Winter Distribution of the Willow Flycatcher (*Empidonax traillii*) In Ecuador and Southern Mexico: 2004

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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 and land management agencies 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; Lynn and Whitfield 2000, 2002; Nishida and Whitfield 2003) have focused on wintering ecology. To continue with these efforts, we surveyed for willow flycatchers from 3–28 January in Ecuador and 22 February through 7 March 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, relocate banded individuals, and identify any threats to willow flycatcher populations on the wintering grounds.

We spent a total of 112.4 survey hours at 39 survey sites in Ecuador and southern Mexico. In Ecuador, we revisited five locations from 2003 and surveyed six new locations. During surveys, we found 70 willow and 12 alder flycatchers. In southern Mexico, all locations were revisited and we found 123 willow flycatchers. 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 seems equivalent to 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 148.4 banding hours to catch 56 willow flycatchers. While in Mexico, we resighted 16 previously banded birds and were able to recapture seven of these. All seven were banded by our survey teams during 2003.

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 primary successional habitat that is both created and destroyed by flooding. This habitat occurs primarily on river islands along the Rio Napo. Potentially, this region is threatened by oil exploits and mining operations. 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

Willow flycatchers (*Empidonax traillii*) breed throughout most of the United States and southern Canada. However, the species has been declining across its breeding range since 1966 (Sauer 2003). In 1991 the species was listed as endangered in California (CDFG 1991), and in 1995 the southwestern subspecies, *E. t. extimus* (one of four recognized subspecies), was listed as federally endangered (USFWS 1995).

The willow flycatcher is a riparian obligate and, therefore, is dependent on one of the most threatened habitats in the southwest (Sogge et al. 2003a). The loss and degradation of this habitat is considered the major cause of the species' population decline (Unitt 1987, Whitfield and Sogge 1999). In California, the willow flycatcher has already been eliminated as a breeding bird from most of its former range, and there is concern that the remaining populations may continue to decline (Harris et al. 1987, Bombay 1999, Stefani et al. 2001, Green et al. 2003).

Willow flycatchers are Neotropical migrants that spend three to four months in the spring and summer breeding in North America. The remainder of the year they spend in migration and on wintering grounds from the Pacific Coast of Mexico through western Central America and into northern South America. Little is known about the winter range, habitat, and ecology of this special-status species. However, increasing demands on natural resources in Latin America have the potential to lead to a significant loss of wintering habitat for willow flycatchers.

In the Amazonian western lowlands of Ecuador, about 95% of the forests have been converted to agricultural lands (Rachowiecki 2001). The exploding human population in Mexico over the last 40–60 years has led to that nation having some of the highest rates of deforestation in the world (Jones 1990, Houghton et al. 1991, Hartshorn 1992) with land being cleared for residences, farming and cattle grazing. Cattle ranching is one of Mexico's most important industries and has been instrumental in generating large-scale changes across the Mexican landscape since the 1500's (Dusenberry 1963). In Ecuador, oil companies have built roads into previously inaccessible regions of the rainforest. Colonists have followed these roads, clearing more forest upon their arrival. This process has led to a deforestation rate of almost a million acres per year in the Oriente province, one of the highest rates in Latin America (Smith 1989, Jukofsky 1991, CESR 1994). In addition, obvious threats to willow flycatchers, such as direct loss of habitat, are exacerbated by insidious threats such as contamination of habitat by pesticides, mercury and oil derivatives.

An understanding of the willow flycatchers winter habitat requirements, including the effects of current land use practices, is crucial to identifying the limiting factors affecting flycatcher populations and subsequent conservation efforts.

Although only the *extimus* subspecies is federally listed, conservation and management research focused specifically on the winter habitat requirements of the southwestern subspecies is difficult. Willow flycatcher subspecies are virtually impossible to differentiate in the field. Visual differences between the subspecies exist, but are limited to slight variations in color or morphology in zones of overlap. Therefore, conservation and management on a subspecies level is difficult on the wintering grounds where the ranges of the subspecies overlap extensively (Unitt 1997). Given this difficulty and the listing of the species at the state level in California, it is important to gather as much information as possible about the entire species throughout its range in Latin America if a sound conservation strategy is to be formed.

OBJECTIVES

Our goal was to add to the baseline data on the distribution and ecology of willow flycatchers throughout Latin America that we had gathered in previous years. In 2004, we returned to the same areas in southern Mexico and Ecuador that were visited in 2003. In addition, we expanded coverage in Ecuador to include an area along the Rio Napo, further east of previously visited sites. Our primary objectives were the same for all sites in both countries, to:

1. Locate and describe occupied willow flycatcher wintering habitat;
2. Identify and compare common habitat characteristics;
3. Describe potential threats to wintering flycatchers and their habitats;
4. Obtain blood samples for future work on subspecies analysis and gender determination; and
5. Obtain feather samples for future work on linking breeding and wintering areas using stable isotopes that carry a geographic signature.

Secondary objectives varied by location. In Mexico, we revisited sites to look for previously banded birds and compare habitat changes between years. Because the birds had not been given unique identifying bands, we also attempted to recapture individuals for confirmation of identity (via genetic analysis) and analysis of site fidelity.

In Ecuador, our goal was to increase both sample size and area to adequately address our five primary objectives. Ecuador surveys in 2003 were preliminary and our sample size of banded willow flycatchers was limited to six individuals.

Both willow and alder flycatchers (*Empidonax alnorum*) occur in Ecuador (Ridgely and Greenfield 2001, Nishida and Whitfield 2004) and we wanted to further document the sharing and/or segregation of habitat between these two species as well as any evidence of interspecific interaction.

METHODS

STUDY AREAS

Survey sites were selected based on willow flycatcher distribution information gathered from museum specimen records (Unitt 1997), field guides (Howell and Webb 1995, Ridgely and Greenfield 2001) and ornithologists familiar with the areas, including Steven N.G. Howell (1999 pers comm.) and Paul Coopmans (1998, 2002 pers comm.). Within each geographical location, we selected several habitat patches as sites to conduct surveys. Site selection was limited by accessibility issues, only those areas readily accessible by roads, rivers or other transportation corridors were considered. In addition, information gathered during our surveys in 2003 was used when selecting new survey locations for 2004.

Ecuador
We surveyed thirty sites in eleven different geographic locations across two Ecuadorian provinces (five revisited and six new locations). The surveys mostly occurred on river islands along the Río Napo in primary successional habitat. However, surveys near Tena and one of the surveys near Sacha were located in either secondary forest or pasture bordered by secondary forest. In addition, surveys along the Tiputini were conducted in an area that was a mix of seasonally flooded and upland forests, as well as along the edge of a shallow laguna. Latitudes at the sites ranged from 00° 27' S at Sani along the Río Napo to 01° 04' S at Jatun Sacha. Longitudes ranged from 077° 49' W at Hacienda Johanna near Tena to 075° 24' W at Nuevo Rocafuerte, two kilometers from the Peruvian border. Elevation ranged from 210–540 m above sea level. Seasonality in Ecuador varies by region. In general, in the northern Oriente where we were surveying, the dry season lasts from December through March and the rainy season lasts from April through November. The climate of this region is considered hot and humid. Temperatures range from 20–30 degrees Celsius with a minimum humidity of 80% and precipitation levels consistently over 3,000 mm annually (Smith 1996).

Mexico
Seven sites were surveyed along the Pacific lowlands of southern Mexico, extending from 16° 43' N, 099° 36' W at La Barra, Guerrero to 14° 43' N, 092° 25' W at Laguna Pampa el Cabildo, Chiapas near the border with Guatemala. Two

of the seven survey locations were east of the Isthmus of Tehuantepec. Although politically still part of Mexico, environmentally these sites were more similar to Central America, having higher temperatures and humidity. All the sites occurred at elevations of 60 m or less with a range from 0–60 m above sea level. The Pacific lowlands are characterized by two distinct seasons, wet and dry. The rainy season, usually lasts from June until September and is followed by the dry season.

SURVEY TECHNIQUE

We conducted surveys from 3–28 January in the Napo and Orellana provinces of Ecuador and from 22 February through 7 March in the states of Guerrero, Oaxaca and Chiapas of southern Mexico. Gorski (1969) found that willow flycatcher activity and response to playback was the greatest between 0600–1000 and 1600–1800 hours. Thus, we tried to limit our survey hours to these times as much as possible. However, because our overall time at any site was limited, we occasionally allowed surveys to spill out of the optimal time frame if weather conditions seemed mild enough for flycatchers to still be active and individuals were still responsive to playback.

Our survey protocol was based on that described by Sogge et al. (1997), but modified slightly for use on the wintering grounds (Koronkiewicz and Whitfield 1999, Nishida and Whitfield 2003). Initially, observers would listen quietly for 1–3 minutes for any spontaneous vocalizations. If no vocalizations were detected, MP3 players attached to portable speakers were used to broadcast willow flycatcher vocalizations at a volume similar to that of a naturally singing bird. Song was broadcast for 15–30 seconds and followed by a 2–4 minute listening period. Only willow flycatcher vocalizations were played at survey sites in Mexico while both alder and willow flycatcher vocalizations were played at sites in Ecuador. Alder flycatcher vocalizations always preceded those of willow flycatchers since the latter is considered behaviorally dominant over the former (Stein 1963, Prescott 1987). Thus, it is possible that alder flycatchers are unlikely to vocalize if they believe a willow flycatcher is in the area. Transects were walked through the vegetation if possible or along the periphery if not. Playback stations were spaced 20–40 m apart depending on vegetation density. If a flycatcher was located, but not confirmed as either an alder or willow flycatcher, transects were interrupted to obtain an affirmation of species identity. However, cessations in transects were limited to a maximum of 30 minutes. Positive identification of a willow flycatcher was based on the detection of a "fitz-bew" vocalization while alder flycatchers were positively identified by the "fee-bee-o" vocalization.

Distance to the nearest town, road, or other landmark from the survey site was measured using Garmin© hand-held GPS (Global Positioning System) units, maps, or the car's odometer reading. GPS units were used to measure the length of the survey route, determine its elevation, record both survey route and detection coordinates, and determine the distance between detections and/or capture of individuals between years. The start time, duration and location of each willow or alder flycatcher detection was recorded. Additionally, data was recorded on whether a bird was detected prior to or after taped playback, its band status, response or lack thereof to conspecific vocalizations and any additional behavior observed. For each site, general habitat characteristics, including distance to water sources, dominant genera of trees and shrubs, estimated canopy heights, severity of human related disturbance and evidence of any other threats to flycatcher persistence, was recorded (Appendix 1). Genus and species of trees, shrubs and herbaceous vegetation was included when known. Sketches were also made of each survey site depicting the route, important landmarks, water sources and areas where flycatchers were detected. Land ownership and management information was recorded whenever possible.

All sites in southern Mexico had been surveyed previously (2003) for willow flycatchers. Therefore surveying for unmarked birds was an ancillary and not primary objective during 2004 surveys. Since new flycatchers were discovered while attempting to resight previously banded individuals, reported survey hours in Mexico reflect both survey and resighting efforts.

BANDING TECHNIQUE

Banding efforts occurred during the morning from sunrise until flycatcher activity waned (typically between 6–11 am). Since time was often the limiting factor, trapping sites were chosen based on accessibility, proximity to known willow flycatchers, and catchability of individuals (presence of suitable habitat to erect nets combined with the behavior and flight pattern of the bird; e.g. if a bird is in an area with tall trees and rarely perches in low vegetation, then we probably would not try to capture it). We used taped playback of pre-recorded willow flycatcher vocalizations to lure birds into 6 or 12-m mist nets. Two speakers were placed on either side of the net to entice birds according to the methods established by Sogge et al (2000). Once flycatchers were captured, an aluminum USFWS band was placed on the right leg. In previous years, this band was silver in color but in 2004 we used USFWS bands anodized bronze so that we can easily distinguish these flycatchers from those that were banded on the breeding grounds. Blood samples were collected for subspecies analysis using a toenail clip technique and stored in a 2% sodium dodecyl sulfate buffer solution. Body, primary covert, and fifth primary feathers were also collected for isotope analysis. Measurements taken included wing chord and tail lengths, fat score, flight feather wear, molt patterns and weight. Capture and processing times were recorded and a GPS unit was used to obtain the capture location coordinates.

In Ecuador, increasing our sample size to facilitate genetic analysis was one of our primary objectives. Thus, a larger number of surveyors were employed than in 2003 in order to increase effort and flexibility, e.g., once flycatchers had been detected and captured, some team members could immediately start banding individuals while others continued surveying.

All locations in Mexico were surveyed in previous years and enough blood samples had already been acquired from most for genetic analysis. Thus, resighting and recapturing previously banded birds was our primary focus. Once willow flycatchers were recaptured, we could positively identify individuals. If a flycatcher had moved from the territory in which it was caught in the previous year, the distance between capture locations was determined using a GPS unit. A few locations were discovered during 2003 surveys and had only one to three banded flycatchers to relocate. At these locations, we split efforts between recapturing banded flycatchers and increasing our sample size by catching new birds.

Pure banding hours occurred, but were not the norm. More often efforts were a mix of activities. During previous years, combined efforts were placed in their own category as survey/banding hours. This causes difficulties in comparing among years as the ratio of survey to banding is unknown. In 2004, surveyors were instructed to determine how much time was devoted to each activity while in the field for greater accuracy and ease of comparisons.

RESULTS

SURVEY EFFORT

Less than 10% of the total hours spent surveying fell outside the times deemed optimal (10.8 of 112.4 survey hours). In Ecuador, the limited time to survey combined with the difficulty and expense of hiring boat time made this slight divergence from standard protocol impossible to avoid, and as a result, 10.7% of the survey hours fell outside of the optimum range (8.8 of 81.5 survey hours). In Mexico, logistics were simpler and only 4.3% of the survey hours fell outside the ideal range (1.3 of 30.9 survey hours).

Ecuador
We conducted 57 surveys during 81.5 survey hours (Table 1, Figure 1, Appendix 2). We detected a minimum of 70 willow flycatchers (Table 2) at 81.8% of the locations (9 of 11 locations) and 43.3% of the sites surveyed (13 of 30 sites). We detected at least 12 alder flycatchers at only 27% of the locations (3 of 11 locations) and 13.3% of the sites (4 of 30 sites).

Table 1: Willow flycatcher survey efforts

Survey Location [a,b]	Sites Surveyed	Number of Surveys	Survey Hours	Banding Hours	Total Hours
Ecuador					
Hacienda Johanna[b]	1	4	6.3	10.0	16.3
Jatun Sacha[b]	6	9	14.2	10.2	24.3
Jaguar	2	5	5.6	7.2	12.9
Moñdana[b]	5	7	10.5	1.2	11.7
Coca[b]	1	3	4.0	7.8	11.8
Sacha	4	5	8.2	2.6	10.8
La Selva[b]	3	8	9.3	4.2	13.5
Sani	3	5	6.0	6.0	12.0
Tiputini	2	4	8.6	-	8.6
Yuturi	2	4	5.9	13.0	18.9
Nuevo Rocafuerte	1	3	2.9	-	2.9
Subtotal	**30**	**57**	**81.5**	**62.1**	**143.6**
Mexico					
La Barra Vieja[b]	1	2	1.0	6.0	7.0
Marquelia[b]	1	3	2.0	6.0	8.0
Cuajinicuilapa[a]	1	3	3.2	24.13	27.33
Bajos de Chila[a]	2	2	3.67	1.75	5.42
Rio Copalita[b]	1	5	5.16	21.42	26.58
Cabeza del Toro[a]	2	4	6.79	12.01	18.8
Laguna Pampa[a]	1	8	9.06	14.98	24.04
Subtotal	**9**	**27**	**30.88**	**86.29**	**117.17**
Total	**39**	**84**	**112.4**	**148.4**	**260.8**

