Surveys for Wintering Willow Flycatchers (*Empidonax traillii*) in Costa Rica and Panamá

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EXECUTIVE SUMMARY

The willow flycatcher (*Empidonax traillii*) is a neotropical migratory bird that is widely distributed as a breeding species across most of the United States and parts of extreme southern Canada. Two of the subspecies (*E.t. extimus* and *E.t. brewsteri*) of the willow flycatcher are of management concern because of documented recent population declines. The southwestern willow flycatcher (*E.t. extimus*) is a federal endangered species, and all three of the western subspecies (*E.t. brewsteri, E.t. extimus* and *E.t. adastus*) are state-listed as endangered in California.

As a neotropical migrant, willow flycatchers breed in North America and winter in portions of southern Mexico, Central America, and northern South America. Conservation and management of endangered neotropical migrants should not ignore conditions on the wintering grounds, yet very little is known about the distribution, habitat use, and ecology of wintering willow flycatchers. There has been much speculation regarding potential human impacts and threats on the winter range, including habitat loss and environmental toxins. However, no published studies have specifically targeted wintering willow flycatchers in over 30 years.

We conducted surveys for wintering willow flycatchers in the Pacific lowlands of Costa Rica, selecting survey locations based on recent sightings and existing information on historical museum specimen collection sites. Our objectives were to determine the occurrence and numbers of willow flycatchers occupying historical and nearby areas, describe and photograph the habitats found at these sites, record details of willow flycatcher behavior and response to the survey protocol, record details of habitat use, note evidence of territoriality, and document threats or impacts to wintering areas.

Between 4 January and 14 February 1999, we surveyed 93 sites in northwest Costa Rica. Willow flycatchers were detected at 12 sites, with between 1 and 54 flycatchers per site. All willow flycatchers were found in habitat that included patches and/or stringers of trees and shrubs associated with surface water or saturated soil.

Willow flycatchers responded well to the tape-playback survey technique, with approximately 70% singing and the remaining 30% calling in response to the tape. We also heard willow flycatchers singing and calling without tape playback, therefore wintering willow flycatchers do sing without artificial stimulus.

We found several aspects of willow flycatcher behavior indicating that winter territories are maintained. We also have found that seasonal site fidelity is exhibited during the middle period of winter with willow flycatchers occupying particular areas within a site for up to 90 days.

The types of habitats in which we found wintering willow flycatchers (low lying wetlands and sluggish rivers) have been and continue to be heavily impacted by intensive and extensive agricultural practices, and these habitats are very scarce throughout the Pacific lowlands of Costa Rica. Almost all of the natural areas throughout the Pacific lowlands have been lost. Water diversions and agrochemical use are widespread in this area.

We also conducted a preliminary assessment of habitats found in and around four historical willow flycatcher wintering areas in western Panamá, selecting locations based on existing information on

historical museum specimen collection sites. Our objectives were to physically locate these sites, document the logistics of working in these areas, describe and photograph the habitats found at historical sites, document threats to the areas, and survey for wintering willow flycatchers.

Between 16 January and 27 February 1999, we surveyed 14 sites in western Panamá. Willow flycatchers were detected at 5 sites, with between 5 and 9 flycatchers per site. Although we focused our surveys in habitats that would most likely hold wintering willow flycatchers, all sites included patches and stringers of trees and shrubs associated with surface water or saturated soil. We do not know conclusively if surface water is a habitat requirement for wintering flycatchers.

We recommend future studies including: expanded surveys (in Costa Rica and elsewhere in the willow flycatcher's winter range); the relationship between surface water and flycatcher habitat use and distribution; determination of winter territoriality; diet composition; subspecies identification through genetic analysis and morphological comparisons; and patterns of land use, impacts, and conservation potential.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

TABLES

FIGURES

INTRODUCTION

The willow flycatcher (*Empidonax traillii*) is a neotropical migratory bird that breeds in shrub and riparian habitats across most of the United States and parts of extreme southern Canada. As a neotropical migrant, willow flycatchers spend less than half of each year on their breeding grounds in North America. The remainder of the year is spent south of the breeding range in the subtropical and tropical areas of southern Mexico, Central America and northern South America, south to eastern Ecuador and east to northwestern Venezuela (Stiles and Skutch 1989, Howell et al. 1995, Ridgely et al. 1989, Ridgely and Tudor 1994, Unitt 1997, Meyer de Schauensee 1978).

