River and Tributaries, 2003–2007. Five-year summary report submitted to the Bureau of Reclamation, Boulder City, Nevada, by SWCA Environmental Consultants, Flagstaff, Arizona. 206 p.

Moore, D. 2016. Bureau of Reclamation, Denver, Colorado, personal communication.

Moore, D. and D. Ahlers. 2008. 2007 Southwestern Willow Flycatcher Study Results: Selected Sites Along the Rio Grande from Velarde to Elephant Butte Reservoir, New Mexico. Report prepared by the Bureau of Reclamation, Technical Service Center, Denver, Colorado. 64 p.

Paradzick, C.E. 2005. Southwestern willow flycatcher habitat selection along the Gila and lower San Pedro Rivers, Arizona: vegetation and hydrogeomorphic considerations. Thesis. Arizona State University, Tempe.

Paradzick, C.E. and A.A. Woodward. 2003. Distribution, abundance, and habitat characteristics of southwestern willow flycatchers in Arizona, 1993–2000. Studies in Avian Biology 26:22–29.

Parametrix, Inc., and Southern Sierra Research Station. 2016. Yellow-billed Cuckoo Surveys on the Lower Colorado River and Tributaries, 2016 Annual Report.

Paxton, E., S. Langridge, and M.K. Sogge. 1997. Banding and Population Genetics of Southwestern Willow Flycatchers in Arizona – 1997 Summary Report. U.S. Geological Survey Colorado Plateau Research Station Northern Arizona University report. 63 p.

Paxton, E.H., M.K. Sogge, S.L. Durst, T.C. Theimer, and J. Hatten. 2007. The Ecology of the Southwestern Willow Flycatcher in Central Arizona – A 10-Year Synthesis Report. U.S. Geological Survey Open-File Report 2007-1381.

Periman, R.D. and J.F. Kelly. 2000. The dynamic environmental history of southwest willow flycatcher habitat: a survey of changing riparian conditions through time. Pages 25–42 *in* D.M. Finch, and S.H. Stoleson (editors). Status, Ecology, and Conservation of the Southwestern Willow Flycatcher. General Technical Report, RMRS-GTR-60. U.S. Forest Service, Rocky Mountain Research Station, Ogden, Utah. 131 p.

Peterson, D., A.R. Pellegrini, M.A. McLeod, and T.C. Theimer. 2015. Distance to standing water is negatively correlated with invertebrate biomass, nestling feeding rate, and productivity in southwestern willow flycatchers (*Empidonax traillii extimus*). Pages 262–270 *in* Proceedings of the 12th Biennial Conference of Science and Management on the Colorado Plateau and Southwest Region.

Phillips, A., J. Marshall, and G. Monson. 1964. The Birds of Arizona. University of Arizona Press, Tucson. 212 p.

Ralph, C.J., G.R. Geupel, P. Pyle, T.E. Martin, and D.F. DeSante. 1993. Handbook of field methods for monitoring landbirds. General Technical Report PSW-GTR-144. U.S. Forest Service Pacific Southwest Research Station, Albany, California. 41 p.

Ridgely, R.S. and G. Tudor. 1994. The Birds of South America, Volume II: The Suboscine Passerines. University of Texas Press, Austin.

Robinson, S.K. 1992. Population dynamics of breeding neotropical migrants in Illinois. Pages 408–418 *in* J.M. Hagan, III and D.W. Johnston (editors). Ecology and Conservation of Neotropical Migrant Landbirds. Smithsonian Institution Press, Washington D.C.

Rourke, J.W., T.D. McCarthey, R.F. Davidson, and A.M. Santaniello. 1999. Southwestern Willow Flycatcher Nest Monitoring Protocol. Nongame and Endangered Wildlife Program Technical Report No. 144. Arizona Game and Fish Department, Phoenix.

Sedgwick, J.A. and W.M. Iko. 1999. Costs of brown-headed cowbird parasitism to willow flycatchers. Pages 167–181 *in* M.L. Morrison, L.S. Hall, S.K. Robinson, S.I. Rothstein, D.C. Hahn, and T.D. Rich (editors). Research and Management of the Brown-headed Cowbird in Western Landscapes. Studies in Avian Biology No. 18. Cooper Ornithological Society.

Skagen, S.K, J.F. Kelly, C. Van Riper, R.L. Hutto, D.M. Finch, D.J. Krueper, and C.P. Melcher. 2005. Geography of spring landbird migration through riparian habitats in southwestern North America. The Condor 107(2):212–227.

Sogge, M.K. and R.M. Marshall. 2000. A survey of current breeding habitats. Pages 43–56 *in* D.M. Finch and S.H. Stoleson (editors). Status, Ecology, and Conservation of the Southwestern Willow Flycatcher. General Technical Report, RMRS-GTR-60. U.S. Forest Service, Rocky Mountain Research Station, Ogden, Utah. 131 p.

Sogge, M.K., J.C. Owen, E.H. Paxton, S.M. Langridge, and T.J. Koronkiewicz. 2001. A targeted mist net capture technique for the willow flycatcher. Western Birds 32:167–172.

Sogge, M.K., D. Ahlers, and S.J. Sferra. 2010. A Natural History Summary and Survey Protocol for the Southwestern Willow Flycatcher. U.S. Geological Survey Techniques and Methods 2A-10. 38 p.

Southwest Environmental Information Network. 2014. SEINet Detailed Collection Record Information. http://www.swbiodiversity.org/seinet/collections/individual/index.php?occid=4684776&clid=0 (accessed on November 13, 2014)

Stiles, F.G. and A.F. Skutch. 1989. A Guide to the Birds of Costa Rica. Cornell University Press, New York.

Stoleson, S.H. and D.M. Finch. 2003. Microhabitat use by breeding southwestern willow flycatchers on the Gila River, New Mexico. Studies in Avian Biology 26:91–95.

Stroud-Settles, J., G. Holm, and R. Palarino. 2013. Surveying for Southwestern Willow Flycatchers in Grand Canyon National Park, 2010–2012. Final project report prepared by the U.S. Department of the Interior, National Park Service, Grand Canyon National Park. 44 p.

Theimer, T., D. Petersen, A. Pellegrini, M.A. McLeod, and T, Koronkiewicz. 2011. Real and Artificial Nest Predation and Parental Attendance Along the Lower Colorado River and Southern Nevada. Final report submitted to the Bureau of Reclamation, Boulder City, Nevada.

U.S. Fish and Wildlife Service (USFWS). 1995. Final rule determining endangered status for the southwestern willow flycatcher. Federal Register 60:10694–10715.

_____. 2002. Final Recovery Plan, Southwestern Willow Flycatcher (*Empidonax traillii extimus*). Prepared by the Southwestern Willow Flycatcher Recovery Team Technical Subgroup, August 2002.

Unitt, P. 1987. *Empidonax traillii extimus*: an endangered subspecies. Western Birds 18:137–162.

_____. 1997. Winter Range of *Empidonax traillii extimus* as Documented by Existing Museum Collections. San Diego Natural History Museum report to the Bureau of Reclamation, Phoenix, Arizona.

Vinson, J. 2017. U.S. Fish and Wildlife Service, Alamo, Nevada, personal communication.

White, G.S. and K.P. Burnham. 1999. Program MARK: survival estimation from populations of marked animals. Bird Study 46 (supplement):S120–139.

Whitfield, M.J. 1990. Willow flycatcher reproductive response to brown-headed cowbird parasitism. M.S. thesis. California State University, Chico. 25 p.

Whitfield, M.J. and K.M. Enos. 1996. A Brown-headed Cowbird Control Program and Monitoring for the Southwestern Willow Flycatcher, South Fork Kern River, California, 1996. Final Report for the U.S. Army Corps of Engineers, Sacramento District, prepared by the Kern River Research Center, Weldon, California.

Whitfield, M.J. and M.K. Sogge. 1999. Range-wide impact of brown-headed cowbird parasitism on the southwestern willow flycatcher (*Empidonax traillii extimus*). Pages 182–190 *in* M.L. Morrison, L.S. Hall, S.K. Robinson, S.I. Rothstein, D.C. Hahn, and T.D. Rich (editors). Research and Management of the Brown-headed Cowbird in Western Landscapes. Studies in Avian Biology No. 18. Cooper Ornithological Society.

Whitfield, M.J., M.K. Sogge, S.J. Sferra, and B.E. Kus. 2003. Ecology and behavior – introduction. Pages 53–55 *in* M.K. Sogge, B.E. Kus, S.J. Sferra, and M.J. Whitfield (editors). Ecology and Conservation of the Willow Flycatcher. Studies in Avian Biology No. 26. Cooper Ornithological Society.

Wiens, J.A. 1989. The Ecology of Bird Communities, Volume 2: Processes and Variations. Cambridge University Press, New York.

Woodward, H.D. and S.H. Stoleson. 2002. Brown-headed cowbird attacks on southwestern willow flycatcher nestlings. The Southwestern Naturalist 47(4):626–628.

Yeates-Burghart, Q. 2017. SWCA Environmental Consultants, Flagstaff, Arizona, personal communication.

Young, W. and D.M. Finch. 1997. Migration of the willow flycatcher along the Middle Rio Grande. Wilson Bulletin 109:253–268.

# ACKNOWLEDGMENTS

This project was made possible by the support of many persons, agencies, private landowners, and SWCA's dedicated staff and field crew. Work was conducted under the auspices of Federal Fish and Wildlife Threatened and Endangered Species Permit TE028605 and Master Banding Permit #23258. Funding was provided by Reclamation, Boulder City, Nevada (Contract No. GS-10F-0209L, Task Order R13PD30017); the NDOW, Reno, Nevada; and the Southern Nevada Water Authority, Las Vegas, Nevada. Chris Dodge from Reclamation provided background information and guidance.

Many thanks to the following national wildlife refuges and personnel for all their assistance: Kevin DesRoberts, Rob Vinson, Laurie Simons, and Jim Doctor at the Pahranagat National Wildlife Refuge; Glenn Klingler, Linda Miller, Brandon Melton, Catherine Bell, and Dr. Kathleen Blair at the Lake Havasu National Wildlife Refuge Complex; and Brenda Zaun, Bill Seese, Curt Kessler, and Nate Caswell at the Southwestern Arizona National Wildlife Refuge Complex. Thanks to Keith Day and Christian Edwards with the Utah Division of Wildlife Resources for their support in St. George. Also, we would like to thank Joe Barnes, Christy Klinger, Bennie Vann, and Ron Mills with the NDOW for their support at the Key Pittman Wildlife Management Area, River Ranch, and the Overton Wildlife Management Area. Thanks to Dave Syzdek with the Southern Nevada Water Authority for support at Warm Springs Natural Area. Thanks to Todd Trapp with the Bureau of Land Management for his support at Meadow Valley Wash.

Thanks to the following agencies and personnel for assistance with obtaining permits: Stacey Stanford, Daniel Marquez, Stacey Love, Carla Wise, and Greg Beatty with the USFWS; Danny Bystrak with the Federal Bird Banding Laboratory; Christina Kondrat-Smith with the Arizona Game and Fish Department; Gloria Shaw with Lake Mead National Recreation Area; Esther Burkett with the California Department of Fish and Game; Cris Tomlinson and Julie Meadows with the NDOW; and Suzanne McMullin with the Utah Division of Wildlife Resources. The Whipple family granted access to their property.

This project would not be a success without SWCA's dedicated staff and field personnel. Many, many thanks to Kimberly Proa who went beyond her administrative duties and coordinated housing, permitting, payroll, vehicles, computers, safety, and telecommunications and handled all manner of crises with cheerful aplomb. A very special thanks to Glenn Dunno for his Geographic Information System talents. Thanks also to Brenda Wharton and Rose Ford for administrative and accounting support. And sincere thanks to the 2016 field personnel for their hard work, dedication, and sweat.

# ATTACHMENTS

1 Study Area and Survey Site Organization Within Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Areas and Sites

2 Field Data Forms

3 Orthophotos Showing Study Sites

4 Southwestern Willow Flycatcher Survey (*Empidonax traillii extimus*) Dates for Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Areas and Sites, 2016

5 Southwestern Willow Flycatcher Survey (*Empidonax traillii extimus*) Results for Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Areas and Sites, 2016

6 Detections of Covered Species Within Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Areas and Sites, 2016

7 Orthophotos Showing Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) Survey Sites

8 All Willow Flycatchers (*Extimus traillii*) Color Banded and/or Resighted, 2012–2016

9 Temperature and Humidity at Southwestern Willow Flycatcher Nests (*Empidonax traillii extimus*) at the Topock Marsh, Bill Williams, and Alamo Lake Study Areas, 2016

10 Contributing Personnel

# ATTACHMENT 1

Study Area and Survey Site Organization Within Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Areas and Sites

Table A1-1.—Study area and survey site organization within LCR MSCP areas and sites, 2016*

| Study area | LCR MSCP area | LCR MSCP site | LCR MSCP section(s) (former survey site name) |
|---|---|---|---|
| Key Pittman | Alamo | Key Pittman Wildlife Management Area | Frenchy Lake |
| | | | Nesbitt Forest |
| | | | Patch 00 |
| | | | Patch 01 |
| | | | Patch 02 |
| | | | Patch 03 |
| | | | Patch 04 |
| | | | Patch 04.5 |
| | | | Patch 05 |
| | | | Patch 06 |
| | | | Patch 07 |
| | | | Patch 08 |
| | | | Patch 09 |
| | | | Patch 10 |
| | | | Patch 10.5 |
| | | | Patch 11 |
| | | | Patch 12 |
| River Ranch | Alamo | River Ranch | East Side |
| | | | West Side |
| | | | Smalls |
| Pahranagat | Alamo | Pahranagat National Wildlife Refuge | Pahranagat North |
| | | | Pahranagat West |
| | | | Pahranagat MAPS (MAPS) |
| | | | Pahranagat South |
| Meadow Valley Wash | Meadow Valley Wash | Meadow Valley Wash North | Rock Springs Canyon |
| | | | Dog Leg |
| Muddy River | Muddy River | Overton Above High-Water Mark | Overton WMA Pond |
| | | Overton Wildlife | Overton WMA |
| Warm Springs | Muddy River | Warm Springs | Muddy Mac |
| | | | Muddy Stringer 01 |
| Topock Marsh | Topock | Topock Marsh | Swine Paradise |
| | | | Platform |
| | | | 250M |
| | | | Hell Bird |
| | | | Glory Hole |
| | | | Farm Ditch Road (Spaghetti) |
| | Beal Lake Conservation Area | CPhase 05 | CPhase 05 (Beal Lake) |
| | Topock | Topock Bay | Lost Lake |

Table A1-1.—Study area and survey site organization within LCR MSCP areas and sites, 2016*

| Study area | LCR MSCP area | LCR MSCP site | LCR MSCP section(s) (former survey site name) |
|---|---|---|---|
| Bill Williams | Bill Williams River West | BW Delta | Coyote Crossing |
| | | North of Main Delta | Bill Willow |
| | | North Burn | Wispy Willow |
| | | | Site 01 |
| | | | Burn Edge |
| | | Mosquito Flats | Site 04 |
| | | | Site 03 |
| | | Cross River | Last Gasp |
| | | | Guinness |
| | | Sandy Wash | Site 05 |
| | | | Black Rail |
| | Bill Williams River East | Esquerra Ranch | Beaver Pond North (Mineral Wash) |
| | | | Beaver Pond |
| | | Honeycomb Bend | Site 08 |
| | | Cave Wash | Upstream from Site 08 |
| Alamo Lake | Alamo Lake | Lake | Bullard Wash |
| | | | Bullard Wash North |
| | | | South Camp |
| | | | Over the Edge |
| | | Brown's Crossing | Sidebar 01 |
| | | | Edgewater 01 |
| | | | Camp 01 |
| | | | Camp 04 |
| | | | Camp 02 |
| | | | Camp 03 |
| | | | Middle Earth 01 |
| | | | Middle Earth 02 |
| | | | Prospect 01 |
| | | | Burro Wash 01 |
| | | | Burro Wash 02 |
| | | | Motherlode 01 |
| | | | Motherlode 02 |
| | | | Motherlode 03 |
| | | | Motherlode 04 |
| | | | Confluence 02 |
| | | | Santa Maria South 01 |
| | | | Santa Maria North 01 |

Table A1-1.—Study area and survey site organization within LCR MSCP areas and sites, 2016*

| Study area | LCR MSCP area | LCR MSCP site | LCR MSCP section(s) (former survey site name) |
|---|---|---|---|
| Palo Verde Ecological Reserve | Palo Verde Ecological Reserve | Phase 02 | Phase 02 |
| | | Phase 03 | Phase 03 |
| | | Phase 04 | Phase 04 Block 01 |
| | | | Phase 04 Block 02 |
| | | | Phase 04 Block 03 |
| | | Phase 05 | Phase 05 Block 01 |
| | | | Phase 05 Block 02 |
| | | | Phase 05 Block 03 |
| | | Phase 06 | Phase 06 Block 01 |
| | | | Phase 06 Block 02 |
| | | Phase 07 | Phase 07 Block 01 |
| | | | Phase 07 Block 02 |
| Cibola | Cibola Valley Conservation Area | Phase 01 | Phase 01 |
| | | Phase 02 | Phase 02 |
| | | Phase 03 | Phase 03 |
| | Cibola National Wildlife Refuge Unit #1 | Nature Trail | Nature Trail |
| | | Crane Roost | C2729 |
| Yuma | Yuma East Wetlands[1] | J | C4703 |
| | | C (formerly South AC) | C4711 |
| | | I | C4702 |

* Except where noted, the LCR MSCP section name corresponds to the current survey site name, though the geography of corresponding sections and survey sites may not be identical.

[1] Data collected at Yuma East Wetlands are reported under the LCR MSCP site name; each survey site constitutes only a small portion of each LCR MSCP site.

# ATTACHMENT 2

Field Data Forms

MSCP Area: Do Not Use MSCP Site: Do Not Use

## SWFL General Site Description

[Complete at least 3 times during season: early (10–25 May), mid-season (10–25 June), and late season (5–20 July)]

**Study Area:** Study Area **Survey Site:** Survey Site **Visit:** Choose an item. **Date:** Date **Observer(s):** Observer(s)

| VEGETATION | | | | | |
|---|---|---|---|---|---|
| **Vegetation Type 1** | | **Vegetation Type 2** | | **Vegetation Type 3** | |
| **Dominant overstory spp:** | Overstory spp | **Dominant overstory spp:** | Overstory spp | **Dominant overstory spp:** | Overstory spp |
| **Overstory ht (m):** | Overstory height | **Overstory ht (m):** | Overstory height | **Overstory ht (m):** | Overstory height |
| **Dominant understory spp:** | Understory spp | **Dominant understory spp:** | Understory spp | **Dominant understory spp:** | Understory spp |
| **Understory height (m):** | Understory height | **Understory height (m):** | Understory height | **Understory height (m):** | Understory height |
| **% Canopy closure:** | % Canopy Closure | **% Canopy closure:** | % Canopy Closure | **% Canopy closure:** | % Canopy Closure |
| **Inundated?** | Yes / No | **Inundated?** | Yes / No | **Inundated?** | Yes / No |
| **Percentage of site:** | % of Site | **Percentage of site:** | % of Site | **Percentage of site:** | % of Site |

**Overall vegetation composition at site:** Choose an item.

**Other vegetation types present (e.g., cattail)?** Yes / No **If yes,** **type of vegetation:** Type of vegetation **percentage of site:** % of site.

**type of vegetation:** Type of vegetation **percentage of site:** % of site

| HYDROLOGY | | | |
|---|---|---|---|
| **% INUNDATED** (% of site) | **% SATURATED Soils** (NOT including inundated areas!) | **% DAMP Soils** (NOT including inundated or saturated areas!) | **% DRY Soils** (NOT including moist soils!) |
| | | | |

**If INUNDATED:**

**Describe type of surface water (e.g., open marsh, surface water within woody vegetation, stream, etc):** Type of surface water

**Average depth of surface water (cm):** Surface water depth

**If NO Inundated or Saturated Soils are present:**

**Distance (m) to Standing Water or Saturated Soil from EDGE of site:** Minimum distance to water **How was distance determined?** Choose an item.

**Describe type of nearest wet soils:** Type of nearest wet soils

**Approximate location of nearest wet soils:** Easting: Easting Northing: Northing

### LIVESTOCK

**Were signs of livestock noted in or near the site? If yes, please describe.** Signs of livestock. Include species, type of sign, freshness of sign, and abundance of sign.

### HABITAT SUITABILITY

**How suitable is the habitat for flycatchers?:** ☐ ☐ ☐ ☐ ☐

## NARRATIVE and PICTORIAL DESCRIPTION

**Does this description cover the entire site?** Yes / No **If not, which portion is described?** Portion of site described

**On the hardcopy map, sketch and label the locations of the major vegetation types you observed. Delineate marshes, open areas, and other habitat that may be unsuitable for flycatchers. If water was present, show its location.**

**Give a narrative description of the site, including adjacent habitats:** Narrative description of site. Use the numbers above to build your narrative. Explain any patterns present in the vegetation (e.g., shorter veg had lower canopy closure or vice versa). If you present averages above, make sure to also include the range in your narrative (as applicable) and vice versa.