[a] Sites surveyed annually since 2002
[b] Sites also surveyed during 2003

Figure 1

Willow Flycatcher (Empidonax trailii) Survey Locations
Ecuador 2003 and 2004

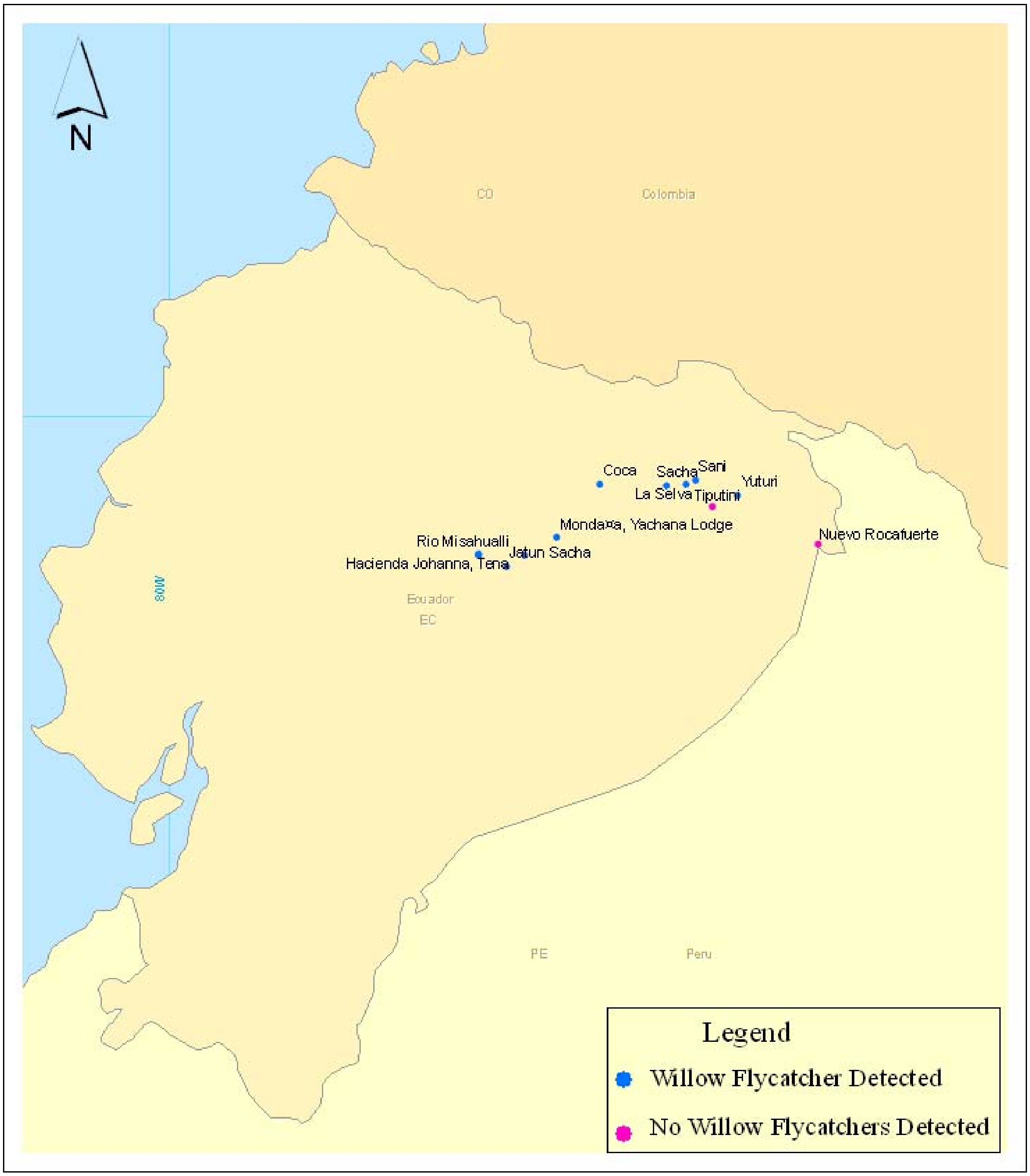

Table 2: Willow and alder flycatcher detections in Ecuador (N = Napo, O = Orellana)

Survey Location	Dates: (January, 2004)	Willow Flycatchers Detected	Willow Flycatchers Caught	Alder Flycatchers Detected	Alder Flycatchers Caught
Hacienda Johanna, N	27–28	9	4[a]	0	0
Jatun Sacha, N	3– 5, 26–27	8	6	2	0
Jaguar, N	24–26	4	2	0	0
Mondaña, N	6–9	9	1	0	0
Coca, O	10–11, 24	11	4	0	0
Sacha, O	10–12	2	2	0	0
La Selva, O	14–15	10	4	0	0
Sani, O	11–13	10	3	8	1
Tiputini, O	21	0	0	0	0
Yuturi, O	16–18	7	4	2	1
Nuevo Rocafuerte, O	18	0	0	0	0
Total		**70**	**30**	**12**	**2**

[a]Includes one recaptured willow flycatcher

We revisited all five locations from 2003 surveys (Hacienda Johanna, Jatun Sacha, Mondaña, Coca and La Selva) and detected more willow flycatchers in 2004 at all locations. Relative densities of willow flycatchers were much higher than those of alder flycatchers during both years of surveys. In 2003, we detected 4.3 times as many and surveys in 2004 detected 5.8 times more willow than alder flycatchers.

Mexico

We detected willow flycatchers at 100% of nine sites in seven different geographic locations. We conducted 27 surveys during 30.9 survey hours (Table 1, Figure 2, Appendix 3) across three Mexican states. A minimum of 123 willow flycatchers were found (Table 3). All survey locations were revisited from previous years. Four of these locations were initially surveyed in 2002 while the other three locations were discovered during 2003. No new locations were added during 2004. We detected more willow flycatchers during 2004 surveys than in previous years at six of the seven locations.

Figure 2. Map of Willow Flycatcher survey sites in Mexico 2002-2004.

Table 3: Willow flycatcher detections, resightings, and banding data for southern Mexico (GRO = Guerrero, OAX = Oaxaca, CHI = Chiapas)

Survey Location	**Dates: (2004)**	**Detected**	**Resighted**	**Recap**	**Banded**
La Barra Vieja, GRO	6–7 March	12	N/A	N/A	6
Marquelia, GRO	4–5 March	10	0/1	0	2
Cuajinicuilapa, GRO[a]	19–21 Feb	24	6/7	1	4
Bajos de Chila, OAX	3 March	12	1/2	1	1
Rio Copalita, OAX	22–23 Feb	17	1/2	1	7
Cabeza del Toro, CHI	25–26 Feb	31	3/6	1	2
Laguna Pampa, CHI	26–28 Feb	17	4/7	3	4
Total		**123**	**15/25**	**7**	**26**

[a]Since surveys in Cuajinicuilapa were conducted along the border between two states, most willow flycatchers were found in Guerrero. However, a few were detected in Oaxaca

RESIGHTING AND BANDING RESULTS

We captured 59 *Empidonax* flycatchers of three different species in Ecuador and southern Mexico during 2004. During 148.4 banding hours, we captured 56 willow flycatchers (n = 30, Ecuador; n = 26, Mexico), two alder flycatchers (Ecuador), and one pacific-slope flycatcher (Mexico). We were able to recapture eight willow flycatchers (n = 1, Ecuador; n = 7, Mexico). Blood and feather samples were collected from all newly captured birds. Only feather samples were collected from recaptured birds.

The sample size of banded willow flycatchers from Ecuador in 2003 (n = 6) was too low to draw any conclusions or make any comparisons with other datasets. However, of six banded birds, we were only able to relocate one. This willow flycatcher was located in pasture around Hacienda Johanna and was caught in the same territory where a flycatcher was caught in 2003. The close proximity to previous capture location suggests that this is the same flycatcher. However, since birds in Ecuador were banded with plain aluminum bands in 2003, this can only be speculative. We removed the plain band and replaced it with USFWS band for future efforts.

In Mexico, we were able to resight 16 of a possible 25 banded willow flycatchers (64.0%) despite the clearing of two of our study locations. These resighted flycatchers were either in or near the previous year's capture sight. Of these 16 resighted flycatchers, we were able to recapture seven (43.8%). All of these recaptured birds were marked by our 2003 survey and banding teams (100%). Willow flycatchers 2004 mist-net locations varied from 0–90 m ($\bar{x}$ = 25.4 ± 12.9) from where they captured during 2003. Two of these flycatchers had an unbanded willow flycatcher in their previous year's territory.

An interesting note was in the difference in molting pattern between birds caught in Ecuador versus those caught in southern Mexico. In Ecuador, we captured willow and alder flycatchers over a span of three weeks (7–28 January, 2004). We noticed that later on in the month, more willow flycatchers showed signs of molt. During the first two weeks only 6.7% of banded willow flycatchers showed any evidence of molt. Whereas, during the third week, 53% of the flycatchers caught had some evidence of molting. Only two alder flycatchers were caught and both were molting symmetrically. By comparison, of willow flycatchers captured in Mexico (n = 26), only four showed signs of molt. Also, the molt pattern on all four of these flycatchers was adventitious, rather than symmetric, indicating that the molt was accidental.

General Habitat Characteristics

Winter habitat for willow flycatchers has been described as of a combination of four main habitat components: standing or slow moving water and/or saturated soils, patches or stringers of trees, wood shrubs, and open areas (Koronkiewicz et al. 1998; Koronkiewicz and Whitfield 1999; Koronkiewicz and Sogge 2000; Lynn and Whitfield 2000, 2003; Lynn et al. 2003; Nishida and Whitfield 2003). In Mexico, all sites where we located willow flycatchers contained all four habitat components. Occupied sites were located near slow-moving rivers, lagunas, and associated floodplains with aquatic and emergent vegetation. These seasonally inundated floodplains were bordered by any combination of the following vegetative growth: woody shrubs, patches or stringers of trees, savanna-woodland edge, second-growth woodland, pasture, and agricultural lands.

In Ecuador, we found willow flycatchers in areas that contained the majority of the four habitat components. Water was prevalent throughout survey sites in Ecuador. All sites contained standing or slow moving freshwater, saturated soils, and were in close proximity to a flowing river. Also present were side channels with varying amounts of water remaining into the dry season. Two sites were located in secondary growth and/or pasture. These four sites were the exception and the majority of survey sites were found along the inside of a meander loop of the Río Napo (n = 26). Rivers in western Amazonia flood annually. During the height of flooding, water levels may rise as much as thirteen meters (Goulding et al. 1996). Flooding occurs with frequency, but is short of duration and this combination causes lowland vegetation to be in a state of dynamic flux (Terborgh 1985). Occupied willow flycatcher was primary successional habitat dominated by two forms of caña (*Gynerium sagittatum*). In the western Amazon Basin, caña exists in both small and large morphs which differ considerably in physical form and mode of reproduction (Kalliola et al. 1992, Francis 2003). This only occurs in the western Amazon Basin and is not noted elsewhere in the distributional range of caña (Francis 2003). This native wild cane ranged in prevalence over the surrounding habitat anywhere from 60–95% and was quite variable in height (1–6 m). The next most dominant plant was *Tessaria* sp., which occurred in patches of short (1–3 m) to medium (3–6 m) sized trees. The two forms of caña and *Tessaria* were collectively the dominant vegetation over much of the survey landscape and thus are referred to from now on as caña-*Tessaria* habitat. Caña stands in the western Amazon vary in density from 0.6 to 2.6 culms per m^2 (Francis 2003). Patchily distributed shrubs (0.5 – 4 m) and scattered trees (primarily *Tessaria* and *Cecropia* spp.) provided elevated perches throughout the caña-*Tessaria* layer.

ECUADOR: SURVEY LOCATIONS

Hacienda Johanna

Willow flycatcher habitat was found 4 km north of the town of Tena. This area, once gently rolling hills covered with secondary forest, has been cleared of forest and converted to cattle pasture. Clusters of larger trees and shrubs remain in the swales and as a thin strip of secondary forest trees (12-15 m in height) bordering a road (1-2 trees wide on either side of the road). Trees included *Cecropia* sp., tree ferns (*Cyathea* sp.), moriche palms (*Mauritia flexuosa*), *Ceiba pentandra*, guavas (*Psidium* sp.), members of the families Rubiaceae, Melastomaceae, and Arecaceae, among others. Despite patches of remaining secondary forest, the landscape was predominantly grass (Poaceae) with a few sparse and isolated trees or shrubs scattered through wide expanses of open pasture (Figure 7). There was evidence of moderate grazing and deep cow paths were embedded in the moist soil. Other areas with less livestock use were dominated by two distinct species of unidentified grass (40 cm average and 1.5 m average). The tree lined main road received moderate traffic. Most traffic was from pedestrians or bicycles, but occasional cars as well. A branch of the main dirt road leads to an area with construction for a new hotel. Beyond the construction, this road continued down to the Río Misahuallí. By expanding the survey area in 2004, we detected more than twice as many willow flycatchers than during 2003 surveys.

Jatun Sacha

Willow and alder flycatchers were located on the northwest bank across the Río Napo from the main trail leading to Jatun Sacha. Flycatcher detections ranged from 275 to 675 m from this trail entrance. Habitat consisted of a strip of caña-*Tessaria* that varied from 30 to 60 m in width and started about 30-40 m from the Río Napo. This caña-*Tessaria* strip was bordered on one side by pebble covered beach leading to the Río Napo and on the other side by dense forest. The narrow

Figure 3. Unoccupied willow flycatcher habitat at Jatun Sacha, Napo Province, Ecuador in 2003.

Figure 4. Occupied willow flycatcher habitat at Jatun Sacha, Napo Province, Ecuador in 2004.

Figure 5. Willow flycatcher habitat near Mondaña, Napo, Ecuador. This site was inundated for several hours 2 days later.

Figure 6. Inundated occupied willow flycatcher habitat near Mondaña, Ecuador. The water receded to mostly puddles by the next morning.

Figure 7. Willow Flycatcher recapture site at Hacienda Johanna, Napo, Ecuador.

Figure 8. Recaptured willow flycatcher. Note the new primaries that are still coming in.

strip of flycatcher habitat (1-2 m average height) was not densely vegetated and could be easily walked through with taller *Cecropia* and *Tessaria* spp. trees (4-6 m) sparsely scattered throughout. The herbaceous layer was negligible. There were houses nearby and during surveys women were washing clothes in the Río Napo. Surveys were conducted in early January while banding occurred later in that same month. During the interim, the Río Napo had visibly dropped by over 1 m. Despite presence of habitat, no flycatchers were detected during 2003 surveys (Figure 3). In 2004, we expanded the survey area and found both willow and alder flycatchers (Figure 4).

Jaguar
Occupied willow flycatcher habitat was found 1.2 km upstream from the Jaguar Lodge on an island along the Río Napo at the confluence with the Huambuno River. This large river island was divided into three smaller islands by seasonally active sub-channels. During the time of our surveys, these sub-channels were dry allowing access to all portions of the island. Though the sub-channels were no longer running, the soils were still saturated and small muddy areas remained toward the center of the island. The first partition of the island was covered with *Tessaria* sp. and two visibly different morphs of caña. The shorter variety of caña was the dominant vegetation on this island. The second island was mostly caña and grass with some young *Tessaria* sp. mixed in. The third island was dominated by caña-*Tessaria*. Recent flooding had lodged trash in the vegetation 1.5 m above the ground. Overall the caña-*Tessaria* layer averaged 2 m in height with trees 3-4 m scattered throughout. There were houses near the habitat on the first island and also to the west in the nearby terra firma forest. Footprints, dog tracks, and garbage were evidence of use. Also, there was a smaller circular area that had been recently burned. It was unclear the cause of the fire, but could be evidence of local trash burning.

Mondaña
We surveyed for willow and alder flycatchers on river islands starting just downstream from the village of Mondaña and continuing to a distance of 4.5 km away. One river island surveyed during 2003 was revisited in 2004 and two new occupied river islands were discovered. Located 3 km downstream from Mondaña on the east side of the Río Napo, this middle river island was surveyed during both years. This large river island had one willow flycatcher and one alder flycatcher during 2003 surveys. In 2004, three willow flycatchers were located, but no alder flycatchers were detected. The habitat formed linear strips 40 m wide bordered on both sides by streambeds. This gave the habitat an overall horseshoe appearance. The *Tessaria* sp. (4–5 m) was quite dense and difficult to maneuver through. The herbaceous layer was negligible and habitat was surrounded by tall walls of trees (5–7 m) with dense caña (1–4 m) along the edges. Water was never more than 25 m away throughout the survey. Often it

was much closer with stagnant pools of water in both streambeds and still flowing through some of the rockier areas. Surveyors noticed oil on top of some of the pools of standing water. At one of the flycatcher detection sites, cars, human voices, and chickens could be heard. After heavy rains, the water level rose over 2 m in one day (Figures 5 and 6). During 2004 surveys, two new occupied river islands were discovered. These showed more signs of human disturbance as one island was just downstream from Mondaña. The other island was 4.5 km downstream, but had an active village with lots of land conversion for houses and gardens. Overall, we found more willow flycatchers during 2004 surveys than were known previously.

Coca

Occupied willow flycatcher habitat was found on a large river island along the south side of the Río Napo three km from the main bridge in Coca. This large river island was dominated by primary successional stage vegetation and was split into multiple islands depending on the water levels. Along the length of the sandy beach ran a partially dry secondary river channel where pools of water still remained from flooding during the rainy season. Soils in general were saturated with standing water prevalent throughout. Habitat patches consisted of linear strips (minimum width 100 m) of dense caña varying from 2.5 to 5 m in height. Though the landscape was dominated by caña, a few taller *Tessaria*, *Cecropia* spp., and Lauraceae trees (5–7 m) were scattered throughout. There also was an herbaceous layer (1 m) interwoven with Fabaceae vines. As the habitat approached the river, caña became less uniform, and was more patchily distributed over the landscape. There was not much evidence human activity on this island. We only saw a few footprints and some trash floating in the Río Napo. In 2003, three alder flycatchers were observed on this island, but were not relocated during 2004 surveys. With expanded survey coverage during 2004, we were able to detect more willow flycatchers than during 2003 surveys.

