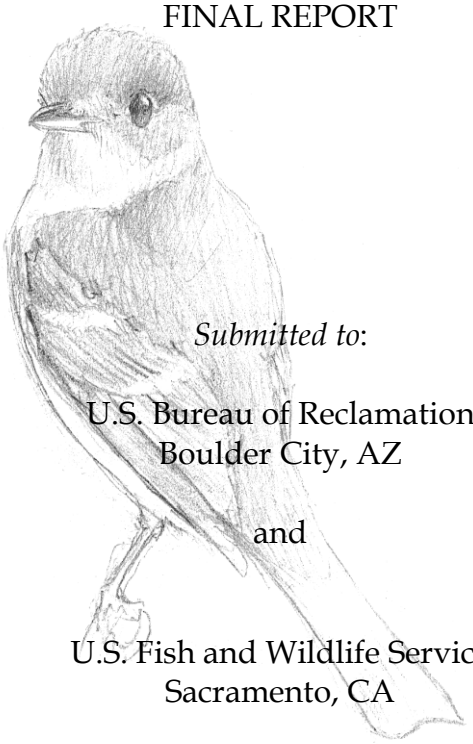
Winter Distribution of the Willow Flycatcher (*Empidonax traillii*) In Ecuador and Southern Mexico

FINAL REPORT



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EXECUTIVE SUMMARY

Concern for the southwestern willow flycatcher (*Empidonax traillii extimus*) has stimulated increases in research, management, and conservation on the breeding grounds. Biologists are seeking a greater understanding and knowledge of the natural history of this species. To supplement current knowledge of breeding populations, recent studies in Latin America (Koronkiewicz et al. 1998; Koronkiewicz and Whitfield 1999; Koronkiewicz and Sogge 2000; Kornokiewicz 2002, Lynn and Whitfield 2000, 2002) have focused on wintering ecology. To continue with these efforts, we surveyed for willow flycatchers from 11-21 January in Ecuador and 8-26 February in Southern Mexico. While in Ecuador, we also surveyed for alder flycatchers (*Empidonax alnorum*). Our goals were to identify occupied locations in Latin America, describe habitat where willow flycatchers were detected, collect blood and feather samples, and identify any threats to willow flycatcher populations on the wintering grounds.

We spent a total of 41.3 survey hours and 47.6 survey/banding hours at 32 survey sites in Ecuador and southern Mexico. In Ecuador, we found 26 willow and six alder flycatchers. We found a total 101 willow flycatchers in southern Mexico. In this region, we revisited four locations and detected 35 more willow flycatchers than had been detected in 2002. We also surveyed six new locations in southern Mexico. Occupied habitat in Mexico was along the pacific coast lowlands and contained all of the four main habitat components: standing or slow moving water and/or saturated soils, patches or stingers of trees, woody shrubs, and open areas. In Ecuador, all occupied sites had a minimum of two of the four habitat components. Willow flycatchers in Ecuador were using caña (*Gynerium sagittatum*), which seemed to substitute for the shrub component as previously found in cane habitat in Panama and El Salvador (Lynn and Whitfield 2000). We also attempted to band birds at detection sites and spent 36.1 banding hours to catch 31 willow flycatchers. While in Mexico, we resighted three previously banded birds near areas where willow flycatchers were banded in 2002. We were able to recapture two of these. One was banded by Lynn and Whitfield (2002) and the other was banded as a nestling four years prior in British Columbia, Canada.

Potential threats to willow flycatchers on the wintering grounds are alteration or loss of habitat. Currently, much of willow flycatcher habitat in Mexico includes some portion of either agriculture or cattle ranching. Habitat in Ecuador is mostly primary successional habitat that is both created and destroyed by flooding. Our work indicates that many aspects of wintering distribution and ecology are still unknown with the impact of human related disturbance and other threats uncertain. Recommendations for future studies include expanded coverage of surveys, return rates and site fidelity, subspecies and sex identification, and the effects of pesticides and agriculture on willow flycatcher populations.

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INTRODUCTION

Neotropical migratory birds are species in the western hemisphere whose populations, all or in part, breed north of the tropic of Cancer and winter south of it (DeGraff and Rappole 1995). Willow flycatchers (*Empidonax traillii*) are classic neotropical migrants in that they spend three to four months on their breeding grounds throughout North America and the remainder of the year on their wintering grounds in subtropical and tropical areas from north central Mexico through Central America to northern South America. Though they spend the majority of their lifecycle south of the United States border, little is known about the distribution and ecology of this species on their wintering grounds.

There are four recognized willow flycatcher subspecies which breed in the United States and Canada (Unitt 1987, Browning 1993). Two subspecies of the willow flycatcher, *E. t. adastus* and *E. t brewsteri*, have been extirpated from most of their range throughout California. In the Sierra Nevada of California, the willow flycatcher can only be found in montane meadows and there is concern that these populations may continue to decline (Harris et al. 1987, Bombay 1999, Stefani et al. 2001, Green et al. 2003). However, the most concern has been stimulated by the southwestern subspecies (*E. t. extimus*) which has declined to such an extent that it is listed as federally endangered (USFWS 1995). *E. t. extimus* is a riparian obligate currently found in the southwestern United States and historically also found in extreme northwestern Mexico (Unitt 1987, Sogge et al. 1997). Habitat degradation is considered the major cause of population declines in the southwest (Unitt 1987, Whitfield and Sogge 1999).

Threats to the populations and current management needs have been identified within the breeding ranges of the western subspecies of willow flycatchers (Unitt 1987, Finch and Stoleson 2000, Green et al. 2003). Concern about the decline in western populations has resulted in an increase in research on the willow flycatcher. In most cases, it has been possible to manage separately for each subspecies on the breeding grounds because the ranges of the subspecies do not overlap extensively. While there has been little conservation or management work on the wintering grounds, it will have to take a different approach because the ranges of the subspecies overlap extensively (Unitt 1997). Willow flycatcher subspecies are virtually impossible to differentiate in the field with the only visual differences being slight changes in color and morphology. Since there is no way to reliably separate the subspecies on the wintering grounds, it is important to gather as much information about the distribution and ecology of the entire species throughout Latin America.

Historical accounts of wintering willow flycatchers in Latin America consist of observations from scientists and habitat descriptions from field guides or other

accounts. Most bird guides (Edwards 1998, Howell and Webb, 1995, Ridgley and Gwynne 1989, Ridgely and Tudor 1994, Stiles and Skutch 1989, Ridgely and Greenfield 2001) or other accounts (Miller 1932, Dickey and Van Rossem 1938, Marshall 1943, Rand and Taylor 1954, Gorski 1969, Fitzpatrick 1980, Stolz et al. 1996) list descriptions of specific sites or regional landscapes and note that, in general, willow flycatchers can be found in moist thickets, dry shrubby areas, and woodland borders in humid to semi-arid habitats. Most of the historical accounts and habitat descriptions are consistent with current findings that conclude wintering willow flycatchers in Latin America were found in habitats with four main habitat components: standing or slow moving water and/or saturated soil, patches or stringers of trees, shrubs, and open areas (Koronkiewicz et al. 1998; Koronkiewicz and Whitfield 1999; Koronkiewicz and Sogge 2000; Lynn and Whitfield 2000, 2002; Lynn et al. 2003)

Increased demands on natural resources resulting from the proliferation of human populations have the potential for serious threats to wintering habitat for willow flycatchers, as well as other wildlife. In the western Amazonian lowlands about 95% of the forests have been converted to agricultural lands with banana plantations accounting for most of this (Rachowiecki 2001). The top three exports of Ecuador are oil, bananas, and shrimp. Systems of roads have been built through and fragmented forests in the Eucadorian Amazonian lowlands since the discovery of oil. Colonists followed the roads and triggered an exponential increase in forest destruction for logging and cattle ranching (Rachowiecki 2001).

In Mexico, ranching was introduced in the 1500s with the arrival of the Spanish which initiated large scale changes upon the landscape as ranching become one of Mexico's most important industries (Dusenberry 1963, Lynn and Whitfield 2002). Even more destructive landscape changes have occurred in Mexico during recent times, especially in the last 40–60 years with the explosion in human populations. During this period, Mexico has had some of the highest rates of deforestation worldwide (Jones 1990, Houghton et al. 1991, Hartshorn 1992). Habitat loss and pesticide use are suspected as possible threats to willow flycatchers on their wintering grounds (USFWS 1995, Koronkiewicz et al. 1998, Lynn and Whitfield 2002). However, little is known about the abundance, size, or ecology of any single wintering willow flycatcher population in Latin America (but see Koronkiewicz 2002). An understanding of willow flycatcher winter habitat characteristics and the effects of current land use practices and their effects on those habitats is crucial to identify limiting factors affecting flycatcher populations in Latin America.

OBJECTIVES

Our main objective was to continue gathering baseline data on the distribution and ecology of the willow flycatcher in Latin America. During the winter of 2003, we continued surveys for willow flycatchers in Mexico and expanded surveys into South America. We had five primary objectives in southern Mexico and Ecuador:

1. Locate and describe occupied winter habitat.
2. Identify and compare common habitat characteristics.
3. Obtain blood samples for future work on subspecies and gender determination.
4. Obtain feather samples for identification of a geographic signature using stable isotopes.
5. Describe any potential threats to wintering flycatchers and their habitats.

Other secondary objectives were particular to either Mexico or Ecuador. Lynn and Whitfield (2002) surveyed Mexico from Sinaloa to Chiapas and time constraints prohibited them from surveying all historical locations; particularly those in southern Mexico. In 2003, we expanded coverage to include more surveys in the states of Guerrero, Oaxaca, and Chiapas. We also revisited some of the same sites as from 2002, which gave us the unique opportunity to look for previously banded birds and compare habitat changes between the years. In Ecuador, we hoped to find both willow and alder flycatchers (*Empidonax alnorum*). We wanted to note whether the different species were segregating by habitat.

METHODS

STUDY AREAS

Ecuador

Survey locations in Ecuador all occurred on river islands along the Río Napo except for two surveys near Tena and Jatun Sacha. These two were in pastures bordered by secondary growth forest. Latitudes ranged from 00° 28' S at La Selva along the Río Napo to 01° 03' S at Jatun Sacha. Longitudes extended from 077° 48' W along the Río Misahuallí near Tena to 076° 18' W at La Selva (Figure 1). Elevations ranged from 220–450 m above sea level. Seasonality in Ecuador varies by region. In general, in the northern Oriente, the dry season lasts from December through March and the rainy season lasts from April through November. April through June are considered the wettest months, but rain occurs afternoons or evenings in any month throughout this part of Ecuador (Rachowiecki 2001).

Mexico

Survey locations in southern Mexico, 2003, were all in the Pacific lowlands. Latitudes and longitudes extended from 16° 43' N, 99° 36' W at La Barra, Guerrero 14° 43' N, 092° 25' W to close to the Guatemalan border at Laguna Pampa el Cabildo, Chiapas (Figure 2). All elevations were between 5 and 50 m above sea level. The pacific lowlands of Mexico are characterized by two distinct wet and dry seasons. These two seasons are of roughly equal duration with the rainy season lasting from May until October followed by the dry season from November until April.

SURVEY LOCATIONS

We selected survey locations based on current and historical willow flycatcher records. We used information from collection locations (Unitt 1997), notes from field guides (Howell and Webb 1995, Ridgely and Greenfield 2001), and recent observations by Steven N. G. Howell (1999, pers. comm.), Paul Coopmans (1998, 2002 pers. comm.), and other ornithologists. Within each geographical location, we selected several specific survey sites or habitat patches and conducted surveys at each site. Site selection was influenced by accessibility and was limited to those sites readily accessible by roads, rivers, or other transportation corridors.

The determination of the number of sites within a location and effort spent per site was determined largely by logistics. Survey effort varied with the the number of surveyors working at each site. In Mexico, we had either two to four surveyors per site at all times. In Ecuador, there were one to three surveyors at each site. A second limitation was the time of arrival on the first afternoon (dictated by the distance between sites). If there was enough time to do preliminary surveys the first afternoon, morning surveys or survey/banding efforts were more efficient.

In Ecuador, we started with preliminary surveys at all areas because there was little to no previous information. Any locations with previous willow flycatcher sightings were prioritized, but there were few of these and information on specific locations were limited. Variation in effort spent per location was also caused by differences in the amount of habitat available to survey and the travel distance between river islands. A minimum of two mornings was spent at each site. If ≥ 3 willow flycatchers were found on the first day of surveys, the second day was spent banding. In these cases, either one team would band while the other surveyed or, if ≥ 5 flycatchers were found, two to three teams attempted to catch birds.

In Mexico, we prioritized revisiting sites where the most willow flycatchers were banded in 2002 so we could search for banded birds. Some of these sites required multiple days to find the survey locations from 2002 causing variation in survey

effort. As we drove south between the different field locations that we were revisiting, we noted the habitat we observed and its potential for willow flycatchers. Once all the 2002 sites were revisited, new sites were added to fill any needed geographical gaps in knowledge.

SURVEY TECHNIQUE

We followed survey protocol as described by Sogge et al (1997). At each site, observers initially listened quietly for spontaneous vocalizations. After 1–3 min, a hand-held tape player was used to broadcast willow flycatcher vocalizations at volumes similar to that of a naturally singing bird. This tape was played for 15–30 seconds followed by a 2–4 minute listening period. Only willow flycatcher vocalizations were played in Mexico while in Ecuador both willow and alder flycatcher vocalizations were broadcast. Surveyors walked 20–40 m depending on the density of the vegetation and repeated the whole process. In this manner, transects were walked through or along the edge of the vegetation. Sites were only considered willow flycatcher habitat if a "fitz-bew" vocalization was heard (or alder flycatcher habitat if the "fee-bee-o" was heard).

We used Garmin© hand-held GPS (global positioning system) units or maps and an odometer reading to measure the distance to the nearest town, road, and other landmark. We also used the GPS unit to measure the length of the survey, measure elevation, and record survey and detection coordinates. Land ownership and management was noted when possible. For each site, we recorded general habitat characteristics including distance to water, dominant species of trees and shrubs, estimated canopy height, and evidence of human related disturbances or other threats (Appendix 1). Genus and species of trees, shrubs, and herbaceous vegetation was noted when known. Time and location of each willow and alder flycatcher detections were recorded. We also noted whether the bird was detected before or after tape broadcast, whether or not the bird was previously banded, and any behavior observed while surveying. We included sketches of each survey site depicting the survey route, important landmarks, water sources, and areas where willow flycatchers were detected.

