



## Willow flycatcher (*Empidonax traillii*) surveys in the Colorado River delta: implications for management

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A subspecies of willow flycatcher, the south-western willow flycatcher, has become endangered in the U.S. The objective of this study was to determine the presence/absence of this subspecies in the Colorado River delta. Surveys were conducted in June–July 1999 and in May–June 2000. We detected a total of 50 birds, most likely south-western willow flycatchers, from May to June and none in July. It appears that the birds found in the delta were migrants. It is important to restore the intensively used stopover sites for the recovery of the subspecies. Additionally, we postulate a migratory route throughout the estuaries of Sonora.

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### Introduction

The willow flycatcher (*Empidonax traillii*) was first described by Audubon (1831). Before 1963 willow and alder flycatcher were lumped as traill's flycatchers. However, willow was differentiated from alder flycatcher primarily on the basis of song, interpreted as 'fitz-bew', but also differences were supported by other physical, behavioral, and genetic characters (Stein, 1963; Seutin & Simon, 1988; McCabe, 1991). Several taxonomists have recognized five subspecies of *E. traillii*. The south-western willow flycatcher (*E.t. extimus*) was described by Phillips (1948) with a collection from the San Pedro River and it is differentiated from other subspecies by color (generally paler) and by wing formula (Unitt, 1987).

Neotropical migrants are defined as western hemisphere species all or part of whose populations breed north of the Tropic of Cancer and winter south of that line (DeGraaf & Rappole, 1995). Willow flycatchers of all subspecies are Neotropical migrants that breed in North America and winter from south Mexico to Panama (Peterson, 1990). The breeding range for *E.t. extimus* includes Arizona, southern California, New Mexico, southern Nevada, southern Utah, south-western Colorado and western Texas, although, specific wintering sites for the south-western subspecies are currently unknown (Phillips, 1948; Sogge *et al.*, 1997).

The south-western willow flycatcher is a riparian obligate bird restricted to dense mesic vegetation and it only breeds near surface water or saturated soil (Sogge *et al.*, 1997). However, loss of wintering habitat, loss and fragmentation of native riparian breeding habitat due to flood control, urban development, agriculture, overgrazing, fire, invasion of exotic plants, and nest predation have contributed to willow flycatcher population declines (Unitt, 1987). With only 300–500 breeding pairs in the U.S., *E.t. extimus* was listed as endangered in 1995 by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service, 1995).

Willow flycatcher breeding area formerly included the lower Colorado River and its delta. In 1902, 34 nests of willow flycatchers containing 93 eggs were collected in the Colorado River near Yuma, Arizona (Sferra *et al.*, 1997). South of Yuma, five specimens of south-western willow flycatcher were collected from a breeding area 11 km east from Cerro Prieto in the Hardy River between May and June of 1928 (Unitt, 1987). This breeding area no longer exists in the delta, it has been transformed to solely agricultural lands. However, there are extensive remnant wetlands and riparian corridors that have survived or that were re-established due to agricultural runoff and pulse floods in the Colorado River delta. Approximately 1800 ha of cottonwood (*Populus fremontii*)–willow (*Salix gooddingii*) gallery forest has regenerated in the delta (Fig. 1) (Glenn *et al.*, 1992a, b, 1996, 1997; Valdes-Casillas *et al.*, 1998; Glenn *et al.*, 1999). These zones create a structurally complex habitat that has been proven to support greater number of bird species and also provides additional cover from extreme summer temperatures in the lower Colorado River (Rosenberg *et al.*, 1991).