Published literature on birds of Central and South America (Stiles and Skutch 1989, Howell and Webb 1995, Ridgely and Gwynne 1989, Ridgely and Tudor 1994, Meyer de Schauensee 1978) describes willow flycatcher wintering habitat as humid to semi-arid, partially open areas such as woodland borders. They also use brushy savanna edge, second growth, and scrubby fields with hedges and fences that are often associated with plantations,and favor areas near water. Gorski (1969) found wintering willow flycatchers in Panamá using transitional areas from a wet, grassy field along the edge of a river to low-lying shrubs interspersed with tall grasses. At another site, Gorski found flycatchers using vegetation consisting largely of shrubs about four feet high with a number of trees present around an open, grassy area. Koronkiewicz et al. (1998) found wintering willow flycatchers in northwest Costa Rica using muddy seeps bordered by trees and open areas, seasonally inundated savanna-woodlands, intermittent wetlands (*lagunas*) bordered by trees and pasture, and an oxbow watercourse bordered by patches of trees and woody shrubs.

The southwestern subspecies (*E. t. extimus*) is federally-listed as endangered (USFWS 1995), and breeds only in dense mesic riparian habitats in the southwestern United States and, at least historically, to extreme northwestern Mexico (Unitt 1987, Sogge et al. 1997). Numerous threats and management needs have been identified within its breeding range (Unitt 1987, Tibbitts et al. 1994), and there has recently been increased research and management attention regarding southwestern willow flycatchers on their breeding grounds (see numerous documents referenced in Deshler et al. 1997). In California, the subspecies *E.t brewsteri* has also declined dramatically and is a state-listed endangered species (Schlorff 1990), and all subspecies occurring there are listed as endangered. Thus, there is management concern for willow flycatcher populations over a substantial part of the species' range. Potential threats and negative impacts such as habitat loss and use of pesticides are suspected on the wintering grounds (Koronkiewicz et al. 1998, USFWS 1993), yet other than preliminary surveys in Costa Rica in 1998 (Koronkiewicz et al. 1998) there has been no research specifically targeting wintering willow flycatchers since Gorski (1969) conducted limited surveys in Panamá over 30 years ago.

Unitt (1997) recently examined 803 museum specimens of willow flycatchers that were collected throughout the year. One of his objectives was to determine the winter range of *E.t. extimus*. He identified 46 certain or probable *extimus*, including four specimens collected from different locations in northwest Costa Rica and one specimen collected in Panamá. Based upon Unitt's (1997) study, Koronkiewicz et al. (1998) recently surveyed nine collection locations in northwest

Costa Rica between 31 January and 19 February and found a total 20 wintering willow flycatchers at three sites. Museum specimens collected at all three of these sites were identified as *extimus* (Unitt 1997).

Koronkiewicz et al. (1998) also determined that willow flycatchers respond well to tape-playback of their vocalizations recorded on the breeding grounds, sing without artificial stimulus, exhibit behavior suggesting that winter territories are maintained, and in northwest Costa Rica are occupying habitats associated with surface water. These wetland habitats have been and continue to be heavily impacted by intensive and extensive agricultural practices. Other than this preliminary work, we know almost nothing about the ecology and winter range of *E.t. extimus*. Because the southwestern willow flycatcher has an estimated population of only approximately 750 known territories (U.S.G.S. *unpublished data*), it is imperative to augment the knowledge available on this rare bird if any protection to the subspecies is to be afforded on its wintering grounds. Effective management and conservation of this endangered neotropical migrant cannot ignore conditions outside of the breeding range, and requires more specific information regarding its ecology and distribution on the wintering grounds.

This study was undertaken to locate willow flycatchers on the wintering grounds. It was designed to initiate behavioral ecology studies of the species and begin focusing research and management attention on wintering willow flycatchers and their habitats. Although it is not possible to distinguish *E.t. extimus* from other wintering subspecies during general surveys, Unitt (1997) found no evidence of separate wintering grounds for the different subspecies. Factors that are affecting one subspecies on the wintering grounds may therefore be affecting several or all subspecies. Thus, the first step in determining wintering ground threats and establishing an understanding of willow flycatcher winter ecology is to identify wintering areas.