BANDING TECHNIQUE

In Ecuador, we banded either in the afternoon or the next morning following productive surveys and split into teams (of 2 to 3 people) to maximize effort. If few willow flycatchers were detected, only one team would band while the others would continue surveying.

In Mexico, we worked from north to south revisiting sites from 2002 surveys. Since all sites were known to have willow flycatchers, banding was the predominate activity. We would arrive at each location in either the afternoon or night. If there was enough light remaining when we arrived, we conducted preliminary surveys in the afternoon to determine which sites would be the most productive for morning banding. If it was too dark when we arrived, we began at first light the next morning. We brought the banding equipment with us for these surveys. In order to collect information on site fidelity, we attempted to re-find areas that were surveyed in 2002 and relocate banded birds. If a banded bird was located, we tried to capture it in order to check whether had been caught the previous year. Once a willow flycatcher was located, habitat permitting, one team would stay and try to catch the bird while the other team continued to locate more birds to catch. Although we had some pure banding hours, most efforts were a combination of activities and were recorded as combined survey/banding hours. Once we had revisited the sites from 2002, we used our notes on potential habitat between these sites and a map to determine new locations that would best fill any gaps in knowledge while still being logistically feasible.

Time was often a limiting factor and banding locations were chosen based on proximity to other willow flycatchers, accessibility of the site, and catchability of individuals (presence of suitable habitat to erect nets combined with the behavior and flight pattern of the bird). Two speakers were placed on either side of a 6 or 12 m mist net and taped playback of pre-recorded willow flycatcher vocalizations was used to entice birds into the net according to the method described by Sogge et al. (2001). Once willow flycatchers were captured, an aluminum USFWS band was placed on the right leg. Blood samples for subspecies analysis were collected using a toenail clip technique and stored in a buffer solution (2% sodium dodecyl sulfate). Body, covert and the ninth primary feathers were collected for isotope analysis. The measurements that were taken include wing chord, tail length, fat score, flight feather wear, molt patterns, and weight. The capture time was noted and a GPS location was marked using a Garmin hand-held GPS unit.

RESULTS

SURVEY EFFORT

We conducted surveys from 11–21 January in the Napo province of Ecuador and 8–26 February in the states of Guerrero, Oaxaca, and Chiapas in Mexico. Willow flycatcher activity and response to playback are the greatest between 0600–1000 and 1600–1800 (Gorski 1969). We tried to limit our survey hours to these times and were successful with a few exceptions. In Ecuador 88% of the surveys were between 0600–1000 hrs (n=21) or 1600–1800 hrs (n=3). These three afternoon surveys were simultaneous and were only conducted because the weather conditions seemed mild enough for flycatchers to still be active beyond the suggested 1000. The limited time to survey combined with the difficulty of coordinating and hiring boat time made this slight digression necessary. In Mexico 100% of the pure survey hours (n=6) were conducted during the times when willow flycatcher activity and response to playback are greatest. However, we allowed survey/banding hours to spill over this optimal time as long as the individual was still responsive to playback (n=3). Combined survey/banding efforts were conducted primarily in the morning hours (n=12) with the remainder of surveys in the late afternoon (n=3).

Ecuador

We surveyed 19 sites in five different geographic locations in one Ecuadorian province. We conducted 27 surveys totaling 34 survey hours (Table 1, Appendix 2). We detected willow flycatchers at 80% of the locations and 42.1% of the sites surveyed (Table 2). Twenty-six willow flycatchers were detected in Ecuador. We detected at least six alder flycatchers at 60% of the locations and 10.5% of the sites. Blood and feather samples were collected from all six banded birds.

Mexico

We surveyed 13 sites in ten different geographic locations across three Mexican states. Four of these locations were initially surveyed in 2002 and revisited in 2003 while six of the locations were new in 2003. We conducted 24 surveys during 54.9 survey or combined survey/banding hours (Table 1, Appendix 3). We found willow flycatchers at 100% of sites both new and revisited (Table 2). We detected 101 willow flycatchers in Mexico. Blood and feather samples were collected from all banded birds.

We also revisited four locations from 2002 and found six new locations to survey for willow flycatchers. We detected willow flycatchers at all sites, both new and revistited. We detected more birds in 2003 than 2002 at all four revisited sites.

At two of these sites, Cuajinicuilapa and Cabeza del Toro, we more than tripled the number of willow flycatchers found. At both of these sites, we increased the effort both in the amount of area covered and the time surveyed.

Table 1: Willow flycatcher survey efforts for Ecuador and southern Mexico in 2003.

Survey Location[a]	Sites Surveyed	Number of Surveys	Survey Hours	Survey/ Banding Hours	Banding Hours	Total Hours
Ecuador						
Río Misahuallí	4	6	8.6	N/A	4.0	
Jatun Sacha	5	5	5.5	N/A	-	
Mondaña	2	3	7.9	N/A	9.3	
Coca	1	2	4.2	N/A	3.1	
La Selva	7	11	7.8	N/A	7.5	
Subtotal	**19**	**27**	**34.0**		**23.9**	**57.9**
Mexico						
La Barra	1	1	0.5	-	-	
Marquelia	1	1	-	3.5	-	
Cuajinicuilapa[a]	1	5	3.2	7.3	5.8	
Bajos de Chila[a]	2	2	0.8	-	3.8	
Puerto Escondido[a]	1	3	-	5.3	2.6	
Rio Copalita	1	2	1.8	3.4	-	
Santa Rita	1	1	-	2.8	-	
Cabeza del Toro[a]	3	3	-	12.5	-	
San Isidro	1	1	-	2.0	-	
Laguna Pampa	1	5	1.0	10.8	-	
Subtotal	**13**	**24**	**7.3**	**47.6**	**12.2**	**67.1**
Total	**32**	**51**	**41.3**	**47.6**	**36.1**	**125.0**

[a]Sites also surveyed in 2002.

Table 2: 2003 willow and alder flycatcher detections for Ecuador and southern Mexico (GRO = Guerrero, OAX = Oaxaca, CHI = Chiapas)

Survey Location	Dates	Willow Flycatchers Detected	Alder Flycatchers Detected	Willow Flycatchers Banded
Ecuador	**January**			
Río Misahuallí	11 – 13	4	0	2
Jatun Sacha	14 – 15	0	0	0
Mondaña	16 – 17	8	2	3
Coca	18, 22	8	3	1
La Selva	19 – 21	6	1	0
Subtotal		**26**	**6**	**6**
Southern Mexico	**February**			
La Barra, GRO	20	3	N/A	0
Marquelia, GRO	26	5	N/A	1
Cuajinicuilapa, GRO	8 – 9	26	N/A	5
Bajos de Chila, OAX	9 – 10	8	N/A	2
Puerto Escondido, OAX	10 – 11	5	N/A	1
Rio Copalita, OAX	24 – 25	14	N/A	2
Santa Rita, OAX	18	3	N/A	1
Cabeza del Toro, CHI	12, 23	20	N/A	6
San Isidro, CHI	17	2	N/A	1
Laguna Pampa, CHI	12 – 14	15	N/A	7
Subtotal		**101**		**26**
Total		**127**	**6**	**32**

RESIGHTING AND BANDING RESULTS

We resighted three banded birds while in Mexico and were successful at recapturing two of these. Two banded willow flycatchers were detected at Río Cortijo near Cuajinicuilapa in Guerrero and the third was seen along the Río Chila in Oaxaca. All birds were seen within 70 m from a location where a willow flycatcher was captured and banded in 2002. The close proximity to previous capture location suggests that the resighted bird was the same between years, but our experience indicates that this is not a valid assumption. Only the bird caught along the Río Chila was the same one captured from 2002. At Cuajinicuilapa, a bird was captured approximately 60 to 70 m from the sight where we previously banded a willow flycatcher in 2002. The bird that we caught in 2003 was not the same bird from 2002. The recaptured flycatcher was banded as a nestling in 1999 in British Columbia, Canada.

General Habitat Characteristics

Our results confirmed those found in previous work, in that willow flycatcher habitat comprised a combination of four main habitat components: standing or slow moving water and/or saturated soils, patches or stringers of trees, woody shrubs, and open areas (Lynn et al. 2003, Lynn and Whitfield 2002). In Ecuador, we only found willow flycatchers in areas that contained at least two of these four components. In Mexico, all sites where we located willow flycatchers contained all four habitat components.

In Ecuador, all sites contained standing or slow moving freshwater and/or saturated soils. All locations had a river flowing nearby along with secondary side channels with varying amounts of water remaining into the dry season. Only one occupied site was located in secondary growth within the pasture. All other occupied sites were along the inside of a meander loop of the Río Napo (Figure 1). Rivers in western Amazonia flood often during the rainy season. Flooding occurs with frequency, but is of short duration and causes the vegetation in the lowlands to be in a state of dynamic flux (Terborgh 1985). Occupied willow flycatcher habitat was primary successional habitat and dominated by caña (*Gynerium sagittatum*). This native cane varied in height from 1–6 m and ranged in prevalence over the surrounding habitat anywhere from 60 to 95 percent. The next most frequently occurring plant was *Tessaria* sp., which occurred in patches of short (1–3 m) to medium (3–6 m) sized trees. All of the areas surveyed can thus be referred to as caña-*Tessaria* habitat. Shrubs ranged from 0.5–4 m tall and were patchily distributed. Scattered *Tessaria* sp. and *Cecropia* sp. trees provided elevated perches throughout the caña-*Tessaria* layer.

In Mexico, the slow moving water and/or saturated soil component at occupied sites consisted of lagunas, slow-moving rivers, and associated floodplains with aquatic and emergent vegetation. All sites except one contained freshwater. The exception was a site that contained salt tolerant vegetation, dried salt on the soil surface, and crab parts, which indicated that the water at this site was probably brackish. The survey sites not only varied in size and shape, but also in retention of water. Inundated floodplains contained standing water through October and November, but these sites and bordering areas begin to dry along with the progression of the dry season. As a result, some of the smaller lagunas or river channels were dry at the time of surveys. These seasonally wet areas were bordered by any combination of the following types of vegetative growth: woody shrubs, patches or stringers of trees, savanna–woodland edge, second-growth woodlands, pasture, and agricultural lands. Shrubs were 1–3 m tall and predominantly *Mimosa* sp. with varying amounts of *Cassia* sp., *Acacia* sp., and other woody shrubs. The shrub layer ranged in density from scattered and sparse to dense impenetrable thickets. Trees fell into two categories: patches

Figure 3.

Figure 4.

Figure 5.

Figure 6.

Figure 7.

Figure 8.

FIGURES

within the habitat or grouped along the bordering edge. Tree patches and stringers ranged from 5–10 m while trees along the edge ranged from 12–25 m for canopy height. Crop plants that we encountered in occupied willow flycatcher sites include mango, papaya, lime, bananas, and coconut palms.

ECUADOR: SURVEY LOCATIONS

Río Misahuallí

The three survey sites near the Río Misahuallí were all just outside the town of Tena. The first survey sites were along the east side of the Río Misahuallí. The habitat was mostly primary successional habitat dominated by dense growing caña (approximately 4–6 m) with some *Tessaria* sp. (approximately 3–6 m) interspersed among the caña. There were larger *Cecropia* sp. and other trees scattered throughout (average 12 m). The soils were saturated. Scattered houses were along the road in low density with some clearing around the homesteads with small fields for growing food. As the road continues uphill and further from the river, the habitat begins to shift. The soils were no longer saturated. The habitat was second growth with an increase in the density and diversity of shrubs and trees while the caña layer dropped out. Occupied willow flycatcher habitat was found at the second survey site 4 km north of Tena (Appendix 6). Flycatchers were found in the cow pastures with few scattered trees (2–6 m) within the pasture and larger trees (average 12 m) along the border with the road (Figure 4). Where the grass was not heavily grazed, it grew tall (average 1.5 m). There was evidence of heavy grazing and deep cows tracks embedded in the moist soils. Pasture occurs on both sides (north and south) of a dirt road that leads to an area with construction for a new hotel. Beyond the construction, the dirt road continued down to the Río Misahuallí, location of the third survey site, which was a caña-*Tessaria* dominated sand bar adjacent to the west shore of the river. No willow or alder flycatchers were detected at this third survey location.

Jatun Sacha

There are two different types of habitat surveyed at Jatun Sacha. The first area was found about 1.5 km west of Jatun Sacha. This area was highly variable with secondary growth forest (average tree height 12 m) bordering open pastures. Within the pasture, there was a heliconia patch (approximately 3–4 m) and other scattered patches of mixed shrubs and small trees (average shrub height 2.5 m; average tree height 6 m). Also, the pasture contained a shallow stream (1–2 m wide) and elsewhere the soils were saturated. Shrubs (1.5–2 m tall) grew near the stream and there was a small farm house 100–150 m away. The pasture area had tall scattered trees (approximately 14–16 m) in low densities throughout. The other four sites surveyed were all on river islands of varying sizes that had primary successional riverside habitat growing on large sandbars in the Río

Napo (all were about a 12–15 minute boatride downstream of Jatun Sacha). The vegetation on the river islands was dominated by caña (approximately 4–5 m), *Tessaria* sp., and *Mimosa* sp. (approximately 1–4 m) often with vines woven through the shrubs making the vegetation even denser. Some taller *Cecropia* sp. and other trees (approximately 16–18 m) were mixed in with the shrubs. The sandy soils were saturated and water still pools in deeper depressions as evidence of river flooding during wetter months. Though there was a favorable mix of dense shrubs and open areas, no willow or alder flycatchers were found at any of the areas surveyed at Jatun Sacha (Figure 5).