**Additional comments:** Additional comments on habitat quality, other notable avian species, site access, etc.

STUDY AREA: _____ UTM NAD 83 Zone 11 _____ E _____ N TERR/NEST #: _____

BANDER: _____ DATE: _____ CAPTURE TIME: _____ RELEASE TIME: _____ NBN: ____ of ____

NOTES:_____

_____

_____

_____

**If a genetic sample or metric was not taken, explain why in notes**

| FEDERAL BAND # | COLOR COMBO | | STATUS | SEX | AGE | FECAL SAMPLE? (Y or N) | GENETIC SAMPLE? (Y or N) | # PHOTOS TAKEN | Adults | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | R | | | | | | | CP | BP | WING CHORD (mm) | TAIL (mm) | CULMEN LENGTH (mm) | CULMEN WIDTH (mm) | FAT |
| | | | | | | | | | | | | | | | |

STATUS: NCP = new cap passive, NCT = new cap target, RCP = recap passive, RCT = recap target, NBN = nestling banded
SEX: U = unknown, F = female, M = male
AGE: AHY = after hatch year; SY = second year; L = nestling banded in nest; HY = hatch year/young of the year
CP: 0 = non-breeding, S = partial breeding, M = full breeding
BP: 0 = none, 1 = smooth, 2 = vascularized and filled with fluid, 3 = wrinkled, 4 = molting
FAT: 0 = no fat; 1 = trace of fat in furculum, deeply concave, scattered patches, less than 5 percent filled; 2 = thin layer of fat in furculum, less than a third filled, trace of thin layer of fat in abdomen; 3 = furculum is ½ filled or more; small patches, not covering some areas, on abdomen; 4 = furculum more than 2/3 filled, level with clavicles, slightly mounded on abdomen

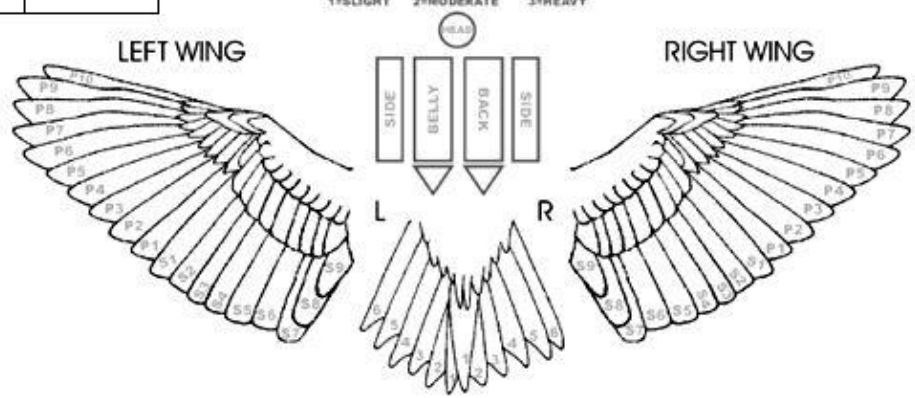
| Nestlings | |
|---|---|
| Developmental Age (days) | MASS (g) |
| | |

| RETAINED FEATHERS? | ACTIVE MOLT? |
|---|---|
| Y or N, if Y use diagram, detail in notes | |
| | |

BODY MOLT

(CIRCLE AREA OF MOLT, AND USE 1, 2, OR 3 TO DESIGNATE DEGREE OF MOLT)

1=SLIGHT 2=MODERATE 3=HEAVY



MSCP Area: Do Not Use MSCP Site: Do Not Use

## Willow Flycatcher Territory/Nest Record Form

Year: Year Study Area: Study Area Survey Site: Survey Site Territory/Nest #: Terr/Nest #

Final Easting: Do Not Use Final Northing: Do Not Use Final Acc: Do Not Use m

**Territory/Nest Location:**
NAD 83 Zone 11
Original Territory UTMs:
Easting: Easting
Northing: Northing
GPS Accuracy: Acc m
Territory UTMs (if moved):
Easting: Easting
Northing: Northing
GPS Accuracy: Acc m
Nest Flag UTMs (optional):
Easting: Easting
Northing: Northing
GPS Accuracy: Acc m
Nest UTMs:
Easting: Easting
Northing: Northing
GPS Accuracy: Acc m

**Nest Height**: Visually Estimated: Ht m Approx Measure: Ht m Measured: Ht m
**Nest Substrate**: Subst (e.g., TAMSPP, SALGOO, SALEXI)

**Distance from nest to standing water or saturated soil TRACKER:**
**When found**: Date: Date Observer: Obs
**At hatch**: Date: Date Observer: Obs
**At fledge/fail**: Date: Date Observer: Obs

**% Veg Volume = TAMSPP:** Date: Date Observer: Obs

**Vegetation type at nest**: Date: Date Observer: Obs

**Nest tree double-flagged**: Date: Date Observer: Obs

**General comments**: Comments

**Confirmed color combos:** Female: female combo
Male: male combo

**FEMALE Color band combination**: Band Combo **Band Number:** Band number
**MALE Color band combination:** Band Combo **Band Number:** Band number

| JUVENILES | | | | | |
|---|---|---|---|---|---|
| **Color combo:** Band combo | **Band #:** Band combo | **Fledged?** Y/N/U | **Color combo:** Band combo | **Band #:** Band number | **Fledged?** Y/N/U |
| **Color combo:** Band combo | **Band #:** Band combo | **Fledged?** Y/N/U | **Color combo:** Band combo | **Band #:** Band number | **Fledged?** Y/N/U |

**Willow Flycatcher**

| Trans dates | Date known? | |
|---|---|---|
| | | Found/Phase |
| | | First egg |
| | | Clutch completion |
| | | Hatching |
| | | Fledged or Failed |

**Willow Flycatcher**

| No. | Presumed | Confirmed | |
|---|---|---|---|
| | | | Eggs |
| | | | Nestlings |
| | | | Fledglings |

**Cowbird**

| Trans dates | |
|---|---|
| | First egg |
| | Hatched |
| | Fledged |

**Cowbird**

| No. | |
|---|---|
| | Eggs |
| | Nestlings |
| | Fledgling |

**Outcome:** Choose an item: Description

**Outcome codes:**
UN= unknown; FV= at least one fledge visually confirmed; PE= probable predation, nest empty and intact; PD= probable predation, damage to nest structure; AB= nest abandoned prior to egg(s) being laid; DE= deserted with egg(s) or young; PA= parasitized, cowbird eggs or young outlived host's; AD= addled, no eggs hatched after >20 d inc; OT= failure due to other, or unknown, causes.

**Mayfield success codes**: S= successful; D= depredated; U= fate unknown; M= mortality other than predation; A= deserted with host egg(s) or young; Z= abandoned, no host eggs laid.

| Mayfield Success | | |
|---|---|---|
| (WIFL) Period | # Exposure days | Success |
| Egg Laying | | |
| Incubation | | |
| Nestling | | |

**Mon Type**: M=mirror, O=obs. with binocs. **Stage**: S =single bird, P = pair, B=building, L=laying, I=incubating, N=nestling, F=fledgling, NA=no activity.
**Field Tasks**: RSM=resight male, RSF=resight female, RSB=resight both, OB=observe in territory, CP=confirm pair, LN=locate nest, LRN=locate renest, PN=pole nest, CA=confirm activity or stage, VN# =verify nestling number, VF# =verify fledgling #, BN=band nestlings, AE=addle cowbird egg, GPS=GPS nest, DW=measure distance to water, PT=% TAMSPP, VT=Veg type at nest

| Date | Time | | Obs | Mon Type | Stage | # Ad | # WE | # CE | # WN | # CN | # WF | Age Yng | Field Tasks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | Out | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

## Observed Leg Injuries

**Study Area:** Study Area **Survey Site:** Survey Site **Territory/Nest #:** Terr #
**Date:** Date **Observer(s):** Observer(s)

---

**Color-band combination:** Color combo **If captured, Federal Band #:** Prefix-Suffix

**PHOTOGRAPH INFORMATION**

**Did you take photos?** Yes / No **If yes, how many?** # of pics

**After you download and name the photos, create a link to each photo:**

| | |
|---|---|
| Photo 1 | |
| Photo 2 | |
| Photo 3 | |
| Photo 4 | |
| Photo 5 | |
| Photo 6 | |

**NOTES**

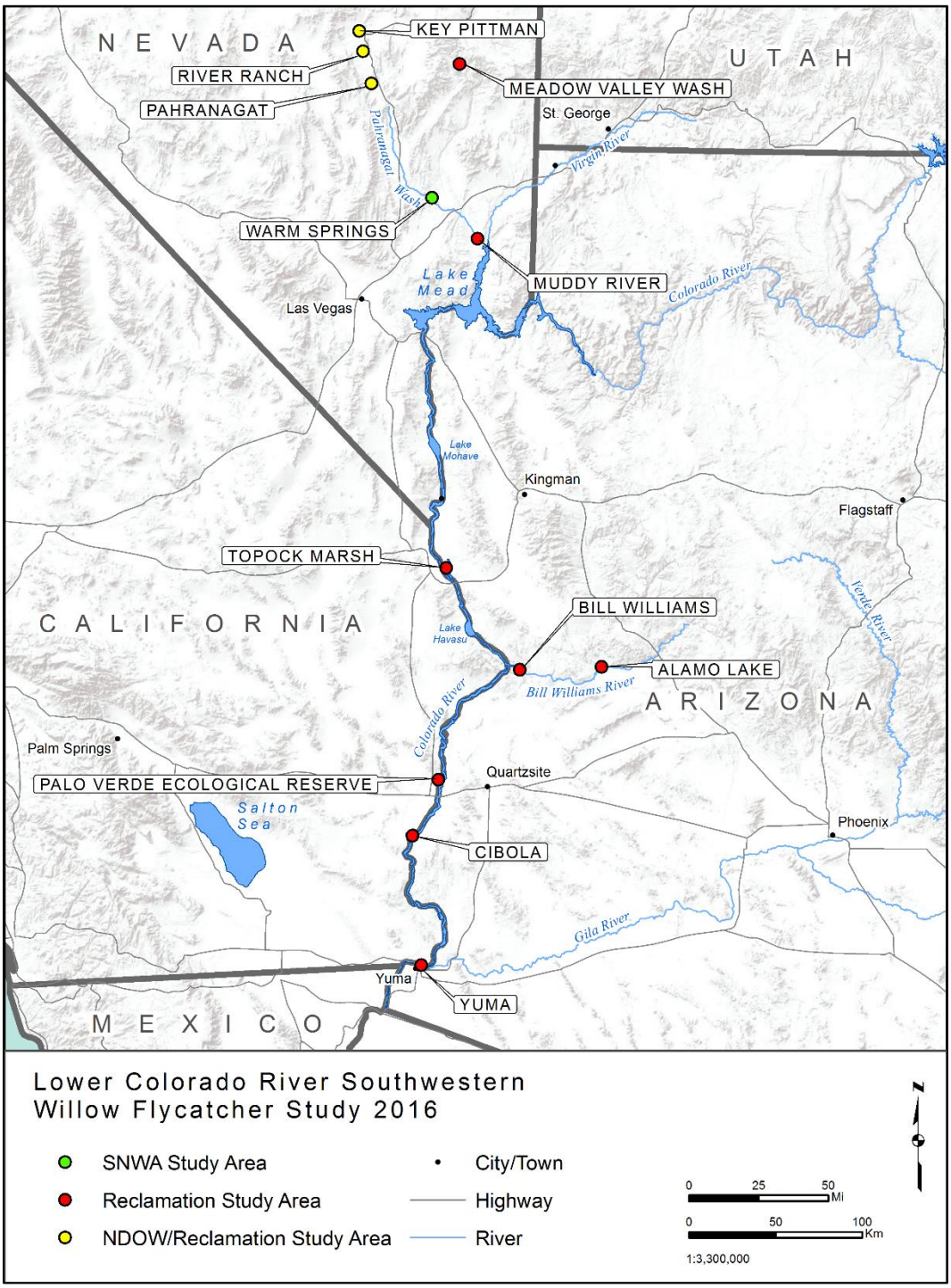
**Detail all pertinent information including duration of observation, behaviors, how bird was holding its leg, whether the bird had use of the leg, etc. **Banders** – describe the injury in detail. Was the band removed? If so, did the leg bleed? Was the bird stressed? Be precise, complete, and detailed.

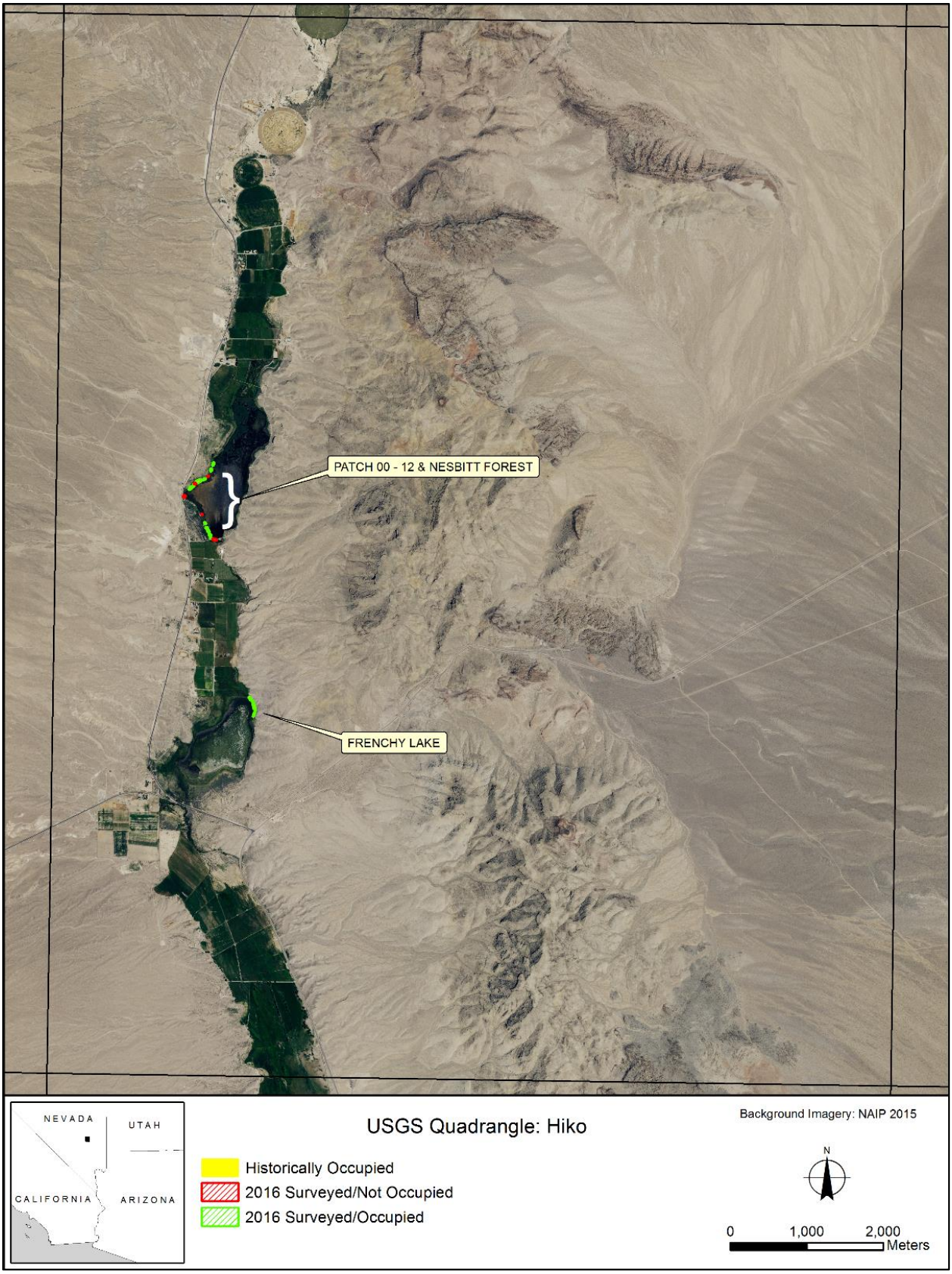
Notes on observed leg injury

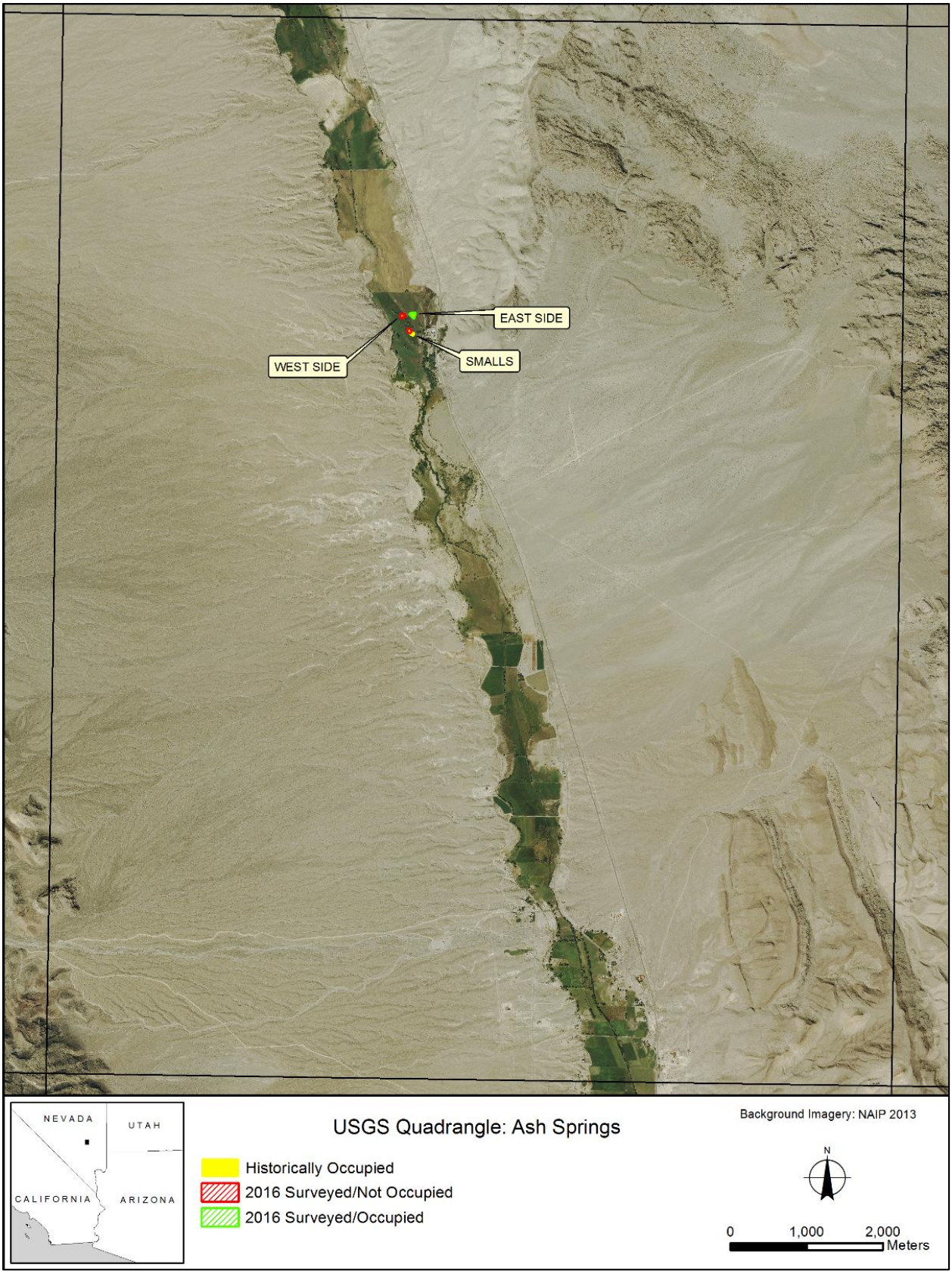
# ATTACHMENT 3

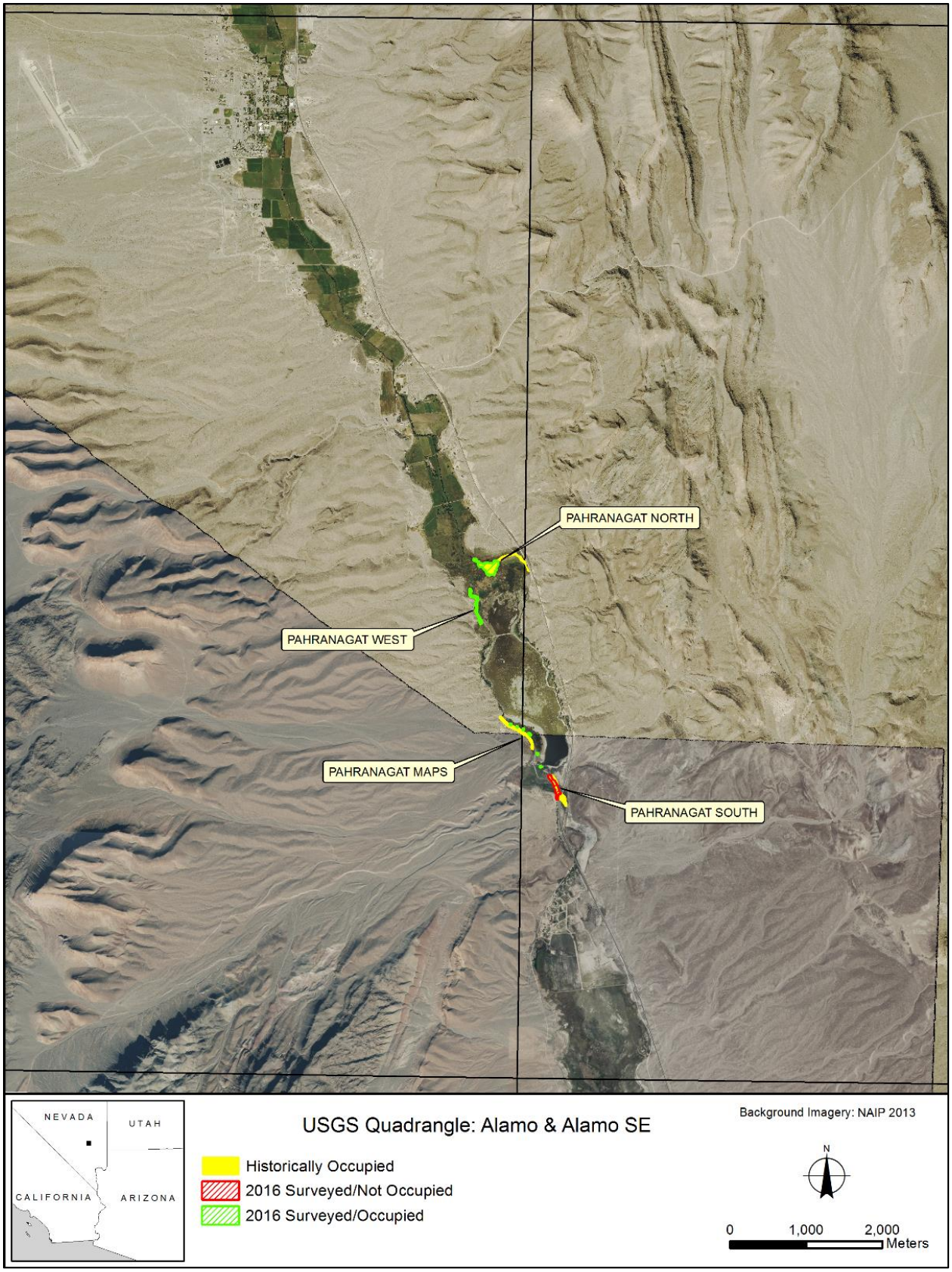
Orthophotos Showing Study Sites

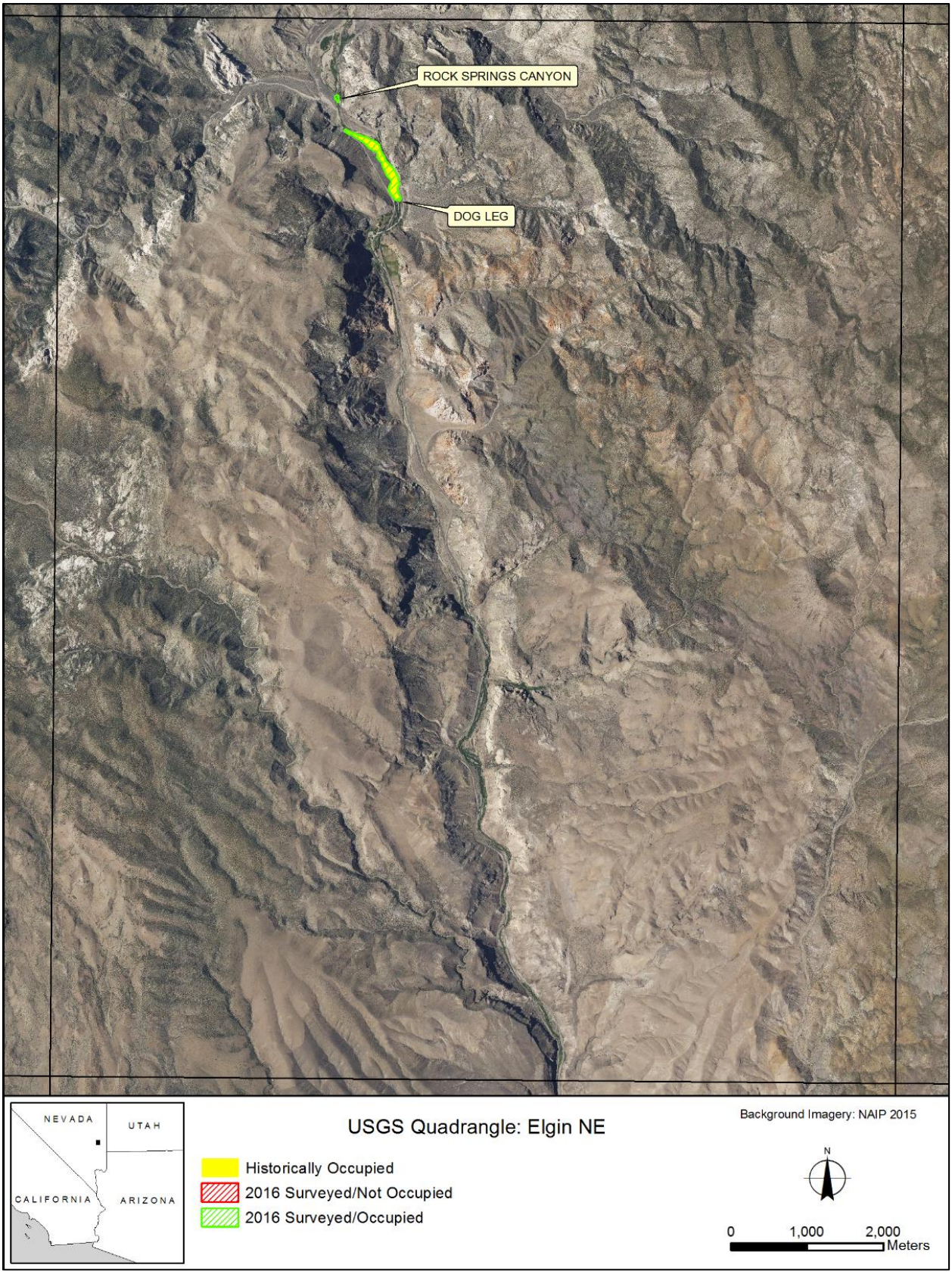
**Definition of Survey Site Occupancy** – Survey sites are considered occupied if resident (i.e., detected in one location for at least 7 days) or breeding flycatchers are detected, or if a flycatcher is detected between June 24 and July 20, regardless of residency status. A site is considered historically occupied if this criterion was met in any year 2003–15.