The objectives of this project were to:

- determine the occurrence and numbers of willow flycatchers occupying historical and nearby areas;
- describe and photograph the habitats found at these sites;
- record details of willow flycatcher behavior, response to the survey protocol and habitat use;
- note evidence of territoriality;
- and document threats or impacts to wintering areas.

METHODS

Study Area

We conducted surveys in Costa Rica at historical willow flycatcher collection locations and in areas where willow flycatchers have been recently reported. These locations occur primarily in lowland areas (sea level to approx. 600 m) along the Pacific coast, and are scattered from Costa Rica's northern border with Nicaragua southward to the Panamá border. The Pacific coast of Costa Rica extends from 8° 2' to 11° 13' N latitude and from 85° 57' to 82° 54' W longitude, and lies within an area of Central America that has two pronounced seasons of the year. During the five to six month dry season or *verano*, from December to April, the coastal lowlands receive very little rain. The rainy season or *invierno*, usually from April until the end of November, provides the pacific lowlands with almost their total annual precipitation (Coen 1983).

These locations lie within eight Holdridge Life Zones; Tropical Dry Forest, Tropical Dry Forest - moist province transition, Tropical Moist Forest, Premontane Moist Forest - basal belt transition, Tropical Wet Forest, Tropical Wet Forest - premontane belt transition, Premontane Wet Forest, and Premontane Wet Forest - basal belt transition (Holdridge 1967, Tosi 1969).

Survey Site Selection in Costa Rica

Based upon Unitt's (1997) study of museum skins, recent flycatcher sightings and surveys (Koronkiewicz et al. 1998), and contacts with professionals familiar with the species (Appendix 14), 20 sites in Costa Rica were identified as probable wintering areas (Figure 1; Table 1). We focused our willow flycatcher surveys and field studies at these 20 sites.

The collection location information associated with the museum specimens from the twenty survey locations was very general, and no precise collection site data were available. In order to select actual survey sites within the general collection area, we first located the town or village noted on the museum specimen. We performed a preliminary survey of local forest habitats by driving the roads in and around the town or village, usually during mid to late afternoon. Based upon these preliminary habitat assessments and accessability considerations, we selected survey sites for the following morning.

Many of the selected survey routes were located on or were accessed via private lands. At all times surveyors asked landowners for permission to enter their land, and landowners were most helpful in providing much needed information such as directions and locations of particular types of habitats. No access was made of lands marked with no trespassing signs.

Table 1. 1999 willow flycatcher survey locations, Costa Rica. Includes willow flycatcher sightings and specimen collection information (NIA = no information available; shaded area = location was not surveyed).

Survey Location	Museum Specimen(s) Collected ?	Willow Flycatchers Reported?	Date Museum Specimen(s) Collected	Subspecies Status of Museum Specimens (P. Unitt)
Parque Nacional Santa Rosa, Guanacaste	NIA	Yes	not applicable	not applicable
Cañas, Guanacaste	Yes	Yes	30 April 1923	*brewsteri*
Tempate, Guanacaste	Yes	NIA	14 Dec. 1930	*adastus*
			16 Dec. 1930	*brewsteri*
Bebedero, Guanacaste	Yes	Yes	26 Feb. 1926	*adastus*
			20 March 1926	*extimus*
			22 Jan. 1890	unidentified
Bolsón, Guanacaste	Yes	Yes	28 Dec. 1907	*extimus*
Parque Nacional Palo Verde, Guanacaste	NIA	Yes	not applicable	not applicable
Puerto Humo, Guanacaste	Yes	No	12 April 1935	*brewsteri*
Santa Cruz, Guanacaste	Yes	NIA	12 Dec. 1950	*extimus*
Solimar, Guanacaste	NIA	Yes	not applicable	not applicable
Hojancha, Guanacaste	Yes	NIA	11 Jan. 1923	*adastus*
			8 Nov. 1929	*brewsteri*
Punta Piedra, Guanacaste	Yes	NIA	26 Feb. 1924	*brewsteri*
Chomes, Puntarenas	Yes	Yes	11 Aug. 1930	*extimus*
Boca de Barranca, Bonilla, Puntarenas	Yes	NIA	20 Nov. 1952	unidentified
			28 Nov. 1952	unidentified
Tarcoles, Rio Tarcoles, Puntarenas	NIA	Yes	not applicable	not applicable
Agujas, Puntarenas	Yes	NIA	2 May 1929	*adastus*
			8 May 1929	*adastus*
			15 May 1929	*adastus*

Table 1 continued.