Sacha

Primary successional habitat was located on the east bank across from the Sacha boat dock. This small river island was on the outside of a bend in the Río Napo. Willow flycatcher habitat started 40 m from the Río Napo and 20–25 m from a partially flowing secondary river channel. This island was dominated by uniformly growing dense caña (4–6 m) interspersed with occasional *Cecropia* sp. trees (6–8 m) and bordered by a shorter layer of caña growth (2–4 m) mixed with negligible amounts of small *Cecropia*, *Tessaria* spp., and other unknown shrubs (2–6 m). Willow flycatchers were located at the border between the tall and short caña layers and were thus using both layers. The presence of mud high up on the vegetation was evidence of recent flooding. The sandy island soils were saturated and water pooled up above the surface under the low lying vegetation and in the muddy secondary channels. Small dwellings were located on the island and denizens had cut trails through the caña to access the river. We could hear dogs and roosters from the habited areas. There were trails cut through the caña to access the river, but no major threats or impacts from humans or cattle evident.

La Selva

We revisited river islands along the Río Napo that were occupied during 2003 surveys. These islands varied in distance from 1.3 km upstream to 6.5 km downstream from the La Selva boat dock. The habitat on all islands was primary successional habitat dominated by caña (2–4 m) mixed with varying amounts of *Tessaria*, *Mimosa*, *Capirona*, and *Cecropia* spp. Tree and shrub height was quite variable and therefore difficult to assign an average height (range 2–10 m). On all islands, the vegetation was dominated by caña, but the degree varied between islands (50–85 %). In general, smaller islands had a higher percentage of caña. Soils were moist to saturated and pools of stagnant water collected in depressions along secondary river channels. Human disturbance overall was minimal, but the La Selva Jungle lodge maintains trails on the river island across from the parrot clay lick. With more survey efforts in 2004 we were able to find more willow flycatchers, but were unable to relocate any alder flycatchers. Since no flycatchers were banded at La Selva during 2003, it was not possible to ascertain whether flycatchers were the same between years. La Selva was a good example of the dynamic state of the habitat along river islands in Ecuador. One island that we found willow and alder flycatchers in 2003 had partially collapsed and no longer had enough habitat to support flycatchers during 2004. Willow flycatcher residence, in general, seemed to match changes in habitat. Some young caña patches had grown between years enough to support flycatchers where as other areas had matured and flycatchers were no longer residing there. However, since we did not actively measure habitat or have banded flycatchers, these observations are purely speculative.

Sani

Willow flycatchers were located on two large river islands at varying distances from the Sani Lodge. The first river island was located just upstream of the junction of the Río Sani with the Río Napo. This island was long and thin with moist soils. Early successional vegetation dominated by caña (2 m) was located on the east side of this island and existed in two patches 30 x 50 m separated by an area of open sandbar. Caña provided 50% cover with *Tessaria* sp. and other Asteraceae trees (4 m) scattered throughout and *Cecropia* trees (5 m) on the western edge. The vegetation increased in height and density from east to west grading into late successional forest bordered by tall (5 m) dense caña. Though the whole island was surveyed, willow flycatchers were only found in the early successional stage vegetation. The other island was located on the Río Napo 800 m upstream from the Sani turnoff and on the same side of the river. This island consisted of two long narrow habitat patches (60 m x 150 m and 200 m x 1 km) separated by an area of open sandbar mixed with deep saturated mud. Habitat was early successional stage vegetation dominated by caña with clumps of *Tessaria*, *Cecropia* spp., and other diverse shrubs interspersed throughout. The vegetation was quite variable in both height and density and therefore it was difficult to assign average heights (range 1–7 m). The understory consisted of grass (50 cm), sedges, ferns, and vines. An interesting pattern of distribution was noted here. Willow flycatchers were located on the southern side of the island while alder flycatchers were congregating on the northern side. No visible differences in vegetation structure were observed.

Tiputini

We surveyed the Lagos trail and nearby laguna for willow and alder flycatchers. The Lagos trail ran through varzea and terra firme forest and ended at a mostly shallow laguna (120 x 150 m) edged by clumps of spiny palms (6 – 7 m in height), and patches of grass (0.5 m in height). The Lagos trail was one of the main trails leaving the Tiputini Station. This trail ran parallel to the Río Tiputini and varied from 30 to 100 m away from the river. Tiputini encompasses 650 hectares of undisturbed lowland rainforest on the north bank of the Río Tiputini, which was a major tributary of the larger Río Napo. The mostly flat trail crossed a dry creek a few times and soils were saturated and sometimes muddy. The trail wound through primary forest with patches of secondary forest growing in the light gaps. The canopy was tall with a high diversity of trees and shrubs of varying heights up to 30 m and included plants from the following families: Rubiaceae (*Psychotria* and *Palicourca* spp.), Bombacaceae (*Ceiba* and *Matisia* spp.), Araceae (*Iriartea* sp.), Melastomaceae (*Miconia* sp.), Cecropiaceae (*Coussapoa* and *Cecropia* spp.) Lecythidaceae (2 *Grias* spp.), Myrtaceae (*Myrcia* sp.), Mimosaceae (*Inga* sp.), Moraceae (*Ficus* spp.), Clusiaceae (*Clusia* sp.), and Bignoniaceae. Trees were covered in epiphytes, Araceaes, orchids, and bromeliads. The subcanopy layer (8–15 m) consisted of saplings, shrubs, and small palms interwoven with lianas. The herbaceous layer (1 m) was meager providing only 30% ground cover although this was variable. There were small light gaps and at least one large tree fall gap with radius 25 m which allowed light into the otherwise dark understory. *Cecropia* spp. and other emergent trees were concentrated in these areas as they take advantage of intermittent light gaps. No willow or alder flycatchers were detected at Tiputini.

Yuturi

Occupied willow and alder flycatcher habitat was located 4.5 km downstream from the mouth of the Yuturi River on a large river island. Habitat on this island was an association of smaller patches of early successional vegetation separated by partially dry secondary river channels and narrow sandbars. During the rainy season, these habitat patches were likely split into separate islands by flowing channels. We surveyed six of these patches of varying size and vegetational composition. In general, these habitat islands were dominated by caña interspersed with even aged *Tessaria* sp. dominated patches varying in height from 1–6 m (average 4 m) and scattered *Cecropia* spp. (two species). Older *Tessaria* sp. patches tended to be toward the middle of the habitat island and only present on the larger habitat islands. This was indicative of flooding creating channels between the habitat patches and keeping the vegetation in a dynamic state of flux.

Nuevo Rocafuerte
Habitat was located on a large river island across the Río Napo 1 km north of the Nuevo Rocafuerte tower and 2 km west of the border with Peru. Habitat was located near a partly dry river channel. Where the river was no longer flowing, soils were completely saturated resulting in a deep layer of mud. Habitat was variable on this island and ranged from patches of even age and height *Tessaria* sp. (4.5 m) with some *Mimosa* and *Cecropia* spp. mixed in to monocultures of young caña. Patch sizes ranged from 5 x 5 meters to 30 x 80 m. Patches were relatively dense and surrounded either by thick grass (1 m) or open sandy soils. There was evidence of recent flooding on this island and as a result, a third of the island was dominated by either open sand or young caña. Both morphs of caña were present on this river island. There were at least a few houses on this island. While we were surveying, children were playing in the river channel, dogs were barking, and a lone cow was foraging nearby. We did not detect willow or alder flycatchers in this area; but due to time and logistical constraints, we were only able to survey once in the late afternoon.

SOUTHERN MEXICO: SURVEY LOCATIONS

La Barra Vieja, Guerrero
This survey site was located 4.5 km south of the La Barra Vieja turnoff. This turnoff was 26 km east from the Cuota Road into Acapulco. Occupied flycatcher habitat was along a mostly dry riverbed that leads to the Río Papagayo. Stagnant pools and small non-flowing channels were evidence of seasonal flooding and result in verdant vegetation remaining into the dry season. An herbaceous layer carpets the ground (0.5 m) providing 85% ground cover. Willows (*Salix* sp.), *Acacia*, *Mimosa* spp., limes, and other unknown trees range 5-6 m in height. Shade is provided by the plantation crops, mostly coconut palms and mangos, that were 20–25 m in height. Coconuts were harvested at a local scale and the ground was littered with old discarded shells. The terrain was quite hilly with lush vegetation in the valley bottoms surrounded by slopes of dense thorn scrub. Willow flycatcher territories were centered in the drainages (15 m elevation), but extended up into the dry slopes (60 m elevation). There was evidence of human

use, but impact appeared minimal. A few houses were located further up the road. Some trash was strewn about the site. There was local foot, bicycle, and horse traffic, but minimal traffic from cars. Though crop plants were growing at this site, the native vegetation remains in the understory. There was no evidence of cows or ranching in the area. There was a bridge that crossed the Río Papagayo in the town of Barra Vieja, but this bridge has not been functional for 30 years.

Marquelia, Guerrero
Heading west on Highway 200, there were two bridges 1 km west of the town of Marquelia. In 2003, we surveyed habitat dominated by wetland plants mixed with shrubs that was located on the northwest side of the second bridge along the Río San Luis. These pastures were fenced off into separate plots. In 2003, the pasture that we surveyed had no evidence of recent cattle use within that enclosure. However, in 2004, this entire plot had been cleared of all woody vegetation and cows were grazing the herbaceous layer that remained (Figures 4 and 5). A strip of woody vegetation (30–50 m wide) remained at the borders of the plot on the east, west, and south sides following the fenceline. Flycatchers have moved into this remaining strip of habitat along the edges. The remaining vegetation was much shorter on the eastern edge with trees an average of 4 m and shrubs 1 m in height. Along the western edge, flycatchers were using much taller trees (10 m) along the fenceline and also adjacent thorn scrub habitat that was across the dirt access road. A local farmer told us that this upland area would be cleared to plant beans and corn in the next few weeks. The cleared survey pasture was surrounded by coconut groves to the south and east. Horses were grazing the plot to the north (2003, 2004) and the next plot north contained rows of corn in 2004. Lots of foot traffic parallels the bridge and trash littered this access route.

Cuajinicuilapa, Guerrero
Willow flycatcher habitat near Cuajinicuilapa was located along the Río Cortijo at an old resevoir dam, Presa Cortijo. Most flycatchers were located on the south side of the river. The Río Cortijo at the reservoir was the border between the states of Oaxaca and Guerrero. Flycatchers located north of the river were residing in Oaxaca. The terrain was relatively flat and dominated by seral stage vegetation. The presence of a laguna allowed shrubs such as *Cassia*, *Mimosa*, and *Acacia* spp. (2–3 m) to form scattered patches on sandy islands in and along the river. Rows of trees (5–7 m average) bordered the riverbanks interspersed with shrubs (1–2 m average), and an herbaceous understory (10-50 cm). Further away from the laguna, there were pasture areas dominated by short Bermuda grass and tall coconut palms where most of the cows grazed. More flycatcher habitat was located between the dirt access road and a concrete lined canal. Taller Guanacaste and mango trees (12 m) border the road and provide shade and

Figure 9. Occupied willow flycatcher habitat at at La Barra Vieja, Guerrero, Mexico.

Figure 10. Willow Flycatcher recapture site Rio Copalita, Oaxaca, Mexico.

Figure 11. Occupied willow flycatcher habitat at Marquelia, Guerrero, Mexico- 2003.

Figure 12. Same area as previous figure, but in 2004. Note that the woody shrubs have been removed and the vegetation has been grazed.

Figure 13. Occupied willow flycatcher habitat at Cabeza del Toro, Chiapas, Mexico –2003.

Figure 14. Same area as previous figure, but in 2004. Note that the shrubs have grown back on the far side of the dry laguna.

perches for the shrubby vegetation that parallels the canal. There were always people present at this site and trash was littered about. Cars were driving both directions on the main road across the dam all day long. While we were there, people were observed using the Río Cortijo for bathing, washing cars, fishing, and swimming. Cattle, horses, goats, and burros were present. There are prominent cattle paths through the dense understory vegetation. However, grazing pressure, though evident, did not appear to be heavy.

Bajos de Chila, Oaxaca
Occupied willow flycatcher habitat was a secondary terrace area dominated by patches of *Cassia*, *Mimosa*, and *Acacia* spp. among other shrubs (approximately 2 m) that were scattered along the river bottom. There were some willow, papaya, *Ficus* sp., and other larger trees (average 11–12 m) that lined the river banks between the pasture and dirt road. The site was fairly open with a minimal understory. There have been periodic fires here, probably to burn trash, which has the secondary effect of eliminating most of the understory vegetation. At the time of our survey, the river was slow moving with low water levels. However, high undercut banks and braided channels remained as evidence of fast flowing waters during the rainy season. There were many people walking along the river and also people herding cows, horses, and goats. The vegetation here was heavily grazed. There was evidence that the river was used as a local trash dump and bathroom. Small scale (wheelbarrow and shovel) gravel mining was common along this part of the Rio Chila and was actively occurring (2002, 2003, 2004) during surveys. There were houses nearby with small agricultural plots encroaching into willow flycatcher habitat. Between 2003 and 2004, many shrubby areas were either cut down or burned.

Río Copalita, Oaxaca
This survey site was located 3.8 km south on the east entrance road to Bahías Huatulco from Highway 200. The road was on the west side of the bridge that crosses the Río Copalita. There was a water purification plant at the access road. Access was via a concrete path behind the plant that continued 700 m west to the mouth of the Río Copalita. The area adjacent to the mouth of the river was an archealogical site and there were plans to further excavate and eventually open access to the public. Willow flycatcher habitat was along the river mouth and contained mostly early seral stage vegetation. This area, subject to periodic inundation, had the potential to be eliminated during heavy floods. Years with heavy rains probably do wipe out the habitat and thus keep the vegetation in a state of dynamic flux. The north side of the survey area had older vegetation than the south side. The southern end was closer to the river mouth and more prone to periodic elimination from flooding. The habitat was located on an emergent sandbar surrounded by a subchannel and the main channel of the Río Copalita. The vegetation was dense and lush near the west subchannel and was

drier elsewhere. Toward the middle of the sandbar island, the vegetation was scattered thorn scrub with minimal forb or grass cover (10 cm) although dense vines wound themselves around the trees and shrubs. There were a wide variety of trees and shrubs that we did not recognize along with some *Cassia*, *Acacia* spp. and willow mixed in. Trees were taller in the north (8 m average) than those in the south (4–5 m average), although shrubs were more consistent (average 2–3 m). The river island was fenced, but several sections were cut out of the fence. People use this area to access the river mouth and adjacent beach. There was minimal trash scattered around and old signs of cattle use along with more recent signs of burro presence. Overall, human and cattle related disturbance seemed negligible.

Cabeza del Toro, Chiapas
We surveyed sites southeast of Cabeza del Toro and south of Laguna La Pampa at Colonia de Belisario Dominguez. These sites were broken into three plots all located on private lands and enclosed by barbed wire fencing. We surveyed for willow flycatchers during the years 2002, 2003, and 2004. During all three years, there was evidence of clearing for cattle grazing. Horses and cows were present during surveys in all years. One of these pasture plots was 85% cleared since surveys were conducted in 2003. Four flycatchers were banded in this cleared plot during 2003. Several tall trees remain scattered throughout the plot along with a narrow strip of trees and scrubby vegetation that paralleled both the north and east fencelines. Flycatchers had moved into this remnant vegetation. To the east there was a seasonally inundated laguna surrounded on three sides by dense mangroves (6–7 m) which were then bordered by drier uplands dominated by *Acacia* and *Mimosa* spp. (average 3 m) with an herbaceous understory (average 50 cm). At the time of the survey, most of the water was gone from the laguna but the soils were still saturated and muddy. Locals said that the whole area is flooded from June until August. Occupied willow flycatcher habitat dominated by M*imosa sp*. was cleared between 2002 and 2003 in an area that bordered the laguna. In 2004, this area had recovered with new *Mimosa* sp. shrubs 1–2 m in height (Figures 6 and 7).

Laguna Pampa el Cabildo, Chiapas
This area was an overflow channel for the Río San Benito which was located just south of the survey area (300–500 m). The habitat was dominated by densely woven mangrove trees (approximately 3–5 m) that were patchily distributed over the landscape. There were two species of mangroves present along with scattered *Acacia* sp., a few other unknown tree species, agaves, and multiple species of cacti. Bromeliads were growing from the tree tops and there were carpets of pickleweed (*Salicornia* sp., 8–10 cm) as ground cover in some areas. Locals said that the rainy season starts in April and the area dries up by late June. Though seasonally inundated, the area was dry during the time of the survey.

