

**Southwestern Willow Flycatcher  
Inventory and Monitoring  
Along the Colorado River in Grand Canyon National Park  
1999 Summary Report**

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## SUMMARY

We conducted inventory and monitoring for the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) along the Colorado River in Grand Canyon National Park, from Lee's Ferry to Diamond Creek. We performed the inventory using a standard survey protocol, broadcasting tape-playback of willow flycatcher vocalizations while moving slowly through or adjacent to habitat. When we located willow flycatchers, we monitored them visually (with binoculars) from a non-intrusive distance to determine breeding status and success. Our surveys focussed on five sites that have been occupied by southwestern willow flycatchers in the past decade: Triple Alcoves (River Mile 46.5), River Mile (RM) 50.5 Left, RM 51.4 Left, Lava-Chuar (RM 65.3 L), and Cardenas Marsh (Rm 71.1 L). Other areas were also surveyed, where flycatchers have never been detected but the habitat appears to be potentially suitable.

In 1999, a single nesting pair was detected and monitored, at RM 50.5 Left. Two willow flycatchers, probable migrants, were detected at RM 5.2 Right. The nesting pair at RM 50.5 Left was observed feeding hatchlings. Fledging success was not confirmed, but was suspected. No cowbird parasitism was detected, although cowbirds were present at the site. This was the second consecutive year in which surveys located a single breeding pair and no unpaired adult willow flycatchers in the Grand Canyon, the lowest population level since surveys began in 1982. The continued presence of the southwestern willow flycatcher in the Grand Canyon appears to be tenuous.

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## INTRODUCTION

The southwestern willow flycatcher (*Empidonax traillii extimus*) was listed as an endangered species in 1995 (USFWS 1995). In 1997, the U.S. Fish and Wildlife Service (1997) designated critical habitat for this flycatcher, including portions of the Colorado River included in this project. This riparian obligate bird and its habitat have declined in recent decades, due to several factors including degradation of riparian habitat, invasion by nonnative plants, brood parasitism by brown-headed cowbirds, and loss of wintering habitat (Hunter et al. 1987, Unitt 1987, Hunter et al. 1988, Harris 1991, USFWS 1993 and 1995).

Because of long-term concern for this subspecies, and the developing movement toward recognizing it as an endangered species, in the past two decades various parties have conducted inventory and monitoring of the small population known in Grand Canyon National Park. The initial investigations in the 1980s by Brown (1988 and 1991) documented a population high point of 11 singing birds in 1986, although only 2 nests were located in that year. From 1992 through 1997, surveys were resumed as a cooperative effort of the Cooperative Park Studies Unit at Northern Arizona University (aka National Biological Service/Colorado Plateau Research Station and USGS Biological Resources Division/Colorado Plateau Field Station), Grand Canyon National Park, the U.S. Fish and Wildlife Service, and the Arizona Game and Fish Department. Throughout that period, the Grand Canyon flycatcher population fluctuated between one and four breeding pairs, with one to three unpaired resident individuals also detected each year (Sogge and Tibbitts 1992, Sogge et al. 1993, Sogge and Tibbitts 1994, Sogge et al. 1995, Petterson and Sogge 1996, Sogge et al. 1997a and 1997b, Sogge 1998). Beginning in 1993, surveys in the Grand Canyon were carried out in close cooperation with state-wide Arizona surveys, coordinated by Arizona Partners In Flight, which is chaired by the Arizona Game and Fish Department. In 1993 at the beginning of the APIF efforts, the Grand Canyon population constituted a fairly significant portion of the known Arizona population of approximately 50 breeding pairs. As of 1998, the APIF efforts had located 218 occupied flycatcher territories, with 179 pairs (Paradzick et al. 1999). This increase in the number of known sites was an expected result of the intensive, coordinated APIF surveys. And while this increased number of known sites does not negate the bird's endangered status, it does reduce somewhat the relative significance of the small Grand Canyon population.