Survey Location	Museum Specimen(s) Collected ?	Willow Flycatchers Reported ?	Date Museum Specimen(s) Collected	Subspecies Status of Museum Specimens (P. Unitt)
Rio Palo Seco, Puntarenas	Yes	NIA	3 Oct. 1951	*campestris*
			6 Oct. 1951	*campestris*
Buenos Aires, Animas, Puntarenas	Yes	NIA	4 May 1952	*brewsteri*
Puerto Jiménez, Puntarenas	Yes	NIA	11 Oct. 1926	unidentified
			11 Dec. 1929	*brewsteri*
			12 Dec. 1929	*brewsteri*
Coto 44, Puntarenas	Yes	NIA	19 May 1997	unidentified[1]
Rio Sixaola, Talamanca	Yes	NIA	24 Sept. 1904	unidentified
			24 Sept. 1904	unidentified

Survey Technique

Willow flycatchers look very similar to most other *Empidonax* flycatchers, some of which could co-occur in portions of the wintering range. Breeding and wintering willow flycatchers readily respond to a broadcast recording of their characteristic primary song, often described as a *fitz-bew* (Gorski 1969, Sogge et al. 1997, Koronkiewicz et al. 1998). Therefore, tape playback appeared to be an effective tool to increase the likelihood of detecting wintering willow flycatchers and to verify species identification by comparison with the tape. We used tape playback during all of our surveys, following methods described by Gorski (1969) and Sogge et al. (1997) and Koronkiewicz et. al. (1998).

Surveys were conducted during a six week period from 4 January through 16 February, primarily during early morning hours (prior to 1000 hrs) when willow flycatcher response rates appear to be greatest (Gorski 1969, Koronkiewicz et. al. 1998). Surveyors revisited 8 of the 12 willow flycatcher detection locations the following morning or some time later, to verify that the flycatchers were still present in the area. Due to the size of the study/survey area and associated time constraints, not all flycatcher detection sites could be revisited.

After initially approaching a survey site, we stood quietly for 1 to 3 minutes to listen for spontaneous singing. We then broadcast willow flycatcher vocalizations, using a hand-held tape player, at a volume similar to that of a naturally singing bird. The tape was played for 15-30 seconds, followed by a 1 to 3 minute listening period. Surveyors walked through or along the vegetation whenever possible and played the tape every 20-40 meters. Where dense vegetation, water or terrain prohibited walking through the target area, tape broadcast was done from the periphery of the area.

At each survey site we recorded the mileage and direction to the nearest city or major landmark.

Surveyors also drew a sketch of the survey area, noting important or useful landmarks, vegetation patch shape, survey route in relation to patch and location of any willow flycatchers detected. Habitat descriptions that included presence of surface water or saturated soil, topography, vegetation and seral stage at each survey location were recorded (Appendix 20). Surveyors photographed survey sites with an emphasis on illustrating general site characteristics.

Using handheld GPS units we recorded latitude and longitude at the start and end points of each survey. When willow flycatchers were located, one GPS coordinate was recorded for any group of birds found within a 200 meter stretch. If willow flycatchers were spread out over a larger area, separate coordinates were recorded for each bird or group detected.

When willow flycatchers were found, we recorded the time and number of detections, whether flycatchers were detected before or after tape broadcast, and how flycatchers responded to the tape. Surveyors also recorded vegetation characteristics and sketched the willow flycatcher detection area to show location of vegetation patch, prominent or useful landmarks, and willow flycatcher location(s) and movement(s) (Appendix 21).

Color Banding Willow Flycatchers

In order to monitor willow flycatcher movements within a site and record behaviors of individual birds, a number of willow flycatchers were uniquely color banded. After an individual willow flycatcher was detected, the net was placed in an area determined to be the area of greatest activity. We used broadcast of willow flycatcher vocalizations recorded on the breeding grounds to lure willow flycatchers into a mist net, and an *Empidonax* taxidermy mount was placed between two speakers to complement tape broadcast.

RESULTS

Willow Flycatcher Winter Distribution and Ecology Information

In an attempt to expand our knowledge of willow flycatcher winter distribution and ecology, we attempted to contact 50 ornithologists, naturalists, professional guides, and agencies working in the United States, Central and South America. These included persons affiliated with universities, professional guiding companies, environmental agencies and government institutions. From these contacts we received information that included 21 possible, probable or confirmed willow flycatcher wintering areas (Table 2), as well as useful habitat information. For details of this information see Appendix 14.