Mondaña

Willow flycatcher and alder flycatcher habitat surveyed consisted of two river islands on the Río Napo downstream from the village of Mondaña (Appendix 7). The smaller river island was located 2.5 km downstream of Mondaña. The soil was sandy and the island probably started as an emergent sandbar. The vegetation started 250 m from the Río Napo and was dominated by caña (average 1 m) with scattered shrubs (approximately 0.5–3 m) and small trees (approximately 4–6 m). The ground was wet and marshy with patches of tall reeds. There was a secondary river channel that ran the length of the river island and eventually flowed into the Río Napo. At the time of the survey, we heard a cow, but there was no visible evidence of grazing. The second river island was 3.5 km downstream from Mondaña and was a long, narrow, sandy island bordered by the Río Napo to the west and a mostly dry rocky channel to the east. The vegetation on the island was at the primary successional stage. Caña (approximately 1–4 m) was the dominant vegetation, followed by *Tessaria* sp. There were lots of shrubs which were mostly young *Tessaria* sp. and *Mimosa* sp. (approximately 1– 3 m) in the foreground. Further back were larger *Tessaria* sp. trees (approximately 4–5 m) mixed with caña and scattered *Cecropia* sp. (approximately 6–7 m). There were a series of shallow stagnant pools remnant of earlier flooding from the rainy season. There was a village to the east of the rocky channel located on higher ground. Besides a few cow tracks, there was no visible evidence of disturbance due to human proximity.

Coca

Occupied willow flycatcher and alder flycatcher habitat was found on a large river island along the south side of the Río Napo, approximately three km to the east of the main bridge in Coca (Appendix 8). The island was dominated by primary successional stage vegetation (Figure 6). Along the length of the narrow sandy beach, ran a partially dry secondary river channel where some pools of water still remained from flooding during the rainy season. The soil in general was saturated. The habitat was fairly open and dominated by caña (average 2–2.5 m) with a few scattered trees, mostly *Tessaria* sp. or *Cecropia* sp. (approximately 3–4 m). There was not much human activity in the area. During

surveys and while banding, we only saw a few footprints. However, the city of Coca, not far away, is a sprawling oil town.

La Selva
The habitat surveyed consisted of seven river islands on the Río Napo both upstream and downstream from the La Selva Lodge boat dock (Appendix 9). Distances vary from 1.3 km upstream to 6.5 km downstream. The habitat on all the islands was primary successional habitat dominated by caña (approximately 1–3 m) mixed with varying amounts of *Tessaria* sp., *Mimosa* sp., and other shrubs (approximately 1–4 m) and scattered trees including, but not limited to *Cecropia* sp. and *Capirona* sp. (approximately 2.5–6 m). On all islands, the vegetation was dominated by caña (Figure 5). However, caña domination varied from a maximum of 95% on some islands while vegetative composition on other islands had shrubs and trees mixed in near equal proportions with the caña (Figure 8). In general, smaller islands had a higher percentage of caña dominated vegetation. A few of the islands had partially dry secondary channels with stagnant pools remnant of flow during the rainy season. Soils were moist to saturated. Human disturbance was minimal and restricted to a few trails and footprints. Surveys detected willow flycatchers on three of the seven islands. In most cases, there was no visible difference in habitat between occupied and seemingly unoccupied islands.

SOUTHERN MEXICO: SURVEY LOCATIONS

La Barra, Guerrero
This survey site was located 4.5 km south of the La Barra turnoff which is east of Acapulco. In 2002, two other sites in Acapulco were surveyed along the road to the airport. These sites were 22–23 km away from La Barra. Occupied habitat was along a dry riverbed with dense thickets of mixed trees (average 5 m) and shrubs (average 2 m) along the banks of the dry river. *Cassia* sp. was the most common shrub. The herbaceous layer (average 0.5 m) showed no evidence of grazing. The terrain was fairly hilly and there was lots of traffic along the main dirt road from horses, bikes, and cars.

Marquelia, Guerrero
This survey site was located 1 km west of the town of Marquelia along the Río San Luis (Figure 9). There are two bridges heading west on Highway 200 and the habitat was on the northwest side of the second bridge. The area was wet pasture with small low area dominated by wetland plants such as *Calathea* sp. (average 3 m) mixed with shrubs (*Mimosa* sp. primarily, average 2.5 m) and grass (average 0.8 m). The pastures were fenced off into plots. There were no cattle in

Figure 9

Figure 10

Figure 11

Figure 12

Figure 13

Figure 14

FIGURES

the enclosure that we surveyed or signs of recent livestock usage. However, the pasture to the north had horses. The grass was considerably shorter in the horse pasture and most of the shrub layer had been removed as well. The area was lined with coconut palms and other large trees (average 25 m). Flycatchers were using these larger trees as elevated perches. The soil overall was saturated and water pooled in a small wide trench that ran the length of the pasture. We only detected willow flycatchers in the small plot that we surveyed. We heard no responses from the horse enclosure to the north even while we were at the closest boundary. However, car traffic at the bridge made it difficult to hear near the bridge. Habitat extended under and south of the bridge and likely there were more willow flycatchers there.

Cuajinicuilapa, Guerrero

Willow flycatcher habitat near Cuajinicuilapa was located on along the Río Cortijo at an old reservoir dam, Presa Cortijo (Appendix 10). This area was surveyed in both 2002 and 2003. In 2002, the study area was bordered by the Río Cortijo in the north and a dirt road running east-west to the south. In 2003, we extended the survey south of this road across a concrete canal that paralleled the river. *Cassia*, *Mimosa* and *Acacia* spp. formed scattered patches on small sandy islands in and along the river (approximately 2–3 m). A row of trees (average 7 m) bordered the riverbanks and understory vegetation consisted of grasses and forbs (approximately 10–30 cm). In 2002, the river was described as slow moving with pools of standing water downstream of the dam. However, in 2003, the water levels were visibly much higher (Figure 10). Rather than pools of standing water, below the dam formed a continuous laguna starting in the east with water spilling over the road to continue on the west side. In the area closer to the canal, the vegetation was denser overall with larger patches of *Acacia* and *Cassia* spp. shrubs (1–3 m) and an understory vegetative layer of grasses and forbs (approximately 30–50 cm) all bordered by taller trees including, but not limited to Guanacaste and mango (approximately 12 m). Evidence of grazing by cattle and burros along with scattered trash were present, but not overwhelming. By expanding the survey area in 2003, we detected more willow flycatchers than the 2002 survey (Table 3).

Bajos de Chila, Oaxaca

In 2002, two sites near Bajos de Chila were surveyed. One was along the Río Chila and the other was along the Río Chiquita. Since these sites were so close together and time was limited, we decided only to re-survey one of the two. We chose the site along the Río Chila as more flycatchers were detected there in 2002 (Appendix 11). Occupied willow flycatcher habitat in 2003 was a secondary terrace area dominated by patches of *Cassia*, *Mimosa*, and *Acacaia* spp. among other shrubs (approximately 1–3 m) scattered along the river bottom. There are some willow (*Salix* sp.), papaya, and other large trees (average 14 m) that line the river bank between the pasture and dirt road. Understory vegetation was minimal. It appears that there are periodic fires in the area, probably to burn trash, but also

has eliminated much of the understory vegetation as well. At the time of our survey the river contained very low with slow moving water. However, high undercut banks and braided channels made it evident that the river could contain fast moving water during the rainy season. Domestic animals and livestock were seen throughout the survey along with evidence of heavy grazing. During the survey, men were actively removing gravel from the river. There was also evidence that the river was used as a local trash dump and bathroom (Figure 11).

Puerto Escondido, Oaxaca

We revisited this site from 2002. Occupied willow flycatcher habitat was located along a laguna approximately 10 km east of Puerto Escondido (Figure 12). This area was cooperatively owned and while some parcels are used for agriculture, the land was considered a conservation area. Permission to visit must be obtained at Barra Navidad 2–3 km west of the laguna. The freshwater laguna was lined with *Juncus* sp. and mangroves (approximately 1.5 m). Surrounding this are agricultural fields and plantations of coconut palms, mangos, bananas, and lime trees (approximately 15 m). The dirt road that allows access to the laguna was bordered by small patches of *Acacia* sp and other shrubs. There is some minimal evidence of livestock, but none seen while surveying. However, in 2002, horses were seen grazing during the survey.

Río Copalita, Oaxaca

This survey site was located 3.8 km south of Hwy 200 from the east entrance road to Bahías Huatulco. The road is on the west side of the bridge that crosses the Río Copalita. From the water purification plant, the survey site is another 700 west and access was via a concrete path behind the plant that led to the river. The area is an archaeological site with plans to further excavate and open the area to the public. The habitat is near the mouth of the Río Copalita and contained mostly early seral stage vegetation (Figure 13), and is subject to periodic inundation and has the potential to be wiped out entirely by heavy flooding. The survey habitat was located on an emergent sandbar that was surrounded by both a subchannel and the main channel of the Río Copalita. The habitat consisted of small trees and various types of shrubs. The vegetation was dense and lush near the west subchannel and was both sparser and drier toward the middle of the sandbar island. The north side of the survey area appeared to have older vegetation than the south side. There was a discrepancy in average tree heights between the two sides with taller trees in the north (8 m average) than in the south (5.5 m average). Shrubs existed in two distinct subclasses, large (2.5 m average) and small (1 m). There were a wide variety of trees and shrubs that we didn't recognize along with some *Cassia* sp., and *Acacia* sp., and willow (*Salix* sp.) mixed in. The island had a fence around part of it, but there were several sections cut out of the fence. We saw old signs of cattle use along with more recent donkey use. Also signs of human usage, but not much trash. Overall, human and cattle related disturbance seemed minimal.

Santa Rita, Oaxaca
This survey site was located 12.1 km south of Reforma de Pineda which was directly south of the Ostuta turnoff from Highway 200. The terrain was fairly uniform. Occupied willow flycatcher habitat was comprised of pasture mixed with shrubs (approximately 2–3 m) and thorny trees (approximately 5–6 m). The herbaceous layer was fairly heavily grazed and cattle were present at the time of the survey.

Cabeza del Toro, Chiapas
We revisited these sites from 2002. The sites southeast of Cabeza del Toro were located just south of Laguna La Pampa at Colonia de Belisario Dominquez (Appendix 12). One survey site was found at a small, unnamed, dry laguna (approximately 100 x 50 m) on private property behind a residence. Occupied willow flycatcher habitat surrounding the laguna consisted of a narrow line of dense mangroves and other shrubs bordered by dry uplands. Some of the mangroves were cleared between 2002 and 2003. The surrounding uplands were dominated by scattered patches of *Mimosa* sp. (average 2–3 m), interspersed with larger palms and other trees (approximately 10 m) all with an understory of grasses and succulents (average 10–50 cm) and mixed in with open pastures. The soil was moist to dry below the surface. Some of the uplands were being cleared to graze more cattle. Occupied willow flycatcher habitat was re-surveyed at a second site 500 m north, which consisted of a large open cattle pasture (Figure 14). There were cows present at the time of survey. There is a small island of *Acacia* sp. and *Mimosa* sp. (approximately 1–2 m) with a few trees (approximately 8–10 m) and an understory of grass (average 60 cm). The soil was dry at the time of survey, but locals indicate that the area is completely flooded from June until August. We covered a larger area of the survey site in 2003 than was possible in 2002 and detected more willow flycatchers than the previous year (Table 3).

San Isidro, Chiapas
This occupied survey site was located 5.3 km southeast of the zocolo in the town of San Isidro (Appendix 13). A bridge along the road crosses a seasonally dry channel next to a dike. *Cassia* sp. and other shrubs (average 1.5 m) grow in dense thickets along the sides of the bank. There was pasture on either side of the dike interspersed with shrubs and larger trees (average 8 m). Overall, the site was a fairly open mix of trees and shrubs. Though there were no livestock present at the time of survey, the area shows signs of recent grazing.

Laguna Pampa el Cabildo, Chiapas
The area appeared to be an overflow channel for the Río San Benito found just south of the survey area (300–500 m). The habitat was predominantly mangrove trees (approximately 3–5.5 m) although there were also some scattered *Acacia* sp., a few other trees of unknown species, agave, and cacti. Some areas had a carpet of

pickleweed (*Salicornia* sp.) as ground cover (8–10 cm). The area appeared to be seasonally inundated, but was dry during the time of the survey. Crab claws, shells, and the vegetation present indicate that when inundated, the water mostly likely was brackish. There was a dirt road that ran east–west that received much traffic from people on foot, bike taxis, and horse carts. Some human refuse piles were scattered about and there were areas where trash was burned. There was no evidence of any cattle grazing. Due to limited time, the western boundary of the survey site was the bridge along the main road (Appendix 14). However, habitat continued east of the road.

POTENTIAL THREATS AND IMPACTS

Willow flycatcher habitat in Mexico and Ecuador was quite different with respect to livestock grazing, trash or other pollutants, and plantations/agriculture. Occupied sites in Mexico had much higher levels of disturbance than did sites in Ecuador. In Ecuador, only five of the 19 survey sites showed signs of cattle (26%). Intensity of grazing varied from negligible (3 sites) to heavily grazed (two sites). In Mexico, most sites were comprised of secondary growth vegetation and had some level of disturbance. Livestock grazing was evident at 11 of the 13 survey sites (85%). The intensity of grazing varied from minimal with just a few tracks or signs of old feces (four sites) to heavily grazed (seven sites). Livestock present included cows, horses, burros, and goats and heavily defined cattle trails were common.

Trash and obvious pollutants were ubiquitous at sites in Mexico. All sites had some trash, but the amount of trash varied from minimal (6 sites) to severe (7 sites). A few of the most disturbed sites appeared to be used as local dumps. Some sites showed evidence of trash burning which sometimes had the secondary effect of removing the understory vegetation. Trash and pollutants were noticeably minimal to completely absent from sites in Ecuador.

Agriculture varied from small-scale farms to large-scale plantations. In Ecuador, only one site had evidence of agriculture and this was restricted to small homesteads with small fields for subsistence crops. In Mexico, however, 4 of 13 sites had some form of agricultural presence (31%). Crops encountered in Mexico included mango, papaya, lime, bananas, and coconut palms. Commercial plantations, especially for coconut and mango, cover large areas of coastal lowlands. Remaining flycatcher habitat was often relegated to small fragmented patches within these large-scale plantations.

DISCUSSION

SURVEY EFFORT

There is no consensus about the range of willow flycatchers in South America. The possibility that willow flycatchers even reach into northern South America has been questioned (Gorski 1971, Stotz et al. 1996, Finch et al. 2000). However, Unitt (1997) and this study show that willow flycatchers occur in northern South America. The confusion over the winter range of the willow flycatcher is exacerbated by the fact that alder and willow flycatchers appear identical and are best separated by voice. Originally considered one species, Traill's flycatcher, this species was split into two based on differences in song (Stein 1963, AOU 1973). Neither willow nor alder flycatchers are prone to much spontaneous singing on the wintering grounds which made sightings by birders or biologists difficult to ascertain which species was seen. Fortunately, both species will respond to playbacks on the wintering grounds and we positively identified at least 26 willow and six alder flycatchers in Ecuador. In addition, we added willow flycatcher to the bird list for the La Selva Lodge which is a popular destination for birders. The lodge formerly only listed alder flycatcher as a winter resident.