In the Grand Canyon, the southwestern willow flycatcher is a rare breeding bird, with very small numbers of birds nesting, or attempting to breed, at several small, isolated habitat patches. Occupancy and reproductive success have been irregular (Brown 1988, Brown 1991, Sogge and Tibbitts 1992, Sogge et al. 1993, Sogge and Tibbitts 1994, Sogge et al. 1995, Petterson and Sogge 1996, Sogge et al. 1997, Sogge 1998, Tibbitts and Johnson 1999). All confirmed willow flycatcher nests in the Grand Canyon have been along the main river corridor, with the exception of nesting in Havasu Canyon and upper Deer Creek reported by Carothers and Aitchison (1976). More recent inventory of tributaries with perennial streams, e.g. Shinamu Creek, Deer Creek, Tapeats Creek, failed to locate willow flycatchers (Sogge and Tibbitts 1992, Sogge et al. 1993, Sogge and Tibbitts 1994). All contemporary nests have been located in "new high water zone" plant associations (see Carothers and Brown 1991) dominated by the nonnative tamarisk (*Tamarix* spp.) with some willows (*Salix* spp) and other native mesic vegetation (*Baccharis*, *Tessaria*, ) usually present. Nest plants have all been tamarisk. While tamarisk is ubiquitous along the river corridor, the few sites occupied by willow flycatchers are somewhat distinct. In these locations, the tamarisk thickets tend to extend relatively far back from the riverbank, in the range of approximately 30 to 50 meters, and are comprised of dense stands of large, old tamarisk. This contrasts with most of the river corridor, where tamarisk thickets exist as relatively narrow strips close by the water's edge. Perhaps the most revealing perspective is from above; occupied thickets tend to be broad oval or crescent-shaped areas, which have a much greater ratio of interior volume to edge when compared to the thin, linear strip of tamarisk that prevails throughout the corridor. Occupied sites also tend to have relatively quiet water, and/or eddies adjacent to them, and notable growths of emergent aquatic vegetation (*Equisetum* sp., *Scirpus* sp.) at the edge of the habitat patch.

Although the relative significance of the Grand Canyon willow flycatchers is slightly lower due to locating more breeding pairs throughout the southwest, the Grand Canyon birds are still important. Because of the endangered status and low numbers of this bird range-wide, conservation of all breeding sites is crucial to

recovery of the bird. Furthermore, information on how this small, widely-dispersed population fares is of value to managing the subspecies as a whole. Finally, willow flycatcher nesting habitat in the Grand Canyon is managed by Grand Canyon National Park, and is also affected by operation of Glen Canyon Dam by the Bureau of Reclamation. Because of the above concerns for conserving the southwestern willow flycatcher, those two agencies and other cooperators (Arizona Game and Fish Department, USFWS, USGS/BRD) have chosen to continue inventory and monitoring of the bird in the Grand Canyon.

## METHODS

We conducted surveys according to the standardized southwestern willow flycatcher survey protocol presented in Sogge et al. (1997b). In brief, this method employs broadcast of taped willow flycatcher songs with a tape player, to elicit responses from resident willow flycatchers, while moving slowly and quietly through or adjacent to habitat. At each calling point along survey routes, we broadcast tapes for 15-30 seconds, then listened quietly for a response for approximately 60 seconds. We then moved along the route and repeated this sequence at 20-30 meter intervals. We sometimes repeated this broadcast/listening sequence several times at a single calling point, if background noise or suspicions that a flycatcher was present warranted. We performed surveys primarily between 0400 hours and 1000 hours, when willow flycatcher song rates are greatest. We surveyed primarily on land, walking or crawling slowly through or adjacent to potential habitat. In several instances where topography and/or dense vegetation made it necessary, we conducted surveys from a boat floating quietly adjacent to the habitat. When possible, we camped near habitat patches so they could be surveyed in the dawn hours when singing activity is greatest.

We focussed the majority of our inventory/monitoring efforts in the first 72 river miles downstream from Lee's Ferry. This area contains all contemporary (post-1980) occurrences of nesting willow flycatchers, and the great majority of potentially suitable nesting habitat, in the Grand Canyon above Diamond Creek. Particular attention was given to the locations where adult pairs and nest sites had been located in the past, and where single adults, unlikely to be migrants, had been detected in previous years. These primary survey areas were: Triple Alcoves (RM 46.5 R); RM 50.5 L; RM 51.4 L; Kwagunt Marsh (RM 56.5 R); Lava-Chuar (RM 65.3 L); Cardenas Marsh (RM 71.1 L). Between Cardenas Marsh and Diamond Creek (RM 225 L) potential nesting habitat is very rare. We conducted surveys at the highest potential quality habitats in this reach. We performed surveys in the area just upstream from Parashant Canyon (approximately RM 194 - 198), and the riparian habitat patches present at the confluences of several major tributary canyons (e.g. Kanab Creek, Fern Glen, Parashant Canyon, Spring Canyon, etc.).

Where we located willow flycatchers, we monitored them nonintrusively for extended periods. Our monitoring goals were to: A) determine the number and gender of birds in the habitat patch; B) verify that they were a nesting pair; C) determine their stage of nesting; D) make observations of their use of the habitat patch; E) make observations on interactions between brown-headed cowbirds and willow flycatchers; F) make general observations on willow flycatcher behavior.