Table 2. Possible, probable, or confirmed willow flycatcher locations yielded from persons working with birds in the United States, Central and South America. Details regarding this information are found in Appendix 13.

Country	Location
Mexico	Singayta, Nayarit
	Chamela, Jalisco
	Rio Cuixmala, Jalisco
	Agua Caliente, Jalisco
	Paracuaro, Michoacan
	Jose Maria Morelos, Jalisco
	Villa Madero
	Ucareo
	Puerto Escondido, Oaxaca
	Tapachula, Chiapas
Panamá	Volcan
	El Real
El Salvador	Laguna El Jocotal, San Miguel
Costa Rica	La Selva, Puerto Viejo, Sarapiqui
	Chomes, Guanacaste
	Parque Nacional Palo Verde
	Rio Tarcoles, Tarcoles
	Dominical, Puntarenas
	San Isidro, Puntarenas
Ecuador	Anaconda Island, Rio Napo
	Rio Napo

Survey Effort

We surveyed 93 sites at 18 of the 20 predesignated survey locations throughout the Pacific lowlands of Costa Rica. Because of the proximity (< 10 km) of Bebedero to Cañas and Tarcoles to Agujas, we refer to each (Bebedero/Cañas; Tarcoles/Agujas) as one survey location (Table 3). No surveys were conducted at Hojancha or Punta Piedra because after lengthy assessments of habitats it seemed unlikely the areas would hold wintering willow flycatchers. However, approx. 30 km west of Punta Piedra suitable habitat was found at Punta Coyote (Caletas) and the area was surveyed. No surveys were conducted at Rio Sixaola because of time constraints. We spent a total of 386 hours conducting 111 surveys between 4 January and 16 February. At least two morning surveys were preformed within each of the 18 predesignated locations (Appendix 1).

Table 3. Summary of survey effort during 1999 winter willow flycatcher surveys in Costa Rica.

Survey Location	Number of Sites Surveyed	Number of Surveys	Survey Hours
Parque Nacional Santa Rosa	5	5	21.5
Bebedero/Cañas	2	2	13.8
Tempate	4	4	23.2
Parque Nacional Palo Verde	5	5	22.4
Puerto Humo	2	2	12.8
Bolsón	5	11	43.4
Santa Cruz	5	8	34.6
Solimar	5	6	21.5
Chomes	4	7	23.0
Boca de Barranca	4	4	15.0
Tarcoles/Agujas	6	6	18.3
Punta Coyote, Caletas	4	4	9.8
Rio Palo Seco	8	9	26.6
Buenos Aires, Animas	18	18	34.5
Coto 44	8	10	32.4
Puerto Jiménez	8	10	33.5
TOTAL	**93**	**111**	**386.3**

Habitats Surveyed

The vast majority of lands in and around the historical and present willow flycatcher wintering areas throughout the Pacific lowlands of Costa Rica have been profoundly altered by man. Large scale cattle ranches have transformed many of the survey locations, and much of the Pacific lowlands of Costa Rica, into pasture land. Agricultural areas, particularly extensive sugar, rice and African oil palm plantations, dominate many of the survey locations. Natural areas throughout lowland Pacific Costa Rica are very scarce and field personal spent a great deal of time surveying heavily disturbed areas.

We surveyed a variety of habitats including:

- patches or stringers of trees (deciduous, semi-deciduous, and evergreen) and/or woody shrubs, bordered by savannas and pasture lands (Figure 2)
- gallery forest consisting of patches or stringers of trees (deciduous, semi-deciduous, and evergreen) and/or woody shrubs, bordered by savannas and pasture lands (Figure 3)
- riparian areas with associated vegetation of varying heights, densities and under story composition (Figure 4)
- riparian areas and adjacent savannas and pasture lands (Figure 5)
- *lagunas* (intermittent fresh water wetlands), seasonally inundated savanna and seeps (Figure 6)
- *lagunas* (intermittent fresh water wetlands) and seasonally inundated savanna with *Parkinsonia spp.* (*"palo verde"*) being the dominant vegetation (Figure 7)
- agricultural areas (Figure 8)
- tidal lowlands (vegetation composed primarily of *Rhizophora spp.* (*"mangrove"*)) (Figure 9)
- patches/areas of tropical dry forest (employing the World Life Zone-System Ecological Classification of L.R. Holdridge 1967) (Figure 10)
- patches/areas of tropical wet forest (employing the World Life Zone-System Ecological Classification of L.R. Holdridge 1967) (Figure 11)

Appendix 1 lists the habitats surveyed during each willow flycatcher survey.