Crab claws, shells, and halophilic vegetation indicate that when inundated, the water was mostly brackish. There was a dirt road through the survey site that ran east–west. Traffic from pedestrians, bike taxis, horses, and horse carts was substantial along this road. There was some evidence of cattle and goats on a limited basis. The area was impacted by waste disposal. Non-degradable waste was significant in some areas and trash burning was evident. Locals harvest wood here and some of the larger trees have been cut down. There were several houses located between the study site and the Río San Benito. Also along the Río San Benito, there was a designated protected area for the mangroves, El Cabildo Amatal. This area was decreed a protected area under state jurisdiction in June of 1999 and covers 3,611 ha (UAC 2004). Unfortunately, we did not visit the protected area and do not know if willow flycatchers occur there.

POTENTIAL THREATS AND IMPACTS

Willow flycatcher habitat in Mexico and Ecuador was quite different with regards to the degree and source of disturbance. All sites in Mexico showed some sign of human derived perturbation whereas sites in Ecuador were affected more by seasonal flooding. In Ecuador, only five of 30 sites showed signs of cattle (13.3%) and only one of these sites had moderate to heavy grazing. In Mexico, signs of cattle and grazing are prevalent among willow flycatcher survey sites (88.9%). Intensity of grazing varies from negligible (one site) to severe (two sites). Two additional sites were cleared of woody growth to provide more herbaceous material for cattle. Heavily defined cattle trails were a frequent occurrence through the secondary growth vegetation common in Mexico. Livestock encountered included cows, burros, and goats.

Trash and other pollutants were ubiquitous throughout sites in Mexico and every survey site had trash present. However, the amount of trash varied and sites were equally distributed between three categories of trash presence: minimal, medium, and severe. The most disturbed sites were used as local dumps. A few sites showed evidence of trash burning which has the secondary effect of removing the understory vegetation. The loss of understory vegetation from burning at these sites exacerbated existing losses from clearing for cattle, firebreaks, and wood harvesting. In Ecuador, trash was present at some survey sites (36.7%). However, presence of trash in all instances was minimal. Often, trash appeared not to have been discarded directly on the river island by humans, but rather to have been brought by the river from recent floods.

Agriculture encountered on willow flycatcher wintering grounds varied from small-scale local gardens to large-scale plantations. In Mexico, a third of the sites (33.3%) had some form of agriculture present. Crops encountered in Mexico included mango, papaya, lime, bananas, beans, corn, and coconut palms. Commercial plantations, especially for mangos, bananas, and coconut palms, cover large areas of coastal lowland Mexico. Remaining flycatcher habitat was often relegated to small fragmented patches within these large-scale plantations. This contrasts with Ecuador where food crops were present at only a few of the survey sites (16.7%). However, in most cases, these were restricted to homesteads with small plots for subsistence crops. In only one case was crop culture more severe. In this case, a large river island supported an entire village and much of the vegetation had been cleared to grow food. There was active clearing apparent during surveys adjacent to willow flycatcher territories. Though this was encountered only on one river island currently; it should be noted that the population in the Oriente region of Ecuador is growing rapidly and the need for more land cultivation may increase. Crops encountered include corn, bananas, and manioc.

Our direct exposure during surveys to other threats are anecdotal in nature. These threats include, but are not limited to, mining for gravel and gold and the exploitation of oil resources. We encountered active gravel mining at the Río Chila in Oaxaca, Mexico and at various locations along the Río Napo and Río Misahuallí in Ecuador (2003–2004). While traveling along the Río Napo, surveyors also noticed locals along the river's edge panning for gold. Evidence of oil exploits were everywhere along the Río Napo: from the presence of sprawling oil towns such as Coca, to equipment and boats along the Río Napo, to surveyors finding oil floating on the top layer of collected water on river islands during 10% of surveys.

DISCUSSION

SURVEY EFFORT

Willow and alder flycatchers were originally considered one species, Traill's flycatcher, which was split into two different species based on variations in song (Stein 1963, AOU 1973). These visually identical flycatchers do not often spontaneously sing on the wintering grounds. Therefore, sightings by birders or biologists were often still lumped as Traill's flycatcher despite the individual species designation. Until recently, 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, data is now available to confirm willow flycatcher presence in northern South America (Unitt 1997, Ridgely and Greenfield 2001, Nishida and Whitfield 2003). Since both alder and willow flycatchers will vocally respond to taped playback, we were able to positively identify over twice as many flycatchers as previous surveys in Ecuador. In the

Napo and Orellana provinces of eastern Ecuador, we identified a minimum of 70 willow and 12 alder flycatchers during 2004 surveys.

Willow and alder flycatchers were detected in caña-*Tessaria* habitat with no apparent separation of habitat between flycatcher species. Often alder flycatchers were found adjacent to willow flycatchers in the same patch of habitat. The only segregation that we found was on one river island upstream from the Sani Lodge. On this island, preliminary surveys indicated that willow flycatchers were located on the southern side of the island while alder flycatchers were congregating on the northern side. However, both flycatcher species were still located on the same island with continuous habitat and no visible differences in vegetation structure. In general, the alder flycatchers that we encountered behaved less aggressively to playback than did willow flycatchers. They would often stay hidden in the dense a caña and would take longer to respond to playback. Typically, the response to playback was with "pit" calls and not the identifying "fee-bee-o" song. Surveyors often would have to spend more time eliciting a song response from alder flycatchers as compared with willow flycatchers. Prescott (1987) found similar discrepancies in aggression and noted that willow flycatchers took less time to approach a playback speaker and had a higher frequency of aggressive vocalizations than did alder flycatchers. Given this disparity in response between the two species of flycatcher, it is likely that surveyors overlooked alder flycatchers on occasion. We did try to compensate for this difference in behavior by increasing the listening times and always playing alder flycatcher vocalizations first. However, numbers and densities of alder flycatchers are still probably higher than indicated by our initial survey results.

In Mexico, all locations were revisited from previous years surveys. Four locations had been surveyed annually since 2002 (Cuajinicuilapa, Bajos de Chila, Cabeza del Toro, and Laguna Pampa El Cabildo) and the focus shifted at these locations to resighting banded willow flycatchers. Similar numbers of flycatchers were documented at these four sites for 2003 and 2004 surveys. This is as expected since no new sites were explored and we concentrated our efforts in the same areas as previous years hoping to encounter banded willow flycatchers. Three locations were discovered in 2003 and objectives at La Barra Vieja, Marquelia, and Río Copalita were twofold. We wanted to relocate banded flycatchers, but still wanted to catch new flycatchers to increase sample size for genetic studies. Therefore, at these three locations we explored new sites and increased sample sizes at all three locations. We doubled the sample size at Marquelia and Rio Copalita and found four times as many willow flycatchers at La Barra Vieja.

Wintering surveys of willow flycatchers have been conducted from Mexico south to northern South America. Flycatchers detected per unit of effort can be used as a relative index for comparison between larger geographical regions (see Nishida and Whitfield 2003). Of the countries surveyed thus far, El Salvador (Lynn and Whitfield 2000) has been the most productive (6.9 flycatchers/survey hour) and Ecuador in 2003 (Nishida and Whitfield 2003) was the least productive (0.8 flycatchers/survey hour). We found 2.7 times as many willow flycatchers in Ecuador in 2004 as compared with 2003. However, this increase is due more to increases in survey effort (number of people, amount of time spent, and area covered) rather than increases in detection frequency. Our increase in survey effort was 2.4 times greater in 2004 allowing for a slight increase in detection frequency (0.86 flycatchers/survey hour). In southern Mexico, our 2004 detection frequency (3.98 flycatchers/survey hour) was between values for all of Mexico in 2002 (2.9 flycatchers/survey hour; Lynn and Whitfield 2002) and 2003 southern Mexico surveys (4.4 flycatchers/survey hour; Nishida and Whitfield 2003). Detection frequencies were higher in southern Mexico for both years than results from all of Mexico. Detection rates in 2004 were slightly lower than in 2003 for southern Mexico. This is probably not due to an actual decrease in frequency, but may instead be an artifact of the shift in effort to resighting bands on individual willow flycatchers.

RESIGHTING AND BANDING

We searched for banded flycatchers in Mexico during surveys conducted in the winter of 2003–2004. During 2003, only two flycatchers were recaptured and one of those was initially banded as a nestling in British Columbia, Canada, and thus can be safely categorized as *E. t. brewsteri* (Nishida and Whitfield 2003). Since this flycatcher was caught in a territory where we had banded a bird the prior year, we were wary of assuming that resights of banded flycatchers in traditional territories were indeed the same individuals. Therefore, attempts were made to recapture banded flycatchers to confirm identity. We were able to recapture seven willow flycatchers during 2004. Combining the recapture data from both years, 89.0% (8 of 9) of flycatchers caught were our birds in or near the same territory.

Our preliminary results from 2003 were suggestive of low site fidelity in Mexico since percentages of banded flycatchers resighted were low (Nishida and Whitfield 2003). We found 23.1% of 13 possible flycatchers during 2003. These initial conjectures of low fidelity were likely due to anomalies resultant from small sample size rather than real patterns. In 2004, we were able to relocate 64% of 25 possible flycatchers during surveys in 2004 despite the clearing of two of our study locations. This percentage indicates high site fidelity and is similar to return rates found by Koronkiewicz (2002) for willow flycatchers in Costa Rica

(43% at Bolsón and 77% at Chomes). Our percentage of 64% was for return rates for all of southern Mexico rather than for discrete study locations. Sample sizes for most locations were too small to be directly comparable with findings in Costa Rica. However, it is still worth mentioning that at the sites where we had greater than five willow flycatchers possible to relocate, resighting rates varied from 50–85% (Cuajinicuilapa, Cabeza del Toro, Laguna Pampa el Cabildo). We were able to relocate half of the banded population at Cabeza del Toro despite the fact that over 85% of two habitat patches were cleared between years. Though we can not currently make direct comparisons between our datasets and those from Costa Rica, high return rates from both countries are still likely indicative of the presence of high quality habitat. High return rates in Costa Rica were thought to indicate potentially high quality habitat able to support relatively larger or more stable populations (Winker et al. 1995, Koronkiewicz and Sogge 2000, Koronkiewicz 2002). Our preliminary results in southern Mexico show high site fidelity as high or even higher than rates in Costa Rica.

Survey locations at Marquelia and Cabeza del Toro had greater than 85% of the vegetation removed in the interim between surveys (2003–2004). Cabeza del Toro had evidence of clearing during all three years of surveying. Local farmers at Marquelia told us of additional plans to clear an adjacent plot to our cleared study site for growing beans. In addition, there was evidence in 2004 of smaller scale clearing at two additional locations. At Bajos de Chila, woody vegetation was removed both manually and secondarily through trash burning fires. At Laguna Pampa el Cabildo, trees were removed probably for local supplies of wood for burning. We were not able to adequately assess whether or not flycatchers from these cleared territories were still in the larger area and return rates of 64% may be an underestimate. On the breeding grounds, flycatchers have been found up to 40 km after the loss of habitat from fire in Arizona (Paxton and Sogge 1996, Paxton et al. 1997, Paxton pers comm. 2004). In Mexico, loss of habitat at our study sites was evident during all three years of the study (2002–2004). However, returning to the same locations in following years allowed us to witness how quickly this vegetation grows back after being cleared.

In Ecuador, our sample size of banded willow flycatchers (n = 6) was too small to make direct comparisons with Mexico. Only one banded flycatcher was resighted and this flycatcher was a resident of pastureland surrounding Hacienda Johanna. Four of the remaining five banded willow flycatchers were located in primary successional habitat on river islands along the Río Napo during 2003 surveys. None of these flycatchers were resighted in 2004. In addition, six alder flycatchers were detected during 2003 surveys on river islands. None of these flycatchers were redetected during 2004 surveys. During the previous year, we made preliminary observations that unbanded flycatchers had large territories and/or moved considerable distances over a short period of time (Nishida and Whitfield 2003). This notion was further confirmed during 2004 by attempting to find flycatchers that we had banded recently. We attempted to resight three willow flycatchers that were banded either the day before or two days prior. Of these, only one was resighted in the same location and the others were not resighted.

Flycatchers in Ecuador appeared to be less aggressive in behavior and often not as responsive to taped playback as compared to flycatchers encountered in Mexico or Central America. In general, it took longer to elicit a vocal response and a higher proportion of birds would not "fitz-bew" or "fee-bee-o" and therefore could not be positively identified as willow or alder flycatchers. Therefore, our counts of flycatchers were conservative and our estimates are probably low. We detected and banded considerably more flycatchers in 2004 than in 2003. However, it is worth mentioning that this is more a result of increased efforts (number of survey teams, weeks spent surveying, and area covered) rather than increases in survey detection. Detection rates between the two years were similar and among the lowest known detection rates and densities for willow flycatchers in Latin America (Lynn et al. 2003, Nishida and Whitfield 2003). The exact reason for a difference in response is unknown at this time. Initial observations indicate that territory sizes in Ecuador may be much larger than those found in Costa Rica, thus they may not be in the area when we are surveying and we do not detect them.

HABITAT

Winter willow flycatcher habitat in southern Mexico and Ecuador continues to follow patterns identified in Mexico and Central America which indicate that flycatcher habitat in Latin America encompasses four components: standing or slow moving water and/or saturated soils, patches or stringers of trees, and open areas (Koronkiewicz et al. 1998; Koronkiewicz and Whitfield 1999; Koronkiewicz and Sogge 2000; Lynn and Whitfield 2000, 2003; Lynn et al. 2003). However, decreases in the density of trees and shrubs in areas dominated by cane have been recorded in El Salvador, Panama (Lynn and Whitfield 2000), and Ecuador (Nishida and Whitfield 2003). Paja canalera (*Saccharum spontaneum*) in El Salvador and Panama is a non-native invasive grass related to sugar cane. Caña in Ecuador is native and grew to heights greater than six meters in some of our survey locations. It seems that the importance of shrub thickets is structural and may be substituted by caña in Ecuador, sugar cane and paja canalera in Central America, or potentially other wild cane species in Latin America. Therefore, we recommend expanding the definition of the four components to include cane.

Willow flycatchers without exception were located in areas that were in close proximity to water and/or flooded by inundation during the rainy season. Our surveys were conducted during the dry season and flycatcher locations varied in the degree to which intermittent waters still were present and/or available. Also, since we revisited many of the same locations in multiple years, we were able to note that often the degree of drying varied between years at the same sites. Studies of related acadian flycatchers (*Empidonax virescens)* in Panama, indicates that site selection occurs before water dries up (Morton 1980). The ramifications of seasonal variation in water saturation levels on habitat selection and quality or movement patterns are unknown. However, these factors may ultimately affect overall survivorship of willow flycatchers on the wintering grounds. In seasonal habitats, studies have shown that large numbers of tropical insects move between habitats in response to the differential disappearance of food through drying and dormancy (Janzen 1973, 1980). The effects of seasonal changes in water levels and/or insect food resources on overwintering willow flycatcher populations warrants further study.

POTENTIAL THREATS

The biggest threat to willow flycatcher populations on the wintering grounds are the complete loss or moderate alteration of habitat which renders it unusable by flycatchers. Unfortunately, with the current proliferation of human populations in Latin America, the threat of habitat loss is an issue for more than just willow flycatchers. Ecuador has the highest rate of rainforest loss in South America (2.3% per year) as colonists in search farmland follow behind the oil roads built to access drilling sites (Jufowsky 1991). In other parts of Latin America, it took less than ten years to convert greater than 75 million ha of forested land to cattle pasture (Houghton et al. 1991). In the past, strong markets for beef and dairy have stimulated livestock expansion and deforestation in Latin America (Kaimowitz 1996). Current diet fads in North America advocating low carbohydrates are coupled with an increase in the consumption of meat and dairy. A recent survey found that an estimated 17% of households are participating in these controversial diets (Sanchez 2004). This could have greater ramifications for future land development practices in Latin America.

Habitat loss and pesticide use have been suspected as possible threats to willow flycatchers on the wintering grounds (USFWS 1995, Koronkiewicz et al. 1998, Lynn and Whitfield 2002). Agrochemicals are widely used on crops throughout Mexico and Central America. Often small farmers or campesinos in Latin America will attempt to try to reverse lower yields or loss of soil fertility through the adoption of chemical inputs that are inappropriately used (Loker 1996). Rather than ameliorating the situation, these methods usually end up causing further environmental degradation. In the Oriente region of Ecuador, African palm oil plantations use large amounts of pesticides and herbicides known to generate toxic runoff that then flow into the surrounding environment untreated (Kimerling 1991). It is suspected that insectivorous birds are affected by the accumulation of agricultural pesticides or mining by-products and may in fact, bioaccumulate these toxicants by feeding on contaminated insects (McCarty and Secord 2000, Mora et al. 2003). Since agrochemical use is ubiquitous throughout Latin America, the effects of different chemicals on willow flycatcher populations should be evaluated.