Southwestern willow flycatcher surveys in the Grand Canyon differ from those elsewhere in the difficulty of access. All known breeding sites and virtually all potential habitats are along the main Colorado River corridor. Therefore, the most practical, safe, and cost-effective access is by boat. All surveys entail an 8-to-12 day river trip, from Lee's Ferry at River Mile 0 to Diamond Creek at RM 225. A minimum safe crew for these trips consists of two surveyors and two boat operators, using two small (18-ft) oar-powered inflatable rafts. We also accomplished surveys by combining with other research trips, where large (22 to 32 ft) motorized rafts are assisted by a small motorized shuttle craft. We attempted to establish camps near or adjacent to survey habitat, to allow for beginning surveys at or before dawn. To access Cardenas Marsh at dawn under those scheduling constraints, surveyors hiked from Lava-Chuar to Cardenas the evening before, camping at Cardenas. Such adjustments were reasonable, and almost all surveys were conducted within the hours prescribed by the survey protocol.

## RESULTS

### Southwestern Willow Flycatcher Detections and Monitoring

Inventory and monitoring efforts and results for 1999 are summarized in Appendix 1. Detections of willow flycatchers are discussed below.

#### *River Mile 50.5 Left*

The only nesting pair of flycatchers was located at this site. This site has been occupied annually since 1993 (Sogge et al. 1993, Sogge and Tibbitts 1994, Sogge et al. 1995, Petterson and Sogge 1996, Sogge et al. 1997, Sogge 1998, Tibbitts and Johnson 1999). The territory was unoccupied on our first survey visit May 16, but a pair was present with a nest on June 1, our second visit. Neither adult was banded. Extended monitoring led to our determination that the site was occupied by the nesting pair, but no other unpaired adults as has occurred in years past. On the next visit on June 15, the adult pair was observed brooding and feeding an unknown number of willow flycatcher hatchlings. On July 5, we were unable to confirm young as fledglings. However, we suspect young may have been fledged. Two and possibly three willow flycatchers were detected on July 5, and all were in the immediate vicinity of the nest. Because fledglings would likely still have been dependent on the adults on this date, we interpret the localized activity and possibly third bird as encouraging. We did not detect any re-nesting activity on July 5, and did not revisit the site to survey for re-nesting. We observed frequent interactions between cowbirds and willow flycatchers.

The 1999 nest was located within several meters **of the location** of the nests located in this patch in 1993-1998 (pers. obs. and Sogge et al. 1993, Sogge and Tibbitts 1994, Sogge et al. 1995, Petterson and Sogge 1996, Sogge et al. 1997, Sogge 1998, Tibbitts and Johnson 1999). It was placed in a small ( 1cm diameter) vertical tamarisk branch, and was well concealed. It was located 4m above ground, 2m below the top of the canopy, and 8m from the nearest edge of the habitat patch, which was also the water's edge.

The elevation of the nest site at RM 50.5 L is approximately 850 m (2,790 ft) above sea level. The habitat patch size was not re-measured in 1999, as it appeared to be unchanged since Sogge and Tibbitts (1995) quantified it as 0.6 ha of "new high water zone" vegetation. The "new high water zone" riparian association, as discussed by Carothers and Brown (1991), is the tamarisk-dominated zone immediately above the river surface, established in the former scour zone after closing of Glen Canyon Dam. The area used by the nesting adults appeared to be approximately 0.4 ha, and included thickets of tamarisk, coyote willow, and a tamarisk-mesquite interface. The marshy shallow water area that was adjacent to the site in the early 1990s, then absent in 1996-1998, appeared to be re-developing in 1999.

#### *River Mile 5.2 Right*

Two willow flycatchers were detected at this location on May 29, but not on May 30 or later surveys. These birds were therefore considered to be migrants. However, this habitat patch is approximately one hectare in extent, comparable to the current and previous nest patches at RM 50.5 L, 51.4 L, and 71.1 L. The site also provides suitable vegetation attributes and contains an internal swampy area. The site is dominated by tamarisk, but mulefat (*Baccharis emoryi*) was also a prominent component, with many large ( 2 m high) plants.

#### *River Mile Minus 7.0 ("Lunch Beach")*

As part of the overall Grand Canyon avian monitoring project, Jennifer Holmes, Lara Dickson, and Chuck LaRue observed a single singing willow flycatcher at mile -7.0 above Lee's Ferry on May 26, June 3, and June 15 (pers. comm.) The flycatcher was not detected on July 9. Because it was present over a span of 21 days, this bird is likely to have been an unpaired male southwestern willow flycatcher (not a migrant) attempting to establish a breeding territory.

### Brown-headed Cowbird Presence and Interactions with Willow Flycatchers

Brown-headed cowbirds (*Molothrus ater*) were observed frequently throughout the river corridor. However, our subjective impression was that they were less common than in recent years. They were

present in the occupied willow flycatcher nest site, and interactions between the two species were observed on several occasions. We observed willow flycatchers chasing both male and female cowbirds, often while also vocalizing (“whitt” and the *Myiarchus*-like “brr-rrrt!” and “wheak-dee-dee”) and/or bill-clacking. We also observed antagonistic interactions between cowbirds and yellow warblers (*Dendroica petechia*), Lucy’s warblers (*Vermivora luciae*), western wood-peewees (*Contopus virens*) Bewick’s wren (*Thryomanes bewickii*), and ash-throated flycatchers (*Myiarchus cinerascens*).