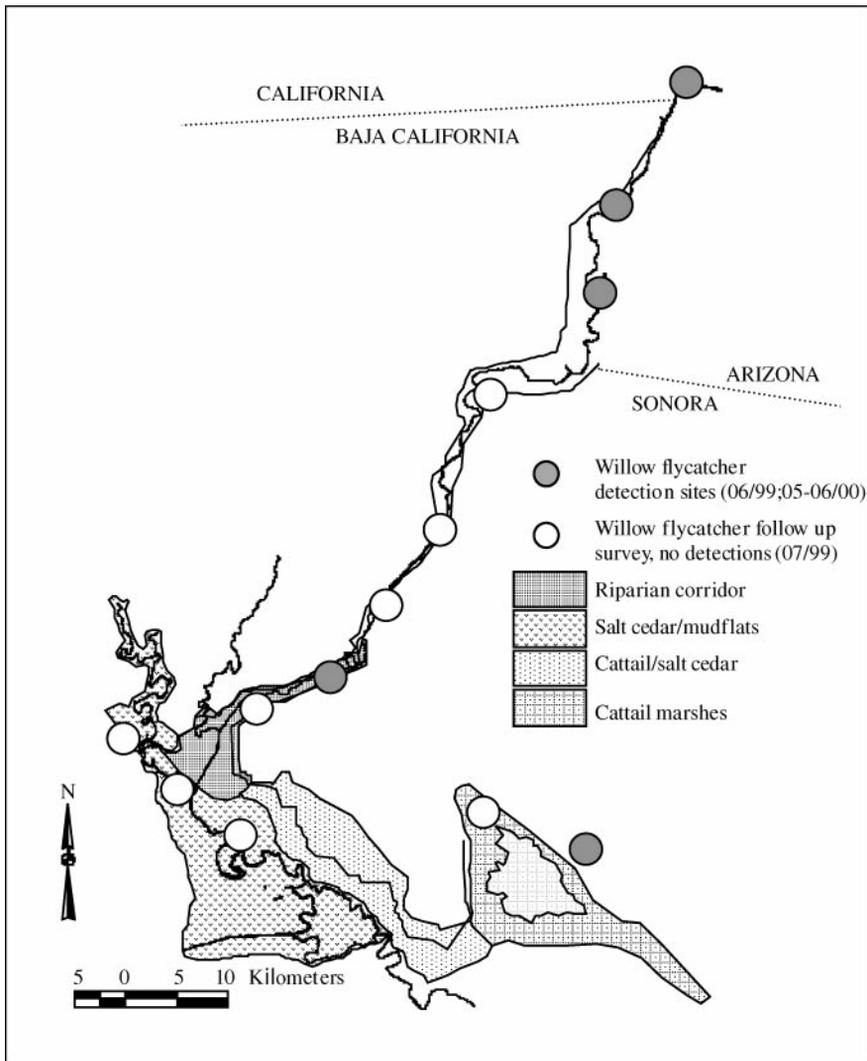
The present work reports the results of 2 years of casual observations and formal willow flycatcher surveys in the Colorado River delta (1999–2000) as well as the management implications and challenges that this area represents for the overall recovery of the subspecies.

## Materials and methods

### *Study area*

The Colorado River delta (between the States of Sonora and Baja California) extends 200 km from the Northern International Boundary (NIB) south into the Gulf of California (Fig. 1). The Colorado River south from the NIB supports a riparian corridor of approximately 1800 ha of cottonwood/willow gallery forest (Fig. 1). Vegetation distribution in this river stretch is comprised of an understory of salt cedar (*Tamarix ramosissima*), seepwillow (*Baccharis salicifolia*), arrowweed (*Pluchea sericea*) and Freemont's cottonwood (*Populus fremontii*). A midstory composed by salt cedar, Goodding's willow (*Salix gooddingii*), arrowweed, common reed (*Phragmites australis*), seepwillow and Freemont's cottonwood, and an overstory dominated by Goodding's willows followed by Freemont's cottonwoods (Zamora-Arroyo *et al.*, 2001).

El Doctor *pozos*, on the eastern part of the delta, are originated and supported by desert springs or *pozos* (Ezcurra *et al.*, 1988) with salinity ranging from fresh to brackish. These *pozos* support a variety of hydrophytic plants (29 species) of which the most abundant are flat sedges (*Cyperus laevigatus*), spike rushes (*Eleocharis geniculata*) and cattails (*Typha domingensis*). Salt tolerant species such as halophytes and exotic salt cedar stands are present at the perimeters and between these *pozos* (Glenn *et al.*, 1996). The area covered by the El Doctor has been stable at 500–700 ha over the past 20 years but vegetation is continuously impacted by cattle grazing and watering of cattle (Glenn *et al.*, 1996). These impacts, however, are being controlled by the placement of exclusion fences around some of the major *pozos* by personnel of the Biosphere Reserve of the Upper Gulf of California and Colorado River Delta (J. Campoy, Areas Naturales



**Figure 1.** Colorado River delta with its different ecosystems. Locations where willow flycatchers were detected are shown with gray circles, and follow up survey sites with no willow flycatcher detection, are indicated with white circles.

Protegidas-SEMARNAP and M. Roman, IMADES pers. comm.) of which El Doctor forms a part.

#### *Field surveys*

Our survey for willow flycatchers in the Colorado River delta started with casual observations during the spring of 1999 and formally during the spring of 2000.