Alder flycatchers were detected in caña-*Tessaria* habitat at Mondaña, Coca, and La Selva in Ecuador. There was no apparent separation of habitat between willow and alder flycatchers. Some alder flycatchers were found adjacent to willow flycatchers in the same patch of habitat. In general, alder flycatchers behaved less aggressively to playback than willow flycatchers. They took longer to respond to playback and would often stay hidden in the dense caña. This is consistent with studies on the breeding grounds that found that willow flycatchers took less time to approach the speaker and had a higher frequency of aggressive vocalizations than did alder flycatchers (Prescott 1999). Given this discrepancy in response between the two species of flycatcher, it is possible that our survey techniques, which were designed to detect willow flycatchers, may have overlooked alder flycatchers on occasion and that numbers and densities are probably higher than indicated by initial survey results.

In 2003, we found more willow flycatchers at all the sites we revisited in Mexico. This is due to the fact that we were able to spend more time surveying each area in 2003 than in 2002 . The objectives of this study required that we balance the time spent surveying and the time spent trying to capture birds. Thus, we rarely had time to survey the entire amount of available habitat in an area and capture birds as well. As a result, most areas were only partially surveyed before we began our banding efforts. Therefore, the number of willow flycatchers detected often is and underestimate of the number of willow flycatchers that were present in the entire habitat patch.

Flycatchers detected per unit of effort can be used as a relative index for comparison between large geographical regions. Slight differences in the type of survey effort between years can be confounding. Efforts between years had varying amounts of pure survey hours and combined survey\banding hours. In order to make comparisons between years and sites, we re-calculated survey effort by adding pure surveys hours plus one third of the survey/banding hours since these efforts were skewed towards banding hours. We applied this recalculation to results from Panama and El Salvador (Lynn and Whitfield 2000) and Mexico (Lynn and Whitfield 2002) as well as our results this year from Ecuador and southern Mexico. The most productive area surveyed was El Salvador (6.9 flycatchers/survey hour). Mexico had higher results in 2003 for southern Mexico (4.4 flycatchers/survey hour) as opposed to 2002 during which we surveyed a greater proportion of Pacific coastal Mexico (2.9 flycatchers/survey hour). Densities of willow flycatchers were the lowest relatively in Panama (1.3 flycatchers/survey hour) and Ecuador (0.8 flycatchers/survey hour).

RESIGHTING AND BANDING

We searched for banded flycatchers in Mexico at the four locations revisited from 2002. We resighted three previously banded flycatchers (though one of these was not banded by our group in 2002) at two of these locations, Cuajinicuilapa (one of a possible four banded in 2002) and Bajos de Chila (one of a possible two banded in 2002). Since all were spotted near banding locations from 2002, the natural assumption would be that it was the bird banded the year prior. However, this proved true for only one of the two birds recaptured. At the two other locations, Puerto Escondido (two flycatchers banded in 2002) and Cabeza del Toro(two flycatchers banded in 2002), no banded willow flycatchers were located in 2003.

At Cabeza del Toro in Chiapas, willow flycatchers were banded at a laguna bordered by dense mangroves and other vegetation in 2002. By February 2003, some of these mangroves had been cleared including the area where a willow flycatcher was captured and banded in 2002. We spent time searching the remaining habitat nearby with no sign of banded flycatchers. Between year return rates ranged from 0 to 50% for our study sites in Mexico. Koronkiewicz (2002) found high site fidelity in Costa Rica with between year return rates that ranged from 43% at Bolsón to 77% at Chomes. Return rates of this magnitude may indicate that the study sites in Costa Rica encompasses high quality habitat able to support relatively larger or more stable local populations (Winker et al. 1995, Koronkiewicz and Sogge 2000, Koronkiewicz 2002). However, our lower between year return rates are not directly comparable to findings in Costa Rica as study objectives were quite different. We spent considerably less time overall at each

location, had a much smaller proportion of local populations marked, and limited knowledge of individuals. In addition, birds in the Costa Rica study were color marked so that individuals could be identified using binoculars, whereas we had to capture individuals to positively identify them. This difference in effort also likely contributed to the difference in return rates and illustrates the importance of color banding individuals when information on return rates is collected. Further studies with more concentrated efforts and color banding are needed to determine if variation in resighting are due to variation in efforts or greater fragmentation of occupied sites in Mexico than study sites in Costa Rica.

In Ecuador, we did not find any previously banded birds. We found fewer flycatchers than in Mexico and at much lower densities. We were able to catch only six willow flycatchers in Ecuador, indictating that densities may be lower and/or birds may be less responsive. In general, flycatchers seemed less aggressive, and therefore less responsive to the tapes, in Ecuador. Often it took longer to solicit a response with taped playback and a higher proportion of birds would not "fitz-bew" in response and thus could not be definitively identified as willow or alder flycatchers. Our counts of flycatchers were conservative and densities of both willow and alder flycatchers may actually be higher than we reported. Other observations that support the idea that all birds were not detected in Ecuador occurred at two survey locations, Mondaña and Coca. At Mondaña, one of our survey teams was surveying through the middle of the habitat patch but did not elicit a response between 0720–0740. However, on the return walk back to the boat along this same area, flycatchers were "whitting" and taped playback enticed four flycatchers to "fitz-bew" that were not initially detected. Whether these flycatchers were initially present and unresponsive or territories were large enough that flycatchers were unable to hear initial playbacks is unknown. At Coca, we suveyed on the 18th of January and returned on the 22nd to capture willow flycatchers. We revisited four territories and of these only found one very non-aggressive bird that was mostly "whitting" and was difficult to elicit a "fitz-bew" response from. This flycatcher would also disappear for stretches of time. On the return walk to the boat, we located a willow flycatcher in one of the original territories. These observations of birds that were missed during initial surveys (or noticeably absent during later visits) and flycatchers that were most likely willow flycatchers, but would not give the diagnostic "fitz-bew" indicate that there were more willow flycatchers in Ecuador and that our estimates are probably low.

HABITAT

We found willow flycatchers in the lowland regions of southern Mexico and western Ecuador. Occupied habitat was consistent with the findings in Costa Rica that indicated that standing or slow moving water and/or saturated soils, patches or stringers of trees, shrubs, and open areas were important habitat components (Koronkiewicz et al. 1998, Koronkiewicz and Whitfield 1999). Our results in Ecuador were in contrast with findings for Costa Rica and Mexico (Koronkiewicz and Whitfield 1999, Lynn and Whitfield 2002) which noted all four components in willow flycatcher wintering areas. However, this was similar to findings in Panama and El Salvador where not all sites surveyed contained all four characteristics (Lynn and Whitfield 2000). Consistent with results in Panama and El Salvador, no one site lacked more than two of the four important habitat components. Also, the missing components followed identifiable patterns.

In Mexico, all locations contained all four habitat components. However, three (of ten) sites did not contain standing or slow moving water and/or saturated soils at the time of surveys. These three sites were La Barra, Santa Rita, and Laguna Pampa el Cabildo. All survey locations were situated in lowland regions that experience seasonal inundation and contained varying amounts of standing water during the rainy season when flycatchers generally arrive at these wintering sites. The sites in Mexico that were dry when we surveyed undoubtedly were not when the flycatchers first arrived. All four habitat components deemed important on the wintering grounds were present when flycatchers were selecting these territories.

In Ecuador, only one of the locations contained all four habitat components. Ironically, Jatun Sacha was also the only survey location where we did not detect willow flycatchers. The habitat component missing from all other locations in Ecuador was the presence of patches and/or stringers of trees. Willow flycatchers were not found in sites that had an absence of trees entirely. The difference between habitat in Ecuador and other sites in Costa Rica or Mexico was in the density of the trees. Occupied willow flycatcher in Ecuador contained scattered trees rather than patches of trees. Lynn and Whitfield (2000) also found similar results in El Salvador and one site along the Río Paz only had one or two lone trees directly at the detection site. Habitat near La Selva was the only site that was missing two of the important habitat components. Not only were patches and stringers of trees absent, shrubs were sparse and scattered as well. Occupied sites at La Selva were all on river islands of varying size. The river islands near La Selva were smaller in size than occupied islands at Coca and Mondaña. In general, the pattern we noticed was that dominance of caña was higher on smaller islands. In El Salvador and Panama, Lynn and Whitfield (2000) found a similar decrease in the density of trees and shrubs in areas dominated by paja canalera

(*Saccharum spontaneum*) which is a non-native and invasive grass related to sugar cane. The caña in our survey locations grew to heights of 6 m in some locations. This was as tall and even taller than some trees found in the requisite patches or stringers of trees. It seems that the importance of thickets of shrubs may be substituted by the density of caña in Ecuador or paja canalera in Panama and El Salvador. For future studies in Latin America, the definition of the four main habitat components should be modified to include caña, paja canalera or other cane as an acceptable substitution for the shrub requirement. Also, the definition of a tree component should be expanded from patches or stringers of trees to include scattered patches of lone trees.

POTENTIAL THREATS

The biggest threats to willow flycatchers on the wintering grounds are complete loss or moderate alteration of habitat. Unfortunately, with burgeoning human populations in Latin America, this threat is becoming a reality. In less than ten years, greater than 75 million ha of forested land was converted to cattle pasture in Latin America (Houghton et al. 1991). As human populations increase, so does the need for natural resources. Direct land altering practices observed at survey sites included livestock grazing, small to large scale agricultural plots and plantations, wood cutting for fuel and timber, and erosion. Less obvious, but also potentially detrimental practices include, pesticide usage and human activities that change sedimentation patterns in rivers such as gravel mining.

Willow flycatchers are sensitive to the levels of both ranching and agricultural practices. As human populations increase, the need for subsistence in the form of grazing cattle or growing crops also grows. Willow flycatchers will use grazed land or agricultural fields as long as scattered shrubs and trees remain. However, in order to provide pasture to graze cattle, woody vegetation is often removed making the land unusable by flycatchers. Plantation crops in Mexico along the Pacific coast such as coconut and mango often retain native understory plants. Sometimes farmers remove the understory vegetation to plant bananas, plantains, or other crops below coconut palms which makes makes the plantation less suitable for flycatchers (Lynn and Whitfield 2002). If farmers and ranchers can manage their land in a manner that maintains the four main habitat components, these lands can remain as willow flycatcher wintering habitat.

RECOMMENDATIONS FOR FUTURE STUDIES

In order to develop conservation and management strategies for willow flycatchers we need more information on all stages of its lifecycle. More specifically, we need to have an understanding of the distribution and ecology of

the willow flycatcher on its wintering grounds and along migratory routes. Through our studies in Ecuador and Mexico and previous studies in El Salvador, Costa Rica, and Panama (Koronkiewicz et al. 1998; Koronkiewicz and Whitfield 1999; Lynn and Whitfield 2000, 2002; Koronkeiwicz and Sogge 2000), we have the beginnings of a baseline of knowledge about winter distribution. More surveys are needed in other countries such as Guatemala, Nicaragua, Columbia, and possibly Venezuela and Peru. Additional surveys in countries we have already visited would be helpful as this would also allow us to collect some information on site fidelity and measure habitat change and/or loss over time.

It would be beneficial to revisit Ecuador in order to collect more samples. Methods of surveying should be adjusted to address the possibility of flycatchers being less responsive and/or having larger territories. Tape playback could be played for a longer duration and the listening period could be increased to detect more flycatchers. When surveying straight line transects, the tape should be played in both directions in case flycatchers are using the habitat, but were non-responsive or initially out of hearing range. The caña habitat in Ecuador is structurally similar to paja canalera found in El Salvador and sugar cane found in Costa Rica, Panama, and El Salvador. A better understanding of the usage patterns of native caña could better enable future management of similar introduced cane species for willow flycatchers.

In Mexico, we found much lower between year return rates than Koronkiewicz and Sogge (2000) found in Costa Rica. As we have discussed, our results are not directly comparable because of vastly different objectives and effort spent. More studies of return rates are needed for comparison with current limited knowledge. It is especially important would be to target smaller, more isolated, or fragmented patches of flycatcher habitat for comparison. However, including large study habitat patches is still important to determine if high return rates are correlated with the size of habitat patch. Other questions that need to be addressed are overwintering survival rates and if distribution and habitat use vary by sex and/or subspecies. Also, models developed combining GIS and remote-sensing technology with data collected on the ground would be an important tool for detecting areas important to the willow flycatcher that may or may not have been surveyed previously or that are threatened by land use change . Studies should be expanded to include new areas on the wintering grounds and also to identify migratory routes.

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Appendix 1. 2003 Willow Flycatcher survey and detection forms.

Willow Flycatcher Winter Survey and Detection Form

Site Name (unique to each survey within same area, include town name)_____

Mileage/direction to nearest landmark (Town, Road, etc.)_____

Site Coordinates: Start: Lat._____ Long. _____ Waypt. Name _____

Stop: Lat._____ Long. _____ Waypt. Name _____

Elevation _____ (m) Length of area surveyed: _____ (m / km) Ownership/Management:_____

Observer(s)	Date (m/d/y) Survey time	Number of WIFLs Found	Number Detected Before Playback	Initial Vocalization: # Wifls	Number Wifls who gave Fitz bew	Photos Roll # & Photo #	Comments **Include** a description of photos taken, survey route or problems, and if WIFL detection was Visual, Aural, or Both
1 _____ _____	date start stop total hrs _____			Fitz bew Whitt Brrr Breet			
2 _____ _____	date start stop total hrs _____			Fitz bew Whitt Brrr Breet			
Overall Summary Total survey hrs_____							

Habitat Description (topography, vegetation, and seral stage) Please be as detailed as possible: _____

_____

_____

Identify the 2-3 predominant trees/shrubs_____

Estimated average height: Trees: _____ (m) Shrubs: _____ (m) Herbaceous Layer: _____ (cm / m)

Was surface water or saturated soil at or near to site? **Yes No** (circle one) If yes, describe: _____

_____

Describe evidence of human or cattle activity, habitat impacts, and threats at the site: _____

_____

Willow Flycatcher Detections

Time of detection: Begin _____ End_____

Detection coordinates: Lat. _____ Long. _____ Waypt. Name _____

Describe response and quality/nature of detection (did WIFL approach, sing strongly/weakly, how long, distance, lighting, wind)

_____

_____

Appendix 1. Continued.