## DISCUSSION

Table 1 summarizes the 1992-1999 history of the 5 sites in Grand Canyon National Park, upstream of Diamond Creek (RM 225), where adult willow flycatchers have been resident. Unfortunately, it is difficult to compare the population trends documented in that period with the earlier surveys of the 1980s. The 1982-1987 and 1991 surveys (Brown 1988, 1991) did not use tape playback, as employed in the protocol we used (Sogge et al 1997b). Brown's surveys also varied from year to year in timing and intensity, making it difficult in some cases to discriminate between resident willow flycatchers and migrants (of other subspecies), which sing during migration. In 1994, Sogge and Tibbitts (1994) found 18 probable migrants in this river reach, detected singing in May and early June but absent in later re-surveys. Also, it is now known that female willow flycatchers will occasionally give the typical male "fitz-bew" song (pers. obs, T. McCarthy pers. comm., M. Whitfield pers. comm., Sogge et al. 1997b). These factors confound Brown's assumption that a singing willow flycatcher represented a resident, male, paired, willow flycatcher. Even so, the 1999 survey result, of a single nesting pair and no unpaired adults, is the lowest population level documented in the Grand Canyon since 1992, and very likely since survey efforts began in 1982. Only the previous year, 1998, had only a single nesting pair - also at RM 50.5 Left.

Site	1992	1993	1994	1995	1996	1997	1998	1999
RM 46.5 R	Vacant	2 single. Banded.	Vacant	Vacant	Vacant	Vacant	Vacant	Vacant
RM 50.5 L	Vacant	Polygynous and 2 ; fledged 1 BHCO	2 pairs; failed	Pair (fledged 1 WIFL) Single	Pair (fledged 1 WIFL) Single	Pair (fledged 1 BHCO) Single	Pair w/ 3 nestlings, fledge unlikely	Pair w/ nestlings, outcome unknown
RM 51.4 L	Single ( ? )	Vacant	2 pairs; failed	Single	Single	Single	Vacant	Vacant
RM 65.3 L	Vacant	Not surveyed	Single	Single	Vacant	Vacant	Vacant	Vacant
RM 71.1 L	2 pairs; 3 young at fledging	Pair (failed) Single	Vacant	Vacant	Vacant (Single on 1 June visit)	Vacant	Vacant	Vacant
Total Adults <sup>2</sup>	5	8	9	5	4	4	2	2
Adult Pairs	2	2.5	4	1	1	1	1	1
Young Fledged	3	0	0	1	1	0	0	1?

<sup>1</sup>Sources for data are: Sogge and Tibbitts 1992, Sogge et al. 1993, Sogge and Tibbitts 1994, Sogge et al. 1995, Petterson and Sogge 1996, Sogge 1998 (for 1997 data), Tibbitts and Johnson 1999 (for 1998 data).

<sup>2</sup>Resident adults detected on more than one visit (likely migrants excluded).

As Table 1 illustrates, it is clear that the southwestern willow flycatcher has a very tenuous existence along the Colorado River in the Grand Canyon. It is a rare breeding bird there, and is almost certainly not a self-sustaining population. Only 5 sites have been repeatedly occupied in the 225 river-miles between Lees Ferry and Diamond Creek. Through the 1990s, there have never been as many as 10 total birds confirmed to be resident adults attempting to pair and breed; the average over the years is less than half that many (4.6). Actual breeding attempts are fewer, with a high of 4 pairs in 1994 but only 1 pair in each of the 5 nesting seasons since. Breeding attempts have been plagued by brown-headed cowbird brood parasitism, and/or other catastrophic events (e.g. predation, severe weather) to the degree that in 1993 and 1994 when the greatest number of nesting attempts took place, no willow flycatcher young were fledged.

We believe the evidence strongly suggests the Colorado River in the Grand Canyon is a small population on the verge of extinction, and/or a sink area for breeding southwestern willow flycatchers. The number of resident adults available to breed has steadily decreased since a high point of 8 and 9 (in 1993 and 1994, respectively) to a single pair in 1998 and 1999. This reduction is probably explained in part by the very low numbers of young fledged. From 1993 through 1999 the average number of young fledged for the *total combined population* (not per nest) has been only 0.625 to 0.75 nestling per year (5 or 6 nestlings in 8 years). This number is certainly inadequate to sustain a recruitment rate that would offset adult mortality. In fact, the Grand Canyon reproductive rate is likely to be so inadequate that, to the extent breeding adults have been present at all, it is partly or entirely due to immigration from other willow flycatcher populations.