PATCH 00 - 12 & NESBITT FOREST
FRENCHY LAKE
NEVADA
UTAH
CALIFORNIA
ARIZONA
USGS Quadrangle: Hiko
Background Imagery: NAIP 2015
Historically Occupied
2016 Surveyed/Not Occupied
2016 Surveyed/Occupied
N
0
1,000
2,000
Meters

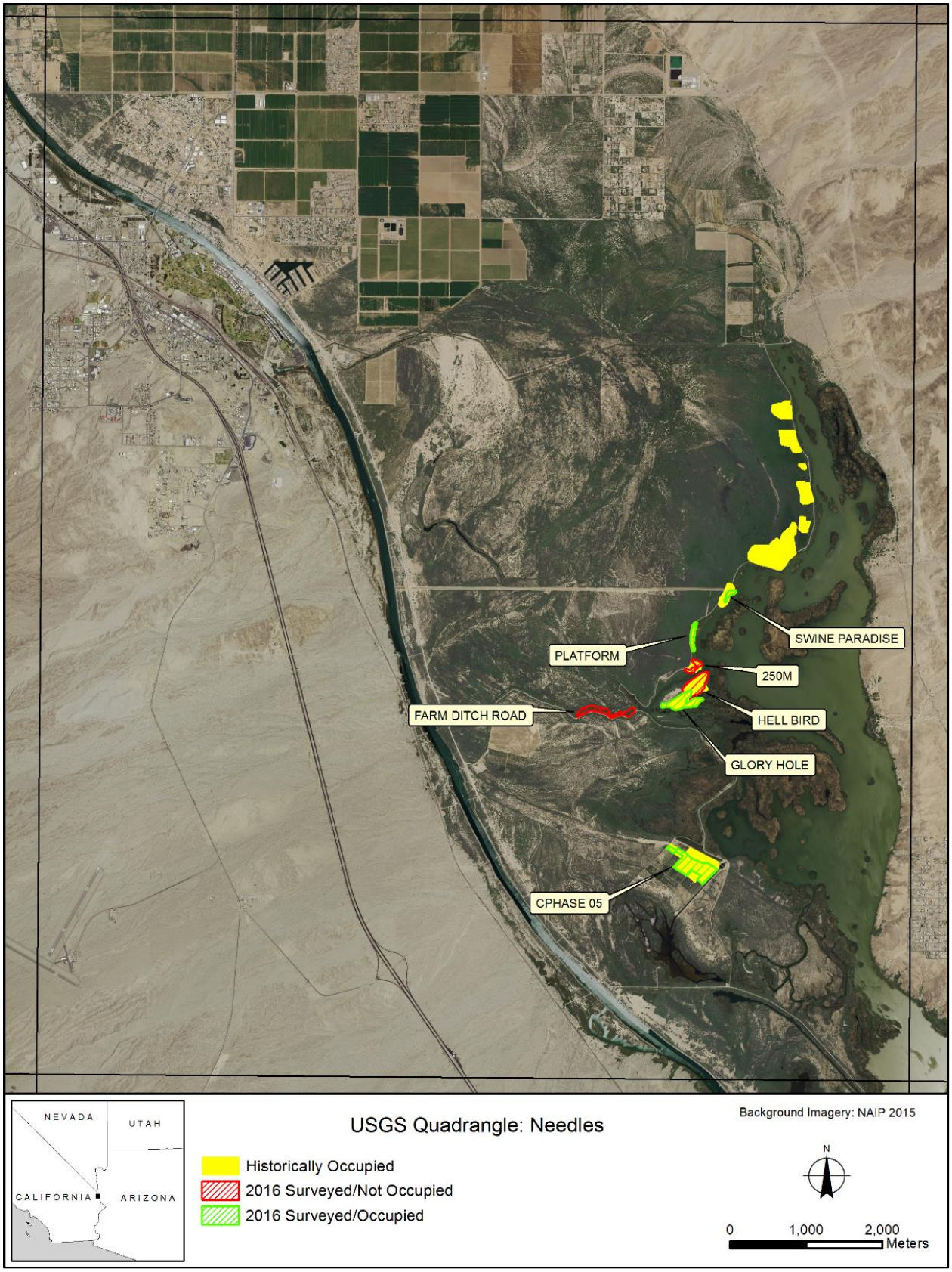

EAST SIDE
WEST SIDE
SMALLS
NEVADA
UTAH
CALIFORNIA
ARIZONA
USGS Quadrangle: Ash Springs
Historically Occupied
2016 Surveyed/Not Occupied
2016 Surveyed/Occupied
Background Imagery: NAIP 2013
N
0
1,000
2,000
Meters

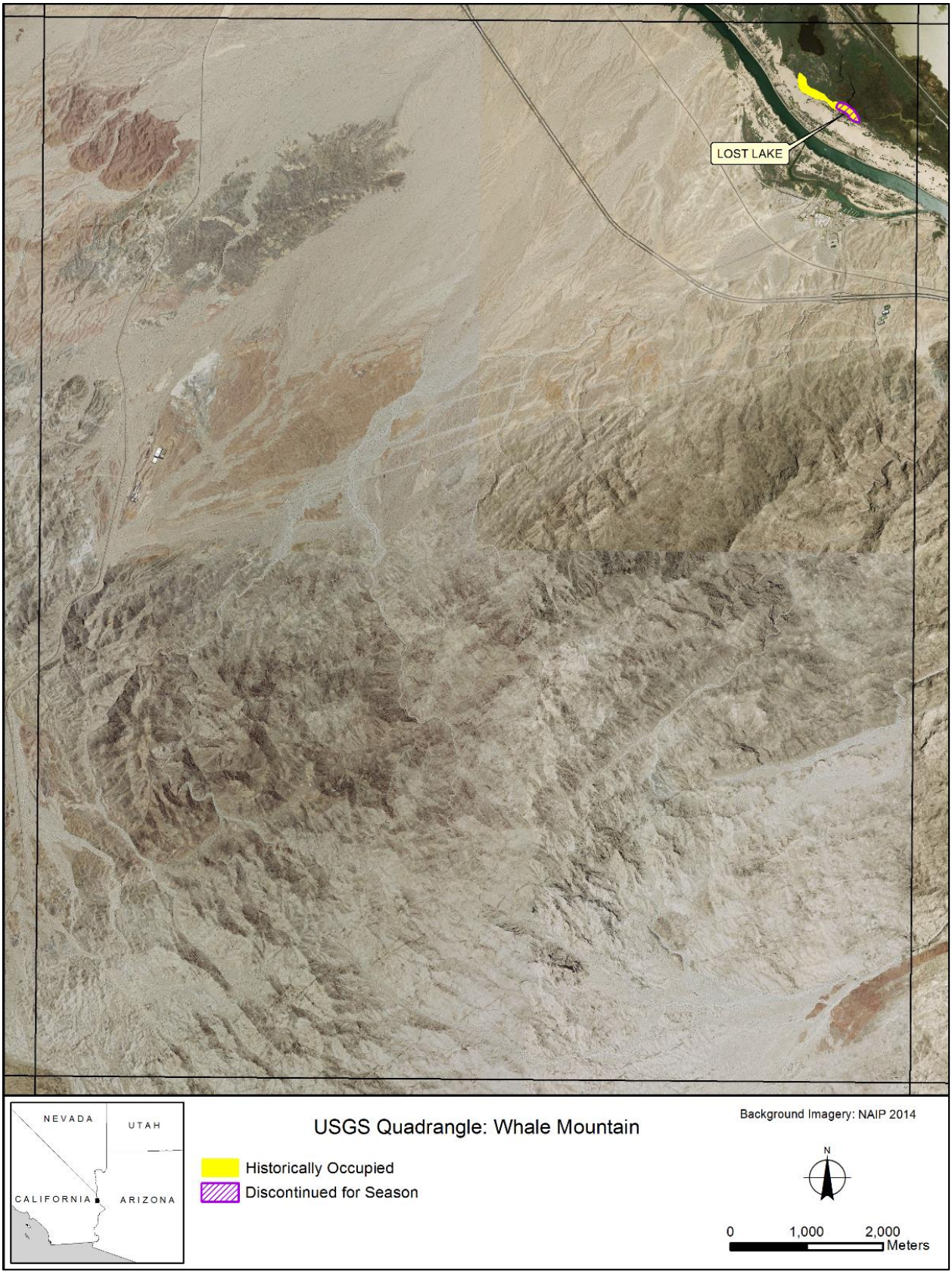

PAHRANAGAT NORTH
PAHRANAGAT WEST
PAHRANAGAT MAPS
PAHRANAGAT SOUTH
NEVADA
UTAH
CALIFORNIA
ARIZONA
USGS Quadrangle: Alamo & Alamo SE
Historically Occupied
2016 Surveyed/Not Occupied
2016 Surveyed/Occupied
Background Imagery: NAIP 2013
N
0
1,000
2,000
Meters

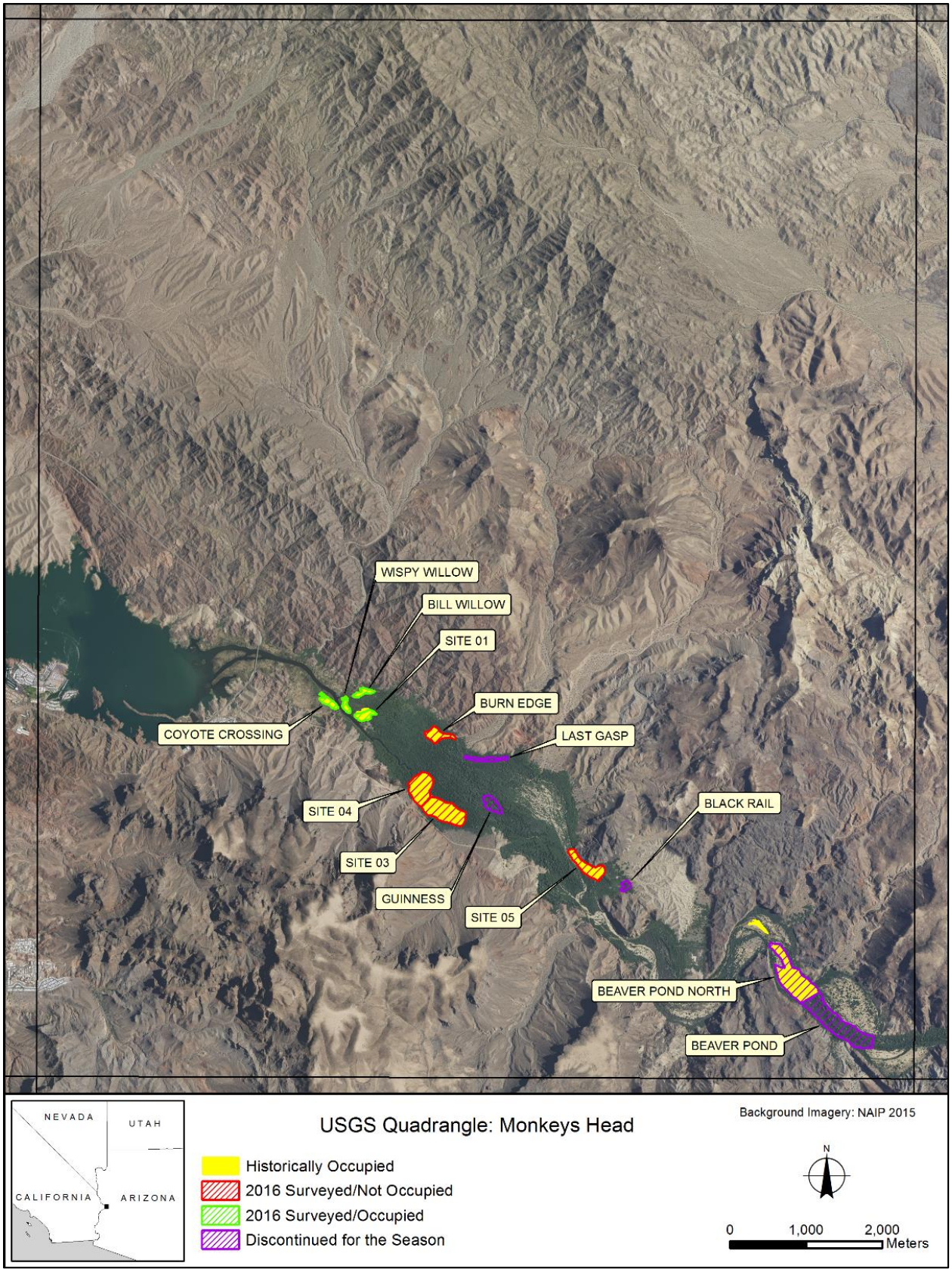

ROCK SPRINGS CANYON
DOG LEG
NEVADA
UTAH
CALIFORNIA
ARIZONA
USGS Quadrangle: Elgin NE
Historically Occupied
2016 Surveyed/Not Occupied
2016 Surveyed/Occupied
Background Imagery: NAIP 2015
N
0
1,000
2,000
Meters

OVERTON WMA POND
OVERTON WMA
NEVADA
UTAH
CALIFORNIA
ARIZONA
USGS Quadrangle: Overton
Historically Occupied
2016 Surveyed/Not Occupied
2016 Surveyed/Occupied
Background Imagery: NAIP 2015
N
0
1,000
2,000
Meters

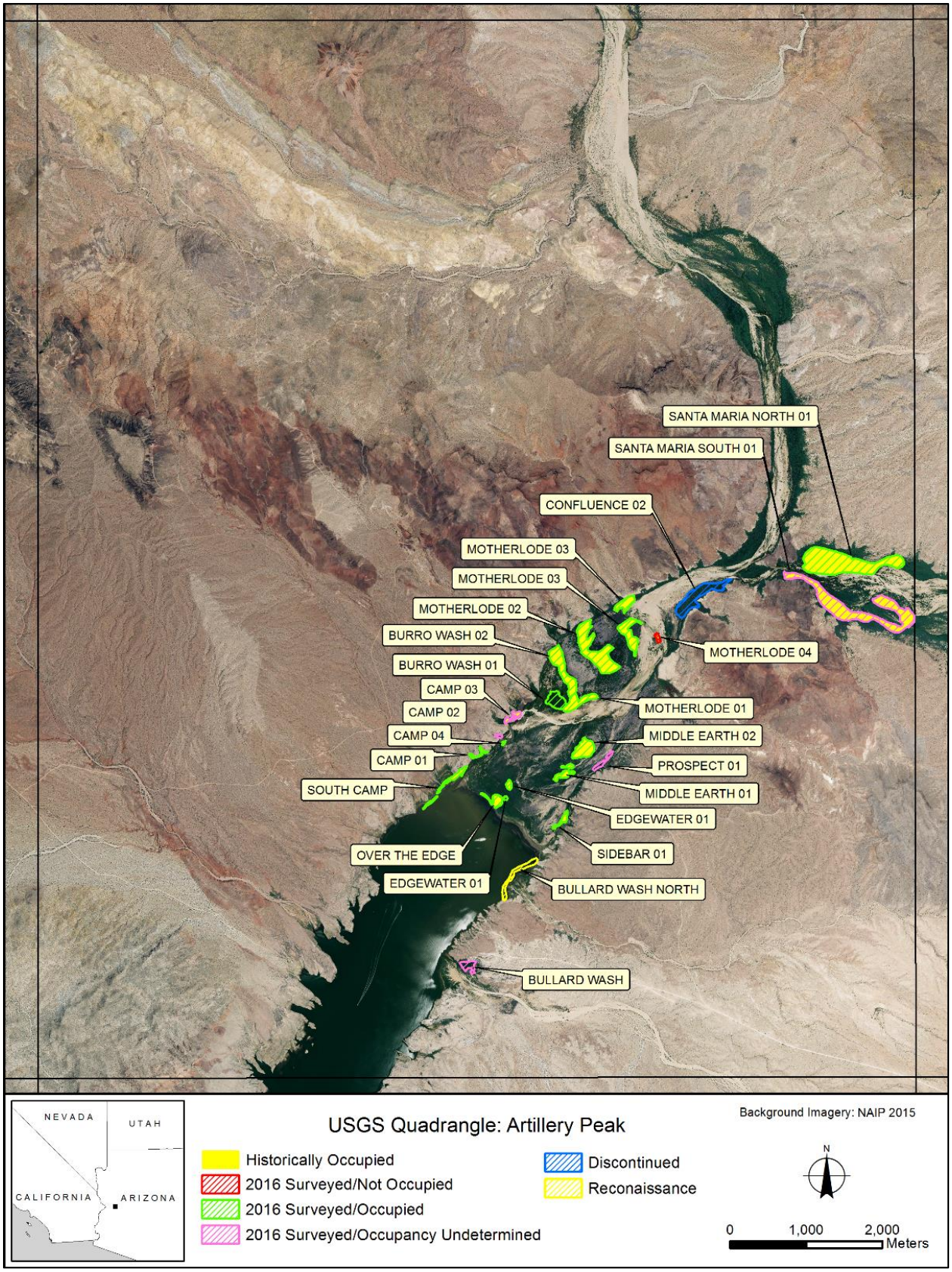
MUDDY STRINGER 01
MUDDY MAC
NEVADA
UTAH
CALIFORNIA
ARIZONA
USGS Quadrangle: Moapa West
Background Imagery: NAIP 2015
Historically Occupied
2016 Surveyed/Not Occupied
2016 Surveyed/Occupied
N
0
1,000
2,000
Meters

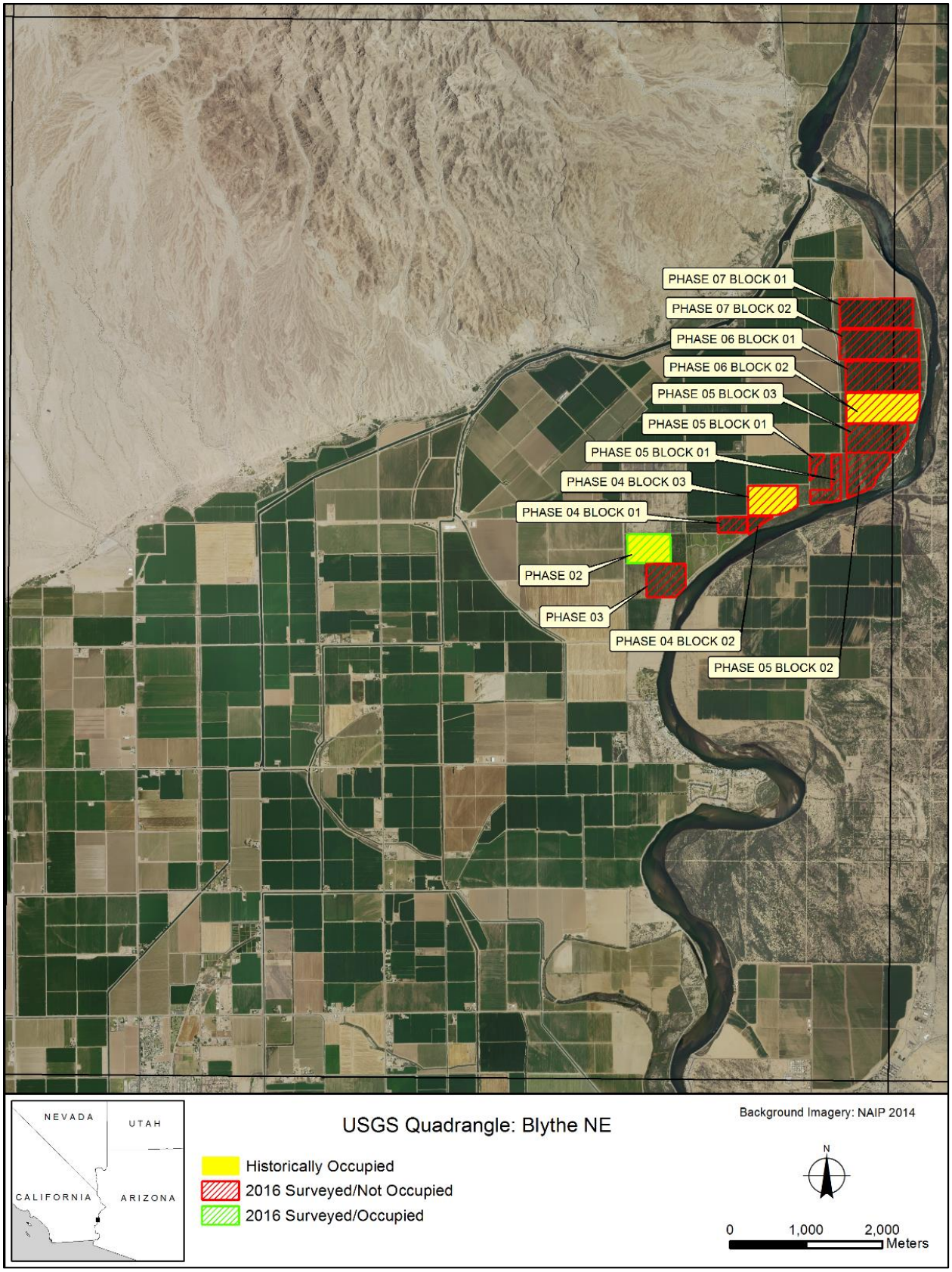

SWINE PARADISE
PLATFORM
250M
FARM DITCH ROAD
HELL BIRD
GLORY HOLE
CPHASE 05
NEVADA
UTAH
CALIFORNIA
ARIZONA
USGS Quadrangle: Needles
Historically Occupied
2016 Surveyed/Not Occupied
2016 Surveyed/Occupied
Background Imagery: NAIP 2015
N
0
1,000
2,000
Meters