Describe Flycatcher's Behavior: (how was it using the habitat, foraging, resting, canopy, low vegetation, etc.): _____
_____
_____
_____

Draw a sketch showing details of survey area and any flycatcher detections. Show the location and shape of the patch, useful landmarks, vegetation characteristics, approximate vegetation height and area, flycatcher location and movements, etc. Be certain to take photographs of the site.

List other bird species seen at this site: _____
_____

Additional Comments: _____
_____
_____
_____

PLEASE ATTACH ALL NOTES FROM YOUR FIELD NOTEBOOK

Appendix 2. Willow flycatcher survey and banding details for Ecuador in 2003. Note that some areas were surveyed by teams and some of the coordinates and/or distances listed are therefore inclusive.

N/A : Not Applicable
S = E : Start is also the end because the path was in a loop
MP : Met partway (Note, these were river islands surveyed by two teams that met in the middle; so start is with the first ground and end is with the second)
IA : Inclusive Area (Again, these were river islands by two teams meeting in the middle and only one cummulative distance is given for both groups)

Surveyors: SM = Shannon McNeil, CN = Catherine Nishida, DT = Diane Tracy, MW = Mary Whitfield, DW = Dave Wilamowski, MiY = Misael Yanéz, MoY = Monica Yanéz.

Survey Location	Site	Date	Coordinates		Time of Survey	Survey Hours	Surveyor	Number of Willow Flycatchers	Elevation (m)	Distance (km)
			Start	Stop						
Río Misahuallí	1	11 Jan	00° 59.072' S 077° 48.352' W	00°58.145' S 077°48.350' W	0639-0920	2.7	MW, CN, DW	0	510	2.5
	1	11 Jan	MP	MP	1600-1700	1.0	MW, CN	0	530	IA
	1	11 Jan	N/A	N/A	1600-1700	1.0	DW, MiY, MoY	0	520	1.0
	2	11 Jan	S = E	00°57.954' S 077°48.715' W	1730-1740	0.2	MW, CN, DW	1	540	0.1
	3	12 Jan	00° 57.709' S 077° 48.694' W	00°57.832' S 077°48.744' W	0745-0957	2.2	MW, CN, DW	3	545	0.5
	4	13 Jan	N/A	N/A	0630-0800	1.5	DW, MiY, MoY	0		0.4
Jatun Sacha	1	14 Jan	01° 03 482' S 077° 36.879' W	S = E	0620-0710	0.8	CN, MiY, MoY	0	390	0.40
	2	14 Jan	01° 03.981' S 077° 37.109' W	01° 03.985' S 077° 37.870' W	0601-0710	1.2	MW	0	415	1.50
	3	15-Jan	01° 02.067' S 077° 35.477' W	S = E	0630-0724	0.9	CN, SM	0	380	0.40
	4	15-Jan	01° 02.450' S 077° 35.879' W	01° 02.763' S 077° 36.320' W	0645-0815	1.5	MW, DT	0	400	1.60
	5	15-Jan	00° 50.960' S 077° 13.438' W	01° 02.448' S 077° 36.145' W	0710-0815	1.1	DW, MiY, MoY	0	380	0.15

Appendix 2 continued

Survey Location	Site	Date	Coordinates		Time of Survey	Survey Hours	Surveyor	Number of Willow Flycatchers	Elevation (m)	Distance (km)
			Start	Stop						
Mondaña	1	16-Jan	00˚ 51.433' S 077˚ 14.767' W	S = E	0632-0850	2.3	CN, DT	1	300	1.40
	2	16-Jan	00˚ 51.164' S 077˚ 14.254' W	00˚ 51.122' S 077˚ 13.821' W	0635-0920	2.8	MW, SM	1	300	1.50
	2	16-Jan	S = E	00˚ 50.884' S 077˚ 13.507' W	0640-0930	2.8	DW, MiY, MoY	6	300	1.20
Coca	1	18-Jan	00˚ 28.590' S 076˚ 57.112' W	00˚ 28.595' S 076˚ 57.066' W	0707-0925	2.3	MW, MoY	4	260	1.50
	1	18-Jan	00˚ 28.553' S 076˚ 56.396' W	00˚ 28.642' S 076˚ 56.900' W	0700-0851	1.9	CN, SM, DT	4	260	1.00
La Selva	1	19-Jan	00˚ 28.894' S 076˚ 20.246' W	MP	0700-0750	0.8	CN, DT	1	225	1.00
	1	19-Jan	MP	00˚ 28.694' S 076˚ 20.055' W	0710-0750	0.7	MW, SM	0	225	IA
	2	19-Jan	00˚ 28.948' S 076˚ 20.202' W	00˚ 28.984' S 076˚ 20.282' W	0705-0734	0.5	DW, MiY, MoY	1	230	0.15
	3	19-Jan	00˚ 29.114' S 076˚ 18.615' W	MP	0825-0910	0.8	MW, SM	0	235	1.00
	3	19-Jan	MP	00˚ 29.232' S 076˚ 18.959' W	0830-0900	0.5	CN, DT	0	235	IA
	4	19-Jan	00˚ 29.049' S 076˚ 18.270' W	00˚ 29.105' S 076˚ 18.031' W	0830-0855	0.4	DW, MiY, MoY	0	235	0.28
	5	19-Jan	00˚ 30.465' S 076˚ 21.752' W	MP	1000-1035	0.6	MW, SM	0	250	0.30
	5	19-Jan	MP	00˚ 30.508' S 076˚ 21.624' W	1008-1022	0.2	DW, MiY, MoY	0	250	0.20
	6	19-Jan	00˚ 30.559' S 076˚ 21.835' W	00˚ 30.616' S 076˚ 21.916' W	1017-1045	0.5	CN, DT	0	240	0.40
	7	20-Jan	00˚ 30.986' S 076˚ 22.182' W	S = E	0731-1000	2.5	DW, MiY	2	230	1.50
	7	21-Jan	00˚ 30.986' S 076˚ 22.182' W	S = E	0700-0720	0.3	MW, SM, DT, MiY	2	240	IA

Appendix 3. Willow flycatcher survey and banding details for Mexico in 2003. Survey hours* include pure survey hours and combined survey/banding hours. Also, note that some areas were surveyed by teams and some of the coordinates and/or distances listed are therefore inclusive.

N/A : Not Applicable
S = E : Start is also the end because the path was in a loop
MP : Met partway (The same general area was surveyd two days in a row, so the start/stop coordinates given are on consecutive days)
IA : Inclusive Area (Again, these were survyed by the same group two days and only one cumulative distance is given for both days)

Surveyors: SA = Steve Albert, CN = Catherine Nishida, KP = Kristen Pearson, MW = Mary Whitfield.

Survey Location	Site	Date	Coordinates		Time of Survey	Survey Hours	Surveyor	Number of Willow Flycatchers	Elevation (m)	Distance (km)
			Start	Stop						
Cuajinicuilapa Guerrero	1	8-Feb	16° 30.001' N 098° 24.264' W	16° 30.062' N 098° 24.526' W	0630-1045	4.25	MW, SA	8	50	1.0
	1	8-Feb	16° 29.993' N 98° 24.530' W	16° 30.033' N 98° 24.530' W	0630-0810	1.67	KP, CN	6	50	0.1
	1	8-Feb	16° 20.052' N 098° 24.387' W	16° 29.978' N 098° 24.302' W	1630-1800	1.50	MW, SA, CN, KP	4	50	0.5
	1	9-Feb	16° 29.978' N 098° 24.302' W	N/A	0630-1000	3.50	MW, SA	5	50	IA
	2	9-Feb	16° 30.186' N 098° 24.325' W	16° 30.143' N 098° 24.342' W	0625-0930	3.08	KP, CN	3	50	0.1
Bajos de Chila Oaxaca	1	9-Feb	16° 29.992' N 098° 24.527' W	S = E	1800-1845	0.75	MW, SA, CN, KP	3	30	1.0
	2	10-Feb	15° 54.848' N 097° 07.080' W	S = E	0700-1030	3.50	MW, SA	5	30	0.3
Puerto Escondido Oaxaca	1	10-Feb	15° 48.542' N 097° 00.174' W	15° 48.514' N 097° 00.141' W	1700-1830	1.50	KP, CN	2	5	0.3
	1	10-Feb	15° 48.505 N 097° 00.098 W	S = E	1715-1830	1.25	MW, SA	2	5	0.5
	1	11-Feb	MP	MP	0630-0900	2.50	MW, SA	1	-	IA
Cabeza del Toro Chiapas	1	12-Feb	15° 53.352' N 093° 42.690' W	15° 53.303' N 093° 42.762' W	0710-1000	2.83	MW, SA	7	10	0.3
	2	12-Feb	15° 53.408' N 093° 42.597' W	15° 53.369' N 093° 42.626' W	0700-1000	3.00	KP, CN	5	10	0.2
	2	23-Feb	15° 53.466' N 093° 42.459' W	15° 53.436' N 093° 42.582' W	0620-0930	3.17	MW, CN	8	10	0.7

Appendix 3 continued

Survey Location	Site	Date	Coordinates		Time of Survey	Survey Hours	Surveyor	Number of Willow Flycatchers	Elevation (m)	Distance (km)
			Start	Stop						
Laguna Pampa Chiapas	1	12-Feb	N/A	N/A	1700-1800	1.00	MW, KP	1	10	0.4
	1	13-Feb	14° 43.504' N 092° 25.250' W	14° 43.630' N 092° 25.344' W	0615-0945	3.50	MW, SA	3	10	0.1
	1	14-Feb	14° 43.588' N 092° 25.288' W	14° 43.588' N 092° 25.303' W	0600-0815	2.25	MW, SA	3	10	IA
	1	13-Feb	14° 43.358' N 092° 25.194' W	14° 43.356' N 092° 25.173' W	0630-1000	3.50	KP, CN	4	10	0.1
	1	14-Feb	14° 43.630' N 092° 25.360' W	14° 43.609' N 092° 25.388' W	0630-0800	1.50	KP, CN	4	10	0.1
San Isidro Chiapas	1	17-Feb	15° 42.206' N 093° 22.853' W	S = E	1600-1800	2.00	KP, SA	2	N/A	0.2
Santa Rita Oaxaca	1	18-Feb	16° 18.020' N 094° 30.285' W	S = E	0815-1100	2.75	KP, SA	3	15	0.1
Acapulco Guerrero	1	20-Feb	16° 43.308' N 099° 36.043' W	S = E	0800-0830	0.50	KP, SA	3	50	0.1
Rio Copalita Oaxaca	1	24-Feb	15° 47.591' N 096° 02.946' W	15° 47.354' N 096° 02.949' W	0815-1000	1.75	MW, CN	12	10	0.5
	1	25-Feb	15° 47.547' N 096° 02.971' W	15° 47.562' N 096° 02.967' W	0605-0930	3.42	MW, CN	2	10	IA
Marquelia Oaxaca	1	26-Feb	16° 35.012' N 098° 49.530' W	S = E	0630-1000	3.50	MW, CN	5	10	0.4

Appendix 4. Bird species list compiled during Willow and Alder Flycatcher survey efforts in Ecuador, January 2003. For a more complete list of the birds that winter in these areas, see Ridgely and Greenfield 2001.

Common Name	Latin Name	Río Misahuallí	Jatun Sacha	Yachana	Coca	La Selva
Little Tinamou	*Crypturellus soui*	x	x			
Speckled Chachalaca	*Ortalis guttata*				x	
Lafresnaye's Piculet	*Picumnus lafresnayi*	x				
Yellow-tufted Woodpecker	*Melanerpes cruentatus*	x				
Spot-breasted Woodpecker	*Colaptes punctigula*	x				
Scarlet-crowned Barbet	*Capito aurovirens*			x		
Chestnut-eared Araçari	*Pteroglossus castanotis*		x			
Black-fronted Nunbird	*Monasa nigrifrons*				x	x
Swallow-wing	*Chelidoptera tenebrosa*					x
Rufous Motmot	*Baryphthengus martii*		x			
Ringed Kingfisher	*Megaceryle torquata*	x		x		
Amazon Kingfisher	*Chloroceryle amazona*		x	x		x
Green Kingfisher	*Chloroceryle americana*					x
Smooth-billed Ani	*Crotophaga ani*	x	x	x		x
Blue-and-yellow Macaw	*Ara ararauna*					x
Chestnut-fronted Macaw	*Ara severa*			x	x	x
White-eyed Parakeet	*Aratinga leucophthalmus*		x			
Blue-winged Parrotlet	*Forpus xanthopterygius*	x				
Yellow-crowned Parrot	*Amazona ochrocephala*			x		
White-collared Swift	*Streptoprocne zonaris*	x	x			
Fork-tailed Palm-Swift	*Tachornis squamata*				x	x
Great-billed Hermit	*Phaethornis malaris*	x				
White-bearded Hermit	*Phaethornis hispidus*					x
Black-eared Fairy	*Heliothryx aurita*	x				
Sand-colored Nighthawk	*Chordeiles rupestris*				x	x
Common Nighthawk	*Chordeiles minor*	x				
Pauraque	*Nyctidromus albicollis*		x			
Blackish Nightjar	*Caprimulgus nigrescens*		x	x		
Ladder-tailed Nightjar	*Hydropsalis climacocerca*			x		x
Pale-vented Pigeon	*Columba cayennensis*				x	x
Ruddy Ground-Dove	*Columbina talpacoti*	x	x	x	x	x