Even this speculation is confused, however, by the situation in the lower Grand Canyon, in the region where the Colorado River becomes influenced by Lake Mead. In that area, the slowing river has deposited extensive sediments, allowing establishment of much riparian vegetation and potential nesting habitat. In 1996 McKernan (1997) located 18 resident willow flycatchers there, confirming 4 successful nests and 9 young fledged. In 1997 and 1998 this area became progressively inundated by the rising level of Lake Mead, and fewer flycatchers were located (McKernan and Braden 1998, and 1999). Aware of the progressive loss of habitat at the Lake Mead inflow, early in the 1998 breeding season we speculated that displaced willow flycatchers might move upstream into the Grand Canyon in search of new nest sites. We speculated that 1998 might produce an unusually high number of resident willow flycatchers in our project area. To have found the opposite, an all-time population low that persists into 1999, likely indicates both how much remains to be learned about inter-population movements of this small songbird, and its overall endangered condition. The questions of year-to-year movements of breeding adults are clearly important for this species, whose habitat is often locally destroyed (and regenerated) by stochastic events, creating a need for opportunistic dispersal capabilities. Research using color-banded individuals could shed much light on the interactions between willow flycatchers in these portions of the Colorado River. Recent studies elsewhere in Arizona suggest immigration and emigration among flycatcher breeding sites may be fairly common. Using color-banded birds, movements among breeding sites have been documented, both within and between drainages, and within and between years. Distances moved range from 0.4 to 190 km (0.25 to 118 mi). (Langridge and Sogge 1997, Paxton et al. 1997, Netter et al. 1999). Such movements could account for sustaining the small numbers of willow flycatchers observed in the Grand Canyon.

## RECOMMENDATIONS

### Site Closures

From 1993 through 1997, Grand Canyon National Park enacted seasonal recreation/camping closures at River Miles 50-52 and Cardenas. Our observations and those of others (Sogge 1998) have been that human recreation has not been a significant disturbance factor in these areas during the years when closures were in effect. It is impossible to know what degree of disturbance would have occurred without closures. However, the National Park Service chose to act conservatively, and by enacting closures precluded even minor human disturbance events. For an endangered species, in designated critical habitat, that action was reasonable. That the Grand Canyon southwestern willow flycatchers have declined, or at least failed to thrive during those years, is likely the result of factors other than recreation including cowbird parasitism, predation, rarity, and habitat conditions.

Site closures may be viewed negatively from certain perspectives. Closures may be seen as unnecessary restrictions, and an inconvenience for river-based recreation. However, we feel these closures are appropriate, reasonable, and of negligible impact on recreation. In the area of the River Mile 50-52 Left closure (see below), many alternate camps are available. During the closure season, camps on river right (opposite the flycatcher sites) are preferred because they provide earlier afternoon shade. Cardenas (RM 71.1 Left) is located in "Furnace Flats," a notoriously hot, exposed camp during the midsummer closure season. We recommend that the seasonal recreation closures be continued, specifically:

1. Close RM 50-52 Left to non-research uses beginning May 5. The closure should last at least 75 days. The specific date for terminating the closure should be based on the breeding status of the resident flycatchers, as determined by surveys and monitoring.
2. Close Cardenas (RM 70-70.2 Left) to non-research river-based camping beginning May 5. Cardenas may be open to hiking-based camping; these groups tend to be smaller, with less likelihood of disturbing resident flycatchers. Also, for hikers the logistical and physical demands of finding an alternate camping location are much greater than for river trips. Therefore, it is reasonable to accommodate hikers. The closure should last at least 75 days. The specific date for terminating the closure should be based on the breeding status of the resident flycatchers, as determined by surveys and monitoring.
2. Immediately close any new area(s) where resident willow flycatchers are found (paired or unpaired), that are unlikely to be migrants. Such closures should be in effect 75 days, or until subsequent surveys determine that the flycatchers have vacated the site.
3. Researchers, National Park Service River Rangers, and other NPS staff should keep the river recreation community and other park users informed of the status and importance of the southwestern willow flycatcher along the Colorado River. Public information opportunities should be maximized to enlist their support of protection measures (closures) and research activities.
4. Research other than willow flycatcher monitoring should be discouraged at the closure sites during the closure periods. Also, research outside this closure period should avoid establishing or using trails through tamarisk-willow thickets. Existing trails should be blocked and rehabilitated. Potential research in these areas should be discussed with the willow flycatcher program coordinator and the U.S. Fish and Wildlife Service. All researchers and assistants working in the closure sites should be briefed on how to avoid disturbance to resident flycatchers: avoid camping within 100 meters of the habitat patches; avoid loud and/or prolonged noise or activity near the habitat patches; use extreme caution when moving through vegetation to avoid damaging nests, impacting vegetation, or disturbing flycatchers; immediately leave the habitat patch if flycatchers give the "whitt" alarm call.
5. Closures should be publicized in river guide newsletters, in Grand Canyon National Park literature, at Lee's Ferry, by the backcountry permit office, and with issuance of all river permits.