Casual observations were done during Yuma clapper rail surveys in the wetlands of the Cienega de Santa Clara and El Doctor on 7–8 June 1999 (Hinojosa-Huerta *et al.*, 2001) and during Rio Grande leopard frog reconnaissance along the Colorado River

on 5–6 June 1999 (S. Sferra pers. comm.) (Fig. 1). A follow-up extensive survey was conducted on 6–9 July 1999 on which the same sites and 20 others were visited to check for breeding activity. Sites included east and west sides of the Colorado River riparian corridor, southern stretch of the Hardy River, the Cienega de Santa Clara, and El Doctor *pozos* (Fig. 1).

Formal surveys for willow flycatchers were conducted in a stretch of riparian vegetation of approximated 30 km along the lower Colorado River within the Cocopah territory, AZ (Fig. 1). The area was visited on 23–24 May on 6–7 June and on 26 June 2000. Forty sites clustered in three major areas known as Hunter's Hole, Gadsen Pond, and Gadsen Bend (Fig. 1) were surveyed between May and June 2000. In addition, two sites at El Doctor *pozos* in the Colorado River delta were also surveyed at the same dates. Formal surveys were performed from dawn to late morning, while birds were most active. An audio tape of southwestern willow flycatcher songs and calls was used to elicit responses from the flycatchers. Although, we did not determine subspecies, we suspect individuals detected were *E.t. extimus*, due to geographic proximity of breeding grounds. Nevertheless, individuals might also be *Empidonax traillii adastus* or *Empidonax traillii brewsteri* both of them with breeding grounds in western United States (Sogge *et al.*, 1997).

## Results

Nine willow flycatchers were identified at two sites in the Colorado River delta during 5–8 June 1999; six at El Doctor *pozos* and three at the Colorado River mainstream south from the railroad bridge at a site called Colorado II. These results are summarized in Table 1. Willow flycatchers at El Doctor were located vocalizing in a salt cedar stand near the main *pozo*. The three willow flycatchers observed in the Colorado II site were seen near a dense cottonwood/willow forest. No willow flycatchers were detected during the extensive follow-up survey of 6–9 July 1999 (Table 1).

During the formal surveys from May to June 2000, a total of 41 willow flycatchers were identified at the sites visited in the Colorado River delta (Table 1 and Fig. 1), 26 were at the riparian corridor between the NIB and the SIB, on the U.S. side of the border. This included 15 birds at Hunter's hole, eight at Gadsen Pond, and three at Gadsen Bend. The latest these birds were detected in the area was mid-June and they were not seen breeding.

Fifteen individuals were detected at El Doctor *pozos* including 13 individuals on 22 May in a small stretch of *pozos* named 'El Mirador', and on 6 June two birds were detected, in the main *pozo*. Insects were exceptionally abundant in El Doctor compared with other areas in the delta. No birds were detected on 26 June at this location (Table 1). Large groups of the parasitic brown headed cowbird (*Molothrus ather*) were detected at all sites during the 1999 and 2000 surveys.

During their migration through the riparian corridor of the Colorado River between the NIB and SIB, the majority of willow flycatchers (70% or 18 birds) preferred native broadleaf dominated areas near standing water. Backwaters from the river were present at the boundaries of the vegetation where mosquitoes and other insects were seen near the water surface in all our three visits. Water temperature from the backwater remained at 26°C and specific electrical conductance (SpEC) remained constant at 3.5 mS/cm (approx. 2200 ppm salinity) from May to the end of June 2000.

The rest of the south-western willow flycatchers (30% or eight birds) were found in fragmented patches of native (Goodding's willows) and exotic (salt cedar) vegetation found adjacent to the river. No backwaters were present in these areas, although soils were saturated at sites where willow flycatchers were present.

No willow flycatchers were detected in any of the surveys in segmented and narrow linear habitat types dominated by exotics (salt cedar). Nor they were in native broadleaf