Appendix 4. Continued

Common Name	Latin Name	Río Misahuallí	Jatun Sacha	Yachana	Coca	La Selva
Blue Ground-Dove	*Claravis pretiosa*	x		x		
Greater Yellowlegs	*Tringa melanoleuca*			x		x
Lesser Yellowlegs	*Tringa flavipes*		x	x	x	
Spotted Sandpiper	*Tringa macularia*	x	x	x	x	x
Least Sandpiper	*Calidris minutilla*					x
Collared Plover	*Charadrius collaris*					x
Pied Lapwing	*Vanellus cayanus*	x	x	x		
Hook-billed Kite	*Chondrohierax uncinatus*					x
Swallow-tailed Kite	*Elanoides forficatus*		x	x		
Roadside Hawk	*Buteo magnirostris*	x	x			x
Black Hawk-Eagle	*Spizaetus tyrannus*					x
Black Caracara	*Daptrius ater*	x	x	x	x	x
Yellow-headed Caracara	*Milvago chimachima*	x			x	
Snowy Egret	*Egretta thula*		x			
Great Egret	*Casmerodius albus*	x	x			
Striated Heron	Butorides striatus	x	x	x	x	x
Green Heron	*Butorides virescens*			x		
Black Vulture	*Coragyps atratus*	x		x	x	x
Spotted Tody-Flycatcher	*Todirostrum maculatum*					x
Common Tody-Flycatcher	*Todirostrum cinereum*	x				
Mottle-backed Elaenia	*Elaenia gigas*	x	x	x		
Fuscous Flycatcher	*Cnemotriccus fuscatus*					x
Euler's Flycatcher	*Lathrotriccus euleri*	x				
Alder Flycatcher	*Empidonax alnorum*			x	x	
Willow Flycatcher	*Empidonax traillii*	x		x	x	x
Drab Water-Tyrant	*Ochthornis littoralis*		x			
Tropical Kingbird	*Tyrannus melancholicus*	x		x	x	
Eastern Kingbird	*Tyrannus tyrannus*				x	
Social Flycatcher	*Myiozetetes similis*		x			x
Piratic Flycatcher	*Legatus leucophaius*	x				
Lesser Kiskadee	*Philohydor lictor*			x		
Great Kiskadee	*Pitangus sulphuratus*	x		x	x	x
Barred Antshrike	*Thamnophilus doliatus*	x			x	
Warbling Antbird	*Hypocnemis cantator*	x				

Appendix 4. Continued

Common Name	Latin Name	Río Misahuallí	Jatun Sacha	Yachana	Coca	La Selva
Dark-breasted Spinetail	*Synallaxis albigularis*			x		
White-bellied Spinetail	*Synallaxis propinqua*					x
Orange-fronted Plushcrown	*Metopothrix aurantiacus*	x				
Crested Foliage-gleaner	*Automolus dorsalis*				x	
Cinnamon-throated Woodcreeper	*Dendrexetastes rufigula*		x	x		
Ocellated Woodcreeper	*Xiphorhynchus ocellatus*	x				
Red-eyed Vireo	*Vireo olivaceus*	x				
Violaceous Jay	*Cyanocorax violaceus*		x			
Black-billed Thrush	*Turdus ignobilis*	x		x		
Black-capped Donacobius	*Donacobius atricapillus*		x			x
House Wren	*Troglodytes aedon*	x	x			
White-winged Swallow	*Tachycineta albiventer*		x	x	x	x
Grey-breasted Martin	*Progne chalybea*	x				
Blue-and-white Swallow	*Pygochelidon cyanoleuca*	x				
White-banded Swallow	*Atticora fasciata*		x			
Southern Rough-winged Swallow	*Stelgidopteryx ruficollis*	x	x		x	
Rufous-collared Sparrow	*Zonotrichia capensis*	x				
Yellow-browed Sparrow	*Ammodramus aurifrons*	x	x		x	x
Red-capped Cardinal	*Paroaria gularis*					x
Tennessee Warbler	*Vermivora peregrina*	x				
Blackpoll Warbler	*Dendroica striata*	x				
Bananaquit	*Coereba flaveola*	x				
Magpie Tanager	*Cissopis leveriana*	x	x	x	x	
White-shouldered Tanager	*Tachyphonus luctuosus*	x				
Summer Tanager	*Piranga rubra*	x	x			
Scarlet Tanager	*Piranga olivacea*	x				
Silver-beaked Tanager	*Ramphocelus carbo*	x	x	x	x	
Blue-grey Tanager	*Thraupis episcopus*	x	x	x		
Palm Tanager	*Thraupis palmarum*	x	x			
Rufous-bellied Euphonia	*Euphonia rufiventris*	x				
Blue-necked Tanager	*Tangara cyanicollis*	x				
Yellow-bellied Dacnis	*Dacnis flaviventer*	x				
Green Honeycreeper	*Chlorophanes spiza*	x				
Blue-black Grassquit	*Volatinia jacarina*	x			x	

Appendix 4. Continued

Common Name	Latin Name	Río Misahuallí	Jatun Sacha	Yachana	Coca	La Selva
Caquetá Seedeater	*Sporophila murallae*	x		x		
Lesson's Seedeater	*Sporophila bouvronides*		x		x	
Black-and-white Seedeater	*Sporophila luctuosa*	x	x			x
Chestnut-bellied Seedeater	*Sporophila castaneiventris*	x	x	x	x	x
Large-billed Seed-Finch	*Oryzoborus crassirostris*	x				
Lesser Seed-Finch	*Oryzoborus angolensis*	x	x			
Greyish Saltator	*Saltator coerulescens*				x	
Russet-backed Oropendola	*Psarocolius angustifrons*	x				
Yellow-rumped Cacique	*Cacicus cela*	x	x	x		x
Oriole Blackbird	*Gymnomystax mexicanus*				x	x
Red-breasted Blackbird	*Leistes militaris*	x				
Shiny Cowbird	*Molothrus bonariensis*				x	
Giant Cowbird	*Scaphidura oryzivora*		x			

Appendix 5. Bird species list compiled during Willow Flycatcher survey efforts in southern Mexico, February 2003 (Santa Rita, Oaxaca, is not included in the list below since all that was noted there were seed-eaters and doves). For a more complete list of bird species that winter in these areas, see Howell 1999.

Location Codes

1 Cuajinicuilapa, Guerrero
2 Bajos de Chila, Oaxaca
3 Barra Navidad Laguna, Puerto Escondido, Oaxaca
4 Boca del Cielo, Chiapas
5 Laguna Pampa, Chiapas
6 San Isidro, Chiapas
7 Acapulco, Guerrero
8 Río Copalita, Oaxaca
9 Marquelia, Guerrero

Common Name	**Latin Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
White-bellied Chachalaca	*Ortalis leucogastra*				x	x				
Golden-cheeked Woodpecker	*Melanerpes chrysogenys*	x		x					x	x
Golden-fronted Woodpecker	*Melanerpes aurifrons*				x	x				
Lineated Woodpecker	*Dryocopus lineatus*	x							x	
Citreoline Trogon	*Trogon citreolus*	x							x	x
Russet-crowned Motmot	*Momotus mexicanus*	x	x		x				x	
Belted Kingfisher	*Megaceryle alcyon*	x								
Ringed Kingfisher	*Megaceryle torquata*	x								
Squirrel Cuckoo	*Piaya cayana*								x	
Groove-billed Ani	*Crotophaga sulcirostris*	x			x	x			x	x
Lesser Ground-Cuckoo	*Morococcyx erythropygus*					x				
Orange-chinned Parakeet	*Brotogeris jugularis*					x	x			
White-fronted Parrot	*Amazona albifrons*				x		x			
Yellow-naped Parrot	*Amazona auropalliata*						x			
Doubleday's Hummingbird	*Cynanthus doubledayi*		x	x						
Cinnamon Hummingbird	*Amazilia rutila*	x		x		x			x	x
Plain-capped Starthroat	*Heliomaster constantii*								x	
Ruby-throated Hummingbird	*Archilochus colubris*								x	
Ferruginous Pygmy-Owl	*Glaucidium brasilianum*							x		
Lesser Nighthawk	*Chordeiles acutipennis*				x					
Pauraque	*Nyctidromus albicollis*								x	
Rock Dove	*Columba livia*		x							
Red-billed Pigeon	*Columba flavirostris*					x			x	x
White-winged Dove	*Zenaida asiatica*	x		x	x	x			x	x
Inca Dove	*Columbina inca*	x	x	x	x	x			x	x
Ruddy Ground-Dove	*Columbina talpacoti*	x	x	x	x				x	
White-tipped Dove	*Leptotila verreauxi*								x	

Appendix 5. Continued

Common Name	Latin Name	1	2	3	4	5	6	7	8	9
Limpkin	*Aramus guarauna*								x	
Purple Gallinule	*Porphyrio martinicus*									x
Greater Yellowlegs	*Tringa melanoleuca*		x							
Spotted Sandpiper	*Tringa macularia*	x	x		x				x	
Least Sandpiper	*Calidris minutilla*	x								
Northern Jacana	*Jacana spinosa*	x								
Black-necked Stilt	*Himantopus mexicanus*	x								
Collared Plover	*Charadrius collaris*	x								
Laughing Gull	*Larus atricilla*					x			x	
Caspian Tern	*Sterna caspia*	x							x	
Osprey	*Pandion haliaetus*			x	x				x	
White-tailed Kite	*Elanus leucurus*				x	x				
Northern Harrier	*Circus cyaneus*			x						
Crane Hawk	*Geranospiza caerulescens*								x	
Grey Hawk	*Asturina plagiata*			x					x	
Roadside Hawk	*Buteo magnirostris*	x	x	x	x	x			x	x
Short-tailed Hawk	*Buteo brachyurus*				x					x
Crested Caracara	*Polyborus plancus*			x	x	x			x	
American Kestrel	*Falco sparverius*			x	x	x			x	
Bat Falcon	*Falco rufigularis*	x								
Peregrine Falcon	*Falco peregrinus*	x		x						
Pied-billed Grebe	*Podilymbus podiceps*	x								
Anhinga	*Anhinga anhinga*					x				
Neotropic Cormorant	*Phalacrocorax brasilianus*	x			x				x	
Tricolored Heron	*Egretta tricolor*	x	x						x	
Little Blue Heron	*Egretta caerulea*	x			x					
Snowy Egret	*Egretta thula*	x			x				x	
Great Blue Heron	*Ardea herodias*	x				x			x	x
Great Egret	*Casmerodius albus*	x	x		x	x			x	x
Cattle Egret	*Bubulcus ibis*	x			x					x
Green Heron	*Butorides virescens*	x							x	
Yellow-crowned Night-Heron	*Nyctanassa violacea*								x	
Black-crowned Night-Heron	*Nycticorax nycticorax*	x								
White Ibis	*Eudocimus albus*	x	x			x			x	
Roseate Spoonbill	*Platalea ajaja*					x				