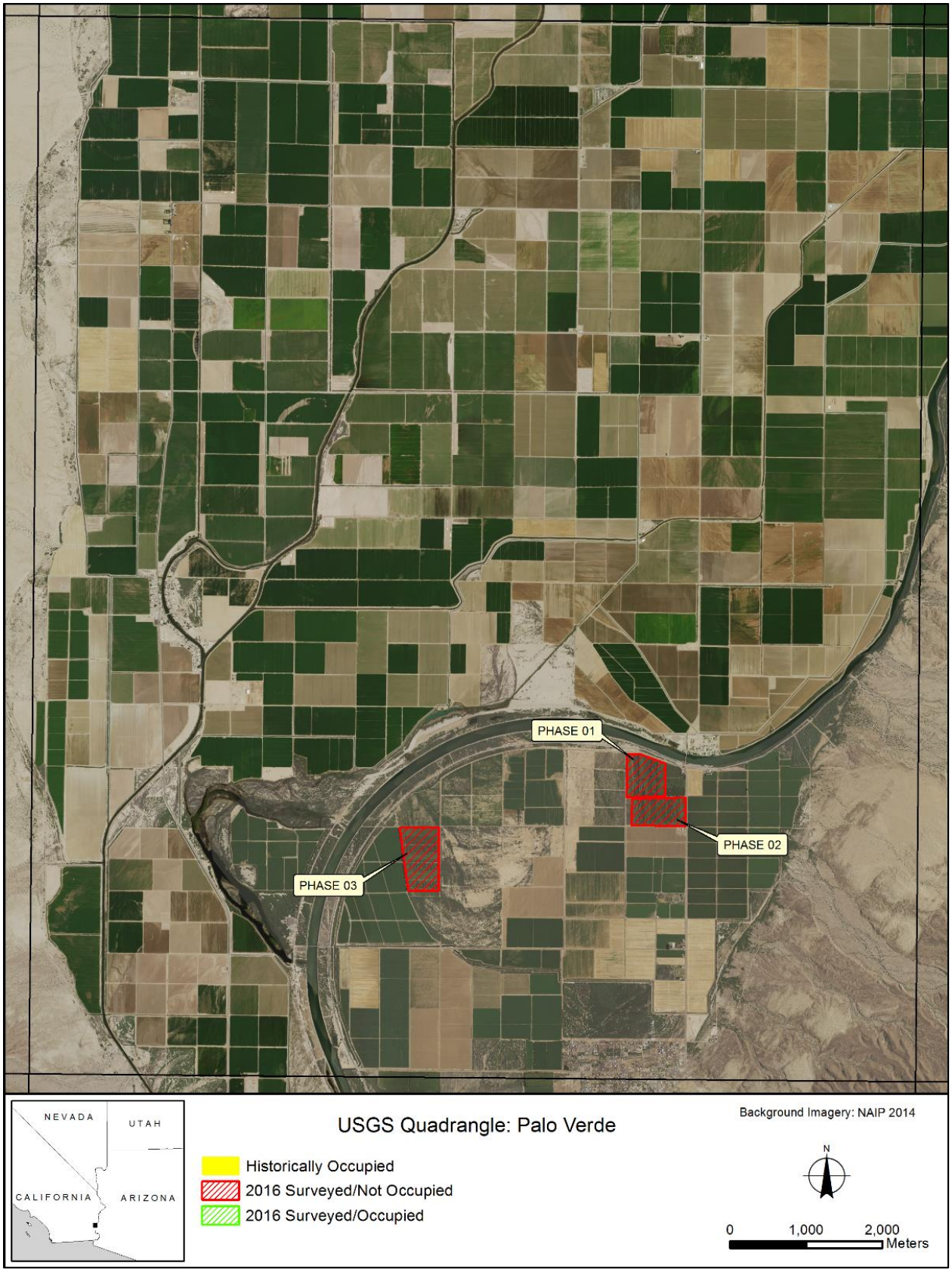

LOST LAKE
NEVADA
UTAH
CALIFORNIA
ARIZONA
USGS Quadrangle: Whale Mountain
Historically Occupied
Discontinued for Season
Background Imagery: NAIP 2014
N
0
1,000
2,000
Meters


WISPY WILLOW
BILL WILLOW
SITE 01
BURN EDGE
COYOTE CROSSING
LAST GASP
SITE 04
BLACK RAIL
SITE 03
GUINNESS
SITE 05
BEAVER POND NORTH
BEAVER POND
NEVADA
UTAH
CALIFORNIA
ARIZONA
USGS Quadrangle: Monkeys Head
Background Imagery: NAIP 2015
Historically Occupied
2016 Surveyed/Not Occupied
2016 Surveyed/Occupied
Discontinued for the Season
N
0
1,000
2,000
Meters

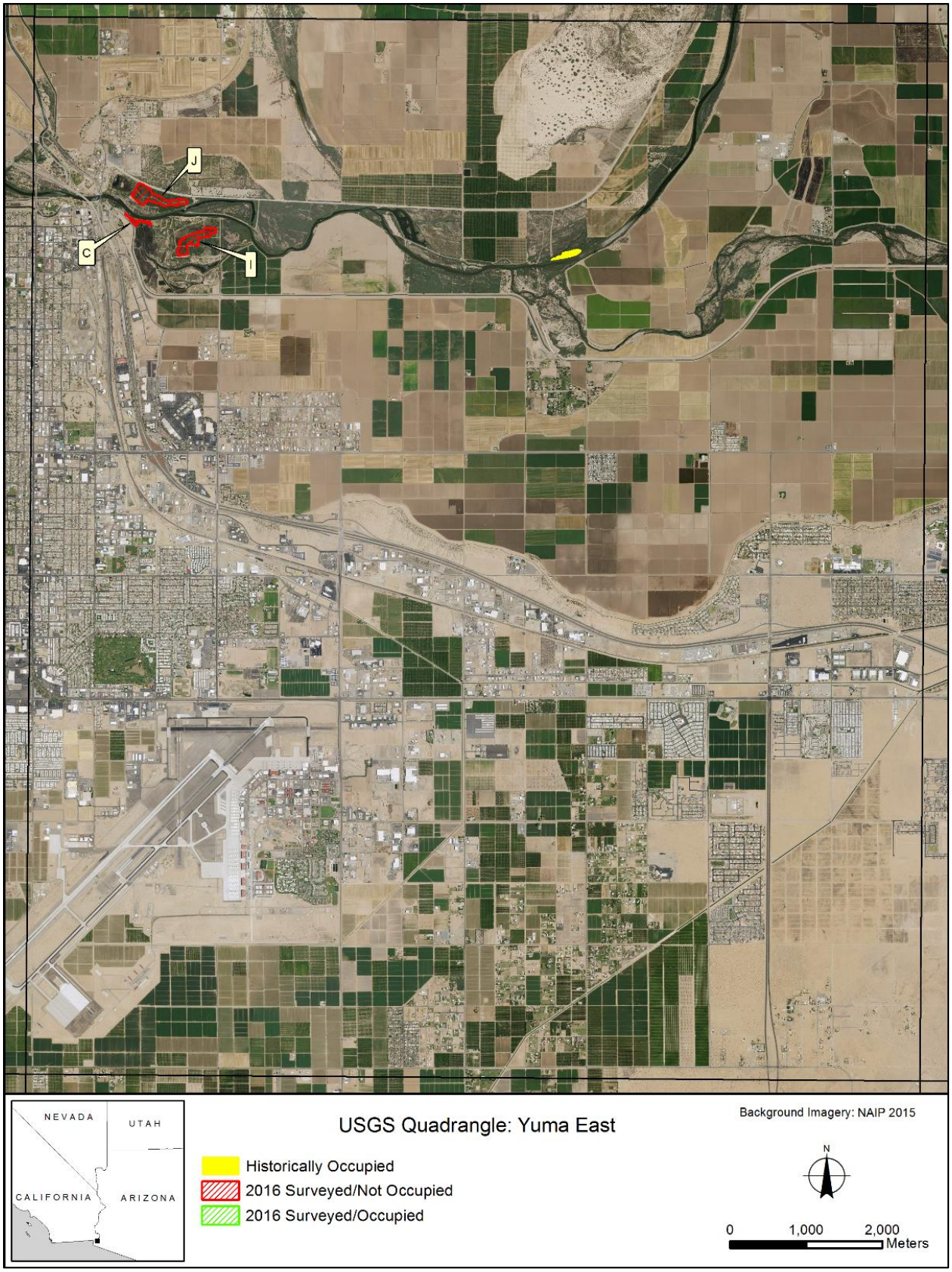
SITE 08
UPSTREAM FROM SITE 08
NEVADA
UTAH
CALIFORNIA
ARIZONA
USGS Quadrangle: Castaneda Hills SW
Historically Occupied
2016 Surveyed/Not Occupied
2016 Surveyed/Occupied
Background Imagery: NAIP 2015
N
0
1,000
2,000
Meters


SANTA MARIA NORTH 01
SANTA MARIA SOUTH 01
CONFLUENCE 02
MOTHERLODE 03
MOTHERLODE 03
MOTHERLODE 02
BURRO WASH 02
BURRO WASH 01
CAMP 03
CAMP 02
CAMP 04
CAMP 01
SOUTH CAMP
OVER THE EDGE
EDGEWATER 01
MOTHERLODE 04
MOTHERLODE 01
MIDDLE EARTH 02
PROSPECT 01
MIDDLE EARTH 01
EDGEWATER 01
SIDEBAR 01
BULLARD WASH NORTH
BULLARD WASH
NEVADA
UTAH
CALIFORNIA
ARIZONA
USGS Quadrangle: Artillery Peak
Background Imagery: NAIP 2015
Historically Occupied
2016 Surveyed/Not Occupied
2016 Surveyed/Occupied
2016 Surveyed/Occupancy Undetermined
Discontinued
Reconaissance
N
0
1,000
2,000
Meters


PHASE 07 BLOCK 01
PHASE 07 BLOCK 02
PHASE 06 BLOCK 01
PHASE 06 BLOCK 02
PHASE 05 BLOCK 03
PHASE 05 BLOCK 01
PHASE 05 BLOCK 01
PHASE 04 BLOCK 03
PHASE 04 BLOCK 01
PHASE 02
PHASE 03
PHASE 04 BLOCK 02
PHASE 05 BLOCK 02
NEVADA
UTAH
CALIFORNIA
ARIZONA
USGS Quadrangle: Blythe NE
Historically Occupied
2016 Surveyed/Not Occupied
2016 Surveyed/Occupied
Background Imagery: NAIP 2014
N
0
1,000
2,000
Meters


PHASE 01
PHASE 02
PHASE 03
NEVADA
UTAH
CALIFORNIA
ARIZONA
USGS Quadrangle: Palo Verde
Historically Occupied
2016 Surveyed/Not Occupied
2016 Surveyed/Occupied
Background Imagery: NAIP 2014
N
0
1,000
2,000
Meters

NATURE TRAIL
C2729
NEVADA
UTAH
CALIFORNIA
ARIZONA
USGS Quadrangle: Cibola
Historically Occupied
2016 Surveyed/Not Occupied
2016 Surveyed/Occupied
Background Imagery: NAIP 2015
N
0
1,000
2,000
Meters


J
C
I
NEVADA
UTAH
CALIFORNIA
ARIZONA
USGS Quadrangle: Yuma East
Historically Occupied
2016 Surveyed/Not Occupied
2016 Surveyed/Occupied
Background Imagery: NAIP 2015
N
0
1,000
2,000
Meters

# ATTACHMENT 4

Southwestern Willow Flycatcher (*Empidonax traillii extimus*) Survey Dates for Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Areas and Sites, 2016

Table A4-1.—Dates of presence/absence surveys for willow flycatchers, 2016

| Study area[1] | LCR MSCP area | LCR MSCP site | LCR MSCP section (survey site) | Survey dates |
|---|---|---|---|---|
| KEPI | Alamo | Key Pittman Wildlife Management Area | Frenchy Lake | June 14, July 10 |
| | | | Nesbitt Forest[2] | May 16 |
| | | | Patches 00–04[3] | May 16 |
| | | | Patch 04.5 | May 16, June 10, June 26 |
| | | | Patch 05[3] | June 10, June 26 |
| | | | Patches 06-10[4] | – |
| | | | Patch 10.5[2] | May 16 |
| | | | Patches 11-12[4] | – |
| RIRA | Alamo | River Ranch | East Side[3] | May 26 |
| | | | West Side[3] | June 10, June 26 |
| | | | Smalls | May 26, June 10, June 26 |
| PAHR | Alamo | Pahranagat National Wildlife Refuge | Pahranagat North | May 15, June 23, July 10 |
| | | | Pahranagat West | May 15, June 15, July 14 |
| | | | Pahranagat MAPS[3] | May 15, June 15 |
| | | | Pahranagat South | May 15, June 9, July 12 |
| MVWA | Meadow Valley Wash | Meadow Valley Wash North | Rock Springs Canyon[4] | – |
| | | | Dog Leg | May 18, June 12, June 21, June 27, July 13 |
| MUDD | Muddy River | Overton Above High-Water Mark | Overton WMA Pond | May 17, June 7, June 25, July 5, July 11 |
| | | Overton Wildlife | Overton WMA | May 17, June 13/15, June 21, June 29, July 7/11, July 14 |
| WMSP | Muddy River | Warm Springs | Muddy Mac | May 24, June 7, June 22, July 5, July 14 |
| | | | Muddy Stringer 01[3] | May 24 |
| TOPO | Topock | Topock Marsh | Swine Paradise[4] | – |
| | | | Platform | May 16, June 6, June 12, June 27, July 6 |
| | | | 250M | May 16, June 7, June 20, June 27, July 3 |
| | | | Hell Bird | May 16, June 3, June 20, June 29, July 10 |
| | | | Glory Hole | May 15, June 3–4, June 21, June 30, July 14 |
| | | | Farm Ditch Road (formerly Spaghetti) | May 16, June 7, June 20, June 27, July 3 |
| | Beal Lake Conservation Area | CPhase 05 | CPhase 05 (formerly Beal Lake) | May 19, June 7, June 21, June 28, July 7 |
| | Topock | Topock Bay | Lost Lake[5] | – |

Table A4-1.—Dates of presence/absence surveys for willow flycatchers, 2016

| Study area[1] | LCR MSCP area | LCR MSCP site | LCR MSCP section (survey site) | Survey dates |
|---|---|---|---|---|
| BIWI | Bill Williams River West | BW Delta | Coyote Crossing[3] | June 22, July 2, July 10 |
| | | North Main Delta | Bill Willow[3] | May 17, June 1 |
| | | North Burn | Wispy Willow[3] | May 15 |
| | | | Site 01[3] | May 17, July 10, July 15 |
| | | | Burn Edge | May 14, May 20, June 1, June 8, June 30, July 10 |
| | | Mosquito Flats | Site 04 | May 17, June 2, June 11, June 28, July 12 |
| | | | Site 03 | May 16, June 1, June 9, June 27, July 4 |
| | | Cross River | Last Gasp[6] | May 14 |
| | | | Guinness[6] | May 14 |
| | | Sandy Wash | Site 05 | May 15, June 1, June 22, June 29, July 6 |
| | | | Black Rail[6] | May 15 |
| | Bill Williams River East | Esquerra Ranch | Beaver Pond North (formerly Mineral Wash)[6] | May 18 |
| | | | Beaver Pond[6] | May 18 |
| | | Honeycomb Bend | Site 08 | May 18, June 2, June 10, June 28, July 8 |
| | | Cave Wash | Upstream from Site 08 | May 18, June 2, June 10, June 28, July 8 |
| ALAM[7] | Alamo Lake | Lake | Bullard Wash | July 19 |
| | | | Bullard Wash North | July 19 |
| | | | South Camp | May 28, June 24 |
| | | | Over the Edge[4] | – |
| | | Brown's Crossing | Sidebar 01[4] | – |
| | | | Edgewater 01[4] | – |
| | | | Camp 01 | May 28 |
| | | | Camp 04 | May 28 |
| | | | Camp 02 | May 28, July 9 |
| | | | Camp 03 | May 28, July 9 |
| | | | Middle Earth 01[4] | – |
| | | | Middle Earth 02[4] | – |
| | | | Prospect 01 | May 29 |
| | | | Burro Wash 01 | May 26 |
| | | | Burro Wash 02 | May 17 |
| | | | Motherlode 01[4] | – |
| | | | Motherlode 02 | May 29 |
| | | | Motherlode 03 | May 18 |
| | | | Motherlode 04 | May 18, June 2, July 19 |
| | | | Confluence 02[8] | May 22 |
| | | | Santa Maria South 01 | May 27, July 20 |
| | | | Santa Maria North 01 | May 27, June 26 |

Table A4-1.—Dates of presence/absence surveys for willow flycatchers, 2016

| Study area[1] | LCR MSCP area | LCR MSCP site | LCR MSCP section (survey site) | Survey dates |
|---|---|---|---|---|
| PVER | Palo Verde Ecological Reserve | Phase 02 | Phase 02 | May 22, June 5, June 13, June 30, July 11 |
| | | Phase 03 | Phase 03 | May 22, June 5–6, June 13, June 30, July 11 |
| | | Phase 04 | Phase 04 Block 01 | May 22, June 5, June 13, July 4, July 11 |
| | | | Phase 04 Block 02 | May 22, June 5, June 13, June 30, July 11 |
| | | | Phase 04 Block 03 | May 22, June 5, June 13, June 30, July 11 |
| | | Phase 05 | Phase 05 Block 01 | May 22, June 6, June 14, July 4, July 11 |
| | | | Phase 05 Block 02 | May 22, June 7, June 14, July 4, July 11 |
| | | | Phase 05 Block 03 | May 23, June 6, June 14, July 4, July 14 |
| | | Phase 06 | Phase 06 Block 01 | May 23, June 7, June 16, July 6, July 14 |
| | | | Phase 06 Block 02 | May 23, June 7, June 14, July 6, July 13 |
| | | Phase 07 | Phase 07 Block 01 | May 25, June 9, June 16, June 29, July 7 |
| | | | Phase 07 Block 02 | May 24, June 9, June 16, June 29, July 13 |
| CIBO | Cibola Valley Conservation Area | Phase 01 | Phase 01 | May 24, June 8, June 15, July 5, July 12 |
| | | Phase 02 | Phase 02 | May 24, June 8, June 15, July 5, July 12 |
| | | Phase 03 | Phase 03 | May 24, June 8, June 15, July 5, July 12 |
| | Cibola National Wildlife Refuge Unit #1 | Nature Trail | Nature Trail | May 25, June 9, June 15, July 7, July 13 |
| | | Crane Roost | C2729 | May 25, June 9, June 15, July 7, July 13 |
| YUMA | Yuma East Wetlands | J | C4703 (J) | May 25, June 8, June 14, July 5, July 12 |
| | | C (formerly South AC) | C4711 (C) | May 25, June 8, June 14, July 5, July 12 |
| | | I | C4702 (I) | May 25, June 8, June 14, July 5, July 12 |

[1] KEPI = Key Pittman, RIRA = River Ranch, PAHR = Pahranagat, MVWA = Meadow Valley Wash, MUDD = Muddy River, WMSP = Warm Springs, TOPO = Topock Marsh, BIWI = Bill Williams, ALAM = Alamo Lake, PVER = Palo Verde Ecological Reserve, CIBO = Cibola, and YUMA = Yuma.

[2] Site immediately adjacent to occupied habitat; no surveys conducted during occupied period.

[3] Site occupied for a portion of the survey season; no surveys completed during occupied period.

[4] Site occupied throughout survey season; no surveys conducted.

[5] No surveys conducted for the season because of poor habitat quality resulting from fire damage.

[6] Surveys discontinued for the season because of the lack of surface water at the site.

[7] Effort at Alamo Lake focused on monitoring known territories, and no site was surveyed more than three times.

[8] Surveys discontinued because of poor habitat quality.

# ATTACHMENT 5

Southwestern Willow Flycatcher Survey (*Empidonax traillii extimus*) Results for Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Areas and Sites, 2016

Table A5-1.—Southwestern willow flycatcher survey and monitoring results by survey site along the lower Colorado River and its tributaries, 2016*

| Study area<br>LCR MSCP area<br>River drainage, State | LCR MSCP site | LCR MSCP section (survey site)[1] | Area (hectares) | Number of surveys | Survey hours | Resident adults | Territories | Pairs | Nests | Number of confirmed fledges | Unknown status[2] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Before June 24 | After June 24 |
| Key Pittman (KEPI)<br>Alamo<br>Pahranagat Valley, Nevada | Key Pittman Wildlife Management Area | Frenchy Lake | 0.7 | 2 | 0.4 | 2 | 1 | 1 | 2 | 0 | 1[3] | 0 |
| | | Nesbitt Forest | 0.2 | 1 | 0.02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Patch 00 | 0.05 | 1 | 0.02 | 2 | 1 | 1 | 2 | 0 | 0 | 0 |
| | | Patch 01 | 0.1 | 1 | 0.02 | 1[3] | 1 | 0 | 0 | 0 | 0 | 0 |
| | | Patch 02 | 0.1 | 1 | 0.01 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | | Patch 03 | 0.1 | 1 | 0.01 | 2 | 1 | 1 | 3 | 0 | 0 | 0 |
| | | Patch 04 | 0.1 | 1 | 0.01 | 3[4,5] | 1 | 1 | 2 | 0 | 0 | 0 |
| | | Patch 04.5 | 0.04 | 3 | 0.3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | | Patch 05 | 0.1 | 2 | 0.1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | | Patch 06 | 0.2 | 0 | – | 2[6] | 1 | 1 | 2 | 0 | 0 | 0 |
| | | Patch 07 | 0.1 | 0 | – | 2 | 1 | 1 | 2 | 0 | 0 | 0 |
| | | Patch 08 | 0.1 | 0 | – | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Patch 09 | 0.3 | 0 | – | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | | Patch 10 | 0.1 | 0 | – | 3[7] | 2 | 2 | 3 | 2 | 0 | 0 |
| | | Patch 10.5 | 0.05 | 1 | 0.03 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Patch 11 | 0.1 | 0 | – | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | | Patch 12 | 0.1 | 0 | – | 3[7] | 2 | 2 | 3 | 0 | 0 | 0 |
| **Study area total** | | | **1.8** | **–** | **0.9** | **22[3,4]** | **14** | **10** | **19** | **2** | **3[3]** | **0** |
| River Ranch (RIRA)<br>Alamo<br>Pahranagat Valley, Nevada | River Ranch | East Side | 0.4 | 1 | 0.1 | 2[8] | 1 | 1 | 3 | 1 | 0 | 2[5,9] |
| | | West Side | 0.3 | 2 | 0.6 | 0 | 0 | 0 | 0 | 0 | 1[5] | 0 |
| | | Smalls | 0.2 | 3 | 0.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Study area total** | | | **1.0** | **–** | **1.1** | **2** | **1** | **1** | **3** | **1** | **1** | **2** |

Table A5-1.—Southwestern willow flycatcher survey and monitoring results by survey site along the lower Colorado River and its tributaries, 2016*

| Study area<br>LCR MSCP area<br>River drainage, State | LCR MSCP site | LCR MSCP section (survey site)[1] | Area (hectares) | Number of surveys | Survey hours | Resident adults | Territories | Pairs | Nests | Number of confirmed fledges | Unknown status[2] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Before June 24 | After June 24 |
| Pahranagat (PAHR)<br>Alamo<br>Pahranagat Valley, Nevada | Pahranagat National Wildlife Refuge | Pahranagat North | 3.2 | 3 | 1.3 | 17[10,11] | 12 | 8 | 14 | 19 | 0 | 5[5,6,8] |
| | | Pahranagat West | 1.3 | 3 | 0.6 | 2 | 1 | 1 | 2 | 4 | 1[11] | 0 |
| | | Pahranagat MAPS | 0.3 | 2 | 1.0 | 5[9,11] | 4 | 1 | 3 | 0 | 0 | 0 |
| | | Pahranagat South | 1.4 | 3 | 1.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Study area total** | | | **6.2** | **–** | **4.1** | **23[11]** | **17** | **10** | **19** | **23** | **1** | **5** |
| Meadow Valley Wash (MVWA)<br>Meadow Valley Wash<br>Meadow Valley Wash, Nevada | Meadow Valley Wash North | Rock Springs Canyon | 0.3 | 0 | – | 2 | 1 | 1 | 1 | 2 | 0 | 0 |
| | | Dog Leg | 10.3 | 5 | 10.2 | 5[7] | 3 | 3 | 3 | 3 | 1 | 0 |
| **Study area total** | | | **10.6** | **–** | **10.2** | **7** | **4** | **4** | **4** | **5** | **1** | **0** |
| Muddy River (MUDD)<br>Muddy River<br>Muddy River, Nevada | Overton Above High-Water Mark | Overton WMA Pond | 0.6 | 5 | 1.5 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| | Overton Wildlife | Overton WMA | 5.9 | 5 | 8.1 | 4 | 2 | 2 | 2 | 0 | 0 | 1 |
| **Study area total** | | | **6.5** | **–** | **9.6** | **4** | **2** | **2** | **2** | **0** | **3** | **1** |
| Warm Springs (WMSP)<br>Muddy River<br>Muddy River, Nevada | Warm Springs | Muddy Mac | 0.9 | 5 | 2.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Muddy Stringer 01 | 0.8 | 1 | 0.1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| **Study area total** | | | **1.7** | **–** | **2.5** | **1** | **1** | **0** | **0** | **0** | **0** | **1** |
| Topock Marsh (TOPO)<br>Topock<br>Colorado River, Arizona | Topock Marsh | Swine Paradise | 0.9 | 0 | – | 5[12] | 4 | 3 | 6 | 0 | 0 | 1 |
| | | Platform | 1.9 | 5 | 2.4 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | | 250M | 1.6 | 5 | 4.1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | | Hell Bird | 5.8 | 5 | 12.1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | | Glory Hole | 6.4 | 5 | 8.9 | 0 | 0 | 0 | 0 | 0 | 3 | 1 |
| | | Farm Ditch Road (formerly Spaghetti) | 4.4 | 5 | 3.4 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