Less obvious, but still potentially detrimental practices, are mining operations in Latin America. Gravel mining was encountered along the Río Napo in Ecuador and the Río Chila in Mexico and depending on the scale and duration, has the potential to change sedimentation patterns in rivers. Over 500 kilometers of roads have been built by the oil industry in the Oriente and road construction uses large amounts of gravel hauled in from the rivers as close to the road as possible (Kimerling 1991). The effects of gold mining are more insidious. Mercury is used to concentrate and isolate gold. Since mercury is cheap, there is little incentive to recover it and therefore mercury pollution is a serious concern in Amazonia with the effects both widespread and severe (Goulding et al 1996). Mercury pollution is tenacious and has longevity once introduced into the environment. Elevated mercury levels in flora and fauna may continue in contaminated areas long after the source of pollution has ceased (Rada et al. 1986, Eisler 1987). In addition, mercury bonds to inorganic particles suspended in the water and can be moved vast distances by currents (Goulding et al 1996). Seasonal flooding in Ecuador has the potential to carry the effects of mercury poisoning far from the original source. Another caveat is that there may be additive effects of mercury poisoning with pesticides or other chemicals that willow flycatchers might encounter. Mercury ingested in combination with compounds such as parthion or elements like cadmium and copper are known to have synergistically toxic effects (Hoffman et al. 1990, Calabrese and Baldwin 1993, Eisler 1987, King et al 2002).

Drilling for oil in the Amazonian rainforest of Ecuador has a multitude of potential negative effects on willow flycatcher. Oil is quite toxic and can harm aquatic life at concentrations as low as one part per hundred billion or can kill fish at a ratio of one gallon of oil to a million gallons of water (Kimerling 1991). Over a 20 year span, more than 19 billion gallons of waste has been dumped into the environment untreated and greater than 16.8 million gallons of crude oil has spilled into the watershed from ruptures in the main Trans-Ecuadorian Pipeline (Kimerling 1991, Miller 2003). For comparison, the Exxon Valdez spilled 10.8 million gallons into the Prince William Sound (Kimerling 1991, Kane 1995). These estimates are conservative and are merely a collection of known events. The actual amounts of contamination are likely much higher than reported.

Colonists typically follow the oil roads into the forest. The Ecuadorian government has encouraged this behavior by granting land titles to any settler who clears and cultivates the land and this has led to a deforestation rate of almost a million acres per year in the Oriente (CESR 1994). During surveys in Ecuador, we ran into minimal levels of human disturbance. Only one large island with a substantial village had cleared land enough to affect flycatcher populations. However, with increasing numbers of campesinos flocking to the Oriente looking for lands to cultivate, this could change. A 1982 census showed that the Oriente's regional population had grown 4.9% per year which was nearly double the national rate and that more specifically, populations in oil-producing areas near roads was increasing by 8% annually (Kimerling 1991).

Recommendations for Future Studies

Future management and conservation strategies for the willow flycatcher need more information pertaining to all stages of this bird's lifecycle to be readily available. The distribution and ecology of the willow flycatcher on the Latin American wintering and migratory routes need to be better understood. Through our studies in Ecuador and Mexico and previous studies in the Central American countries of El Salvador, Costa Rica, and Panama (Koronkiewicz et al. 1998; Koronkiewicz and Whitfield 1999; Koronkeiwicz and Sogge 2000; Lynn and Whitfield 2000, 2002; Lynn et al. 2003), we now have baseline knowledge about winter distribution that we can build upon. However, more surveys are needed in other countries such as Guatemala, Nicaragua, Columbia, and potentially Venezuela and Peru. More surveys in Mexico would helpful, especially in the northern Pacific lowlands. Also, additional surveys in areas previously visited would be useful to allow collection of more specific information such as site fidelity or to assess habitat change and/or loss over time.

Since only one subspecies of willow flycatcher is federally listed as endangered, it is critical to understand where this flycatcher overwinters and what habitat features are critical to it's continuing survivorship in Latin America. Until now, we have relied on blood sample analysis cross-referenced with survey data to answer this question. The blood analysis is time consuming and therefore distribution results have been slow. Measurements using a colorimeter have the potential to garner results in the field to identify subspecies of willow flycatcher. The colorimeters will be used to collect a range of measurement on *E. t. extimus* and other subspecies in Arizona, Utah, Washington and possibly Oregon during the 2004 breeding season and on willow flycatchers in Latin America during the winter of 2005. Hopefully, we will be able to distinguish a range of identifiable differences between subspecies over the next few field seasons.

In Ecuador, we were able to accomplish our goal of collecting more blood samples. Now have a large enough sample size of banded flycatchers to attempt to resight banded flycatchers to compare with results from other locations. We have noticed that flycatchers in Ecuador are less responsive, may have larger territories, and move greater distances than flycatchers in Mexico and Central America. We suspect that relocating flycatchers between years in Ecuador may be more difficult than in Mexico or Costa Rica and may not be as representative of site fidelity. Recent studies on willow flycatcher in Utah found that radio transmitters are diminutive enough now to be placed on birds as small as willow flycatchers without affecting survivorship (Paxton et al. 2003). Telemetry studies have the potential to address our questions of home range size and movement patterns of willow flycatchers in Ecuador to compare with other sites in Central America and Mexico.

In Mexico, we found similar between year return rates to previous studies in Costa Rica (Koronkiewicz and Sogge 2000), which indicate high site fidelity. We plan to continue to survey countries for a minimum of two consecutive years to continue to collect data on site fidelity for future comparisons between locations. Of concern was the amount of clearing that we encountered in Mexico as 57.1% of the locations we visited showed some sign of vegetation clearing. We will continue to collect information pertaining to circumstance surrounding loss of willow flycatcher habitat that we encounter in Latin America. However, it is important to note that willow flycatcher habitat in southern Mexico, as in neighboring Central America, appeared to be abundant.

Other questions that need to be addressed include overwintering survival rates of willow flycatchers, whether distribution and habitat use vary by sex and/or subspecies. As aforementioned, between season comparisons of habitat use and change as related to water saturation and insect abundance warrants further study. Also, models could be developed combining GIS and remote-sensing technologies with data collected in the field. If developed properly, this could be an important tool for detecting critical habitat for willow flycatchers to focus future studies or that may be threatened by land use changes. Research should be expanded to include new sites for wintering ecology studies in order to compare with the results found by Koronkiewicz (2002) in Costa Rica. These studies should also be designed to identify the characteristics of high quality wintering habitat versus low quality wintering habitat.

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Appendix 1. 2004 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.)____

Coordinates: Start: Lat./Long ________________________ UTM _______________________ Waypt. Name _________

Stop: Lat./Long ________________________ UTM________________________ Waypt. Name _________

Elevation ______ (m) Total 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 Camera # & Photo #	Comments **Include** a description of photos taken, survey route or problems, and if WIFL detection was Visual, Aural, or Both
1 ________ ________ Length of area surveyed: ________	date start stop total hrs ____			Fitz bew Whitt Brrr Breet			
2 ________ ________ Length of area surveyed: ________	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__________ UTM:____

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

Additional Willow Flycatcher Detections: ____
____
____
____
____
____

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 2004. Note that some areas were surveyed by teams and therefore some of the coordinates and/or distances listed are inclusive.

MP : Met Partway (Indicates that surveyor teams met in the middle, start coordinates are with one group and the end coordinates are with another)
SA: Same as Above (Indicates that the survey had a break, however it is still one survey and the distance is a total distance)

Surveyors: MC = Monica Cevallos, EC = Emily Cohen, KE = Kristen Ecton, PH = Phil Heavin, SM = Shannon McNeil, DM = Diego Mosquera, CN = Catherine Nishida, EP = Eben Paxton, DT = Diane Tracy, MW = Mary Whitfield, MY = Misael Yanez

Survey Location	Site	Date	Coordinates		Time of Survey	Survey Hours	Surveyor	Number of Willow Flycatchers	Elevation (m)	Distance (km)
			Start	Stop						
Hacienda Johanna	1	27-Jan	00° 57.865' S 077° 48.748' W	00° 57.515' S 077° 48.638' W	0610-0710	1.0	CN, SM, DT	3	530	0.70
	1	27-Jan	00° 57.515' S 077° 48.638' W	00° 57.389' S 077° 48.660' W	0920-0950	0.5	CN, SM, DT	-	540	SA
	1	27-Jan	00° 57.602' S 077° 48.503' W	00° 57.659' S 077° 48.545' W	0645-0835	1.8	MW, DM	2	520	0.65
	1	28-Jan	00° 57.524' S 077° 48.699' W	00° 57.153' S 077° 48.624' W	0615-0915	3.0	MY, MC	4	-	1.00
Jatun Sacha	1	3-Jan	01° 03.612' S 077° 37.589' W	01° 03.723' S 077° 37.884' W	0638-0738	1.0	KE, EP	0	< 400	1.50
	1	3-Jan	01° 03.723' S 077° 37.884' W	01° 03.480' S 077° 37.551' W	0615-0730	1.3	EC, PH	0	< 400	1.50
	2	3-Jan	01° 03.654' S 077° 38.195' W	01° 03.023' S 077° 38.893' W	0756-1015	2.3	KE, EP	-	< 400	3.00
	2	5-Jan	01° 02.089' S 077° 35.488' W	01° 01.903' S 077° 35.280' W	0635-0750	1.3	EC, PH	0	380	0.53
	3	3-Jan	01° 02.719' S 077° 39.187' W	01° 02.697' S 077° 39.348' W	0802-1030	2.5	EC, PH	0	< 400	1.50
	4	5-Jan	01° 02.548' S 077° 36.141' W	01° 02.842' S 077° 36.345' W	0815-1000	1.8	KE, EP	0	< 400	1.50

Appendix 2 (cont.).

Survey Location	Site	Date	Coordinates		Time of Survey	Survey Hours	Surveyor	Number of Willow Flycatchers	Elevation (m)	Distance (km)
			Start	Stop						
Jatun Sacha	5	5-Jan	01˚ 02.393' S 077˚ 35.952' W	01˚ 02.285' S 077˚ 35.841' W	0630-0730	1.0	KE, EP	0	< 400	0.75
	6	5-Jan	01˚ 03.161' S 077˚ 36.752' W	01˚ 03.367' S 077˚ 37.057' W	0833-1110	2.6	EC, PH, KE, EP	7	< 400	0.70
	6	27-Jan	01˚ 03.403' S 077˚ 37.183' W	01˚ 03.356' S 077˚ 37.342' W	0820-0850	0.5	EC, PH, MY, MC	1	384	0.35
Jaguar	1	24-Jan	00˚ 58.383' S 077˚ 27.851' W	00˚ 58.182' S 077˚ 27.723' W	1652-1807	1.3	CN, DT, SM	0	335	0.44
	1	24-Jan	00˚ 58.322' S 077˚ 27.784' W	00˚ 57.993' S 077˚ 27.686' W	1700-1800	1.0	MW, DM	0	335	0.20
	2	25-Jan	00˚ 58.670' S 077˚ 28.439' W	00˚ 59.110' S 077˚ 28.572' W	0820-0943	1.4	MW, DM	2	345	0.90
	2	25-Jan	00˚ 58.677' S 077˚ 28.463' W	00˚ 59.110' S 077˚ 28.572' W	0825-0950	1.4	CN, DT, SM	1	330	0.60
	2	26-Jan	00˚ 59.068' S 077˚ 28.531' W	00˚ 59.083' S 077˚ 28.620' W	0818-0853	0.6	CN, DT, SM	1	340	0.17
Mondaña	1	6-Jan	00˚ 50.970' S 077˚ 13.298' W	00˚ 50.965' S 077˚ 13.487' W	0630-0745	1.3	EC, PH	0	295	0.58
	2	6-Jan	00˚ 50.977' S 077˚ 13.728' W	00˚ 50.963' S 077˚ 13.832' W	0640-0656	0.3	EP, KE	0	< 300	0.05
	3	6-Jan	00˚ 51.032' S 077˚ 14.030' W	00˚ 51.130' S 077˚ 14.207' W	0715-1105	3.8	EP, KE	3	< 300	2.50
	3	7-Jan	00˚ 51.130' S 077˚ 14.207' W	00˚ 51.032' S 077˚ 14.030' W	1500-1510	0.2	EC, PH, EP, KE	1	-	SA
	4	6-Jan	00˚ 51.401' S 077˚ 14.744' W	00˚ 51.389' S 077˚ 14.790' W	0830-1100	2.5	EC, PH	3	300	0.90
	4	8-Jan	00˚ 51.389' S 077˚ 14.790' W	00˚ 51.401' S 077˚ 14.744' W	1400-1530	1.5	EC, PH, EP, KE	1	-	SA
	5	9-Jan	00˚ 52.208' S 077˚ 15.425' W	00˚ 52.295' S 077˚ 15.579' W	0640-0740	1.0	EC, PH	1	300	0.45
Coca	1	10-Jan	00˚ 28.552' S 076˚ 56.375' W	00˚ 28.471' S 076˚ 56.467' W	1630-1715	0.8	PH, SM, MC	0	-	0.40
	1	11-Jan	00˚ 28.508' S 076˚ 57.432' W	00˚ 28.576' S 076˚ 57.050' W	0645-0700	0.3	PH, SM, MC	5	255	0.40
	1	11-Jan	00˚ 28.576' S 076˚ 57.050' W	00˚ 28.508' S 076˚ 57.432' W	0645-0945	3.0	EC, MC	6	< 300	0.70

Appendix 2. Continued

Survey Location	Site	Date	Coordinates Start	Stop	Time of Survey	Survey Hours	Surveyor	Number of Willow Flycatchers	Elevation (m)	Distance (km)
Sacha	1	10-Jan	00˚ 29.210' S 076˚ 28.700' W	00˚ 29.234' S 076˚ 28.633' W	1645-1730	0.8	MW, CN, DM, DT	1	230	0.10
	1	11-Jan	00˚ 29.234' S 076˚ 28.633' W	00˚ 29.422' S 076˚ 28.504' W	0642-0900	2.3	CN, DM	1	230	0.55
	2	11-Jan	00˚ 29.815' S 076˚ 24.736' W	00˚ 29.815' S 076˚ 24.736' W	0945-1045	1.0	MW, CN, DM, DT	0	225	0.25
	3	12-Jan	00˚ 28.864' S 076˚ 28.686' W	00˚ 28.852' S 076˚ 28.701' W	0906-0938	0.5	CN, DM	0	230	0.06
	4	12-Jan	00˚ 28.672' S 076˚ 28.488' W	00˚ 28.672' S 076˚ 28.488' W	0630-1006	3.6	MW, DT	0	230	0.65
La Selva	1	14-Jan	00˚ 31.026' S 076˚ 22.315' W	00˚ 31.016' S 076˚ 22.387' W	0630-0740	1.2	MW, CN, DM	1	230	0.15
	1	14-Jan	00˚ 30.829' S 076˚ 22.295' W	00˚ 30.791' S 076˚ 22.284' W	0630-0955	3.4	MY, MC	5	-	0.45
	2	15-Jan	00˚ 28.872' S 076˚ 20.249' W	MP	0645-0730	0.8	EC, PH	0	233	0.70
	2	15-Jan	MP	00˚ 28.697' S 076˚ 20.065' W	0643-0723	0.7	SM, DT	0	-	SA
	3	15-Jan	00˚ 29.224' S 076˚ 18.945' W	MP	0805-0836	0.5	EC, PH	3	226	0.60
	3	15-Jan	MP	MP	0945-1025	0.7	EC, PH	-		SA
	3	15-Jan	MP	MP	0745-0837	0.9	SM, DT	1	228	0.85
	3	15-Jan	MP	00˚ 28.990' S 076˚ 18.162' W	0857-1012	1.3	SM, DT	-	-	SA
Sani	1	11-Jan	00˚ 26.668' S 076˚ 12.116' W	00˚ 26.668' S 076˚ 12.116' W	0650-0715	0.4	EC, PH	0	215	0.10
	2	12-Jan	00˚ 27.050' S 076˚ 40.728' W	00˚ 27.041' S 076˚ 14.925' W	0751-0950	2.0	SM, MY	1	-	0.36
	3	12-Jan	00˚ 26.955' S 076˚ 16.368' W	00˚ 27.164' S 076˚ 16.368' W	0815-1030	2.3	EC, PH	5	218	0.70
	3	13-Jan	00˚ 27.193' S 076˚ 16.464' W	00˚ 27.279' S 076˚ 16.544' W	0636-0704	0.5	CN, SM	4	220	0.20
	3	13-Jan	00˚ 27.174' S 076˚ 16.513' W	00˚ 27.250' S 076˚ 16.596' W	0635-0725	0.8	MW, MY, MC	0	-	1.00