#### Cowbird Monitoring and Control

Brood parasitism by brown-headed cowbirds (*Molothrus ater*) on willow flycatchers was not detected this year. However, this problem has been acute in other recent years, and we observed cowbirds throughout the river corridor. Cowbirds continue to be a major threat to southwestern willow flycatchers and other nesting birds in the Grand Canyon. We support the recommendations of Johnson and Sogge (1993, 1995) regarding continuing and expanding cowbird monitoring in Grand Canyon National Park and surroundings. These recommendations include:

1. Continue (resume) monitoring cowbird abundance at livestock pack stations in Grand Canyon.
2. Determine movement patterns (e.g. between rim and river) of cowbirds frequenting pack stations, using radiotelemetry.
3. In addition, we recommend that Grand Canyon National Park work with adjacent land owners and land managers, to identify other potential sources of cowbirds (e.g. livestock corals, feedlots, buffalo ranches).
4. We also recommend that Grand Canyon National Park work with adjacent land owners and land managers, to evaluate instituting cowbird control programs at feeding sources (e.g. livestock

corals, feedlots, buffalo ranches) and/or the river corridor.

### Future Inventory and Monitoring

Some comments on how surveys and monitoring proceed in 2000 and beyond are warranted. As discussed above, despite differing methodologies the surveys over the past 17 years have established that between Lee's Ferry and Diamond Creek, the southwestern willow flycatcher exists as a very small, widely dispersed population that currently is not likely to be self-sustaining. Repeated surveys have identified and confirmed that territorial adults and all nesting attempts have been confined to a small number of sites. At least under the "interim flows" regime of relatively moderate daily fluctuations in river flow, these habitat patches appear to be fairly stable in size and composition.

The Grand Canyon willow flycatcher sites and potential habitat areas are remote and small in number. Accessing them for surveying and monitoring incurs costs and logistics that are disproportionately high, when compared to most other southwestern willow flycatcher sites and populations. The unknown timing of an upcoming breeding season, combined with the advance scheduling required to mobilize river trips makes it difficult to time the final visit to confirm fledging - a crucial data point. Finally, as noted in "Introduction," recent range-wide surveys have now demonstrated that the Grand Canyon flycatchers constitute a small portion of the total southwestern willow flycatcher numbers. These realities raise several questions that should be weighed in considering what intensity of surveying and monitoring are desired in the future:

1. From the perspective of simple numbers of the southwestern willow flycatcher range-wide, how important is continued detailed (3-4 visits/year) surveying and monitoring of the Grand Canyon birds?
2. From the perspective of the flycatcher's population ecology (dispersal, immigration/emigration, dynamics of marginal populations) how important is continued detailed (3-4 visits/year) surveying and monitoring of the Grand Canyon birds?
3. From the perspective of the Bureau of Reclamation and Grand Canyon National Park and their management needs and obligations, how important is continued detailed (3-4 visits/year) surveying and monitoring of the Grand Canyon flycatchers?

The answers to these questions may dictate reducing survey effort, or maintaining it at 1992-1999 levels, or increasing to include mist-netting, color banding, postbreeding monitoring, radiotelemetry, and/or genetics research. We offer the following observations on the implications of the above three questions.

1. From the perspective of simple numbers of the southwestern willow flycatcher range-wide, annual monitoring of these Grand Canyon sites is not necessary. With approximately 500 territories known range-wide (M. Sogge and Southwestern Willow Flycatcher Recovery Team unpubl. data), these five sites, with their history of erratic occupancy and poor reproduction, are of small demographic consequence to the subspecies. Still, as an endangered species all sites have importance. Some reduced level of monitoring may be desired. Options could include:
  - 1a. Discontinue surveys and monitoring indefinitely.
  - 1b. Perform 4-visit surveys and monitoring periodically, e.g. every second, third, or fourth year.
  - 1c. Institute reduced-effort surveys and monitoring, e.g. one or two visits annually (or every third or fourth year) to determine simple presence/absence. It must be noted that currently, through their endangered species research permitting authority, the U.S. Fish and Wildlife Service requires that surveys conform to Sogge et al (1997b), which requires three survey visits per breeding season.