Table A5-1.—Southwestern willow flycatcher survey and monitoring results by survey site along the lower Colorado River and its tributaries, 2016*

| Study area<br>LCR MSCP area<br>River drainage, State | LCR MSCP site | LCR MSCP section (survey site)[1] | Area (hectares) | Number of surveys | Survey hours | Resident adults | Territories | Pairs | Nests | Number of confirmed fledges | Unknown status[2] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Before June 24 | After June 24 |
| Topock Marsh (TOPO)<br>Beal Lake Conservation Area<br>Colorado River, Arizona | CPhase 05 | CPhase 05 (formerly Beal Lake) | 11.4 | 5 | 13.7 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **Study area total** | | | **32.3** | **–** | **44.6** | **6** | **5** | **3** | **6** | **0** | **5** | **4** |
| Bill Williams (BIWI)<br>Bill Williams River West<br>Bill Williams River, Arizona | BW Delta | Coyote Crossing | 2.1 | 3 | 5.1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | North of Main Delta | Bill Willow | 1.6 | 2 | 2.0 | 5[7,13] | 3 | 3 | 4 | 6 | 0 | 1[14] |
| | North Burn | Wispy Willow | 1.3 | 1 | 0.8 | 5 | 3 | 2 | 4 | 1 | 0 | 1 |
| | | Site 01 | 2.4 | 3 | 6.2 | 1 | 1 | 0 | 0 | 0 | 3 | 0 |
| | | Burn Edge | 4.1 | 6 | 5.7 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| | Mosquito Flats | Site 04 | 9.9 | 5 | 14.9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Site 03 | 12.9 | 5 | 15.5 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| | Cross River | Last Gasp[15] | 2.1 | 1 | 0.9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Guinness[15] | 3.4 | 1 | 0.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Sandy Wash | Site 05 | 6.8 | 5 | 11.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Black Rail[15] | 1.2 | 1 | 0.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bill Williams (BIWI)<br>Bill Williams River East<br>Bill Williams River, Arizona | Esquerra Ranch | Beaver Pond North (formerly Mineral Wash)[15] | 19.0 | 1 | 2.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Beaver Pond[15] | 21.5 | 1 | 2.3 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| | Honeycomb Bend | Site 08 | 12.1 | 5 | 8.1 | 1[14] | 1 | 0 | 0 | 0 | 2 | 0 |
| | Cave Wash | Upstream from Site 08 | 1.5 | 5 | 3.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Study area total** | | | **101.9** | **–** | **79.4** | **13** | **9** | **5** | **8** | **7** | **14** | **2** |

Table A5-1.—Southwestern willow flycatcher survey and monitoring results by survey site along the lower Colorado River and its tributaries, 2016*

| Study area<br>LCR MSCP area<br>River drainage, State | LCR MSCP site | LCR MSCP section (survey site)[1] | Area (hectares) | Number of surveys | Survey hours | Resident adults | Territories | Pairs | Nests | Number of confirmed fledges | Unknown status[2] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Before June 24 | After June 24 |
| Alamo Lake[16] (ALAM)<br><br>Alamo Lake<br><br>Santa Maria River, Bill Williams River, Alamo Lake, Arizona | Lake | Bullard Wash | 1.9 | 1 | 1.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | South Camp | 2.4 | 2 | 1.4 | 2 | 1 | 1 | 1 | 0 | 0 | 0 |
| | | Over the Edge | 2.1 | 0 | – | 4 | 2 | 2 | 2 | 0 | 1 | 0 |
| | Brown's Crossing | Sidebar 01 | 1.1 | 0 | – | 4[17] | 2 | 1 | 1 | 1 | 0 | 0 |
| | | Edgewater 01 | 0.9 | 0 | – | 4 | 2 | 2 | 2 | 0 | 0 | 0 |
| | | Camp 01 | 0.7 | 1 | 0.4 | 2 | 1 | 1 | 1 | 0 | 0 | 0 |
| | | Camp 04 | 0.2 | 1 | 0.1 | 3[7] | 2 | 2 | 2 | 1 | 0 | 1 |
| | | Camp 02 | 0.3 | 2 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Camp 03 | 1.3 | 2 | 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Middle Earth 01 | 2.2 | 0 | – | 2 | 1 | 1 | 0 | 0 | 0 | 0 |
| | | Middle Earth 02 | 5.0 | 0 | – | 16[13,18] | 10 | 10 | 12 | 11 | 0 | 0 |
| | | Prospect 01 | 1.1 | 1 | 0.7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Burro Wash 01 | 4.1 | 1 | 1.2 | 5 | 3 | 2 | 3 | 0 | 0 | 1 |
| | | Burro Wash 02 | 7.9 | 1 | 1.3 | 5 | 3 | 2 | 2 | 3 | 0 | 3[19] |
| | | Motherlode 01 | 4.3 | 0 | – | 11[20] | 7 | 6 | 7 | 10 | 0 | 1 |
| | | Motherlode 02 | 14.2 | 1 | 2.5 | 4[7] | 3 | 2 | 2 | 0 | 0 | 0 |
| | | Motherlode 03 | 8.3 | 2 | 2.3 | 3 | 2 | 1 | 0 | 0 | 0 | 0 |
| | | Motherlode 04 | 0.5 | 3 | 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Confluence 02[21] | 9.8 | 1 | 2.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Santa Maria South 01 | 25.6 | 2 | 5.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Santa Maria North 01 | 27.7 | 2 | 2.0 | 10 | 5 | 5 | 5 | 10 | 0 | 2[19] |
| **Study area total** | | | **121.6** | **–** | **24.2** | **75** | **44** | **38** | **40** | **36** | **1** | **7[19]** |

Table A5-1.—Southwestern willow flycatcher survey and monitoring results by survey site along the lower Colorado River and its tributaries, 2016*

| Study area<br>LCR MSCP area<br>River drainage, State | LCR MSCP site | LCR MSCP section (survey site)[1] | Area (hectares) | Number of surveys | Survey hours | Resident adults | Territories | Pairs | Nests | Number of confirmed fledges | Unknown status[2] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Before June 24 | After June 24 |
| Palo Verde Ecological Reserve (PVER) | Phase 02 | Phase 02 | 21.4 | 5 | 9.6 | 1 | 1 | 0 | 0 | 0 | 3 | 0 |
| Palo Verde Ecological Reserve | Phase 03 | Phase 03 | 21.4 | 5 | 9.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Colorado River, California | Phase 04 | Phase 04 Block 01 | 7.6 | 5 | 5.4 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | | Phase 04 Block 02 | 4.0 | 5 | 4.2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | | Phase 04 Block 03 | 23.7 | 5 | 13.6 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | Phase 05 | Phase 05 Block 01 | 15.9 | 5 | 10.0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| | | Phase 05 Block 02 | 23.6 | 5 | 11.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Phase 05 Block 03 | 29.6 | 5 | 15.9 | 0 | 0 | 0 | 0 | 0 | 6 | 0 |
| | Phase 06 | Phase 06 Block 01 | 38.7 | 5 | 17.5 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | | Phase 06 Block 02 | 37.6 | 5 | 16.7 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| | Phase 07 | Phase 07 Block 01 | 36.8 | 5 | 18.5 | 0 | 0 | 0 | 0 | 0 | 7 | 0 |
| | | Phase 07 Block 02 | 40.6 | 5 | 17.0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 |
| **Study area total** | | | **300.9** | **–** | **148.9** | **1** | **1** | **0** | **0** | **0** | **37** | **0** |
| Cibola (CIBO) | Phase 01 | Phase 01 | 26.2 | 5 | 6.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cibola Valley Conservation Area | Phase 02 | Phase 02 | 25.5 | 5 | 6.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Colorado River, Arizona | Phase 03 | Phase 03 | 38.4 | 5 | 11.2 | 0 | 0 | 0 | 0 | 0 | 6 | 0 |
| Cibola (CIBO) | Nature Trail | Nature Trail | 13.7 | 5 | 12.3 | 0 | 0 | 0 | 0 | 0 | 9 | 0 |
| Cibola National Wildlife Refuge Unit 1<br>Colorado River, Arizona | Crane Roost | C2729 | 6.0 | 5 | 13.6 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| **Study area total** | | | **109.7** | **–** | **50.0** | **0** | **0** | **0** | **0** | **0** | **20** | **0** |

Table A5-1.—Southwestern willow flycatcher survey and monitoring results by survey site along the lower Colorado River and its tributaries, 2016*

| Study area<br>LCR MSCP area<br>River drainage, State | LCR MSCP site | LCR MSCP section (survey site)[1] | Area (hectares) | Number of surveys | Survey hours | Resident adults | Territories | Pairs | Nests | Number of confirmed fledges | Unknown status[2] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Before June 24 | After June 24 |
| Yuma (YUMA) | J | C4703 (J) | 8.4 | 5 | 7.1 | 0 | 0 | 0 | 0 | 0 | 6 | 0 |
| Yuma East Wetlands[22] | C (formerly South AC) | C4711 (C) | 0.9 | 5 | 4.6 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| Colorado River, Arizona | I | C4702 (I) | 6.4 | 5 | 2.8 | 0 | 0 | 0 | 0 | 0 | 14 | 0 |
| **Study area total** | | | **15.7** | **–** | **14.5** | **0** | **0** | **0** | **0** | **0** | **24** | **0** |

* This table includes only sites where regular surveys were scheduled and territory monitoring was conducted. Sites where habitat reconnaissance and opportunistic surveys were conducted are not included unless a southwestern willow flycatcher was detected.

[1] Survey site is equivalent to the Arizona Department of Game and Fish definition of site. LCR MSCP section names correspond to those of their respective survey sites, though geographies may not be identical.

[2] Total number of individuals recorded that could not be classified as resident or migrant because of brief appearance.

[3] One male was detected at KEPI Frenchy Lake May 30 – Jun 2, then June 8 – July 18 at KEPI Patch 01.

[4] Original male was displaced by a second male. The identity of the original male is unknown, but it is suspected to be from a neighboring territory and is not counted as a separate individual in the study area total.

[5] One male was detected May 26–30 at RIRA West Side, then displaced the male at KEPI Patch 04, then was detected July 19–21 at RIRA East Side, and was finally detected July 26 in PAHR Pahranagat North.

[6] One individual was detected June 6 – July 11 at KEPI Patch 06 and was then detected July 20 in PAHR Pahranagat North.

[7] One male was polygynous with two females.

[8] One individual was detected June 10 – July 13 at RIRA East Side and was then detected Aug 2 at PAHR Pahranagat North.

[9] One individual was detected May 15 – July 6 at PAHR Pahranagat MAPS and was then detected July 21 at RIRA East Side.

[10] Three males were each polygynous with two females.

[11] One male was detected in three different survey sites in PAHR and is only counted once in the total number of resident adults. This individual was detected May 15 at Pahranagat West, then established a territory May 18 – July 6 at Pahranagat MAPS, then established a second territory July 10 – July 19 at Pahranagat North.

[12] One male was polygynous with three females.

[13] One female was detected through June 13 at ALAM Middle Earth 02 and was then detected starting June 17 at BIWI Bill Willow.

[14] One male was detected May 14 – June 19 at BIWI Site 08 and was then detected July 28 at BIWI Bill Willow.

[15] Surveys were discontinued for the season after the first visit due to a lack of surface water.

[16] Surveys at ALAM did not follow a regular survey schedule.

[17] One female was paired consecutively with two different males.

[18] Four males were each polygynous with two females.

[19] One male was captured in Santa Maria North 01, and subsequently detected July 7 in Burro Wash 02, and is only counted once in the study area total.

[20] Two males were each polygynous with two females.

[21] Surveys were discontinued at this site due to poor habitat quality.

[22] Data collected at Yuma East Wetlands are reported under the LCR MSCP site name; each survey site constitutes only a small portion of each LCR MSCP site.

# ATTACHMENT 6

Detections of Covered Species Within Lower Colorado River Multi-Species Conservation Program (LCR MSCP) Areas and Sites, 2016

Table A6-1.—Number of detections of each covered species recorded during southwestern willow flycatcher (*Empidonax traillii extimus*) broadcast surveys at each survey site, 2016*

| Study area | LCR MSCP area | LCR MSCP site | LCR MSCP section (survey site) | Species[1] | | | |
|---|---|---|---|---|---|---|---|
| | | | | CLRA | YBCU | GIFL | VEFL |
| Key Pittman | Alamo | Key Pittman Wildlife Management Area | Frenchy Lake | 0 | 0 | 0 | 0 |
| | | | Patches 00–12 and Nesbitt Forest | 0 | 0 | 0 | 0 |
| River Ranch | Alamo | River Ranch | East Side | 0 | 0 | 0 | 0 |
| | | | West Side | 0 | 0 | 0 | 0 |
| | | | Smalls | 0 | 0 | 0 | 2 |
| Pahranagat | Alamo | Pahranagat National Wildlife Refuge | Pahranagat North | 0 | 0 | 0 | 0 |
| | | | Pahranagat West | 0 | 0 | 0 | 0 |
| | | | Pahranagat MAPS | 0 | 0 | 0 | 1 |
| | | | Pahranagat South | 0 | 0 | 0 | 0 |
| Meadow Valley Wash | Meadow Valley Wash | Meadow Valley Wash North | Rock Springs Canyon[2] | – | – | – | – |
| | | | Dog Leg | 0 | 0 | 0 | 0 |
| Muddy River | Muddy River | Overton Above High-Water Mark | Overton WMA Pond | 0 | 0 | 0 | 0 |
| | | Overton Wildlife | Overton WMA | 0 | 0 | 0 | 0 |
| Warm Springs | Muddy River | Warm Springs | Muddy Mac | 0 | 1 | 0 | 0 |
| | | | Muddy Stringer 01 | 0 | 0 | 0 | 2 |
| Topock Marsh | Topock | Topock Marsh | Swine Paradise[2] | – | – | – | – |
| | | | Platform | 1 | 0 | 0 | 0 |
| | | | 250M | 3 | 0 | 0 | 0 |
| | | | Hell Bird | 3 | 0 | 0 | 0 |
| | | | Glory Hole | 0 | 2 | 0 | 1 |
| | | | Farm Ditch Road | 1 | 0 | 0 | 0 |
| | Beal Lake Conservation Area | CPhase 05 | CPhase 05 | 1 | * | 0 | 0 |
| Bill Williams | Bill Williams River West | BW Delta | Coyote Crossing | 0 | 0 | 0 | 0 |
| | | North of Main Delta | Bill Willow | 0 | 0 | 0 | 0 |
| | | North Burn | Wispy Willow[2] | 0 | 0 | 0 | 0 |
| | | | Site 01 | 0 | 0 | 1[3] | 0 |
| | | | Burn Edge | 0 | 0 | 0 | 0 |
| | | Mosquito Flats | Site 04 | 0 | 0 | 0 | 0 |
| | | | Site 03 | 0 | 0 | 0 | 0 |

Table A6-1.—Number of detections of each covered species recorded during southwestern willow flycatcher (*Empidonax traillii extimus*) broadcast surveys at each survey site, 2016*

| Study area | LCR MSCP area | LCR MSCP site | LCR MSCP section (survey site) | Species[1] | | | |
|---|---|---|---|---|---|---|---|
| | | | | CLRA | YBCU | GIFL | VEFL |
| Bill Williams (cont.) | Bill Williams River West (cont.) | Cross River | Last Gasp[4] | 0 | 0 | 0 | 0 |
| | | | Guinness[4] | 0 | 0 | 0 | 0 |
| | | Sandy Wash | Site 05 | 0 | 0 | 0 | 0 |
| | | | Black Rail[4] | 0 | 0 | 0 | 0 |
| | Bill Williams River East | Esquerra Ranch | Beaver Pond North[4] | 0 | 0 | 0 | 0 |
| | | | Beaver Pond[4] | 0 | 0 | 0 | 0 |
| | | Honeycomb Bend | Site 08 | 0 | 0 | 0 | 0 |
| | | Cave Wash | Upstream from Site 08 | 1 | 0 | 1[5] | 0 |
| Alamo Lake[6] | Alamo Lake | Lake | Bullard Wash | 0 | 0 | 0 | 0 |
| | | | Bullard Wash North | 0 | 0 | 0 | 0 |
| | | | South Camp | 0 | 0 | 0 | 0 |
| | | | Over the Edge[2] | – | – | – | – |
| | | Brown's Crossing | Sidebar 01[2] | – | – | – | – |
| | | | Edgewater 01[2] | – | – | – | – |
| | | | Camp 01 | 0 | 0 | 0 | 0 |
| | | | Camp 04 | 0 | 0 | 0 | 0 |
| | | | Camp 02 | 0 | 0 | 0 | 0 |
| | | | Camp 03 | 0 | 0 | 0 | 0 |
| | | | Middle Earth 01[2] | – | – | – | – |
| | | | Middle Earth 02[2] | – | – | – | – |
| | | | Prospect 01 | 0 | 0 | 0 | 0 |
| | | | Burro Wash 01 | 0 | 0 | 0 | 0 |
| | | | Burro Wash 02 | 0 | 0 | 0 | 0 |
| | | | Motherlode 01[2] | – | – | – | – |
| | | | Motherlode 02 | 0 | 0 | 0 | 0 |
| | | | Motherlode 03 | 0 | 0 | 0 | 0 |
| | | | Motherlode 04 | 0 | 0 | 0 | 0 |
| | | | Confluence 02[7] | 0 | 0 | 0 | 0 |
| | | | Santa Maria South 01 | 0 | 0 | 0 | 0 |
| | | | Santa Maria North 01 | 0 | 0 | 0 | 0 |

Table A6-1.—Number of detections of each covered species recorded during southwestern willow flycatcher (*Empidonax traillii extimus*) broadcast surveys at each survey site, 2016*

| Study area | LCR MSCP area | LCR MSCP site | LCR MSCP section (survey site) | Species[1] | | | |
|---|---|---|---|---|---|---|---|
| | | | | CLRA | YBCU | GIFL | VEFL |
| Palo Verde Ecological Reserve | Palo Verde Ecological Reserve | Phase 02 | Phase 02[3] | 0 | * | 0 | 0 |
| | | Phase 03 | Phase 03 | 0 | 0 | 0 | 0 |
| | | Phase 04 | Phase 04 Block 01 | 0 | 0 | 0 | 0 |
| | | | Phase 04 Block 02 | 0 | * | 0 | 0 |
| | | | Phase 04 Block 03 | 0 | * | 0 | 0 |
| | | Phase 05 | Phase 05 Block 01 | 0 | * | 0 | 0 |
| | | | Phase 05 Block 02 | 0 | * | 0 | 0 |
| | | | Phase 05 Block 03 | 0 | * | 0 | 0 |
| | | Phase 06 | Phase 06 Block 01 | 0 | * | 0 | 0 |
| | | | Phase 06 Block 02 | 0 | * | 0 | 0 |
| | | Phase 07 | Phase 07 Block 01 | 0 | * | 0 | 0 |
| | | | Phase 07 Block 02 | 0 | * | 0 | 0 |
| Cibola | Cibola Valley Conservation Area | Phase 01 | Phase 01 | 0 | * | 0 | 0 |
| | | Phase 02 | Phase 02 | 0 | 0 | 0 | 0 |
| | | Phase 03 | Phase 03 | 0 | * | 0 | 0 |
| | Cibola National Wildlife Refuge Unit #1 | Nature Trail | Nature Trail | 0 | * | 0 | 2 |
| | | Crane Roost | C2729 | 0 | * | 0 | 0 |
| Yuma | Yuma East Wetlands | J | C4703 (J) | 0 | 0 | 0 | 0 |
| | | C (formerly South AC) | C4711 (C) | 0 | 0 | 0 | 1 |
| | | I | C4702 (I) | 0 | 0 | 0 | 0 |

* Only detections of covered species recorded during southwestern willow flycatcher playback surveys are reported in this table. Additional detections of both yellow-billed cuckoos (*Coccyzus americanus occidentalis*) and Yuma clapper rails (*Rallus longirostris yumanensis* [also known as Yuma Ridgway's rail = R. obsoletus yumanensis]) were recorded during nest monitoring activities and are reported in tables A6-2 and A6-3 in this attachment, respectively. Passive yellow-billed cuckoo detections were recorded at several survey sites monitored for yellow-billed cuckoos as part of another LCR MSCP project (Parametrix, Inc., and Southern Sierra Research Station 2016). The number of individuals detected at these sites is not reported.

[1] CLRA = Yuma clapper rail, YBCU = yellow-billed cuckoo, GIFL = gilded flicker (*Colaptes chrysoides*), and VEFL = vermilion flycatcher (*Pyrocephalus rubinus*).
[2] This survey site was not surveyed; site was occupied during the breeding season.
[3] A flicker (*Colaptes* spp.) was detected at this site in late May, but no positive identification to species was made.
[4] Only one survey conducted. Surveys were discontinued for the season due to a lack of surface water.
[5] A flicker was detected at this site in early June, but no positive identification to species was made.
[6] No site was surveyed more than three times.
[7] Surveys discontinued after the first visit due to poor habitat quality.

Table A6-2.—Details on all passive detections of yellow-billed cuckoos, 2016*

| Study area[1] | Survey site | Date(s) | Behavioral observations[2] |
|---|---|---|---|
| KEPI | Patch 05 | June 14 | One individual seen perched |
| PAHR | Pahranagat North | June 15 | One individual seen perched |
| | | June 27 | One individual heard (CON) |
| | Pahranagat MAPS | Aug 3 | One individual heard (VO) |
| MUDD | Overton WMA | June 11 | One individual heard (ALA) |
| WMSP | Muddy Mac | July 5 | One individual heard (CON); likely same individual that responded to protocol level survey 30 minutes prior |
| TOPO | Swine Paradise | June 25 | One individual heard (CON) |
| | 250M | July 6 | One individual heard (COO) |
| | Glory Hole | July 14 | Two individuals heard (CON) |
| | CPhase 05 | June 21 | One individual heard (CON) |
| | | July 7 | One individual heard (COO) |
| BIWI | Wispy Willow | July 28 | One individual heard (COO and CON) |
| ALAM | Sidebar 01 | June 14 | One individual seen foraging |
| | | June 26 | One individual heard (COO) |
| | Burro Wash 01 | July 5 | One individual heard (COO) |
| | | July 9 | One individual heard (CON); individual counter-singing with detected bird at Burro Wash 02 |
| | | July 11 | One individual heard (ALA) |
| | | July 27 | One individual heard (CON) |
| | Burro Wash 02 | July 9 | Two individuals heard (CON); one individual was counter-singing with detected bird at Burro Wash 01 |
| | | July 19 | One individual heard (CON) |
| | Motherlode 01 | July 11 | One individual heard (ALA and COO) |
| | Santa Maria North 01 | July 9 | One individual heard (COO) |

* All individuals were detected passively, and no protocol surveys were conducted. These detections indicate the presence of the species in a given location but cannot be used to estimate population size or infer absence of the species in other locations. Detections at sites that are monitored for yellow-billed cuckoos as part of another LCR MSCP project are not included.