Appendix 2. Continued

Survey Location	Site	Date	Coordinates		Time of Survey	Survey Hours	Surveyor	Number of Willow Flycatchers	Elevation (m)	Distance (km)
			Start	Stop						
Tiputini	1	21-Jan	00˚ 38.251' S 076˚ 08.993' W	MP	0554-0811	2.3	CN, DM	0	210	0.80
	1	21-Jan	MP	MP	0600-0818	2.3	MY, MC	0	210	0.80
	1	21-Jan	MP	00˚ 38.111' S 076˚ 09.859' W	0600-0811	2.2	EC, PH	0	210	0.60
	2	21-Jan	00˚ 38.111' S 076˚ 09.859' W	00˚ 38.111' S 076˚ 09.859' W	0608-0800	1.9	MW, SM, DT	0	-	0.20
Yuturi	1	16-Jan	00˚ 33.387' S 075˚ 59.888' W	00˚ 33.435' S 075˚ 59.722' W	0640-0710	0.5	EC, DT, MC, MY	0	212	0.50
	2	16-Jan	00˚ 33.528' S 075˚ 57.984' W	00˚ 33.535' S 075˚ 58.166' W	0810-1000	1.8	EC, MC, MY	1	210	0.60
	2	16-Jan	00˚ 33.630' S 075˚ 57.854' W	00˚ 33.560' S 075˚ 57.805' W	0656-0915	2.3	CN, DM	6	210	0.55
	2	17-Jan	00˚ 33.560' S 075˚ 57.805' W	00˚ 33.593' S 075˚ 57.852' W	0545-0700	1.3	CN, SM	-	210	0.15
Nuevo Rocafuerte	1	18-Jan	00˚ 54.515' S 075˚ 24.169' W	00˚ 54.518' S 075˚ 24.080' W	1640-1745	1.1	MW, EC, MC	0	190	0.25
	1	18-Jan	00˚ 54.409' S 075˚ 24.183' W	00˚ 54.331' S 075˚ 24.272' W	1644-1735	0.9	SM, DT	0	195	0.22
	1	18-Jan	00˚ 54.383' S 075˚ 24.131' W	00˚ 54.304' S 075˚ 24.425' W	1652-1747	0.9	CN, DM	0	190	0.30

Appendix 3. Willow flycatcher survey details for Mexico in 2004. Since one of our objectives was to resight banded birds, survey hours below were combined survey and resighting hours (an additional 4.68 hours of pure resighting was not included in this table as the both the location and number of flycatchers were exactly the same as the listed survey).

Surveyors: AA = Ariadne Angulo, OF = Oscar Fernando, GM = Gabe Martinez, CN = Catherine Nishida, KP = Kristen Pearson, TP = Talima 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						
Barra Vieja Guerrero	1	6-Mar-04	16˚43.388' N 099˚35.972' W	16˚43.374' N 099˚35.962' W	0710-0740	0.5	CN, GM	4	15	0.20
	1	7-Mar-04	16˚43.309' N 099˚36.014' W	16˚43.471' N 099˚35.820' W	0630-0700	0.5	KP, OF	8	52	0.50
Marquelia Guerrero	1	4-Mar-04	16˚35.018' N 098˚49.552' W	16˚34.946' N 098˚49.565' W	0630-0700	0.5	KP, OF	2	11	0.10
	1	4-Mar-04	16˚35.012' N 098˚49.530' W	16˚34.999' N 098˚49.516' W	0630-0710	0.7	CN, GM	2	10	0.10
	1	5-Mar-04	16˚34.946' N 098˚49.565' W	16˚35.018' N 098˚49.552' W	0900-1030	1.5	KP, OF	6	10	0.50
Cuajinicuilapa Guerrero	1	20-Feb-04	16˚30.186' N 098˚24.325' W	16˚30.217' N 098˚24.308' W	0642-0740	1.0	CN, GM	6	40	0.35
	1	20-Feb-04	16˚30.091' N 098˚24.477' W	16˚30.001' N 098˚24.464' W	0635-0735	1.0	MW, AA	9	36	0.40
	1	21-Feb-04	16˚29.992' N 098˚24.549' W	16˚30.043' N 098˚24.680' W	0640-0754	1.2	CN, GM	6	40	0.40
Bajos de Chila Oaxaca	1	3-Mar-04	15˚54.990' N 097˚07.068' W	15˚55.039' N 097˚07.095' W	0620-0700	0.7	CN, GM	3	20	0.10
	2	3-Mar-04	15˚54.844' N 097˚07.069' W	15˚54.799' N 097˚07.159' W	0630-0930	3.0	KP, OF	9	18	0.90

Appendix 3. Continued

			Coordinates							
Survey Location	Site	Date	Start	Stop	Time of Survey	Survey Hours	Surveyor	Number of Willow Flycatchers	Elevation (m)	Distance (km)
Rio Copalita	1	22-Feb-04	15˚47.562' N 096˚02.967' W	15˚47.420' N 096˚03.024' W	0635-0810	1.6	MW, AA	4	10	0.60
	1	23-Feb-04	15˚47.420' N 096˚03.024' W	15˚47.562' N 096˚02.967' W	0625-0725	1.0	MW, AA	5	10	-
	1	22-Feb-04	15˚47.625' N 096˚02.932' W	15˚47.572' N 096˚02.931' W	0640-0725	0.8	CN, GM	5	4	0.30
	1	23-Feb-04	15˚47.585' N 096˚02.925' W	15˚47.592' N 096˚02.848' W	0620-0720	1.0	CN, GM	3	11	0.15
Boca del Cielo Chiapas	2	25-Feb-04	15˚53.369' N 093˚42.626' W	15˚53.521' N 093˚42.552' W	0650-0930	2.7	CN, GM	11	0	0.57
	2	25-Feb-04	15˚55.851' N 093˚48.018' W	15˚53.369' N 093˚42.626' W	0713-1020	3.1	KP, TP	11	1	0.50
	2	25-Feb-04	15˚53.402' N 093˚42.547' W	15˚53.493' N 093˚42.438' W	0645-0715	0.5	MW, AA	7	12	0.20
	1	26-Feb-04	15˚53.358' N 093˚42.663' W	15˚53.310' N 093˚42.704' W	0930-1000	0.5	MW, AA	2	6	0.10
Laguna Pampa Chiapas	1	26-Feb-04	14˚43.631' N 092˚25.355' W	14˚43.609' N 092˚25.387' W	1645-1800	1.3	KP, TP	3	7	0.15
	1	26-Feb-04	14˚43.504' N 092˚25.250' W	14˚43.570' N 092˚25.290' W	1730-1815	0.8	MW, AA	5	7	0.25
	1	26-Feb-04	14˚43.358' N 092˚25.194' W	14˚43.356' N 092˚25.173' W	1730-1815	0.8	CN, GM	3	10	0.10
	1	28-Feb-04	14˚43.503' N 092˚25.250' W	14˚43.510' N 092˚25.236' W	0825-0933	1.1	KP, TP	3	-	0.15
	1	28-Feb-04	14˚43.478' N 092˚25.279' W	14˚43.504' N 092˚25.250' W	0600-0630	0.5	CN, GM	3	12	0.10

Appendix 4. Bird species list compiled during Willow and Alder Flycatcher survey efforts in Ecuador, January and February 2004. For a more complete list of the birds that occur in these areas, see Ridgely and Greenfield 2001.

Location Codes

1	Hacienda Johanna, Napo	7	La Selva, Orellana
2	Jatun Sacha, Napo	8	Sani, Orellana
3	Jaguar, Napo	9	Tiputini, Orellana
4	Mondaña, Orellana	10	Yuturi, Orellana
5	Coca, Orellana	11	Nuevo Rockafuerte, Orellana
6	Sacha, Orellana		

Common Name	**Latin Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Little Tinamou	*Crypturellus soui*	X	X									
Undulated Tinamou	*Crypturellus undulatus*									X		
Speckled Chachalaca	*Ortalis guttata*					X						
Common Piping-Guan	*Pipile pipile*									X		
Muscovy Duck	*Cairina moschata*								X			
Lafresnaye's Piculet	*Picumnus lafresnayi*	X										
Yellow-tufted Woodpecker	*Melanerpes cruentatus*	X							X			
Spot-breasted Woodpecker	*Colaptes punctigula*	X					X					
Scarlet-crowned Barbet	*Capito aurovirens*				X							
Gilded Barbet	*Capito auratus*	X		X								
Ivory-billed Araçari	*Pteroglossus azara*	X										
Chestnut-eared Araçari	*Pteroglossus castanotis*		X									
White-throated Toucan	*Ramphastos tucanus*									X		
Black-fronted Nunbird	*Monasa nigrifrons*					X		X				
Yellow-billed Nunbird	*Monasa flavirostris*									X		
Swallow-winged Puffbird	*Chelidoptera tenebrosa*						X	X				
White-tailed Trogon	*Trogon viridis*			X								

Appendix 4. Continued

Common Name	**Latin Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Collared Trogon	*Trogon collaris*									X		
Rufous Motmot	*Baryphthengus martii*	X	X	X						X		
Ringed Kingfisher	*Megaceryle torquata*		X	X	X		X		X			
Amazon Kingfisher	*Chloroceryle amazona*		X		X			X				
Green Kingfisher	*Chloroceryle americana*		X					X		X		
Little Cuckoo	*Piaya minuta*										X	
Hoatzin	*Opisthocomus hoazin*									X		
Greater Ani	*Crotophaga major*	X					X	X	X	X		X
Smooth-billed Ani	*Crotophaga ani*	X	X		X	X	X	X	X			X
Blue-and-yellow Macaw	*Ara ararauna*							X				
Chestnut-fronted Macaw	*Ara severa*				X	X		X				
Dusky-headed Parakeet	*Aratinga weddellii*		X									
White-eyed Parakeet	*A. leucophthalmus*		X									
Blue-winged Parrotlet	*Forpus xanthopterygius*	X					X					
Cobalt-winged Parakeet	*Brotogeris cyanoptera*	X										
Yellow-crowned Amazon	*Amazona ochrocephala*				X							
Orange-winged Amazon	*Amazona amazonica*						X		X			
Mealy Amazon	*Amazona farinosa*							X		X		
White-collared Swift	*Streptoprocne zonaris*	X	X		X							
Short-tailed Swift	*Chaetura brachyura*		X									
Neotropical Palm-Swift	*Tachornis squamata*					X	X	X	X		X	X
Great-billed Hermit	*Phaethornis malaris*	X										
White-bearded Hermit	*Phaethornis hispidus*							X				
Olive-spotted Hummingbird	*Leucippus chlorocercus*										X	
Tawny-bellied Screech-Owl	*Otus watsonii*									X		
Common Potoo	*Nyctibius jamaicensis*									X		
Sand-colored Nighthawk	*Chordeiles rupestris*					X		X				

Appendix 4. Continued

Common Name	**Latin Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Pauraque	*Nyctidromus albicollis*		X			X						
Blackish Nightjar	*Caprimulgus nigrescens*		X		X							
Ladder-tailed Nightjar	*Hydropsalis climacocerca*		X		X			X				
Pale-vented Pigeon	*Columba cayennensis*		X			X	X	X			X	X
Plumbeous Pigeon	*Columba plumbea*		X									
Ruddy Pigeon	*Columba subvinacea*			X				X	X	X		X
Ruddy Ground-Dove	*Columbina talpacoti*	X	X		X	X		X				
Blue Ground-Dove	*Claravis pretiosa*				X							
Blackish Rail	*Pardirallus nigricans*	X										
Greater Yellowlegs	*Tringa melanoleuca*			X	X			X	X		X	X
Lesser Yellowlegs	*Tringa flavipes*		X		X	X						
Spotted Sandpiper	*Tringa macularia*		X	X	X	X	X	X			X	X
Least Sandpiper	*Calidris minutilla*							X				
Wilson's Plover	*Charadrius wilsonia*			X								
Collared Plover	*Charadrius collaris*							X	X			
Pied Lapwing	*Vanellus cayanus*		X		X		X		X			
Yellow-billed Tern	*Sterna superciliaris*			X			X		X			
Osprey	*Pandion haliaetus*			X		X		X	X			
Hook-billed Kite	*Chondrohierax uncinatus*							X				
Swallow-tailed Kite	*Elanoides forficatus*	X	X		X						X	
Roadside Hawk	*Buteo magnirostris*	X	X	X				X			X	X
Black Hawk-Eagle	*Spizaetus tyrannus*							X				
Black Caracara	*Daptrius ater*	X	X	X	X	X	X	X	X		X	
Yellow-headed Caracara	*Milvago chimachima*	X	X			X	X		X		X	
Peregrine Falcon	*Falco peregrinus*					X					X	
Little Blue Heron	*Egretta caerulea*										X	
Snowy Egret	*Egretta thula*		X			X	X		X			

Appendix 4. Continued

Common Name	Latin Name	1	2	3	4	5	6	7	8	9	10	11
Cocoi Heron	*Ardea cocoi*						X	X	X		X	
Great Egret	*Ardea alba*	X	X			X	X		X		X	X
Cattle Egret	*Bubulcus ibis*	X	X	X			X	X				X
Striated Heron	*Butorides striatus*		X	X	X	X	X	X	X	X	X	X
Green Heron	*Butorides virescens*				X							
Roseate Spoonbill	*Platalea ajaja*								X			
Black Vulture	*Coragyps atratus*	X			X	X	X	X	X			X
Turkey Vulture	*Cathartes aura*	X	X	X		X		X	X			X
Spotted Tody-Flycatcher	*Todirostrum maculatum*							X				
Common Tody-Flycatcher	*Todirostrum cinereum*	X										
Mottle-backed Elaenia	*Elaenia gigas*	X	X	X	X		X	X	X		X	
Lesser Wagtail-Tyrant	*Stigmatura napensis*										X	
Fuscous Flycatcher	*Cnemotriccus fuscatus*						X	X			X	
Alder Flycatcher	*Empidonax alnorum*		X		X	X		X	X		X	
Willow Flycatcher	*Empidonax traillii*	X	X	X	X	X	X	X	X		X	
Drab Water-Tyrant	*Ochthornis littoralis*		X									
Pied Water-Tyrant	*Fluvicola pica*				X							
Long-tailed Tyrant	*Colonia colonus*		X									
Eastern Sirystes	*Sirystes sibilator*						X					
Dusky-capped Flycatcher	*Myiarchus tuberculifer*										X	
Tropical Kingbird	*Tyrannus melancholicus*	X		X	X	X	X	X		X		X
Eastern Kingbird	*Tyrannus tyrannus*					X	X					
Social Flycatcher	*Myiozetetes similis*	X	X	X			X	X	X	X		
Piratic Flycatcher	*Legatus leucophaius*						X					
Lesser Kiskadee	*Philohydor lictor*	X		X	X							
Great Kiskadee	*Pitangus sulphuratus*	X		X	X	X	X	X	X	X	X	X
Black-tailed Tityra	*Tityra cayana*						X			X		

Appendix 4. Continued

Common Name	Latin Name	1	2	3	4	5	6	7	8	9	10	11
Black-crowned Tityra	*Tityra inquisitor*		X									
Blue-crowned Manakin	*Pipra coronata*									X		
Dwarf Tyrant-Manakin	*Tyranneutes stolzmanni*									X		
Barred Antshrike	*Thamnophilus doliatus*					X					X	
Warbling Antbird	*Hypocnemis cantator*	X										
Bay Hornero	*Furnarius torridus*											X
Dark-breasted Spinetail	*Synallaxis albigularis*				X							
White-bellied Spinetail	*Synallaxis propinqua*						X	X	X		X	
Plain-crowned Spinetail	*Synallaxis gujanensis*								X		X	
Orange-fronted Plushcrown	*Metopothrix aurantiacus*	X										
Crested Foliage-gleaner	*Automolus dorsalis*					X						
Cinnamon-thr. Woodcreeper	*Dendrexetastes rufigula*		X		X							
Ocellated Woodcreeper	*Xiphorhynchus ocellatus*	X										
Red-eyed Vireo	*Vireo olivaceus*	X										
Violaceous Jay	*Cyanocorax violaceus*		X				X	X		X		
Black-billed Thrush	*Turdus ignobilis*	X	X	X	X			X	X	X		X
Black-capped Donacobius	*Donacobius atricapillus*	X	X					X				
Thrush-like Wren	*Campylorhynchus turdinus*									X		
House Wren	*Troglodytes aedon*	X	X									
White-winged Swallow	*Tachycineta albiventer*		X	X	X	X	X	X	X		X	
Brown-chested Martin	*Phaeoprogne tapera*	X										
Grey-breasted Martin	*Progne chalybea*	X										
Blue-and-white Swallow	*Pygochelidon cyanoleuca*	X										
White-banded Swallow	*Atticora fasciata*	X	X							X	X	X
So. Rough-winged Swallow	*Stelgidopteryx ruficollis*		X			X	X		X			
Barn Swallow	*Hirundo rustica*										X	
Olivaceous Siskin	*Carduelis olivacea*	X										