2. From the perspective of the flycatcher's population ecology (dispersal, immigration/emigration, dynamics of marginal populations) the Grand Canyon flycatchers may be of considerable interest. The dynamics of this small, dispersed, isolated group of sites and its interactions with other flycatcher populations may be of considerable relevance to understanding the bird range-wide. A range of research studies could be brought to bear on the Grand Canyon birds, and would need to be done in combination (or close coordination) with other regional populations. Possible projects might include: intensive capture and banding of all individuals; tissue sampling for genetic analysis; more intense monitoring to better define habitat use and dispersal behavior; radiotelemetry studies to examine the latter over large scales.
3. From the perspectives of the Bureau of Reclamation and Grand Canyon National Park (and the Arizona Game and Fish Department and U.S. Fish and Wildlife Service) and their management needs and obligations, continued surveying and monitoring may be desired. Management issues may include operation of Glen Canyon Dam, recreation impacts, management of non-native species, development of information for the general public, or addressing the research questions outlined in 2. above. However, as in item 1. above, the intensity of monitoring might be adjusted to fit respective needs. The options 1a., 1b., and 1c. can all be considered. However, costs are a significant factor. With that in mind, we offer the following thoughts on accessing the five primary willow flycatcher habitat sites.
  - 3a. **River Access:** There are several important advantages to doing surveys based from river trips. Access is physically easier, and probably safer than hiking. The sites at RM 46.5 R, 50.5 L, and 51.4 L can only be reached reasonably by boat. Further, boat travel makes it possible to visit all sites in quick sequence. This is important, as it allows investigators to establish the status of all sites at essentially the same point in the breeding season. Also, if the required 3 (or 4) visits are going to be made at all sites within the time windows prescribed in the protocol, boat transportation becomes a virtual necessity. Finally, boat access allows surveyors to have sufficient supplies to spend extra time at sites if conditions (e.g. ambiguous breeding status) warrant.
  - 3b. **Hiking Access:** The sites at Lava-Chuar (RM 65.3 L) and Cardenas (RM 71.1 L) can be accessed by foot from the South Rim. Being only approximately 8 miles apart by trail, these sites could be checked by foot, on consecutive days. An important consideration should be that the hikes involved are demanding, and would be done at midsummer through a notoriously hot portion of the Grand Canyon.
  - 3c. With the above considerations in mind, a number of cost-cutting options are available. Flycatcher researches could be conducted by boat to the first three sites, then Lava-Chuar and Cardenas could be visited by foot with the surveyor(s) hiking out to the South Rim from Cardenas. Surveyors might be on dedicated willow flycatcher trips, or may tag along on other research trips, or may join commercial trips. However, when considering cost-cutting measures, it must be realized that placing a surveyor at a willow flycatcher site represents a significant investment of effort and cost. Once there, surveyors must have the time and ability to confidently determine the status at each site. ***The main surveying requirement must be accommodated: surveyors must be able to spend 2 to 6 hours at each site, on consecutive mornings, beginning at first light.*** If several surveyors are available, adjacent sites may be visited simultaneously.
  - 3d. All the above discussions operate on the assumption that surveys should be focussed on the five primary sites identified in Table 1, with opportunistic surveying elsewhere. We believe this premise is reasonable, as these five sites have consistently been the only ones to repeatedly host territorial willow flycatchers from 1992-1998. Resumption of more extensive surveys may be desired in the future, but does not seem warranted now.

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Appendix 1. Summary of southwestern willow flycatcher inventory/monitoring effort, along the Colorado River (Miles 0 - 225) in Grand Canyon National Park, 1999.

River Reach	Date	Time Start	Time Stop	Surveyors	Surveyor Hours	WIFL	BHCO
RM -0.25 to +0.5 R	5/14/99	0515	0628	M. Johnson, J. Petterson,	2.5	No	Yes
	5/29/99	0445	0530	T. Tibbitts	0.75	No	Yes
RM 5.2 R	5/29/99	0730	0845	T. Tibbitts, N. Brown	2.5	Yes; 1 bird, full range of vocals, chases WWPE and BHCO	Yes
	5/29/99	1555	1845	T. Tibbitts, L. Abbott, K. Barnett	8.25	Yes; 2 birds, vocals suggest mated pair. Nest searches find nothing.	Yes
	5/30/99	0505	0605	T. Tibbitts, L. Abbott, K. Barnett	3.0	No	Yes
	6/13/99	0930	1000	T. McCarthey, S. Williams, L. McGrath	1.5	No	No
	7/2/99	1436	1540	N. Brown	1.0	No	?
RM 46.5 R Triple Alcoves	5/15/99	1805	1900	M. Johnson, L. McGrath	2.0	No	No
	5/16/99	0545	0800	L. McGrath	2.25	No	No
	5/31/99	1630	1730	T. Tibbitts, L. Abbott, K. Barnett	3.0	No	Yes
	6/1/99	1630	1715	T. Tibbitts, L. Abbott, K. Barnett	2.25	No	Yes
	6/15/99	0600	0630	T. McCarthey, S. Williams, L. McGrath	1.5	No	No