[1] KEPI = Key Pittman, PAHR = Pahranagat, MUDD = Muddy River, WMSP = Warm Springs, TOPO = Topock Marsh, BIWI = Bill Williams, ALAM = Alamo Lake.

[2] Vocalization codes follow those described in the standard yellow-billed cuckoo survey protocol. ALA = alarm call (kuk-kuk-kuk), COO = coo call, CON = contact call (kuk and kowlp notes), and VO = other vocalization.

Table A6-3.—Details on all passive detections of Yuma clapper rails, 2016*

| Study area[1] | Survey site | Date(s) | Behavioral observations |
|---|---|---|---|
| TOPO | Swine Paradise | May 19 | One individual heard (kek-kek-kek) |
| | | June 4 | Two individuals heard (kek-kek-kek) |
| | Platform | June 6 | One individual heard (kek-kek-kek) |
| | 250M | May 16 | One individual heard (kek-kek-kek) |
| | | May 20 | One individual heard (kek-kek-kek) |
| | | May 24 | One individual heard (kek-kek-kek) |
| | | May 30 | Two individuals heard (kek-kek-kek) |
| | | June 20 | Two individuals heard (kek-kek-kek) |
| | | July 6 | One individual heard (kek-kek-kek) |
| | Hell Bird | May 16 | One individual heard (clatter) |
| | | June 3 | Two individuals heard (kek-kek-kek) |
| | | June 20 | One individual heard (kek-kek-kek) |
| | Glory Hole | May 15 | One individual heard (kek-kek-kek) |
| | | May 25 | One individual heard (kek-kek-kek) |
| | Farm Ditch Road | May 16 | One individual heard (kek-kek-kek) |
| | CPhase 05 | May 19 | One individual heard (kek-kek-kek) |
| | Lost Lake | May 16 | Two individuals heard (clatter and kek-kek-kek) |
| BIWI | Wispy Willow | June 8 | Four individuals heard (kek-kek-kek) |
| | | June 15 | One individual heard (kek-kek-kek) |
| | Upstream Site 08 | June 2 | One individual seen standing |

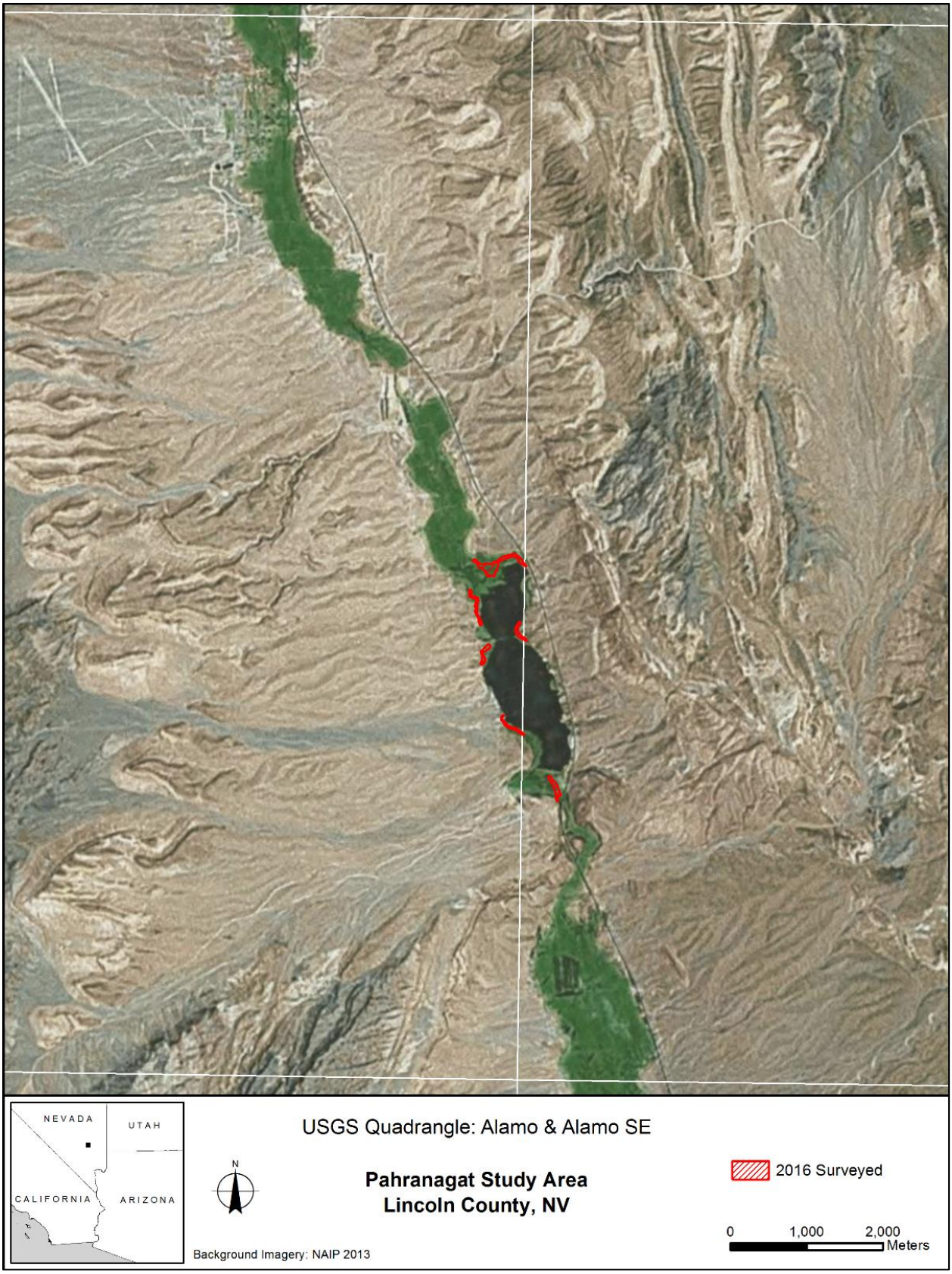
* All individuals were detected passively, and no protocol surveys were conducted. These detections indicate the presence of the species in a given location but cannot be used to estimate population size or infer absence of the species in other locations.

[1] TOPO = Topock Marsh, and BIWI = Bill Williams.

# ATTACHMENT 7

Orthophotos Showing Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) Survey Sites

NEVADA
UTAH
CALIFORNIA
ARIZONA
N
USGS Quadrangle: Ash Springs
River Ranch Study Area
Clark County, NV
2016 Surveyed
0
1,000
2,000
Meters
Background Imagery: NAIP 2013


NEVADA
UTAH
CALIFORNIA
ARIZONA
USGS Quadrangle: Alamo & Alamo SE
N
Pahranagat Study Area
Lincoln County, NV
2016 Surveyed
0
1,000
2,000
Meters
Background Imagery: NAIP 2013

NEVADA
UTAH
CALIFORNIA
ARIZONA
N
USGS Quadrangle: Moapa West
Warm Springs Study Area
Clark County, NV
2016 Surveyed
0
1,000
2,000
Meters
Background Imagery: NAIP 2015

# ATTACHMENT 8

All Willow Flycatchers (*Extimus traillii)* Color Banded and/or Resighted, 2012–2016