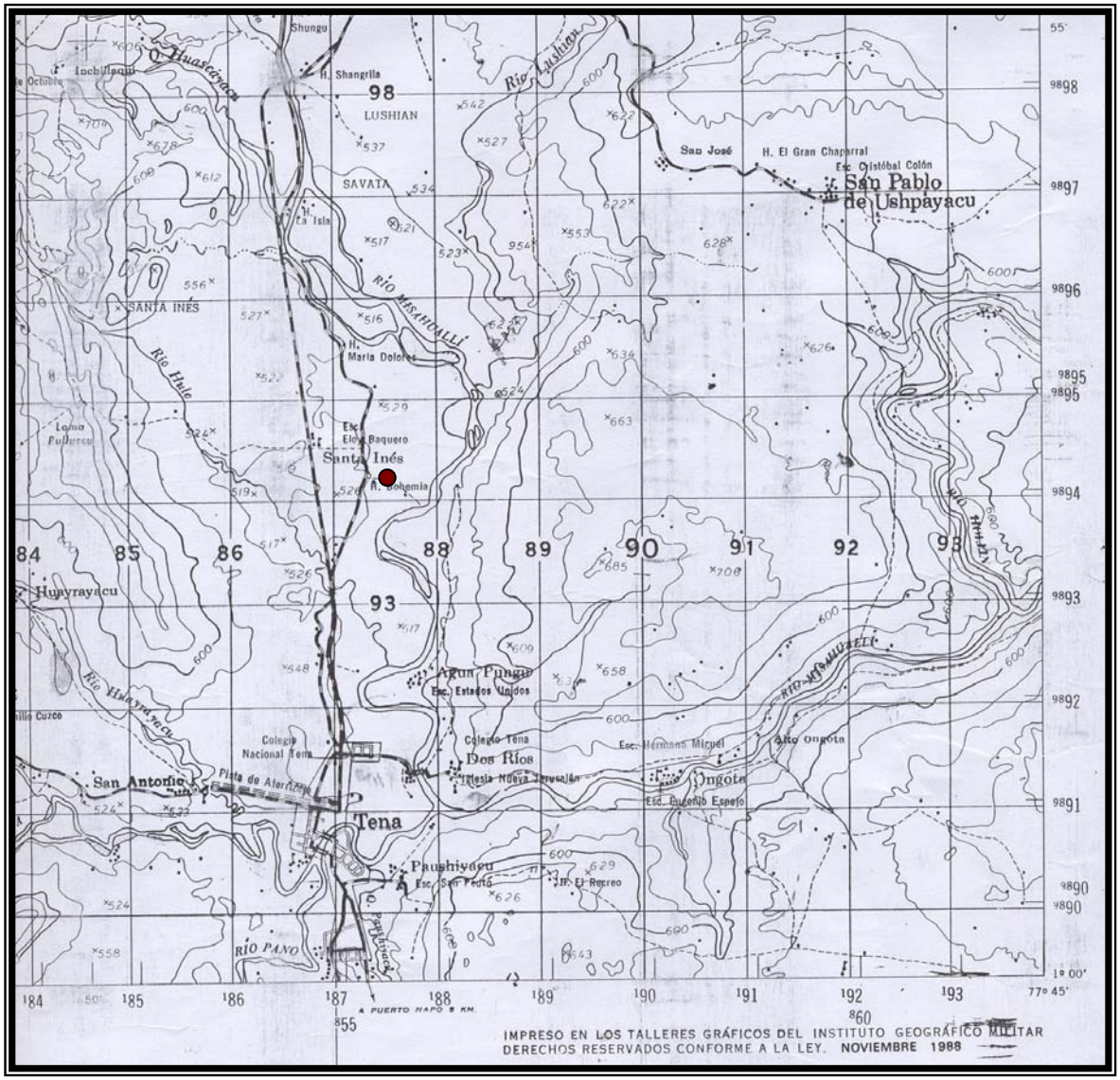
Appendix 5. Continued

Common Name	Latin Name	1	2	3	4	5	6	7	8	9
American White Pelican	*Pelecanus erythrorhynchos*		x							
Brown Pelican	*Pelecanus occidentalis*				x				x	
Black Vulture	*Coragyps atratus*	x	x		x	x			x	x
Turkey Vulture	*Cathartes aura*	x	x	x	x	x			x	x
Wood Stork	*Mycteria americana*				x	x			x	x
Magnificent Frigatebird	*Fregata magnificens*				x	x			x	
Common Tody-Flycatcher	*Todirostrum cinereum*					x				
Northern Beardless-Tyrannulet	*Camptostoma imberbe*					x				
Willow Flycatcher	*Empidonax traillii*	x	x	x	x	x			x	x
White-throated Flycatcher	*Empidonax albigularis*								x	
Pacific-slope Flycatcher	*Empidonax difficilis*		x						x	
Vermilion Flycatcher	*Pyrocephalus rubinus*	x		x					x	
Dusky-capped Flycatcher	*Myiarchus tuberculifer*					x				
Nutting's Flycatcher	*Myiarchus nuttingi*					x				x
Brown-crested Flycatcher	*Myiarchus tyrannulus*				x					
Tropical Kingbird	*Tyrannus melancholicus*	x	x		x	x			x	x
Western Kingbird	*Tyrannus verticalis*	x				x				
Scissor-tailed Flycatcher	*Tyrannus forficatus*				x	x			x	
Boat-billed Flycatcher	*Megarynchus pitangua*	x								
Social Flycatcher	*Myiozetetes similis*				x		x			
Great Kiskadee	*Pitangus sulphuratus*	x	x	x	x	x	x	x	x	x
Rose-throated Becard	*Pachyramphus aglaiae*	x			x	x				
Bell's Vireo	*Vireo bellii*	x							x	
Western Warbling-Vireo	*Vireo swainsonii*		x							
White-throated Magpie-Jay	*Calocitta formosa*	x	x	x	x	x			x	x
Clay-colored Thrush	*Turdus grayi*				x					
Rufous-backed Robin	*Turdus rufopalliatus*	x	x						x	x
Giant Wren	*Campylorhynchus chiapensis*				x					
Rufous-naped Wren	*Campylorhynchus rufinucha*	x	x	x		x			x	x
Banded Wren	*Thryothorus pleurostictus*								x	
Blue-grey Gnatcatcher	*Polioptila caerulea*	x	x		x	x			x	
Grey-breasted Martin	*Progne chalybea*				x				x	
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	x		x					x	x
House Sparrow	*Passer domesticus*		x							
Stripe-headed Sparrow	*Aimophila ruficauda*				x					

Appendix 5. Continued

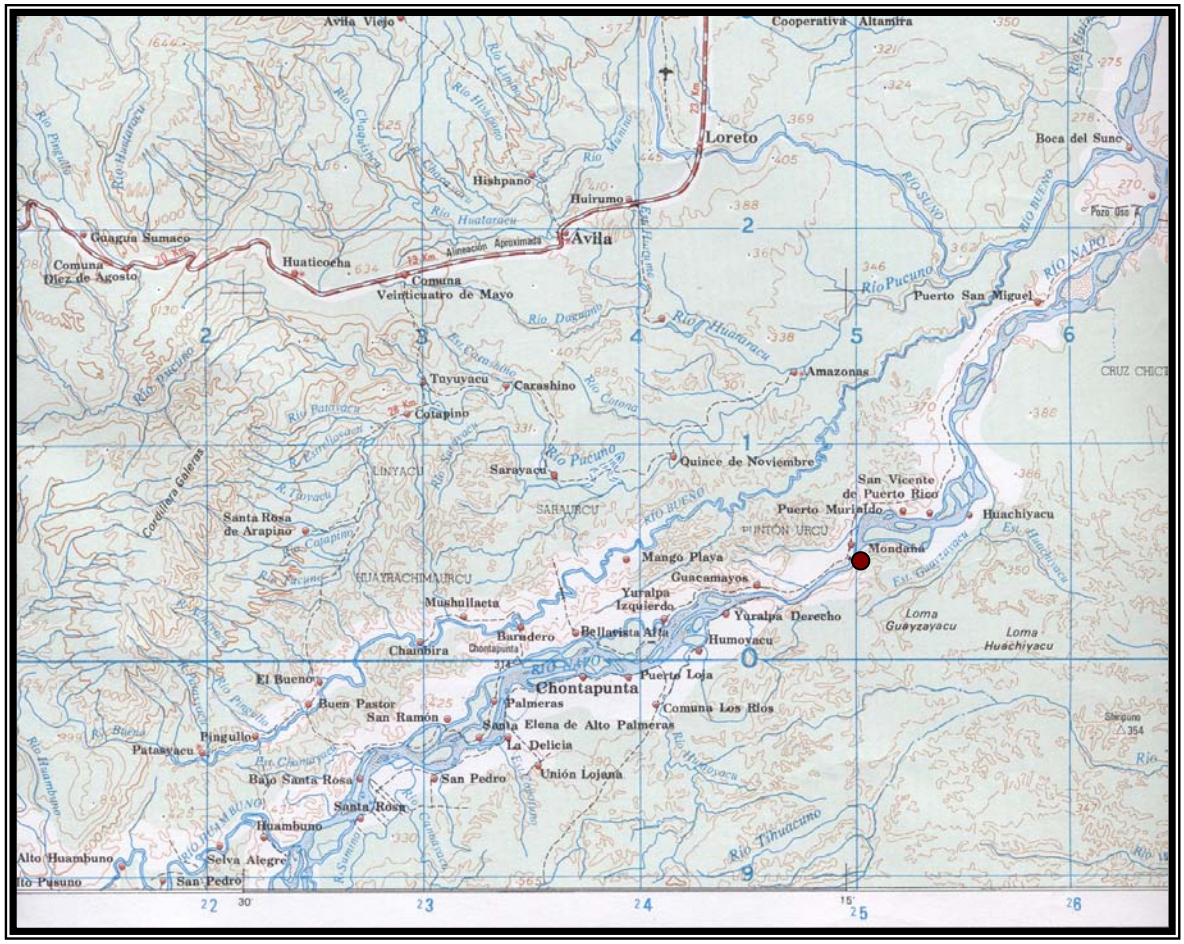
Common Name	Latin Name	1	2	3	4	5	6	7	8	9
Nashville Warbler	*Vermivora ruficapilla*								x	
Northern Parula	*Parula americana*				x					
Yellow Warbler	*Dendroica petechia*	x	x	x	x	x			x	x
Magnolia Warbler	*Dendroica magnolia*				x					
Yellow-rumped Warbler	*Dendroica coronata*								x	
Black-and-white Warbler	*Mniotilta varia*				x	x			x	
American Redstart	*Setophaga ruticilla*				x					
Ovenbird	*Seiurus aurocapillus*					x				
Northern Waterthrush	*Seiurus noveboracensis*					x				
MacGillivray's Warbler	*Oporornis tolmiei*	x								
Common Yellowthroat	*Geothlypis trichas*	x		x	x	x			x	x
Yellow-breasted Chat	*Icteria virens*		x		x					
Red-breasted Chat	*Granatellus venustus*								x	
Summer Tanager	*Piranga rubra*	x			x					
Blue-grey Tanager	*Thraupis episcopus*						x			
Blue-black Grassquit	*Volatinia jacarina*		x							x
White-collared Seedeater	*Sporophila torqueola*	x					x			x
Ruddy-breasted Seedeater	*Sporophila minuta*								x	x
Black-headed Grosbeak	*Pheucticus melanocephalus*	x								
Indigo Bunting	*Passerina cyanea*			x	x					
Painted Bunting	*Passerina ciris*	x				x				
Orange-breasted Bunting	*Passerina leclancherii*								x	
Yellow-winged Cacique	*Cacicus melanicterus*		x		x				x	
Altamira Oriole	*Icterus gularis*				x				x	
Streak-backed Oriole	*Icterus pustulatus*	x	x		x					x
Baltimore Oriole	*Icterus galbula*				x	x				
Hooded Oriole	*Icterus cucullatus*					x				x
Orchard Oriole	*Icterus spurius*	x	x	x	x		x	x	x	x
Great-tailed Grackle	*Quiscalus mexicanus*	x	x		x	x	x		x	x

Appendix 6. Topographical map of Hacienda Johanna, Napo Province, Ecuador. Tena Quad 4091-III, Instituto Geografico Militar en coloboracion con el Interamerican Geodectic Survey; scale: 1:50,000. Major contour lines are 40 meters. A maroon dot depicts the detection site.



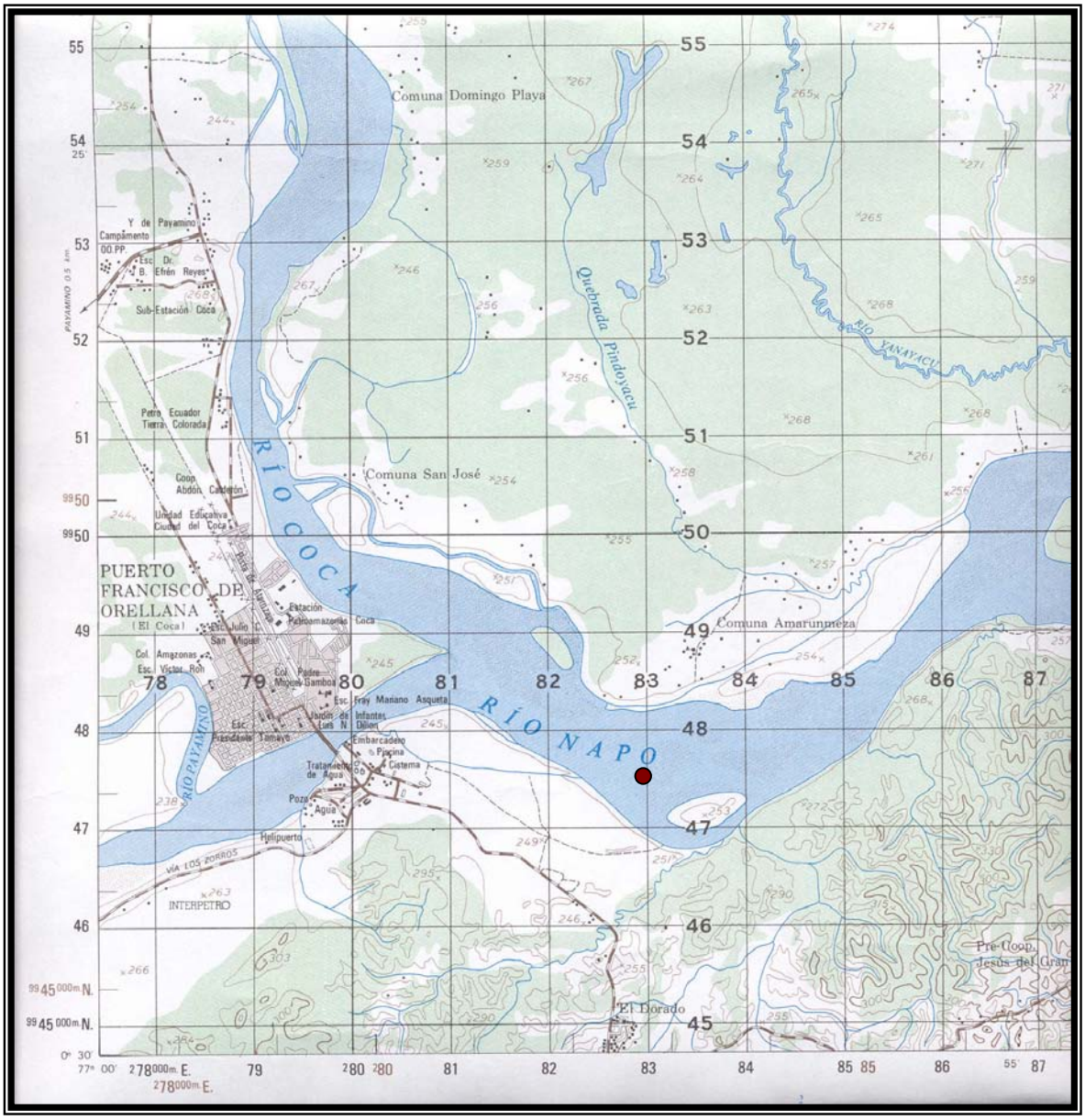
Detection Site: Río Misahuallí
Number of Willow Flycatchers Detected: 4
Mileage/direction to nearest landmark: 4 km North of Tena
Detection coordinates: 00° 57.95' S, 077° 48.72' W

Appendix 6. Topographical map of Moñdana, Napo Province, Ecuador. Tena Quad SA18-1, Instituto Geografico Militar en coloboracion con el Interamerican Geodectic Survey; scale: 1:250,000. Major contour lines are 100 meters. A maroon dot depicts the detection sites (actually two river islands, but cannot delineate into two at this map scale with the relatively small size of the islands).