Appendix 1, cont. Summary of southwestern willow flycatcher inventory/monitoring effort, along the Colorado River (Miles 0 - 225) in Grand Canyon National Park, 1999.						
River Reach	Date	Time Start	Time Stop	Surveyors	Surveyor Hours	BHCO
RM 50.5 L	5/16/99	0610	0828	M. Johnson, J. Petterson	4.5	No
	5/16/99	1730	1905	J. Petterson	1.5	No
	5/17/99	0520	0730	M. Johnson	2.0	No
	6/1/99	0515	0945	T. Tibbitts, K. Barnett, L. Abbott	7.0	Pair with nest, early incubation
	6/2/99	0600	0745	L. Abbott, K. Barnett	3.5	Pair with nest, early incubation
	6/15/99	0745	0840	T. McCarthey, S. Williams, L. McGrath	3.0	Pair feeding unknown number of hatchlings
	7/5/99	0850	1110	N. Brown	2.25	2 WIFLs, possible a 3rd
RM 50.5 L to 51.4 L	5/17/99	0503	0533	J. Petterson, L. McGrath	1.0	No
RM 51.4 L	5/16/99	1745	1840	M. Johnson	1.0	No
	5/17/99	0536	0624	J. Petterson, L. McGrath	1.5	No
	6/1/99	0510	0700	K. Barnett, L. Abbott	3.5	No
	6/2/99	0645	0715	T. Tibbitts	0.5	No
	6/15/99	0950	1030	T. McCarthey, S. Williams, L. McGrath	3.0	No
	5/17/99	0730	0855	J. Petterson	1.5	No
	6/2/99	0755	0825	T. Tibbitts	0.5	No
RM 56.0R Kwagunt Marsh	5/17/99	0730	0855	J. Petterson	1.5	No
	6/2/99	0755	0825	T. Tibbitts	0.5	No

Appendix 1, cont. Summary of southwestern willow flycatcher inventory/monitoring effort, along the Colorado River (Miles 0 - 225) in Grand Canyon National Park, 1999.

River Reach	Date	Time Start	Time Stop	Surveyors	Surveyor Hours	WIFL	BHCO
RM 65.3 L Lava-Chuar	5/17/99	1800	1900	J. Petterson	1.0	No	Yes
	5/18/99	0515	0615	M. Johnson, J. Petterson	2.0	No	Yes
	6/3/99	0540	0710	K. Barnett	1.5	No	Yes
	6/17/99	0535	0610	S. Williams	0.5	No	No
RM 71.1 L Cardenas	5/18/99	0600	0800	L. McGrath	2.0	No	Yes
	6/2/99	1845	1915	T. Tibbitts, L. Abbott	1.0	No	No
	6/3/99	0400	0545	T. Tibbitts, L. Abbott	3.5	No	Yes
	6/17/99	0640	0725	T. McCarthy, L. McGrath	1.5	No	No
	7/8/99	1030	1108	N. Brown	0.5	No	?
Tapeats Creek	5/21/99	0605	0640	L. McGrath	0.5	No	No
RM 143 R Kanab Creek	5/21/99	0800	0815	J. Hart, C. Shannon, C. Brien	0.75	No	No
	5/23/99	0552	0607	J. Hart, C. Shannon, C. Brien	0.75	No	No
RM 191.2 L to RM 196.0 L	6/6/99	1425	1440	T. Tibbitts, K. Barnett, L. Abbott	0.75	No	No
	5/23/99	0545	0845	L. McGrath	3.0	No	No
RM 191.2 R to RM 196.0 RL	5/23/99	0625	0745	J. Hart, C. Shannon, C. Brien	4.0	No	No
	6/7/99	0600	0700	T. Tibbitts, K. Barnett, L. Abbott	3.0	No	No

Appendix 1, cont. Summary of southwestern willow flycatcher inventory/monitoring effort, along the Colorado River (Miles 0 - 225) in Grand Canyon National Park, 1999.

River Reach	Date	Time Start	Time Stop	Surveyors	Surveyor Hours	W/FL	BHCO
RM 196 L to RM 198 L	5/23/99	0850	1030	L. McGrath	1.75	No	No
RM 196 R to RM 198 R	5/23/99	0750	0915	J. Hart, C. Shannon, C. Brien	4.25	No	No
	6/22/99	0630	0730	T. McCarthey, S. Williams, L. McGrath	3.0	No	No
RM 204.5 R Spring Canyon	5/24/99	0615	0635	J. Hart, C. Shannon, C. Brien	1.0	No	No
	6/9/99	0650	0750	T. Tibbitts, K. Barnett, L. Abbott	3.0	No	No
				Total:	106.0		