Appendix 4. Continued

Common Name	**Latin Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Yellow-browed Sparrow	*Ammodramus aurifrons*	X	X			X		X	X		X	
Red-capped Cardinal	*Paroaria gularis*			X			X	X		X		
Tennessee Warbler	*Vermivora peregrina*	X										
Blackpoll Warbler	*Dendroica striata*	X										
Bananaquit	*Coereba flaveola*	X										
Magpie Tanager	*Cissopis leveriana*	X	X		X	X	X	X				
Orange-headed Tanager	*Thlypopsis sordida*		X						X		X	
White-shouldered Tanager	*Tachyphonus luctuosus*	X										
Red-crowned Ant-Tanager	*Habia rubica*	X										
Summer Tanager	*Piranga rubra*	X	X									
Scarlet Tanager	*Piranga olivacea*	X										
Masked Crimson Tanager	*Ramphocelus nigrogularis*			X					X	X		
Silver-beaked Tanager	*Ramphocelus carbo*	X	X	X	X	X	X	X	X		X	
Blue-grey Tanager	*Thraupis episcopus*	X	X	X	X			X		X	X	X
Palm Tanager	*Thraupis palmarum*	X	X		X							
Thick-billed Euphonia	*Euphonia laniirostris*	X										
Orange-bellied Euphonia	*Euphonia xanthogaster*	X										
Blue-necked Tanager	*Tangara cyanicollis*	X										
Black-faced Dacnis	*Dacnis lineata*									X		
Yellow-bellied Dacnis	*Dacnis flaviventer*	X										
Swallow Tanager	*Tersina viridis*	X										
Blue-black Grassquit	*Volatinia jacarina*	X	X			X						
Variable Seedeater	*Sporophila corvina*		X				X					
Caquetá Seedeater	*Sporophila murallae*			X	X							
Lesson's Seedeater	*Sporophila bouvronides*	X	X			X						
Black-and-white Seedeater	*Sporophila luctuosa*	X	X					X				
Chestnut-bellied Seedeater	*S. castaneiventris*	X	X	X	X	X	X	X			X	X

Appendix 4. Continued

Common Name	**Latin Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Large-billed Seed-Finch	*Oryzoborus crassirostris*	X									X	
Lesser Seed-Finch	*Oryzoborus angolensis*	X	X									
Yellow-faced Grassquit	*Tiaris olivacea*				X							
Buff-throated Saltator	*Saltator maximus*			X								
Greyish Saltator	*Saltator coerulescens*	X	X	X		X	X	X	X		X	X
Blue-black Grosbeak	*Cyanocompsa cyanoides*								X			
Russet-backed Oropendola	*Psarocolius angustifrons*	X						X		X	X	X
Yellow-rumped Cacique	*Cacicus cela*	X	X	X	X	X	X	X		X		X
Oriole Blackbird	*Gymnomystax mexicanus*	X		X	X	X	X	X	X		X	X
Red-breasted Blackbird	*Leistes militaris*	X										
Shiny Cowbird	*Molothrus bonariensis*					X		X				
Giant Cowbird	*Scaphidura oryzivora*		X					X				

Appendix 5. Bird species list compiled during Willow Flycatcher survey efforts in southern Mexico, February and March 2004 (Note: since all sites were visited in 2003 and 2004, this is a compilation of both years). For a more complete list of bird species that winter in these areas, see Howell 1999.

Location Codes

1	Barra Vieja, Guerrero	5	Río Copalita, Oaxaca
2	Marquelia, Guerrero	6	Boca del Cielo, Chiapas
3	Cuajinicuilapa, Guerrero	7	Laguna Pampa, Chiapas
4	Bajos de Chila, Oaxaca		

Common Name	**Latin Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
White-bellied Chachalaca	*Ortalis leucogastra*						X	X
Muscovy Duck	*Cairina moschata*			X				
Golden-cheeked Woodpecker	*Melanerpes chrysogenys*	X	X	X		X		
Golden-fronted Woodpecker	*Melanerpes aurifrons*						X	X
Lineated Woodpecker	*Dryocopus lineatus*	X	X	X		X	X	
Pale-billed Woodpecker	*Campephilus guatemalensis*	X						
Citreoline Trogon	*Trogon citreolus*	X	X	X		X		
Russet-crowned Motmot	*Momotus mexicanus*	X		X	X	X	X	
Belted Kingfisher	*Megaceryle alcyon*			X				
Ringed Kingfisher	*Megaceryle torquata*			X		X		
Amazon Kingfisher	*Chloroceryle amazona*			X				
Green Kingfisher	*Chloroceryle americana*			X	X	X		
Squirrel Cuckoo	*Piaya cayana*					X		
Groove-billed Ani	*Crotophaga sulcirostris*	X	X	X	X	X	X	X
Lesser Ground-Cuckoo	*Morococcyx erythropygus*							X
Orange-fronted Parakeet	*Aratinga canicularis*	X				X		
Orange-chinned Parakeet	*Brotogeris jugularis*							X
White-fronted Parrot	*Amazona albifrons*					X	X	

Appendix 5. Continued

Common Name	**Latin Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Yellow-naped Parrot	*Amazona auropalliata*						X	
Salvin's Emerald	*Chlorostilbon salvini*							X
Doubleday's Hummingbird	*Cynanthus doubledayi*	X			X	X		
Cinnamon Hummingbird	*Amazilia rutila*	X	X	X	X	X	X	X
Plain-capped Starthroat	*Heliomaster constantii*					X		
Ruby-throated Hummingbird	*Archilochus colubris*			X		X		
Ferruginous Pygmy-Owl	*Glaucidium brasilianum*	X	X	X	X	X	X	X
Striped Owl	*Asio clamator*							X
Lesser Nighthawk	*Chordeiles acutipennis*						X	
Pauraque	*Nyctidromus albicollis*					X		X
Rock Dove	*Columba livia*				X			
Red-billed Pigeon	*Columba flavirostris*		X	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	X
White-tipped Dove	*Leptotila verreauxi*	X				X		X
Limpkin	*Aramus guarauna*					X		
Purple Gallinule	*Porphyrio martinicus*		X	X				
Whimbrel	*Numenius phaeopus*							X
Greater Yellowlegs	*Tringa melanoleuca*				X			
Spotted Sandpiper	*Tringa macularia*			X	X	X	X	
Least Sandpiper	*Calidris minutilla*			X				
Northern Jacana	*Jacana spinosa*		X	X		X		
Black-necked Stilt	*Himantopus mexicanus*			X				
Collared Plover	*Charadrius collaris*			X				
Laughing Gull	*Larus atricilla*					X		
Caspian Tern	*Sterna caspia*		X	X		X		

Appendix 5. Continued

Common Name	Latin Name	1	2	3	4	5	6	7
Osprey	*Pandion haliaetus*			X		X	X	
White-tailed Kite	*Elanus leucurus*						X	X
Crane Hawk	*Geranospiza caerulescens*					X	X	
Grey Hawk	*Asturina plagiata*	X	X			X	X	
Roadside Hawk	*Buteo magnirostris*		X	X	X	X	X	X
Short-tailed Hawk	*Buteo brachyurus*		X	X			X	
Zone-tailed Hawk	*Buteo albonotatus*	X						
Crested Caracara	*Polyborus plancus*			X		X	X	X
American Kestrel	*Falco sparverius*					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	X	X
Tricolored Heron	*Egretta tricolor*			X	X	X		
Little Blue Heron	*Egretta caerulea*			X		X	X	
Snowy Egret	*Egretta thula*			X	X	X	X	X
Great Blue Heron	*Ardea herodias*		X	X		X	X	X
Great Egret	*Ardea albus*		X	X	X	X	X	X
Cattle Egret	*Bubulcus ibis*		X	X	X		X	X
Green Heron	*Butorides virescens*		X	X	X	X		
Yellow-crowned Night-Heron	*Nyctanassa violacea*					X		
Black-crowned Night-Heron	*Nycticorax nycticorax*			X				
Bare-throated Tiger-Heron	*Tigrisoma mexicanum*		X				X	
White Ibis	*Eudocimus albus*		X	X	X	X		X
White-faced Ibis	*Plegadis chihi*		X					
Roseate Spoonbill	*Platalea ajaja*							X

Appendix 5. Continued

Common Name	Latin Name	1	2	3	4	5	6	7
American White Pelican	*Pelecanus erythrorhynchos*				X			X
Brown Pelican	*Pelecanus occidentalis*					X	X	
Black Vulture	*Coragyps atratus*	X	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	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
Least Flycatcher	*Empidonax minimus*			X				
Grey Flycatcher	*Empidonax wrightii*			X				
Pacific-slope Flycatcher	*Empidonax difficilis*	X		X	X	X		
Vermilion Flycatcher	*Pyrocephalus rubinus*		X	X	X	X		
Dusky-capped Flycatcher	*Myiarchus tuberculifer*				X		X	X
Ash-throated Flycatcher	*Myiarchus cinerascens*					X		X
Nutting's Flycatcher	*Myiarchus nuttingi*	X	X					X
Brown-crested Flycatcher	*Myiarchus tyrannulus*			X		X	X	X
Tropical Kingbird	*Tyrannus melancholicus*	X	X	X	X	X	X	X
Thick-billed Kingbird	*Tyrannus crassirostris*			X		X		
Western Kingbird	*Tyrannus verticalis*			X				X
Scissor-tailed Flycatcher	*Tyrannus forficatus*					X	X	X
Boat-billed Flycatcher	*Megarynchus pitangua*			X			X	
Social Flycatcher	*Myiozetetes similis*	X	X	X	X		X	X
Great Kiskadee	*Pitangus sulphuratus*	X	X	X	X	X	X	X
Rose-throated Becard	*Pachyramphus aglaiae*	X		X	X	X	X	X
Bell's Vireo	*Vireo bellii*	X		X		X	X	X
Cassin's Vireo	*Vireo cassinii*	X				X		

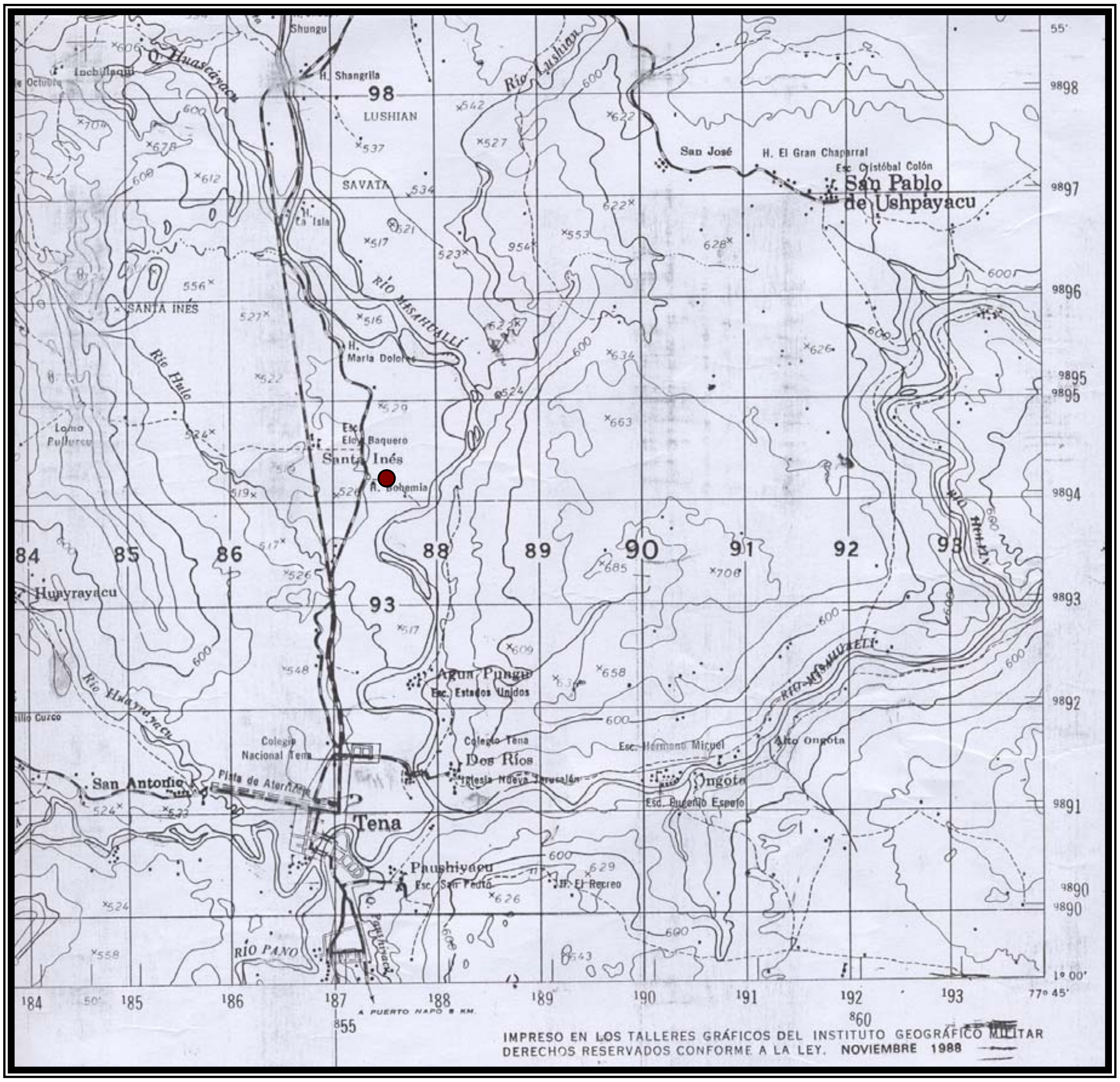
Appendix 5. Continued

Common Name	Latin Name	1	2	3	4	5	6	7
Western Warbling-Vireo	*Vireo swainsonii*	X	X	X	X		X	X
White-throated Magpie-Jay	*Calocitta formosa*	X	X	X	X	X	X	X
Clay-colored Thrush	*Turdus grayi*						X	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		
Plain Wren	*Thryothorus modestus*							X
Blue-grey Gnatcatcher	*Polioptila caerulea*	X		X	X	X	X	X
Mangrove Swallow	*Tachycineta albilinea*						X	
Grey-breasted Martin	*Progne chalybea*					X	X	
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*		X	X		X		X
Bank Swallow	*Riparia riparia*			X				
House Sparrow	*Passer domesticus*				X			
Stripe-headed Sparrow	*Aimophila ruficauda*	X					X	
Nashville Warbler	*Vermivora ruficapilla*	X		X		X		
Northern Parula	*Parula americana*						X	
Yellow Warbler	*Dendroica petechia*	X	X	X	X	X	X	X
Magnolia Warbler	*Dendroica magnolia*						X	X
Yellow-rumped Warbler	*Dendroica coronata*					X		
Black-throated Grey Warbler	*Dendroica nigrescens*	X						
Black-and-white Warbler	*Mniotilta varia*				X	X	X	X
American Redstart	*Setophaga ruticilla*						X	X
Ovenbird	*Seiurus aurocapillus*							X
Northern Waterthrush	*Seiurus noveboracensis*							X
MacGillivray's Warbler	*Oporornis tolmiei*	X	X	X				
Common Yellowthroat	*Geothlypis trichas*		X	X		X	X	X