**Table 1.** Site name, location, date surveyed, and number of willow flycatchers detected during the 1999–2000 surveys in the Colorado River delta

| Site name                         | Latitude  | Longitude  | Date surveyed  | No. of willow flycatchers |
|-----------------------------------|-----------|------------|----------------|---------------------------|
| Gadsen Bend (12 sites)            | 32°44'24" | 114°41'24" | 23–24 May 2000 | 1                         |
|                                   |           |            | 6–7 June 2000  | 2                         |
|                                   |           |            | 26 June 2000   | 0                         |
| Gadsen Pond (19 sites)            | 32°36'36" | 114°48'36" | 23–24 May 2000 | 2                         |
|                                   |           |            | 6–7 June 2000  | 6                         |
|                                   |           |            | 26 June 2000   | 0                         |
| Hunter's Hole (10 sites)          | 32°34'12" | 114°42'00" | 23–24 May 2000 | 11                        |
|                                   |           |            | 6–7 June 2000  | 4                         |
|                                   |           |            | 26 June 2000   | 0                         |
| North railroad crossing (4 sites) | 32°18'00" | 113°00'25" | 6–9 July 1999  | 0                         |
| Vado Carranza (2 sites)           | 31°11'55" | 115°09'22" | 6–9 July 1999  | 0                         |
| Colorado II (2 sites)             | 32°10'09" | 115°10'47" | 5–6 June 1999  | 3                         |
|                                   |           |            | 6–9 July 1999  | 0                         |
| Cucapa Complex (9 sites)          | 32°06'16" | 115°14'22" | 6–9 July 1999  | 0                         |
| Cienega de Santa Clara (2 sites)  | 32°03'19" | 114°54'27" | 7–8 June 1999  | 0                         |
|                                   |           |            | 6–9 July 1999  | 0                         |
|                                   |           |            | 6–7 June 2000  | 0                         |
| El Doctor (2 sites)               | 31°56'51" | 114°44'51" | 6–7 June 1999  | 6                         |
|                                   |           |            | 6–9 July 1999  | 0                         |
|                                   |           |            | 23–24 May 2000 | 13                        |
|                                   |           |            | 6–7 June 2000  | 2                         |
|                                   |           |            | 26 June 2000   | 0                         |
|                                   |           |            |                | Total = 50                |

vegetation along the mainstream of the river where the currents are relatively fast and insects not as abundant as they were at the backwaters.

### Discussion

A total of 50 willow flycatchers, most likely south-western willow flycatchers, were detected in the Colorado River delta.

Arizona Partners in Flight, an interagency program dedicated to conserve native land birds, has reported in their surveys, an annual mean of 37 willow flycatchers from 1993 to 1999 along the 30 km stretch of river between the NIB and the SIB. Of these, a mean of 16 were detected at Hunter's hole, eight at Gadsen Pond and 12 at Gadsen Bend (Muiznieks *et al.*, 1994; Sferra *et al.*, 1995, 1997; Spencer *et al.*, 1996; Paradzick *et al.*, 1999, 2000). A similar number of birds were found at these three locations for the 2000 survey.

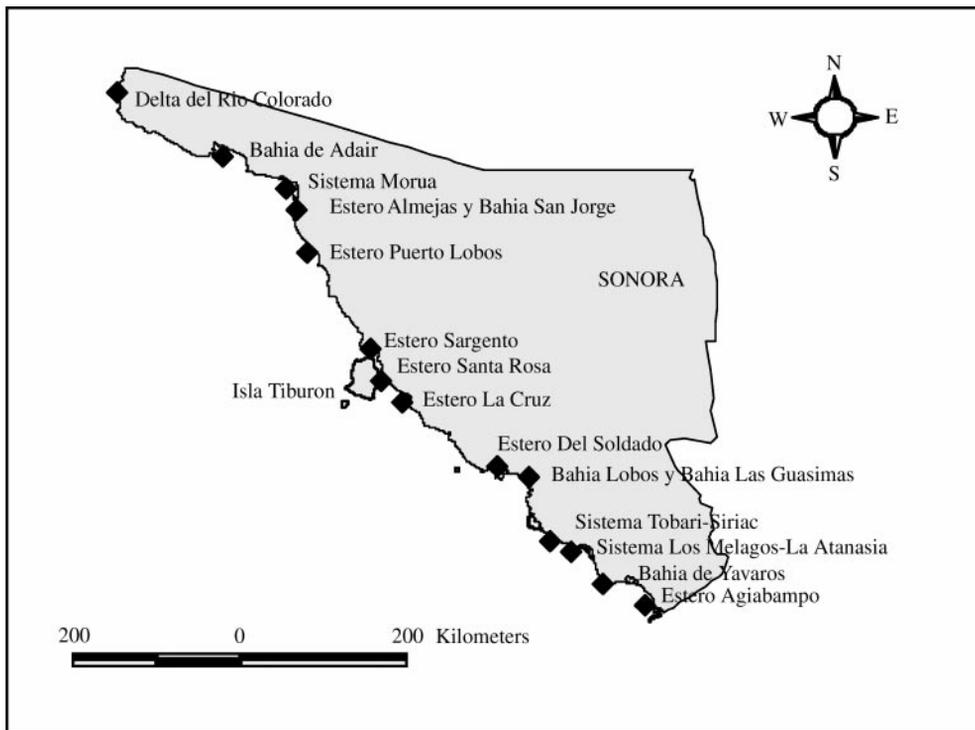
Results from our surveys along the Colorado River delta suggests that the willow flycatchers no longer breed in the area. However, the remnant habitats of riparian corridors and desert *pozos* are used intensively during their spring migration between the months of May and June. Willow flycatchers appear to prefer areas where backwaters are present and insects are abundant because one of the major priorities of migrants is to restore their depleted energy storage in order to continue their flight (Petit, 2000).