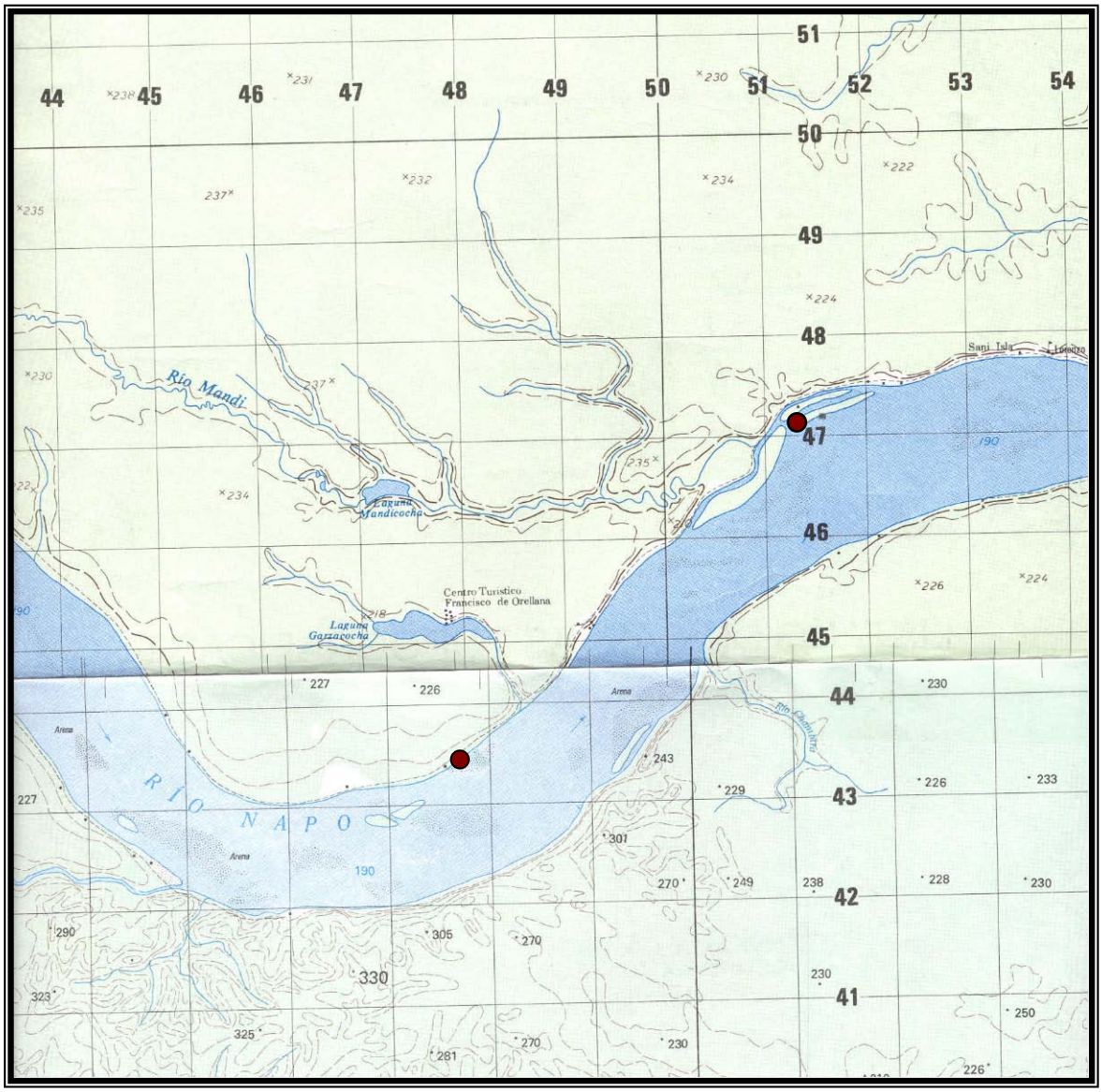
Detection Site: Mondaña
Number of Willow Flycatchers Detected: 8
Mileage/direction to nearest landmark: 3 km downstream of Mondaña
Detection coordinates: 00° 51.12' S, 077° 13.82' W

Appendix 7. Topographical map of Coca, Orellana Province, Ecuador. Puerto Francisco de Orellana Quad 4292-IV, Instituto Geografico Militar en coloboracion con el Interamerican Geodectic Survey; scale: 1:50,000. Major contour lines are 20 meters. A maroon dot depicts the detection site.



Detection Site: Coca
Number of Willow Flycatchers Detected: 8
Mileage/direction to nearest landmark: 3 km from the Coca Bridge
Detection coordinates: 00° 28.60' S, 076° 57.11' W

Appendix 8. Topographical map of La Selva, Orellana Province, Ecuador. Río Napo Quad 4392-IV, Instituto Geografico Militar en coloboracion con el Interamerican Geodectic Survey; scale: 1:50,000. Major contour lines are 30 meters. Maroon dots depict the detection site.

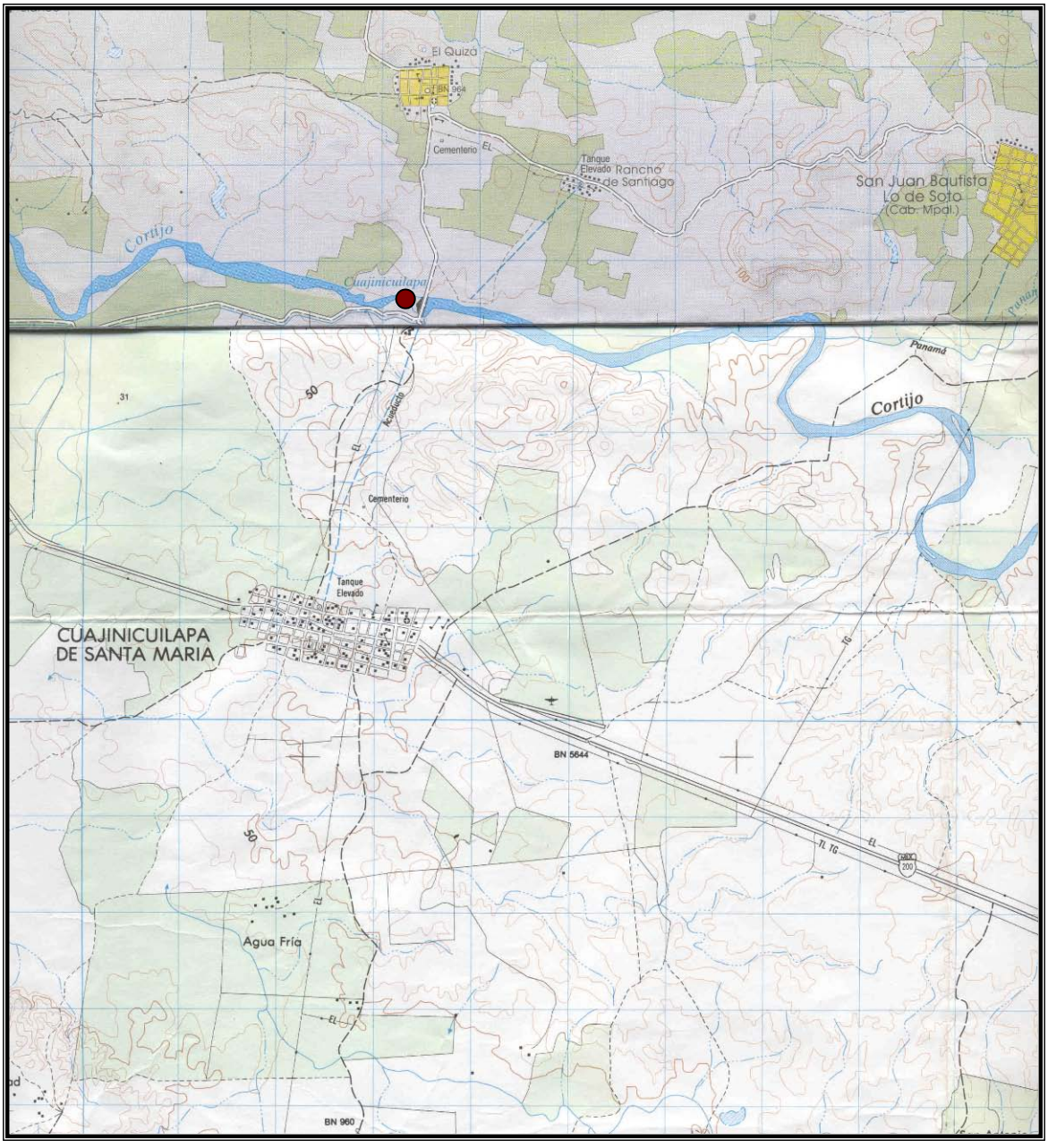


Detection Site: La Selva
Number of Willow Flycatchers Detected: 6
Mileage/direction to nearest landmark: 4.5 km downstream and 1.3 km upstream from the La Selva dock
Detection coordinates: 00° 28.89' S, 076° 20.25' W and 00° 28.89' S, 076° 20.25'

Appendix 9. Topographical map of Marquelia, Guerrero, Mexico. Copala Quad E14D61, Instituto Nacional de Estadistica Geografia E Informatica de Mexico; scale 1:50,000. Major contour lines are 10 meters. A maroon dot depicts the detection site.

Detection Site: Marquelia, Guerrero, Mexico.
Number of Willow Flycatchers Detected: 5
Mileage/Direction to Nearest Landmark: 1 km w. of Marquelia, n. of second bridge
Detection coordinates: 16° 35.012' N, 98° 49.53' W

Appendix 10. Topographical map of Cuajinicuilapa de Santa Maria, Guerrero, Mexico. Cuajinicuilapa and Ometepec Quads E14D72 and E14D62, Instituto Nacional de Estadistica Geografia E Informatica de Mexico; scale 1:50,000. Major contour lines are 10 meters. A maroon dot depicts the detection site.



Detection Site: Presa de Cortijo, Cuajinicuilapa de Santa Maria, Guerrero, Mexico.
Number of Willow Flycatchers Detected: 26
Mileage/Direction to Nearest Landmark: 3 km north of Cuajinicuilapa de Santa Maria
Detection coordinates: 16° 30.05' N, 98° 24.39' W

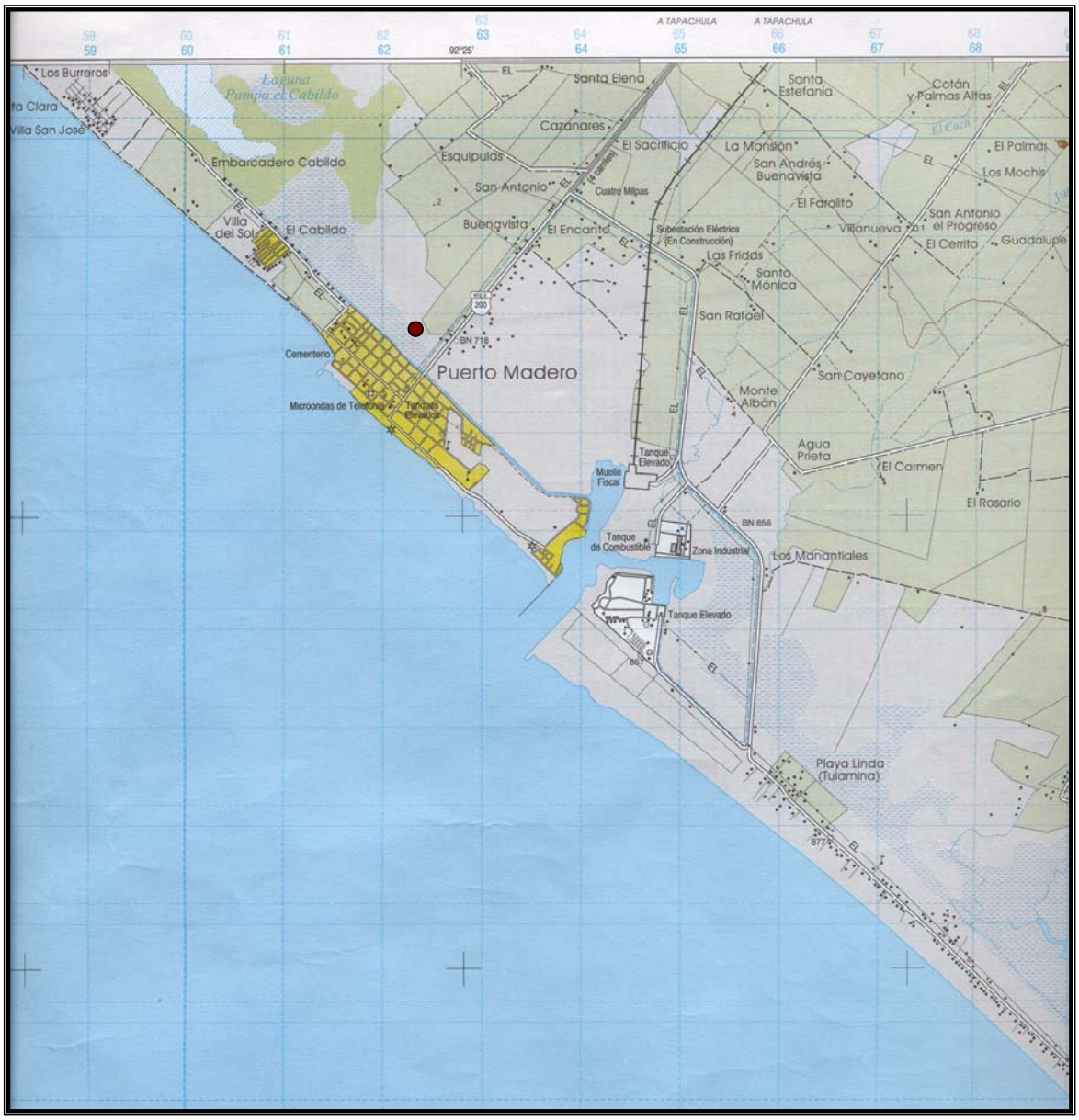
Appendix 11. Topographical map of Bajo de Chila, Oaxaca, Mexico. Puerto Escondido Quad D14B16, Insstituto de Estadistica Geographica de Mexico; scale: 1:50,000. Major contour lines are 20 meters. Maroon dot represents detection site.

Detection Site: Rio Chila, Bajos de Chila, Oaxaca, Mexico.
Number of Willow Flycatchers Detected: 8
Mileage/Direction to Nearest Landmark: 7.5 km northwest of Puerto Escondido.
Detection Coordinates: 15° 54.86' N, 97° 07.05' W

Appendix 12. Topographical map of Cabeza del Toro, Chiapas, Mexico. Cabeza del Toro Quad D15A17, Instituto de Estadistica Geografia E Informatica de Mexico; scale: 1:50,000. Major contour lines are 10 meters. Maroon dots depict the detection sites.

Detection Site: Cabeza del Toro, Colonia Belesario Dominguez, Chiapas, Mexico.
Number of Willow Flycatchers Detected: 20
Mileage/direction to Nearest Landmark: 8 km southeast from the intersection to Puerto Arista and 6 km southeast of Cabeza del Toro
Detection Coordinates: 15° 53.40' N, 93° 42.53' W

Appendix 13. Topographical map Laguna Pampa el Cabildo, Chiapas, Mexico. Puerto Madero Quad D15B62, Instituto Nacional de Estadistica Geografica E Informatica de Mexico; scale: 1:50,000. Major contour lines are 10 meters. A maroon dot depicts the detection site.



Detection Site: Laguna Pampa el Cabildo
Number of Willow Flycatchers Detected: 15
Mileage/direction to nearest landmark: 0.3 km North of Rio San Benito
Detection coordinates: 14° 43.36' N, 092° 25.19' W