Appendix 5. Continued

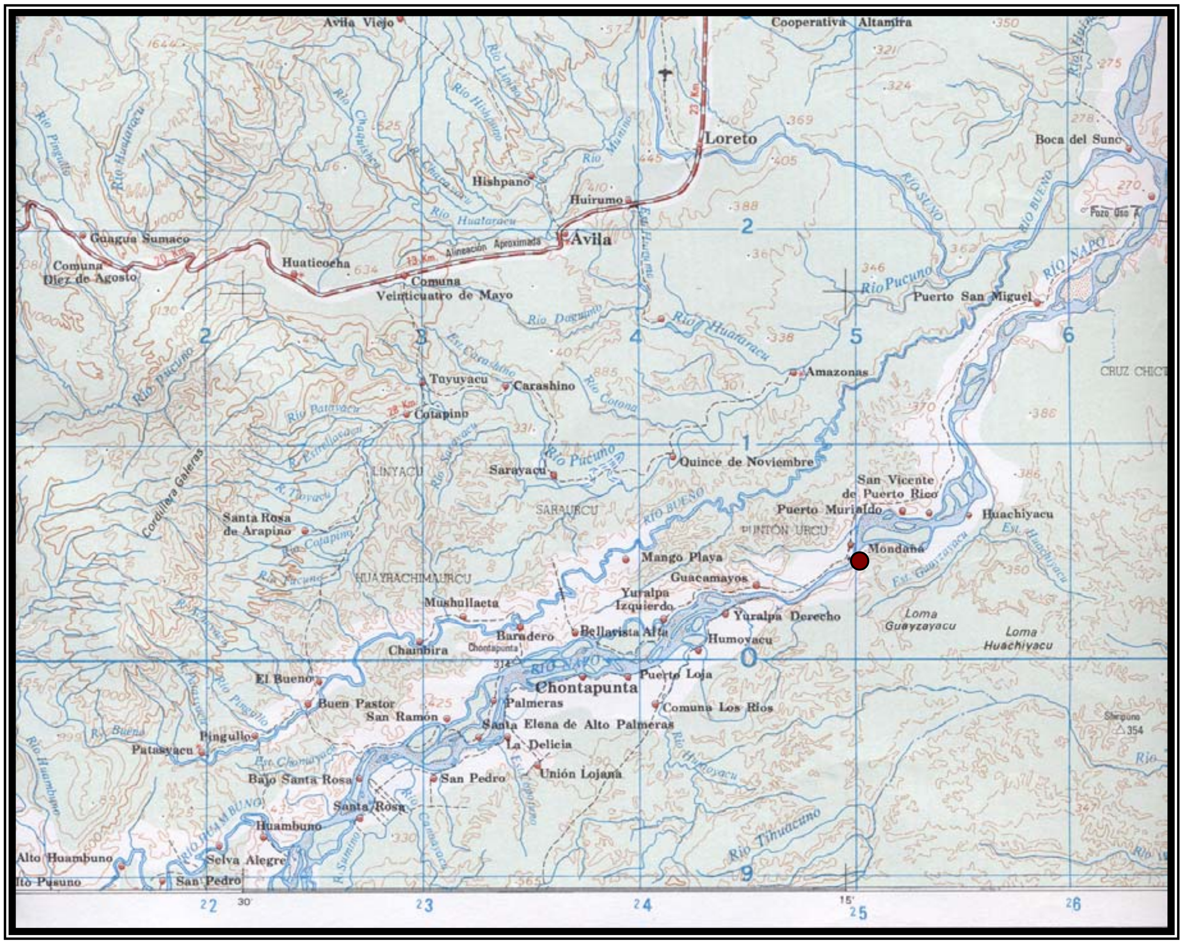
Common Name	**Latin Name**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Grey-crowned Yellowthroat	*Geothlypis poliocephala*						X	
Yellow-breasted Chat	*Icteria virens*	X	X	X	X		X	X
Summer Tanager	*Piranga rubra*			X			X	
Western Tanager	*Piranga ludoviciana*					X		
Scrub Euphonia	*Euphonia affinis*						X	X
Blue-black Grassquit	*Volatinia jacarina*		X	X	X		X	
White-collared Seedeater	*Sporophila torqueola*		X	X			X	
Ruddy-breasted Seedeater	*Sporophila minuta*		X	X		X	X	
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	X						
Black-headed Grosbeak	*Pheucticus melanocephalus*			X				
Northern Cardinal	*Cardinalis cardinalis*	X						
Greyish Saltator	*Saltator coerulescens*	X						
Blue Bunting	*Cyanocompsa parellina*	X						
Blue Grosbeak	*Guiraca caerulea*	X			X	X	X	
Indigo Bunting	*Passerina cyanea*						X	
Painted Bunting	*Passerina ciris*	X	X	X	X		X	X
Orange-breasted Bunting	*Passerina leclancherii*	X				X		
Yellow-winged Cacique	*Cacicus melanicterus*	X	X	X	X	X	X	
Yellow-billed Cacique	*Amblycercus holosericeus*							X
Spot-breasted Oriole	*Icterus pectoralis*				X			
Altamira Oriole	*Icterus gularis*					X	X	X
Streak-backed Oriole	*Icterus pustulatus*	X	X	X	X	X	X	
Baltimore Oriole	*Icterus galbula*						X	X
Hooded Oriole	*Icterus cucullatus*		X			X	X	X
Orchard Oriole	*Icterus spurius*	X	X	X	X	X	X	
Melodious Blackbird	*Dives dives*						X	
Great-tailed Grackle	*Quiscalus mexicanus*		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).

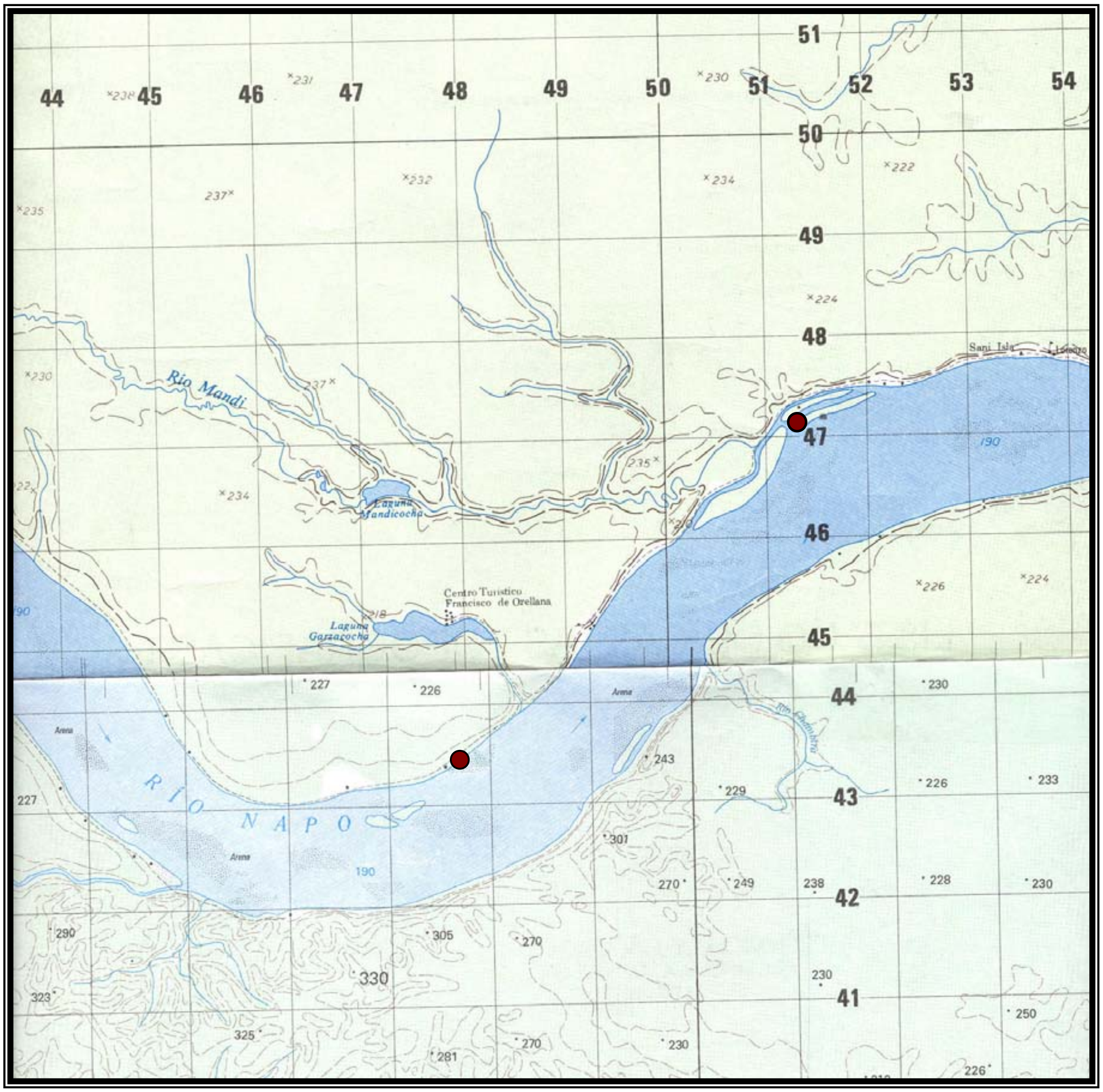


Detection Site: Mondaña
Number of Willow Flycatchers Detected: 8
Mileage/direction to nearest landmark: 3 km downstream of Mondaña
Detection coordinates: 00° 51.12' S, 077° 13.82' W

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.

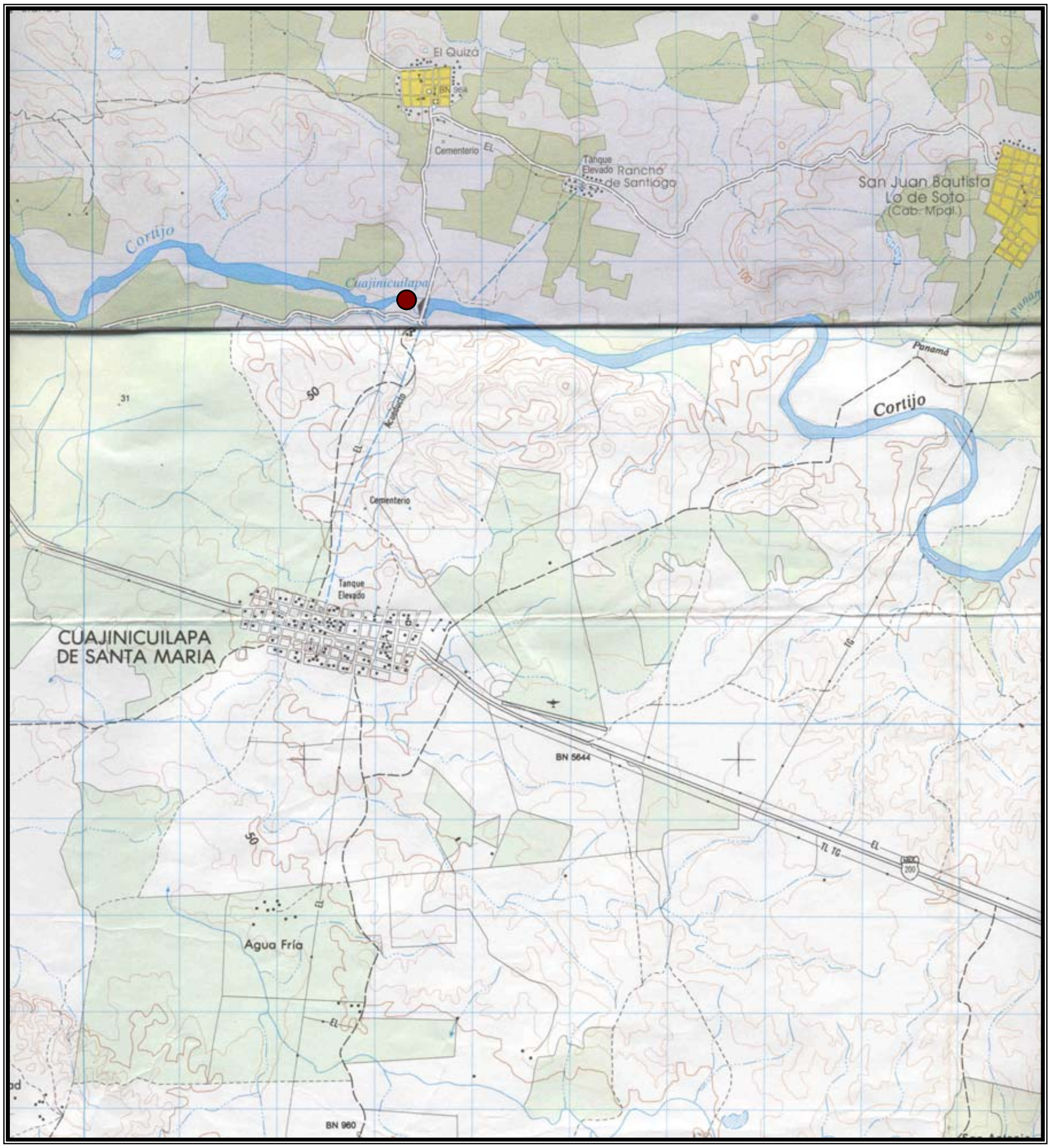


Detection Site: La Selva
Number of Willow Flycatchers Detected: 6
Mileage/direction to nearest landmark: 4.5 km downstream and 1.3 km upstream from the La Selva dock
Detection coordinates: 00° 28.89' S, 076° 20.25' W and 00° 28.89' S, 076° 20.25'

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

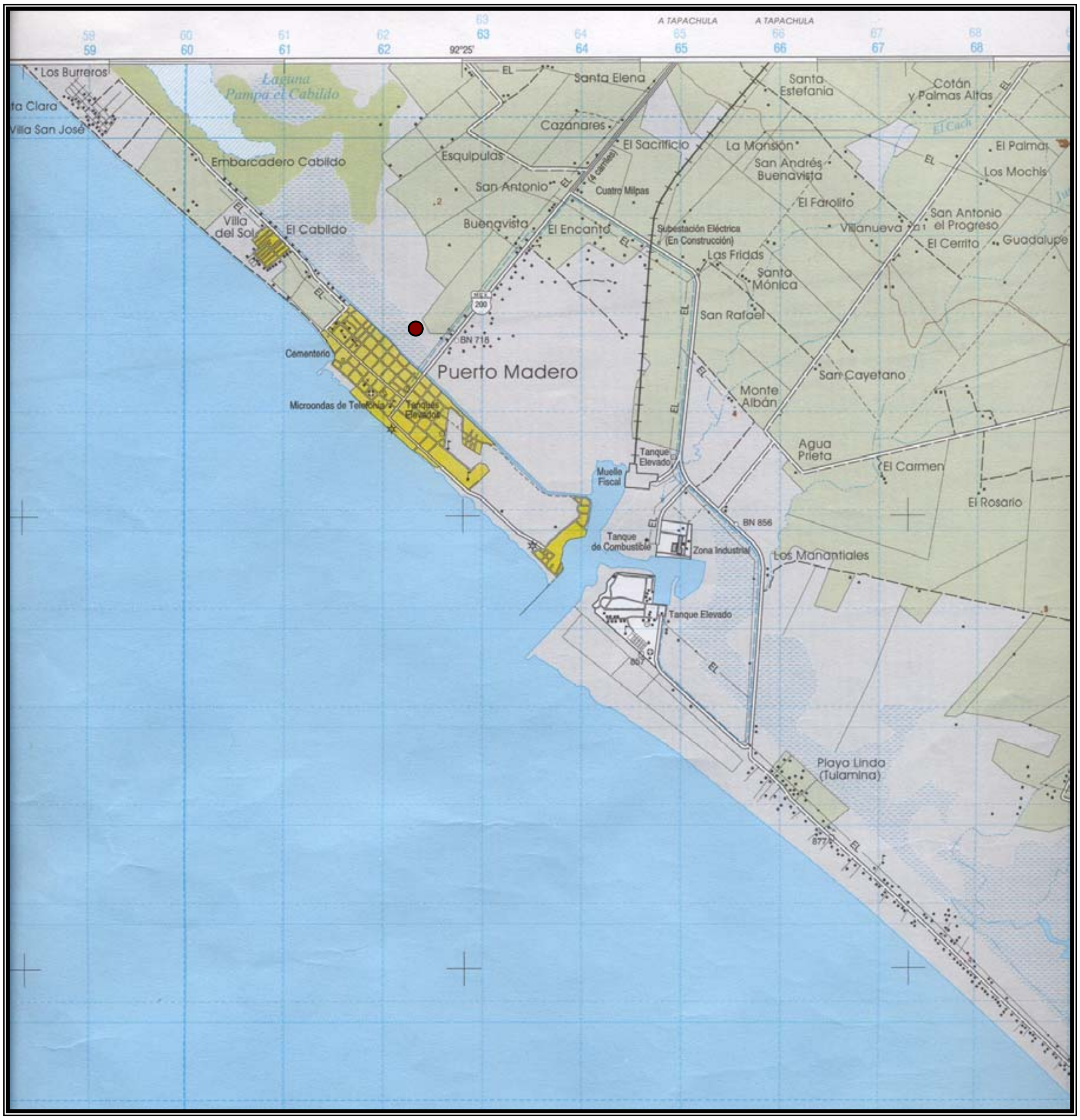
Appendix 11. Topographical map of Bajo de Chila, Oaxaca, Mexico. Puerto Escondido Quad D14B16, Insstituto de Estadistica Geographica de Mexico; scale: 1:50,000. Major contour lines are 20 meters. Maroon dot represents detection site.

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