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2140-66709 | M | A | Q | Q | Q | | Q[4] | M | M | M | M | M | M[5] | M | | | |
| 2320-31595 | M | A | | | P | P | P | P | P | P | P | P | P | | | | |
| 2320-31632 | F | A | | | Q | | M | M | M[6] | | M | M | M | M | | | |
| 2320-31688 | M | J | | | | Q | Q | Q | Q | Q | Q | Q | Q | | | | |
| 2360-59777 | F | J | | | | | | Q | | | | M | M | | | | |
| 2360-59788 | F | J | | | | D | D | M | M | M | M | M | M | M | | | |
| 2370-39938 | M | A | | | | | M | M | M | M | M | M | M | M | | | |
| 2370-39956 | F | A | | | | D | D | D | | | M | M | M | | | | |
| 2370-40000 | M | A | | | | | | | | | D | D | D | D | | | |
| 2370-40010 | M | J | | | | | | | | | D | K | K | | | | |
| 2370-40024 | M | J | | | | | | | | K | K | K | K | K | K | K | K |
| 2370-40037 | F | A | | | | | G | M | | M | M | M | M | | | | |
| 2370-40046 | M | A | | | | | G | G[7] | M | M | M | M | M | M | | | |
| 2370-40047 | F | A | | | | | P | P | P | P | P | P | P | | | | |
| 2370-40072 | F | J | | | | | | | | M | | | Q | | | | |
| 2370-40077 | M | A | | | | | | | | | | | | | W | W | |
| 2370-40088 | M | A | | | | | | | | | D | D | D | P | P | P | P |
| 2370-40091 | F | J | | | | | | | | | M | D | | D | | | |
| 2370-40094 | U | J | | | | | | | | | | | | | P | | |
| 2370-40155 | M | A | | | | | | | | L | | | P | | | | |
| 2370-40175 | M | J | | | | | | | | M | Q | Q | D | D | | | |
| 2370-40190 | M | J | | | | | | P | | | | K | K | K | | | |
| 2370-40197 | M | A | | | | | | M | Q | Q | M | M | M | M | | | |
| 2430-61080 | M | A | | | | | | | P | P | P | P | P | | | | |
| 2430-61083 | M | A | | | | | | | P | P | P | P | P | P | P | P | P |
| 2430-61085 | M | A | | | | | | | | D | D | D | D | | | | |
| 2430-61087 | F | A | | | | | | | | P | P | P | P | P | | | |
| 2430-61088 | M | A | | | | | | | | | N | D | E | K | K | K | K |
| 2430-61099 | M | J | | | | | | | | | K | E[8] | K | | | | |
| 2430-61100 | F | A | | | | | | | | | K | K | K | | | | |
| 2430-61120 | F | J | | | | | | | P | P | P | P | P | | | | |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2430-61124 | F | J | | | | | | | P | | K | | | K | | | |
| 2430-61134 | M | A | | | | | | | T | | N | N | N | T | N | N | N |
| 2430-61137 | F | A | | | | | | | B | B | B | B | B | | | | |
| 2430-61154 | F | J | | | | | | | | Q | S | S | S | | | | |
| 2430-61158 | M | A | | | | | | | | K | K | K | K | K | K | K | |
| 2430-61159 | M | J | | | | | | | | M | | K | K | K | K | | |
| 2430-61176 | M | J | | | | | | | Q | | P | P | P | | | | |
| 2430-61179 | M | A | | | | | | | K | P | P | P | P | | | | |
| 2430-61180 | M | A | | | | | | | K | | K | K | K | | | | |
| 2430-61197 | M | J | | | | | | | P | | K | K | K | | | | |
| 2430-61218 | F | J | | | | | | | | | | P | P | | | | |
| 2430-61220 | F | J | | | | | | | | | | P | P | P | P | P | P |
| 2430-61230 | F | A | | | | | | | | | S | S | S | | | | |
| 2430-61231 | U | J | | | | | | | | | S | | M | | | | |
| 2430-61257 | M | A | | | | | | | | | | | P | | | | |
| 2430-61258 | U | J | | | | | | | | | | | K | | | | |
| 2430-61259 | M | A | | | | | | | | | | | M | | | | |
| 2430-61260 | M | A | | | | | | | | | | | D | D | | | |
| 2430-61261 | M | A | | | | | | | | | | | D | | | | |
| 2430-61262 | M | J | | | | | | | | | | | K | P | P | | |
| 2430-61263 | U | J | | | | | | | | | | | K | | | | |
| 2430-61264 | U | J | | | | | | | | | | | K | | | | |
| 2430-61265 | U | J | | | | | | | | | | | M | | | | |
| 2430-61266 | U | J | | | | | | | | | | | M | | | | |
| 2430-61267 | F | A | | | | | | | | | | | P | P | P | | P |
| 2430-61279 | F | J | | | | | | | | P | K | K | K | K | K | K | |
| 2430-61281 | M | A | | | | | | | | | | | M | M | | | |
| 2430-61282 | M | A | | | | | | | | | | | M | M | M | M | M |
| 2430-61286 | M | A | | | | | | | | | | | M | M | | | |
| 2430-61287 | U | J | | | | | | | | | | | K | | | | |
| 2430-61288 | U | J | | | | | | | | | | | K | | | | |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2430-61289 | U | J | | | | | | | | | | | K | | | | |
| 2430-61290 | M | J | | | | | | | | | | | P | E | | | |
| 2430-61291 | U | J | | | | | | | | | | | P | | | | |
| 2430-61292 | U | J | | | | | | | | | | | P | | | | |
| 2430-61293 | U | J | | | | | | | | | | | P | | | | |
| 2430-61294 | U | J | | | | | | | | | | | P | | | | |
| 2430-61295 | U | J | | | | | | | | | | | K | | | | |
| 2430-61296 | U | J | | | | | | | | | | | D | | | | |
| 2430-61297 | U | J | | | | | | | | | | | D | | | | |
| 2430-61298 | F | A | | | | | | | | | | | M | M | P | P | P |
| 2430-61299 | U | J | | | | | | | | | | | M | | | | |
| 2430-61300 | F | J | | | | | | | | | | | P | P | K | | |
| 2540-58111 | F | A | | | | | | | | | | P | P | | | | |
| 2540-58114 | F | J | | | | | | | | | | P | P | P | P | K | |
| 2540-58116 | M | J | | | | | | | | | B | | T | | | | |
| 2540-58121 | U | J | | | | | | | | | | | | K | | | |
| 2540-58122 | U | J | | | | | | | | | | | | K | | | |
| 2540-58123 | U | J | | | | | | | | | | | | K | | | |
| 2540-58124 | F | J | | | | | | | | | | | | S | | S | S |
| 2540-58125 | M | J | | | | | | | | | | | | S | | S | |
| 2540-58126 | U | J | | | | | | | | | | | | S | | | |
| 2540-58127 | F | J | | | | | | | | | | | | K | P | | |
| 2540-58128 | U | J | | | | | | | | | | | | K | | | |
| 2540-58129 | U | J | | | | | | | | | | | | K | | | |
| 2540-58130 | U | J | | | | | | | | | | | | D | | | |
| 2540-58132 | M | A | | | | | | | | S | S | S | S | | | | |
| 2540-58133 | F | J | | | | | | | | | | | | D | | Q | |
| 2540-58134 | M | A | | | | | | | | | | | | | D | | |
| 2540-58135 | F | A | | | | | | | | | | | | | P | | |
| 2540-58136 | F | A | | | | | | | | | | | | | P | | |
| 2540-58137 | U | J | | | | | | | | | | | | | P | | |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2540-58138 | F | J | | | | | | | | | | | | | K | K | |
| 2540-58139 | U | J | | | | | | | | | | | | | P | | |
| 2540-58140 | F | A | | | | | | | | | | | | | W | W | W |
| 2540-58153 | U | J | | | | | | | | | | | | | K | | |
| 2540-58154 | M | J | | | | | | | | M | T[9] | D[10] | M | | | | |
| 2540-58156 | F | A | | | | | | | | | K | K | K | | | | |
| 2540-58157 | M | J | | | | | | | | | K | E | | P | P | P | P |
| 2540-58158 | M | J | | | | | | | | | K | K | K | K | K[11] | P | |
| 2540-58159 | F | J | | | | | | | | | K | K | K | | | | |
| 2540-58160 | M | J | | | | | | | | | S | | S | S | S | S | S |
| 2540-58173 | M | J | | | | | | | | | | M | D | | | | |
| 2540-58174 | F | J | | | | | | | | | | M | M[6] | | M | | |
| 2540-58175 | F | A | | | | | | | | | | K | K | K | K | | |
| 2540-58177 | F | A | | | | | | | | | | K | K | K | K | K | K |
| 2540-58178 | F | J | | | | | | | | | | K | K | | | | |
| 2540-58179 | M | J | | | | | | | | | | K | K | K | P | P | P |
| 2540-58182 | F | J | | | | | | | | | | K | | K | | | |
| 2540-58184 | F | A | | | | | | | | | | M | M | | | | |
| 2540-58192 | M | A | | | | | | | | | Q | Q[4] | M | M | M | M | |
| 2540-58193 | F | A | | | | | | | | | N | N | N | | D | | |
| 2540-58199 | M | J | | | | | | | | | K | | P | P | P | | |
| 2540-58201 | M | J | | | | | | | | | K | P | P | P | P | P | P |
| 2540-58202 | M | A | | | | | | | | | K | | K | K | K | K | |
| 2540-58211 | M | J | | | | | | | | | | K | K | K | | | |
| 2540-58215 | U | J | | | | | | | | | | | | | P | | |
| 2540-58217 | M | A | | | | | | | | S | S | | | S | S | S | |
| 2540-58223 | M | A | | | | | | | | | K | K | K | K | K | | |
| 2540-58224 | F | J | | | | | | | | | K | K | K | K | | | |
| 2540-58231 | F | A | | | | | | | | | T | M | M | M | T | T | |
| 2540-58238 | F | J | | | | | | | | | K | E[8] | | P | P | P | P |
| 2540-58239 | M | J | | | | | | | | | K | | | K | K | K | K |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2540-58240 | F | J | | | | | | | | | K | E | K | K | K | | |
| 2540-58245 | M | A | | | | | | | | | | P | K | K | K | K | K |
| 2540-58246 | M | A | | | | | | | | | | E | P | P | P | P | |
| 2540-58247 | F | J | | | | | | | | | | K | K | | | | |
| 2540-58248 | F | J | | | | | | | | | | | | P | K | | |
| 2540-58249 | U | J | | | | | | | | | | | | P | | | |
| 2540-58250 | M | J | | | | | | | | | | | | P | P | P | P |
| 2540-58251 | U | J | | | | | | | | | | | | P | | | |
| 2540-58252 | U | J | | | | | | | | | | | | K | | | |
| 2540-58253 | U | J | | | | | | | | | | | | K | | | |
| 2540-58254 | F | J | | | | | | | | | | | | P | K | | |
| 2540-58255 | F | A | | | | | | | | | | | | M | | | |
| 2540-58258 | U | J | | | | | | | | | | | K | | | | |
| 2540-58259 | M | J | | | | | | | | | | | K | K | P | P | |
| 2540-58260 | U | J | | | | | | | | | | | M | | | | |
| 2540-58261 | F | A | | | | | | | | | | | M | | | | |
| 2540-58262 | M | J | | | | | | | | | | | K | E | P | P | |
| 2540-58263 | U | J | | | | | | | | | | | K | | | | |
| 2540-58264 | U | J | | | | | | | | | | | K | | | | |
| 2540-58265 | U | J | | | | | | | | | | | M | | | | |
| 2540-58266 | U | J | | | | | | | | | | | P | | | | |
| 2540-58267 | U | J | | | | | | | | | | | P | | | | |
| 2540-58268 | M | A | | | | | | | | | | | K | | | | |
| 2540-58269 | F | A | | | | | | | | | | | K | K[11] | P | P | P |
| 2540-58270 | F | A | | | | | | | | | | | | K | K | K | K |
| 2540-58271 | F | A | | | | | | | | | | | | P | P | | |
| 2540-58277 | M | J | | | | | | | | | | K | K | | K | | |
| 2540-58281 | F | A | | | | | | | | | | | | K | K | K | K |
| 2540-58285 | M | J | | | | | | | | | | P | K | | | | |
| 2540-58286 | F | J | | | | | | | | | | P | P | P | P | | |
| 2540-58287 | M | A | | | | | | | | | | S | S | | | | |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2540-58293 | F | A | | | | | | | | | P | P | P | | | | |
| 2540-58300 | F | J | | | | | | | | | | | K | K | | | |
| 2540-58301 | M | J | | | | | | | | | | | P | W | | | |
| 2540-58302 | U | J | | | | | | | | | | | P | | | | |
| 2540-58303 | U | J | | | | | | | | | | | P | | | | |
| 2540-58304 | F | J | | | | | | | | | | | P | K | | | |
| 2540-58305 | F | J | | | | | | | | | | | | K | K | | |
| 2540-58306 | U | J | | | | | | | | | | | | P | | | |
| 2540-58307 | U | J | | | | | | | | | | | | K | | | |
| 2540-58308 | U | J | | | | | | | | | | | | K | | | |
| 2540-58309 | F | J | | | | | | | | | | | | K | P | P | |
| 2540-58310 | U | J | | | | | | | | | | | | K | | | |
| 2540-58311 | M | J | | | | | | | | | | | | | P | P | P |
| 2540-58312 | F | A | | | | | | | | | | | | | P | | |
| 2540-58313 | U | J | | | | | | | | | | | | | | W | |
| 2540-58314 | M | A | | | | | | | | | | | | | | | W |
| 2540-58315 | U | J | | | | | | | | | | | | | | | P |
| 2540-58316 | F | A | | | | | | | | | | | | | O | O | |
| 2540-58317 | M | A | | | | | | | | | | | | | O | | O |
| 2540-58318 | F | A | | | | | | | | | | | | | O | | |
| 2540-58319 | F | A | | | | | | | | | | | | | O | | |
| 2540-58320 | F | J | | | | | | | | | | | K | | K | K | K |
| 2540-58321 | U | J | | | | | | | | | | | D | | | | |
| 2540-58322 | F | A | | | | | | | | | | | K | K | | | |
| 2540-58323 | U | J | | | | | | | | | | | P | | | | |
| 2540-58325 | U | J | | | | | | | | | | | K | | | | |
| 2540-58326 | M | J | | | | | | | | | | | K | P | | | |
| 2540-58327 | U | J | | | | | | | | | | | K | | | | |
| 2540-58328 | F | A | | | | | | | | | | | | | O | | |
| 2540-58329 | M | A | | | | | | | | | | | | | O | O | O |
| 2540-58330 | U | J | | | | | | | | | | | | | W | | |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2540-58331 | U | J | | | | | | | | | | | | | P | | |
| 2540-58332 | M | J | | | | | | | | | | | | | P | E | E[15] |
| 2540-58333 | U | J | | | | | | | | | | | | | K | | |
| 2540-58334 | U | J | | | | | | | | | | | | | K | | |
| 2540-58335 | U | J | | | | | | | | | | | | | K | | |
| 2540-58336 | F | A | | | | | | | | | | | | | | D | D |
| 2540-58337 | U | J | | | | | | | | | | | | | | | P |
| 2540-58338 | U | J | | | | | | | | | | | | | O | | |
| 2540-58339 | U | J | | | | | | | | | | | | | O | | |
| 2540-58340 | F | J | | | | | | | | | | | | | O | B | |
| 2540-58341 | M | A | | | | | | | | | | | | | O | O | |
| 2540-58342 | F | A | | | | | | | | | | | | | O | | |
| 2540-58343 | U | J | | | | | | | | | | | | | O | | |
| 2540-58344 | U | J | | | | | | | | | | | | | T | | |
| 2540-58345 | U | J | | | | | | | | | | | | | | B | |
| 2540-58346 | F | J | | | | | | | | | | | | | | O | O |
| 2540-58347 | U | J | | | | | | | | | | | | | T | | |
| 2540-58348 | U | J | | | | | | | | | | | | | T | | |
| 2540-58349 | F | A | | | | | | | | | | | | | T | | |
| 2540-58350 | M | A | | | | | | | | | | | | | O | | |
| 2540-58351 | U | J | | | | | | | | | | | | | O | | |
| 2540-58352 | F | J | | | | | | | | | | | | | B | B | |
| 2540-58353 | F | A | | | | | | | | | | | | | O | O | |
| 2540-58354 | U | J | | | | | | | | | | | | | | | P |
| 2540-58355 | M | J | | | | | | | | | | | | | | O | O |
| 2540-58356 | F | A | | | | | | | | | | | | | B | B | B |
| 2540-58357 | U | J | | | | | | | | | | | | | | O | |
| 2540-58358 | U | J | | | | | | | | | | | | | K | | |
| 2540-58359 | U | J | | | | | | | | | | | | | | B | |
| 2540-58360 | U | J | | | | | | | | | | | | | D | | |
| 2540-58361 | F | J | | | | | | | | | | | | | P | P | P |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2540-58362 | F | A | | | | | | | | | | | | | O | | O[16] |
| 2540-58363 | M | A | | | | | | | | | | | | | W | | |
| 2540-58364 | U | J | | | | | | | | | | | | | | P | |
| 2540-58365 | M | A | | | | | | | | | | | | | | Z | |
| 2540-58366 | U | J | | | | | | | | | | | | | | | P |
| 2540-58367 | U | J | | | | | | | | | | | | | | K | |
| 2540-58368 | U | J | | | | | | | | | | | | | | S | |
| 2540-58369 | U | J | | | | | | | | | | | | | | P | |
| 2540-58370 | M | A | | | | | | | | | | | | | | | W |
| 2540-58371 | U | J | | | | | | | | | | | | | | W | |
| 2540-58372 | U | J | | | | | | | | | | | | | | E | |
| 2540-58373 | U | J | | | | | | | | | | | M | | | | |
| 2540-58374 | M | A | | | | | | | | | | | | V | | | |
| 2540-58375 | M | A | | | | | | | | | | | | P | | | |
| 2540-58376 | M | A | | | | | | | | | | | | E | K | | |
| 2540-58377 | F | J | | | | | | | | | | | | K | K | | |
| 2540-58379 | U | J | | | | | | | | | | | | | | P | |
| 2540-58380 | U | J | | | | | | | | | | | | | | W | |
| 2540-58381 | U | J | | | | | | | | | | | | | | E | P |
| 2540-58382 | M | A | | | | | | | | | | | | | | | K |
| 2540-58383 | U | J | | | | | | | | | | | | | | E | |
| 2540-58384 | U | A | | | | | | | | | | | | | | | K |
| 2540-58387 | M | A | | | | | | | | | | K | K | K | K | | |
| 2540-58388 | U | J | | | | | | | | | | | | | | | K |
| 2540-58389 | M | A | | | | | | | | | | | | | | | B |
| 2540-58390 | U | J | | | | | | | | | | | | | | | O |
| 2540-58391 | M | A | | | | | | | | | | | | | | | O |
| 2540-58392 | U | A | | | | | | | | | | | | | | | O |
| 2540-58393 | U | J | | | | | | | | | | | | | | | O |
| 2540-58394 | M | A | | | | | | | | | | | | | | | O |
| 2540-58395 | U | J | | | | | | | | | | | | | | | O |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2540-58396 | F | A | | | | | | | | | | | | | | | O |
| 2540-58397 | U | J | | | | | | | | | | | | | | | P |
| 2540-58398 | U | J | | | | | | | | | | | | | | | K |
| 2540-58399 | F | A | | | | | | | | | | | | | | | O |
| 2540-58400 | F | A | | | | | | | | | | | | | | | O |
| 2590-53101 | M | J | | | | | | | | | | P | | | K | K | K |
| 2590-53106 | F | J | | | | | | | | | | M | | | D | | |
| 2590-53107 | M | J | | | | | | | | | | M | Q[12] | | | | |
| 2590-53112 | M | J | | | | | | | | | | K | K | | | | |
| 2590-53114 | M | J | | | | | | | | | | K | | K | | | |
| 2590-53117 | M | J | | | | | | | | | | M | Q | Q[13] | | | |
| 2590-53120 | U | J | | | | | | | | | | | | K | | | |
| 2590-53121 | F | A | | | | | | | | | | K | K | K | K | K | K |
| 2590-53128 | M | A | | | | | | | | | | | | | O | | |
| 2590-53129 | M | A | | | | | | | | | | | | | O | O | |
| 2590-53130 | M | A | | | | | | | | | | | | | O | | |
| 2590-53131 | U | J | | | | | | | | | | | | | T | | |
| 2590-53148 | M | A | | | | | | | | | | K | K | | | | |
| 2590-53153 | M | A | | | | | | | | | | | K | | | | |
| 2590-53155 | U | J | | | | | | | | | | | M | | | | |
| 2590-53156 | F | A | | | | | | | | | | | M | M | | | |
| 2590-53157 | F | J | | | | | | | | | | | M | D | D | | |
| 2590-53158 | U | J | | | | | | | | | | | K | | | | |
| 2590-53159 | U | J | | | | | | | | | | | | S | | | |
| 2590-53160 | F | J | | | | | | | | | | | | S | S | | |
| 2590-53165 | F | A | | | | | | | | | | | B | | | | |
| 2590-53166 | M | A | | | | | | | | | | | T | | | | |
| 2590-53167 | M | A | | | | | | | | | | | | | T | | |
| 2590-53168 | M | A | | | | | | | | | | | | | T | T | |
| 2590-53169 | U | J | | | | | | | | | | | | | K | | |
| 2590-53170 | M | A | | | | | | | | | | | | | | | P |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2590-53171 | F | A | | | | | | | | | | E | K | K | K | K | |
| 2590-53173 | F | A | | | | | | | | | | K | K | | | | |
| 2590-53174 | U | J | | | | | | | | | | | | S | | | |
| 2590-53175 | M | J | | | | | | | | | | | | | P | K | |
| 2590-53176 | U | J | | | | | | | | | | | | | | E | |
| 2590-53177 | M | A | | | | | | | | | | | | Q | Q | Q | Q |
| 2590-53178 | U | J | | | | | | | | | | | | K | | | |
| 2590-53179 | U | J | | | | | | | | | | | | K | | | |
| 2590-53180 | U | J | | | | | | | | | | | | K | | | |
| 2590-53181 | U | J | | | | | | | | | | | | K | | | |
| 2590-53183 | U | J | | | | | | | | | | | | | P | | |
| 2590-53201 | M | A | | | | | | | | | | | | | | | P |
| 2590-53202 | M | A | | | | | | | | | | | | | | | D |
| 2590-53203 | U | J | | | | | | | | | | | | | | | K |
| 2590-53204 | U | J | | | | | | | | | | | | | | | P |
| 2590-53205 | U | J | | | | | | | | | | | | | | | P |
| 2590-53206 | U | J | | | | | | | | | | | | | | | K |
| 2590-53207 | U | J | | | | | | | | | | | | | | | P |
| 2590-53208 | F | A | | | | | | | | | | | | | | | P |
| 2590-53209 | U | J | | | | | | | | | | | | | | | P |
| 2590-53210 | U | J | | | | | | | | | | | | | | | W |
| 2590-53219 | M | A | | | | | | | | | | | | | | | D |
| 2590-53220 | U | J | | | | | | | | | | | | | | | P |
| 2590-53222 | U | J | | | | | | | | | | | | | | | P |
| 2590-53223 | U | J | | | | | | | | | | | | | | | P |
| 2590-53236 | F | A | | | | | | | | | | | | | | | O |
| 2590-53237 | U | J | | | | | | | | | | | | | | | B |
| 2590-53238 | U | J | | | | | | | | | | | | | | | B |
| 2590-53239 | U | J | | | | | | | | | | | | | | | B |
| 2590-53240 | M | A | | | | | | | | | | | | | | | O |
| 2590-53241 | M | A | | | | | | | | | | | | | | | O |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2590-53242 | U | J | | | | | | | | | | | | | | | O |
| 2590-53243 | U | J | | | | | | | | | | | | | | | B |
| 2590-53254 | U | J | | | | | | | | | | | | | | | O |
| 2590-53255 | U | J | | | | | | | | | | | | | | | O |
| 2590-53256 | U | J | | | | | | | | | | | | | | | B |
| 2590-53272 | M | A | | | | | | | | | | | | | | | Z |
| 2590-53273 | M | A | | | | | | | | | | | | | | | Q |
| 2590-53275 | F | A | | | | | | | | | | | | | | | P |
| 2590-53276 | M | A | | | | | | | | | | | | | | | O |
| 2590-53277 | F | A | | | | | | | | | | | | | | | B |
| 2660-23001 | M | A | | | | | | | | | | | | K | K | | |
| 2660-23002 | U | J | | | | | | | | | | | | M | | | |
| 2660-23003 | U | J | | | | | | | | | | | | K | | | |
| 2660-23004 | U | J | | | | | | | | | | | | K | | | |
| 2660-23005 | U | J | | | | | | | | | | | | K | | | |
| 2660-23006 | U | J | | | | | | | | | | | | | P | | |
| 2660-23007 | M | J | | | | | | | | | | | | S | S | S | S |
| 2660-23008 | U | J | | | | | | | | | | | | S | | | |
| 2660-23009 | U | J | | | | | | | | | | | | S | | | |
| 2660-23010 | F | J | | | | | | | | | | | | S | S | S | S |
| 2660-23011 | U | J | | | | | | | | | | | | S | | | |
| 2660-23012 | U | J | | | | | | | | | | | K | | | | |
| 2660-23013 | U | J | | | | | | | | | | | | S | | | |
| 2660-23014 | U | J | | | | | | | | | | | P | | | | |
| 2660-23015 | F | J | | | | | | | | | | | | S | | S | |
| 2660-23016 | F | A | | | | | | | | | | | | D | D | | |
| 2660-23017 | M | A | | | | | | | | | | | | D | D | D | D |
| 2660-23018 | U | J | | | | | | | | | | | | K | | | |
| 2660-23019 | U | J | | | | | | | | | | | | K | | | |
| 2660-23020 | U | J | | | | | | | | | | | | K | | | |
| 2660-23021 | M | J | | | | | | | | | | | | K | P | | |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2660-23022 | U | J | | | | | | | | | | | | K | | | |
| 2660-23023 | U | J | | | | | | | | | | | | K | | | |
| 2660-23024 | U | J | | | | | | | | | | | M | | | | |
| 2660-23025 | U | J | | | | | | | | | | | | K | | | |
| 2660-23026 | U | J | | | | | | | | | | | | K | | | |
| 2660-23027 | U | J | | | | | | | | | | | | K | | | |
| 2660-23028 | U | J | | | | | | | | | | | | K | | | |
| 2660-23029 | M | A | | | | | | | | | | | | K | K | | |
| 2660-23031 | M | J | | | | | | | | | | | | K | K[11] | P | P |
| 2660-23033 | U | J | | | | | | | | | | | | P | | | |
| 2660-23034 | U | J | | | | | | | | | | | | K | | | |
| 2660-23036 | U | J | | | | | | | | | | | | | P | | |
| 2660-23037 | U | J | | | | | | | | | | | | | K | | |
| 2660-23038 | F | J | | | | | | | | | | | | | P | K | K |
| 2660-23039 | F | J | | | | | | | | | | | | | W | W | W |
| 2660-23040 | U | J | | | | | | | | | | | | | W | | |
| 2660-23041 | U | J | | | | | | | | | | | | | K | | |
| 2660-23042 | F | J | | | | | | | | | | | | K | K | P | P |
| 2660-23043 | U | J | | | | | | | | | | | | | K | | |
| 2660-23044 | M | J | | | | | | | | | | | | | P | E | K |
| 2660-23045 | F | J | | | | | | | | | | | | | P | E | E |
| 2660-23046 | U | J | | | | | | | | | | | | | K | | |
| 2660-23047 | U | J | | | | | | | | | | | | | K | | |
| 2660-23048 | M | J | | | | | | | | | | | | | P | E | K |
| 2660-23049 | U | J | | | | | | | | | | | | | P | | |
| 2660-23051 | U | J | | | | | | | | | | | | | P | | |
| 2660-23052 | U | J | | | | | | | | | | | | | D | | |
| 2660-23053 | F | A | | | | | | | | | | | | | K | P | P |
| 2660-23054 | M | A | | | | | | | | | | | | | | P[14] | |
| 2660-23055 | F | A | | | | | | | | | | | | | | N | |
| 2660-23056 | F | A | | | | | | | | | | | | | | W | |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2660-23057 | U | J | | | | | | | | | | | | | | W | |
| 2660-23058 | U | J | | | | | | | | | | | | | | W | |
| 2660-23059 | U | J | | | | | | | | | | | | | | W | |
| 2660-23060 | M | A | | | | | | | | | | | | | P | | |
| 2660-23061 | M | A | | | | | | | | | | | | | O | | |
| 2660-23062 | M | A | | | | | | | | | | | | | O | | |
| 2660-23063 | F | A | | | | | | | | | | | | | O | O | O |
| 2660-23064 | M | A | | | | | | | | | | | | | O | | |
| 2660-23065 | F | A | | | | | | | | | | | | | P | | |
| 2660-23066 | M | A | | | | | | | | | | | | | O | O | O |
| 2660-23067 | M | A | | | | | | | | | | | | | K | K | K |
| 2660-23068 | U | J | | | | | | | | | | | | | D | | |
| 2660-23069 | U | J | | | | | | | | | | | | | W | | |
| 2660-23070 | U | J | | | | | | | | | | | | | W | | |
| 2660-23071 | U | J | | | | | | | | | | | | | P | | |
| 2660-23072 | U | J | | | | | | | | | | | | | P | | |
| 2660-23073 | U | J | | | | | | | | | | | | | K | | |
| 2660-23074 | U | J | | | | | | | | | | | | | K | | |
| 2660-23075 | U | J | | | | | | | | | | | | | K | | |
| 2660-23076 | U | J | | | | | | | | | | | | | K | | |
| 2660-23077 | F | J | | | | | | | | | | | | | K | K | P |
| 2660-23078 | U | J | | | | | | | | | | | | | K | | |
| 2660-23079 | U | J | | | | | | | | | | | | | K | | |
| 2660-23080 | U | J | | | | | | | | | | | | | P | | |
| 2660-23081 | U | J | | | | | | | | | | | | | P | | |
| 2660-23082 | F | A | | | | | | | | | | | | | D | | |
| 2660-23083 | F | A | | | | | | | | | | | | | D | D | |
| 2660-23084 | F | J | | | | | | | | | | | | | | P | K |
| 2660-23085 | U | J | | | | | | | | | | | | | O | | |
| 2660-23086 | U | J | | | | | | | | | | | | | O | | |
| 2660-23087 | M | A | | | | | | | | | | | | | B | | |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2660-23088 | U | J | | | | | | | | | | | | | | P | |
| 2660-23089 | U | J | | | | | | | | | | | | | T | | |
| 2660-23090 | U | J | | | | | | | | | | | | | T | | |
| 2660-23091 | M | A | | | | | | | | | | | | | O | | |
| 2660-23092 | U | J | | | | | | | | | | | | | B | | |
| 2660-23093 | U | J | | | | | | | | | | | | | M | | |
| 2660-23094 | U | J | | | | | | | | | | | | | M | | |
| 2660-23095 | U | J | | | | | | | | | | | | | K | | |
| 2660-23096 | U | J | | | | | | | | | | | | | K | | |
| 2660-23097 | U | J | | | | | | | | | | | | | | P | |
| 2660-23098 | U | J | | | | | | | | | | | | | P | | |
| 2660-23099 | U | J | | | | | | | | | | | | | P | | |
| 2660-23100 | F | A | | | | | | | | | | | | | P | | |
| 2660-23101 | F | A | | | | | | | | | | | | | | K | |
| 2660-23102 | M | A | | | | | | | | | | | | | O | | |
| 2660-23103 | M | A | | | | | | | | | | | | | | W | W |
| 2660-23104 | U | J | | | | | | | | | | | | | | W | |
| 2660-23105 | U | J | | | | | | | | | | | | | | W | |
| 2660-23106 | U | J | | | | | | | | | | | | | | D | |
| 2660-23107 | U | J | | | | | | | | | | | | | | K | |
| 2660-23109 | M | A | | | | | | | | | | | | | | Q | |
| 2660-23110 | U | J | | | | | | | | | | | | | | Q | |
| 2660-23111 | F | A | | | | | | | | | | | | | | E | |
| 2660-23112 | U | J | | | | | | | | | | | | | | D | |
| 2660-23113 | U | J | | | | | | | | | | | | | | D | |
| 2660-23114 | M | A | | | | | | | | | | | | | | W | W |
| 2660-23115 | U | J | | | | | | | | | | | | | | K | |
| 2660-23116 | U | J | | | | | | | | | | | | | | K | |
| 2660-23117 | U | J | | | | | | | | | | | | | | M | |
| 2660-23118 | F | A | | | | | | | | | | | | | | M | |
| 2660-23119 | M | A | | | | | | | | | | | | | | | O |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2660-23120 | U | J | | | | | | | | | | | | | | | K |
| 2660-23121 | U | J | | | | | | | | | | | | | | | P |
| 2660-23122 | U | J | | | | | | | | | | | | | | | P |
| 2660-23123 | U | J | | | | | | | | | | | | | | | K |
| 2660-23124 | U | J | | | | | | | | | | | | | | | P |
| 2660-23125 | U | J | | | | | | | | | | | | | | | P |
| 2660-23126 | F | A | | | | | | | | | | | | | | | D |
| 2660-23127 | U | A | | | | | | | | | | | | | | | P |
| 2660-23128 | U | J | | | | | | | | | | | | | | | W |
| 2660-23133 | M | A | | | | | | | | | | | | | | K | P[17] |
| 2660-23134 | M | A | | | | | | | | | | | | | | E | K |
| 2660-23135 | U | J | | | | | | | | | | | | | | P | |
| 2660-23136 | U | J | | | | | | | | | | | | | | K | |
| 2660-23137 | U | J | | | | | | | | | | | | | | K | |
| 2660-23138 | F | J | | | | | | | | | | | | | | K | K |
| 2660-23139 | U | J | | | | | | | | | | | | | | P | |
| 2660-23140 | U | J | | | | | | | | | | | | | | P | |
| 2660-23141 | U | J | | | | | | | | | | | | | | P | |
| 2660-23142 | U | J | | | | | | | | | | | | | | P | |
| 2660-23143 | U | J | | | | | | | | | | | | | | W | |
| 2660-23144 | U | J | | | | | | | | | | | | | | E | |
| 2660-23145 | F | J | | | | | | | | | | | | | | W | W |
| 2660-23150 | U | J | | | | | | | | | | | | | | | P |
| 2660-23151 | U | J | | | | | | | | | | | | | | | P |
| 2660-23152 | U | J | | | | | | | | | | | | | | | P |
| 2660-23153 | U | J | | | | | | | | | | | | | | | P |
| 2660-23154 | U | J | | | | | | | | | | | | | | | E |
| 2660-23170 | M | A | | | | | | | | | | | | | | | O |
| 2660-23171 | U | J | | | | | | | | | | | | | | | O |
| 2660-23172 | U | J | | | | | | | | | | | | | | | B |
| 2660-23173 | U | J | | | | | | | | | | | | | | | O |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2660-23174 | M | A | | | | | | | | | | | | | | O | O |
| 2660-23175 | F | A | | | | | | | | | | | | | | O | |
| 2660-23176 | F | A | | | | | | | | | | | | | | O | O |
| 2660-23177 | M | A | | | | | | | | | | | | | | O | O |
| 2660-23178 | M | A | | | | | | | | | | | | | | T | |
| 2660-23179 | U | J | | | | | | | | | | | | | | O | |
| 2660-23180 | U | J | | | | | | | | | | | | | | O | |
| 2660-23181 | U | J | | | | | | | | | | | | | | O | |
| 2660-23182 | U | J | | | | | | | | | | | | | | O | |
| 2660-23183 | U | J | | | | | | | | | | | | | | O | |
| 2660-23184 | U | J | | | | | | | | | | | | | | O | |
| 2660-23185 | U | J | | | | | | | | | | | | | | O | |
| 2660-23186 | U | J | | | | | | | | | | | | | | O | |
| 2660-23187 | M | J | | | | | | | | | | | | | | O | P |
| 2660-23188 | U | J | | | | | | | | | | | | | | O | |
| 2660-23190 | M | A | | | | | | | | | | | | | | T | |
| 2660-23191 | M | A | | | | | | | | | | | | | | B | |
| 2660-23192 | M | A | | | | | | | | | | | | | | O | |
| 2660-23193 | F | A | | | | | | | | | | | | | | B | B |
| 2660-23194 | U | J | | | | | | | | | | | | | | B | |
| 2660-23195 | U | J | | | | | | | | | | | | | | B | |
| 2660-23196 | U | J | | | | | | | | | | | | | | | B |
| 2660-23203 | M | A | | | | | | | | | | | | | | O | |
| 2660-23204 | F | J | | | | | | | | | | | | | | O | O |
| 2660-23205 | U | J | | | | | | | | | | | | | | O | |
| 2660-23206 | U | J | | | | | | | | | | | | | | O | |
| 2660-23207 | M | A | | | | | | | | | | | | | | O | |
| 2660-23208 | M | A | | | | | | | | | | | | | | T | |
| 2660-23209 | M | A | | | | | | | | | | | | | | T | |
| 2660-23210 | M | A | | | | | | | | | | | | | | T | |
| 2660-23211 | F | A | | | | | | | | | | | | | | T | T |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2660-23212 | U | J | | | | | | | | | | | | | | O | |
| 2660-23213 | U | J | | | | | | | | | | | | | | O | |
| 2660-23214 | U | J | | | | | | | | | | | | | | B | |
| 2660-23215 | U | J | | | | | | | | | | | | | | B | |
| 2660-23216 | U | J | | | | | | | | | | | | | | B | |
| 2660-23217 | F | A | | | | | | | | | | | | | | B | |
| 2660-23218 | M | A | | | | | | | | | | | | | | B | B |
| 2660-23219 | U | J | | | | | | | | | | | | | | O | |
| 2660-23220 | U | J | | | | | | | | | | | | | | O | |
| 2660-23221 | U | J | | | | | | | | | | | | | | O | |
| 2660-23222 | U | J | | | | | | | | | | | | | | O | |
| 2660-23223 | U | J | | | | | | | | | | | | | | O | |
| 2660-23224 | F | A | | | | | | | | | | | | | | T | |
| 2660-23225 | U | J | | | | | | | | | | | | | | T | |
| 2660-23226 | U | J | | | | | | | | | | | | | | T | |
| 2660-23231 | M | A | | | | | | | | | | | | | | T | |
| 2660-23232 | U | J | | | | | | | | | | | | | | S | |
| 2660-23233 | U | J | | | | | | | | | | | | | | S | |
| 2660-23234 | U | J | | | | | | | | | | | | | | P | |
| 2660-23235 | M | J | | | | | | | | | | | | | | P | K |
| 2660-23236 | U | J | | | | | | | | | | | | | | N | |
| 2660-23237 | U | J | | | | | | | | | | | | | | P | |
| 2660-23238 | M | J | | | | | | | | | | | | | | K | E[18] |
| 2660-23239 | F | J | | | | | | | | | | | | | | K | K[11] |
| 2660-23240 | U | J | | | | | | | | | | | | | | S | |
| 2660-23241 | F | J | | | | | | | | | | | | | | S | S |
| 2660-23242 | U | J | | | | | | | | | | | | | | P | |
| 2660-23243 | U | J | | | | | | | | | | | | | | P | |
| 2660-23246 | M | A | | | | | | | | | | | | | | | B |
| 2660-23247 | U | J | | | | | | | | | | | | | | | O |
| 2660-23248 | M | A | | | | | | | | | | | | | | | O |

Table A8-1.—Detection history for willow flycatchers banded and/or resighted by SWCA Environmental Consultants along the Virgin and lower Colorado Rivers, 2012–16*

| Original Federal band number | Sex[2] | Age when banded[3] | Study area detected[1] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| 2660-23249 | U | J | | | | | | | | | | | | | | | O |
| 2660-23250 | U | J | | | | | | | | | | | | | | | O |
| 2660-23251 | U | J | | | | | | | | | | | | | | | O |
| 2660-23252 | U | J | | | | | | | | | | | | | | | B |
| 2660-23253 | U | J | | | | | | | | | | | | | | | B |
| 2660-23264 | U | J | | | | | | | | | | | | | | | P |
| 2660-23266 | U | J | | | | | | | | | | | | | | | P |
| 2660-23267 | U | J | | | | | | | | | | | | | | | P |
| 2660-23268 | U | J | | | | | | | | | | | | | | | P |
| 2660-23269 | U | J | | | | | | | | | | | | | | | K |
| 2660-23272 | M | A | | | | | | | | | | | | | | | O |
| 2660-23273 | M | A | | | | | | | | | | | | | | | M |
| 2660-23274 | M | A | | | | | | | | | | | | | | | Q |
| 9999-99999 | M | A | | | | | | | | | | | | | K | K | K |

* Table includes individuals banded at sites prior to 2012, including some individuals banded prior to 2003 (Braden and McKernan, unpublished data), and recaptured or resighted by SWCA Environmental Consultants between 2012 and 2016.