Willow flycatcher surveys (1998, 1999) by Arizona Partners in Flight, show that the sites with the largest number of migrant birds occurred in the lower Colorado River (86% of the total migratory birds were detected in the lower Colorado River, Yuma County) (Paradzick *et al.*, 1999, 2000). It is possible, then, that the Colorado River delta acts as a passage for the majority of migratory birds on their spring migration. This information further justifies the importance of the Colorado River delta riparian areas and its urgent restoration to help in the recovery of the south-western willow flycatcher.

Wetland and riparian management and restoration efforts in the Colorado River delta, both in Mexico and in the U.S., would be greatly rewarded if a series of permanent backwaters are created along the Colorado River. This habitat type will probably be attractive for the migrants and if sufficient area is restored, they could even return to their historic nesting grounds. However, backwaters will need to be closely monitored for selenium and pesticide concentrations in order to prevent any adverse effect on wildlife (García-Hernández *et al.*, 2000). Selenium is a naturally occurring contaminant, widely distributed along the lower Colorado River (Radtke *et al.*, 1988) and known for its toxic effects on wildlife (Ohlendorf *et al.*, 1986). Nevertheless, the rate of selenium uptake by the food chain in the created backwaters, could be minimized by the use of a mix of Colorado River water and agricultural runoff, a continuous outflow, and restraint of dredging activities in these areas (García-Hernández *et al.*, 2001).

El Doctor *pozos* seem to be a very important stopover site for the willow flycatchers. Six to 15 birds were detected in only 1 km of *pozos*, but it is possible that the complete area of 500–700 km could be used as a stopover site. Physical barriers such as the Gran Desierto on the east and south-east and the ocean on the west make this area particularly important for migratory birds. Isolated stopover areas have been recognized in the population dynamics of shorebirds, waterfowl, and rails (Petit, 2000). A thorough willow flycatcher survey at the El Doctor needs to be conducted to support this idea. Immediate actions such as exclusion fences around some of these *pozos* are already helping these areas and their migratory visitors.

This study confirms that willow flycatchers use El Doctor *pozos* and the Colorado River riparian corridors as a migratory route. However, a complete migratory pattern for the willow flycatcher, and specifically for the south-western willow flycatcher, is largely unknown (Sferra *et al.*, 1997) despite their influence in the nesting success of the subspecies (Petit, 2000).



**Figure 2.** Map of the Sonoran coastal estuaries (Cervantes, 1994).

It is proposed that a possible willow flycatcher summer migratory route, could be traced throughout the series of coastal estuaries found adjacent to the coast of Sonora (Fig. 2). There are previous records of willow flycatchers found along the coastal estuaries of Bahia Adair, Estero Sargento, Estero Santa Rosa and Estero la Cruz (Russell & Monson, 1998). Thirty-three birds from the Isla Tiburon area were captured in May 1970 using a mist net (Russell & Monson, 1998). There are 20 wetlands along the Sonoran coast with an approximate 173,000 ha of halophytes and mangroves (Cervantes, 1994). Although, these areas have different a vegetation composition to their summer and wintering habitats, many long-distance migratory species are capable of using a wide variety of habitat types during their migration (Petit, 2000). The most important factors for the distribution of birds among habitat types during migration are: (1) food abundance or effectiveness in exploiting the food base; (2) competition with other species; (3) predation pressure or relative safety from predators; and (4) productive opportunities (Petit, 2000). The proposed migratory route could provide enough food and protection from predators for migrants.

It is evident that more surveys are needed in the Colorado River delta and along the coast of Sonora. Nevertheless, we encourage continued binational cooperation between institutions from Mexico and the U.S. to protect the breeding areas and migratory routes of the south-western willow flycatcher.

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