[1] B = Bill Williams, D = Muddy River, E = River Ranch, G = Grand Canyon, K = Key Pittman, L = Littlefield, M = Mormon Mesa, N = Warm Springs, O = Alamo Lake, P = Pahranagat, Q = Mesquite, S = St. George, T = Topock Marsh, V = Las Vegas Wash, W = Meadow Valley Wash, and Z = Palo Verde Ecological Reserve. Study area indicated is the study area where the individual was first detected during the given season. Within-season movements are indicated with individual footnotes.

[2] M = male, F = female, and U = unknown.

[3] A = adult, and J = juvenile.

[4] Within-season movement from Mesquite to Mormon Mesa.

[5] Within-season movement from Mormon Mesa to Mesquite, then from Mesquite back to Mormon Mesa.

[6] Within-season movement from Mormon Mesa to Muddy River.

[7] Within-season movement from the Grand Canyon to Mormon Mesa.

[8] Within-season movement from River Ranch to Key Pittman.

[9] Likely within-season movement from Topock Marsh to Muddy River.

[10] Within-season movement from Muddy River to Mormon Mesa.

[11] Within-season movement from Key Pittman to Pahranagat.

[12] Within-season movement from Mesquite to Key Pittman.

[13] Within-season movement from Mesquite to Muddy River.

[14] Within-season movement from Pahranagat to Key Pittman.

[15] Within-season movement from River Ranch to Key Pittman, then from Key Pittman back to River Ranch, then from River Ranch to Pahranagat.

[16] Within-season movement from Alamo Lake to Bill Williams.

[17] Within-season movement from Pahranagat to River Ranch.

[18] Within-season movement from River Ranch to Pahranagat.

# ATTACHMENT 9

Temperature and Humidity at Southwestern Willow Flycatcher Nests (*Empidonax traillii extimus*) at the Topock Marsh, Bill Williams, and Alamo Lake Study Areas, 2016

Table A9-1.—Maximum daily temperature (degrees Celsius) at southwestern willow flycatcher nests at the Topock Marsh, Bill Williams, and Alamo Lake study areas, 2016

| Study area[1] | Vegetation type[2] | June 1–15 | | June 16–30 | | July 1–15 | | July 16–31 | | Aug 1–15 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Median (25th–75th percentile)** | **Mean (standard error)** | **Median (25th–75th percentile)** | **Mean (standard error)** | **Median (25th–75th percentile)** | **Mean (standard error)** | **Median (25th–75th percentile)** | **Mean (standard error)** | **Median (25th–75th percentile)** | **Mean (standard error)** |
| TOPO | TAMSPP (n = 1) | N/A[3] | N/A | 40.6 (39.1–41.1) | 40.4 (0.5) | 37.6 (37.1–38.6) | 37.2 (0.6) | 39.3 (38.3–40.8) | 39.6 (0.6) | 40.6 (39.6–41.6) | 40.6 (1.0) |
| | **Overall** | **N/A** | **N/A** | **40.6 (39.1–41.1)** | **40.4 (0.5)** | **37.6 (37.1–38.6)** | **37.2 (0.6)** | **39.3 (38.3–40.8)** | **39.6 (0.6)** | **40.6 (39.6–41.6)** | **40.6 (1.0)** |
| BIWI | TAMSPP (n = 6) | 34.2 (33.7–35.7) | 34.4 (0.4) | 36.6 (35.1–38.1) | 36.7 (0.4) | 36.2 (35.6–37.1) | 36.3 (0.1) | 36.1 (35.1–37.2) | 35.8 (0.2) | 36.1 (35.6–37.1) | 36.2 (0.2) |
| | **Overall** | **34.2 (33.7–35.7)** | **34.4 (0.4)** | **36.6 (35.1–38.1)** | **36.7 (0.4)** | **36.2 (35.6–37.1)** | **36.3 (0.1)** | **36.1 (35.1–37.2)** | **35.8 (0.2)** | **36.1 (35.6–37.1)** | **36.2 (0.2)** |
| ALAM | SALGOO (n = 17) | 35.1 (34.1–36.1) | 35.1 (0.3) | 37.6 (35.6–39.6) | 37.7 (0.2) | 37.6 (36.6–39.1) | 37.9 (0.1) | 37.6 (36.1–39.6) | 38.0 (0.1) | 35.6 (34.6–36.1) | 35.4 (0.4) |
| | SALGOO_TAMSPP (n = 8) | 40.3 (38.6–42.6) | 40.4 (0.5) | 42.6 (40.6–44.6) | 42.9 (0.5) | 41.6 (37.1–45.6) | 41.4 (0.6) | 39.6 (36.3–46.1) | 40.8 (0.5) | 36.4 (35.1–42.1) | 38.0 (1.1) |
| | TAMSPP (n = 4) | 45.5 (44.0–47.5) | 45.4 (0.8) | 47.5 (42.5–51.5) | 45.6 (1.2) | 44.5 (32.1–46.5) | 41.2 (1) | 42.6 (33.4–45.8) | 41.0 (0.8) | 36.1 (32.1–42.0) | 36.6 (2.4) |
| | TAMSPP_SALGOO (n = 1) | N/A | N/A | 40.1 (37.1–41.6) | 39.6 (0.6) | 42.6 (41.1–43.6) | 42.4 (0.5) | 44.6 (43.3–46.8) | 44.9 (0.5) | 42.1 (40.6–42.1) | 41.4 (0.6) |
| | **Overall** | **38.1 (35.6–43.6)** | **39.2 (0.5)** | **39.6 (36.6–42.6)** | **40.3 (0.4)** | **38.6 (36.6–41.7)** | **39.4 (0.2)** | **38.1 (36.1–41.7)** | **39.4 (0.2)** | **35.6 (34.6–39.2)** | **36.7 (0.5)** |

[1] TOPO = Topock Marsh, BIWI = Bill Williams, and ALAM = Alamo Lake.
[2] TAMSPP = > 75% tamarisk, SALGOO = > 75% Goodding's willow, SALGOO_TAMSPP = Goodding's willow with tamarisk understory, TAMSPP_SALGOO = tamarisk with emergent Goodding's willow, and n = number of nests.
[3] N/A = data not available.

Table A9-2.—Minimum daily temperature (degrees Celsius) at southwestern willow flycatcher nests at the Topock Marsh, Bill Williams, and Alamo Lake study areas, 2016

| Study area | Vegetation type[1] | June 1–15 | | June 16–30 | | July 1–15 | | July 16–31 | | Aug 1–15 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Median (25th–75th percentile)** | **Mean (standard error)** | **Median (25th–75th percentile)** | **Mean (standard error)** | **Median (25th–75th percentile)** | **Mean (standard error)** | **Median (25th–75th percentile)** | **Mean (standard error)** | **Median (25th–75th percentile)** | **Mean (standard error)** |
| TOPO | TAMSPP (n = 1) | N/A[3] | N/A | 27.1 (22.6–28.1) | 26.0 (1.0) | 22.6 (22.1–24.6) | 23.2 (0.4) | 28.4 (27.1–29.6) | 28.1 (0.4) | 28.6 (27.6–29.6) | 28.6 (1.0) |
| | **Overall** | **N/A** | **N/A** | **27.1 (22.6–28.1)** | **26.0 (1.0)** | **22.6 (22.1–24.6)** | **23.2 (0.4)** | **28.4 (27.1–29.6)** | **28.1 (0.4)** | **28.6 (27.6–29.6)** | **28.6 (1.0)** |
| BIWI | TAMSPP (n = 6) | 18.7 (16.7–19.7) | 18.2 (0.7) | 20.9 (19.1–22.2) | 20.6 (0.6) | 17.6 (16.7–19.1) | 18.1 (0.3) | 23.2 (21.6–24.7) | 23.1 (0.2) | 24.6 (24.2–24.7) | 24.4 (0.2) |
| | **Overall** | **18.7 (16.7–19.7)** | **18.2 (0.7)** | **20.9 (19.1–22.2)** | **20.6 (0.6)** | **17.6 (16.7–19.1)** | **18.1 (0.3)** | **23.2 (21.6–24.7)** | **23.1 (0.2)** | **24.6 (24.2–24.7)** | **24.4 (0.2)** |
| ALAM | SALGOO (n = 17) | 13.6 (12.6–15.1) | 13.8 (0.3) | 18.6 (16.1–22.6) | 18.8 (0.4) | 17.1 16.1–18.7) | 17.5 (0.2) | 22.6 (21.1–23.6) | 22.3 (0.1) | 22.7 (22.6–23.4) | 23 (0.1) |
| | SALGOO_TAMSPP (n = 8) | 13.6 (12.6–14.1) | 13.7 (0.3) | 17.6 (16.1–23.1) | 18.8 (0.8) | 16.6 (15.1–17.6) | 16.6 (0.3) | 22.1 (20.6–23.1) | 21.8 (0.2) | 22.6 (22.6–23.1) | 22.8 (0.2) |
| | TAMSPP (n = 4) | 13.1 (12.1–15.6) | 13.6 (0.5) | 17.6 (15.1–21.6) | 18.0 (0.7) | 16.1 (14.6–17.6) | 16.6 (0.4) | 22.1 (20.3–23.1) | 21.5 (0.3) | 22.6 (22.1–23.1) | 22.6 (0.2) |
| | TAMSPP_SALGOO (n = 1) | N/A | N/A | 19.6 (16.6–23.6) | 19.6 (1.1) | 19.1 (18.1–21.6) | 19.3 (0.7) | 24.1 (22.6–25.1) | 23.8 (0.5) | 23.6 (23.6–24.6) | 23.9 (0.4) |
| | **Overall** | **13.6 (12.6–14.6)** | **13.7 (0.2)** | **18.1 (16.1–22.6)** | **18.7 (0.3)** | **17.1 (15.6–18.6)** | **17.2 (0.2)** | **22.6 (21.1–23.6)** | **22.1 (0.1)** | **22.7 (22.6–23.2)** | **23.0 (0.1)** |

[1] TOPO = Topock Marsh, BIWI = Bill Williams, and ALAM = Alamo Lake.
[2] TAMSPP = > 75% tamarisk, SALGOO = > 75% Goodding's willow, SALGOO_TAMSPP = Goodding's willow with tamarisk understory, TAMSPP_SALGOO = tamarisk with emergent Goodding's willow, and n = number of nests.
[3] N/A = data not available.

Table A9-3.—Daily temperature range (degrees Celsius) at southwestern willow flycatcher nests at the Topock Marsh, Bill Williams, and Alamo Lake study areas, 2016

| Study area[1] | Vegetation type[2] | June 1–15 | | June 16–30 | | July 1–15 | | July 16–31 | | Aug 1–15 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Median (25th–75th percentile)** | **Mean (standard error)** | **Median (25th–75th percentile)** | **Mean (standard error)** | **Median (25th–75th percentile)** | **Mean (standard error)** | **Median (25th–75th percentile)** | **Mean (standard error)** | **Median (25th–75th percentile)** | **Mean (standard error)** |
| TOPO | TAMSPP (n = 1) | N/A[3] | N/A | 14.5 (12.5–16.5) | 14.4 (1.0) | 14.0 (13.0–15.5) | 14.0 (0.6) | 11.5 (9.7–13.2) | 11.4 (0.6) | 12.0 (10.0–14.0) | 12.0 (2.0) |
| | **Overall** | **N/A** | **N/A** | **14.5 (12.5–16.5)** | **14.4 (1.0)** | **14.0 (13.0–15.5)** | **14.0 (0.6)** | **11.5 (9.7–13.2)** | **11.4 (0.6)** | **12.0 (10.0–14.0)** | **12.0 (2.0)** |
| BIWI | TAMSPP (n = 6) | 16.0 (15.0–17.0) | 16.3 (0.6) | 16.0 (14.5–18.0) | 16.1 (0.8) | 18.5 (16.5–20.5) | 18.2 (0.4) | 13.0 (11.0–15.0) | 12.7 (0.3) | 11.5 (10.5–12.5) | 11.8 (0.4) |
| | **Overall** | **16.0 (15.0–17.0)** | **16.3 (0.6)** | **16.0 (14.5–18.0)** | **16.1 (0.8)** | **18.5 (16.5–20.5)** | **18.2 (0.4)** | **13.0 (11.0–15.0)** | **12.7 (0.3)** | **11.5 (10.5–12.5)** | **11.8 (0.4)** |
| ALAM | SALGOO (n = 17) | 21.5 (19–24) | 21.3 (0.5) | 20.0 (15.0–22.5) | 18.9 (0.4) | 21.0 (18.5–23.0) | 20.4 (0.3) | 15.5 (14.0–17.5) | 15.7 (0.1) | 12.5 (11.2–13.2) | 12.4 (0.4) |
| | SALGOO_TAMSPP (n = 8) | 27.0 (25.0–29.5) | 26.7 (0.6) | 25.5 (21.5–27.4) | 24.1 (0.8) | 24.5 (20.0–28.5) | 24.8 (0.6) | 17.7 (14.2–23.4) | 19.0 (0.5) | 13.5 (11.0–19.5) | 15.2 (1.2) |
| | TAMSPP (n = 4) | 33.0 (29.5–35.0) | 31.8 (1.0) | 29.5 (19.0–35.9) | 27.7 (1.5) | 26.0 (19.5–31.0) | 24.7 (1.0) | 20.0 (14.0–24.2) | 19.5 (0.7) | 13.2 (10.0–20.0) | 14.0 (2.4) |
| | TAMSPP_SALGOO (n = 1) | N/A | N/A | 21.0 (16.5–22.5) | 20.0 (1.0) | 24.5 (21.0–25.5) | 23.1 (1.1) | 20.7 (19.2–22.5) | 21.1 (0.6) | 17.0 (16.0–18.5) | 17.5 (0.8) |
| | **Overall** | **25.0 (21.5–29.5)** | **25.5 (0.6)** | **21.5 (17.5–25.0)** | **21.6 (0.5)** | **22.0 (19.0–25.0)** | **22.2 (0.3)** | **16.0 (14.0–19.5)** | **17.3 (0.2)** | **13.0 (11.5–16.0)** | **13.7 (0.5)** |

[1] TOPO = Topock Marsh, BIWI = Bill Williams, and ALAM = Alamo Lake.
[2] TAMSPP = > 75% tamarisk, SALGOO = > 75% Goodding's willow, SALGOO_TAMSPP = Goodding's willow with tamarisk understory, TAMSPP_SALGOO = tamarisk with emergent Goodding's willow, and n = number of nests.
[3] N/A = data not available.

Table A9-4.—Mean diurnal vapor pressure (Pascals) at southwestern willow flycatcher nests at the Topock Marsh, Bill Williams, and Alamo Lake study areas, 2016

| Study area[1] | Vegetation type[2] | June 1–15 | | June 16–30 | | July 1–15 | | July 16–31 | | Aug 1–15 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Median (25th–75th percentile) | Mean (standard error) | Median (25th–75th percentile) | Mean (standard error) | Median (25th–75th percentile) | Mean (standard error) | Median (25th–75th percentile) | Mean (standard error) | Median (25th–75th percentile) | Mean (standard error) |
| TOPO | TAMSPP (n = 1) | N/A[3] | N/A | 2,459 (2,324–2,571) | 2,410 (83) | 2,020 (1,902–2,477) | 2,140 (106) | 2,723 (2,434–2,829) | 2,609 (76) | 2,837 (2,832–2,842) | 2,837 (5) |
| | **Overall** | **N/A** | **N/A** | **2,459 (2,324–2,571)** | **2,410 (83)** | **2,020 (1,902–2,477)** | **2,140 (106)** | **2,723 (2,434–2,829)** | **2,609 (76)** | **2,837 (2,832–2,842)** | **2,837 (5)** |
| BIWI | TAMSPP (n = 6) | 1,744 (1,488–2,008) | 1,763 (125) | 2,369 (2,092–2,770) | 2,379 (72) | 2,222 (2,005–2,368) | 2,206 (35) | 2,865 (2,648–3,090) | 2,846 (28) | 3,058 (2,957–3,132) | 3,046 (22) |
| | **Overall** | **1,744 (1,488–2,008)** | **1,763 (125)** | **2,369 (2,092–2,770)** | **2,379 (72)** | **2,222 (2,005–2,368)** | **2,206 (35)** | **2,865 (2,648–3,090)** | **2,846 (28)** | **3,058 (2,957–3,132)** | **3,046 (22)** |
| ALAM | SALGOO (n = 17) | 1,494 (1,398–1,793) | 1,553 (41) | 1,907 (1,710–2,164) | 1,920 (29) | 1,772 (1,546–2,002) | 1,789 (23) | 2,363 (2,170–2,480) | 2,328 (13) | 2,715 (2,547–2,970) | 2,764 (45) |
| | SALGOO_TAMSPP (n = 8) | 1,487 (1,262–1,663) | 1,500 (53) | 1,834 (1,526–2,100) | 1,801 (62) | 1,647 (1,468–1,841) | 1,655 (37) | 2,407 (2,172–2,539) | 2,340 (22) | 2,741 (2,613–3,028) | 2,772 (77) |
| | TAMSPP (n = 4) | 1,509 (1,190–1,742) | 1,478 (79) | 1,874 (1,475–2,219) | 1,908 (88) | 1,811 (1,488–2,217) | 1,881 (69) | 2,349 (2,086–2,725) | 2,414 (51) | 2,889 (2,331–3,107) | 2,798 (170) |
| | TAMSPP_SALGOO (n = 1) | N/A | N/A | 1,799 (1,576–1,936) | 1,765 (65) | 1,251 (1,114–1,651) | 1,364 (89) | 1,761 (1,609–1,839) | 1,756 (53) | 2,370 (2,302–2,500) | 2,453 (152) |
| | **Overall** | **1,497 (1,313–1,694)** | **1,518 (31)** | **1,872 (1,599–2,134)** | **1,884 (27)** | **1,754 (1,506–1,986)** | **1,755 (20)** | **2,363 (2,141–2,519)** | **2,323 (13)** | **2,725 (2,533–2,998)** | **2,742 (39)** |

[1] TOPO = Topock Marsh, BIWI = Bill Williams, and ALAM = Alamo Lake.
[2] TAMSPP = > 75% tamarisk, SALGOO = > 75% Goodding's willow, SALGOO_TAMSPP = Goodding's willow with tamarisk understory, TAMSPP_SALGOO = tamarisk with emergent Goodding's willow, and n = number of nests.
[3] N/A = data not available.

Table A9-5.—Mean nocturnal vapor pressure (Pascals) at southwestern willow flycatcher nests at the Topock Marsh, Bill Williams, and Alamo Lake study areas, 2016

| Study area | Vegetation type[1] | June 1–15 | | June 16–30 | | July 1–15 | | July 16–31 | | Aug 1–15 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Median (25th–75th percentile)** | **Mean (standard error)** | **Median (25th–75th percentile)** | **Mean (standard error)** | **Median (25th–75th percentile)** | **Mean (standard error)** | **Median (25th–75th percentile)** | **Mean (standard error)** | **Median (25th–75th percentile)** | **Mean (standard error)** |
| TOPO | TAMSPP (n = 1) | N/A[3] | N/A | 2,088 (1839–2267) | 2,072 (95) | 1,728 (1,562–2,173) | 1,923 (110) | 2,270 (2,160–2,403) | 2,272 (50) | 2,566 (2,516–2,617) | 2,566 (51) |
| | **Overall** | **N/A** | **N/A** | **2,088 (1,839–2,267)** | **2,072 (95)** | **1,728 (1,562–2,173)** | **1,923 (110)** | **2,270 (2,160–2,403)** | **2,272 (50)** | **2,566 (2,516–2,617)** | **2,566 (51)** |
| BIWI | TAMSPP (n = 6) | 1,627 (1,445–1,999) | 1,686 (103) | 2,088 (2,012–2,349) | 2,138 (47) | 1,858 (1,776–2,008) | 1,898 (23) | 2,447 (2,326–2,697) | 2,483 (24) | 2,825 (2,711–2,853) | 2,786 (20) |
| | **Overall** | **1,627 (1,445–1,999)** | **1,686 (103)** | **2,088 (2,012–2,349)** | **2,138 (47)** | **1,858 (1,776–2,008)** | **1,898 (23)** | **2,447 (2,326–2,697)** | **2,483 (24)** | **2,825 (2,711–2,853)** | **2,786 (20)** |
| ALAM | SALGOO (n = 17) | 1,264 (1,213–1,483) | 1,324 (28) | 1,620 (1,501–1,926) | 1,676 (28) | 1,507 (1,350–1,752) | 1,570 (22) | 2,141 (2,007–2,259) | 2,105 (14) | 2,451 (2,383–2,716) | 2,541 (30) |
| | SALGOO_TAMSPP (n = 8) | 1,267 (1,205–1,507) | 1,316 (30) | 1,625 (1,497–1,904) | 1,666 (50) | 1,472 (1,318–1,661) | 1,509 (32) | 2,114 (2,007–2,268) | 2,102 (20) | 2,474 (2,390–2,736) | 2,545 (56) |
| | TAMSPP (n = 4) | 1,251 (1,161–1,522) | 1,318 (42) | 1,607 (1,416–1,896) | 1,677 (58) | 1,606 (1,358–1,803) | 1,619 (45) | 2,186 (2,002–2,362) | 2,157 (32) | 2,535 (2,357–2,664) | 2,534 (86) |
| | TAMSPP_SALGOO (n = 1) | N/A | N/A | 1,375 (1,285–1,772) | 1,463 (73) | 1,239 (1,085–1,642) | 1,354 (90) | 1,817 (1,697–1,921) | 1,815 (62) | 2,591 (2,365–2,633) | 2,498 (95) |
| | **Overall** | **1,257 (1,201–1,520)** | **1,320 (18)** | **1,615 (1,452–1,898)** | **1,657 (22)** | **1,503 (1,337–1,743)** | **1,555 (17)** | **2,135 (1,994–2,270)** | **2,102 (11)** | **2,477 (2,383–2,711)** | **2,538 (24)** |

[1] TOPO = Topock Marsh, BIWI = Bill Williams, and ALAM = Alamo Lake.
[2] TAMSPP = > 75% tamarisk, SALGOO = > 75% Goodding's willow, SALGOO_TAMSPP = Goodding's willow with tamarisk understory, TAMSPP_SALGOO = tamarisk with emergent Goodding's willow, and n = number of nests.
[3] N/A = data not available.

# ATTACHMENT 10

Contributing Personnel

| Contributor | Role |
|---|---|
| Mary Anne McLeod, M.S. | Project Manager/Scientific Investigator/Field Supervisor |
| Anne Pellegrini, M.S. | Project Coordinator/Scientific Investigator/Field Supervisor |
| Thomas J. Koronkiewicz, M.S. | Banding Lead |
| Glenn A. Dunno, M.A. | Geographic Information System Specialist |
| Kimberly Proa | Project Administrator/Formatting Specialist |
| Dorothy A. House, M.A. | Technical Editor |
| Laura Duval | Field Coordinator/Bander |
| Jerry Kreiser | Field Coordinator/Nest Monitor |
| Darin Blood | Bander/Nest Monitor |
| Chance Hines | Bander/Nest Monitor |
| Thomas Thalhuber | Bander/Nest Monitor |
| Guillermo Alba | Nest Monitor/Surveyor |
| Tasso Cocoves | Nest Monitor/Surveyor |
| Tyler Walcheff | Nest Monitor/Surveyor |
| Quick Yeates-Burghart, M.S. | Nest Monitor/Surveyor |