Figure 2. A willow flycatcher survey site near Puerto Humo, Costa Rica. Habitat consisted of dry pasture/savanna bordered by trees and woody shrubs of varying height and density.
Figure 3. A willow flycatcher survey site near Buenos Aires, Costa Rica. Habitat is gallery forest along a fast flowing stream.
Figure 4. A willow flycatcher survey site on the Rio Ceibo, Costa Rica. Habitat consists of fast moving river bordered by patches of trees and woody shrubs.
Figure 5. A willow flycatcher survey site in San Isidro, Costa Rica. Habitat consists of a stream running through dry, heavily grazed pasture interspersed with trees and woody shrubs.
Figure 6. A seasonally inundated savanna wetland in Bolsón, Costa Rica. Willow flycatchers were detected along the woodline in the background.

Figure 2 (see Appendix 1, Habitat(s) Surveyed - 1).

Figure 3 (see Appendix 1, Habitat(s) Surveyed - 2,3).

Figure 4 (see Appendix 1, Habitat(s) Surveyed - 3).

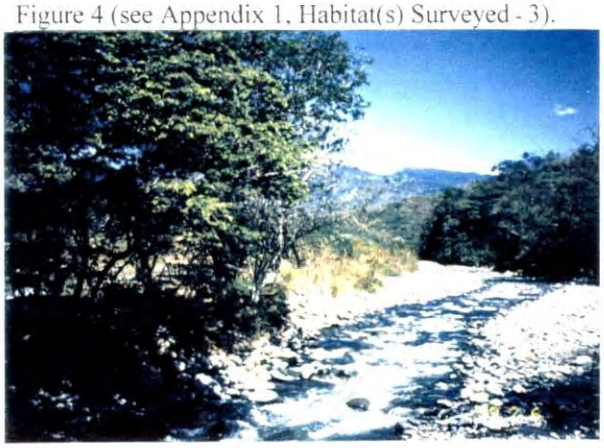


Figure 5 (see Appendix 1, Habitat(s) Surveyed - 3, 4).

Figure 6 (see Appendix 1, Habitat(s) Surveyed - 5).

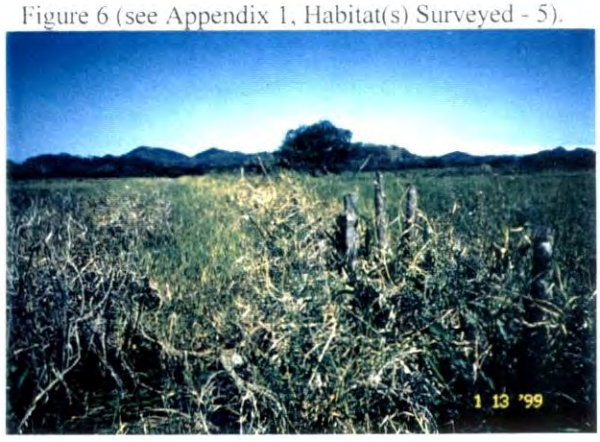


Figure 7. Laguna Bocanna, Parque Nacional Palo Verde, Costa Rica. Survey area composed primarily of flooded *Palo Verde (Parkinsonia sp.)* forest, extending into areas of dense woody shrubs and grasses.
Figure 8. An agricultural area near Bebedero, Costa Rica. Rice fields such as this one are a dominant part of the landscape throughout the Pacific lowlands, particularly in northwestern Guanacaste Province.
Figure 9. A tidal lowland survey area near Parque Nacional Palo Verde, Costa Rica. Vegetation here consisted primarily of dense mangrove (*Rhizophora* sp.) along the Rio Tempisque.
Figure 10. A tropical dry forest survey area in Parque Nacional Santa Rosa, Costa Rica. Figure shows interior and understory along forest edge.
Figure 11. Patches of second growth tropical wet forest surveyed near Potrero Grande, Costa Rica.

Figure 7 (see Appendix 1, Habitat(s) Surveyed - 6).

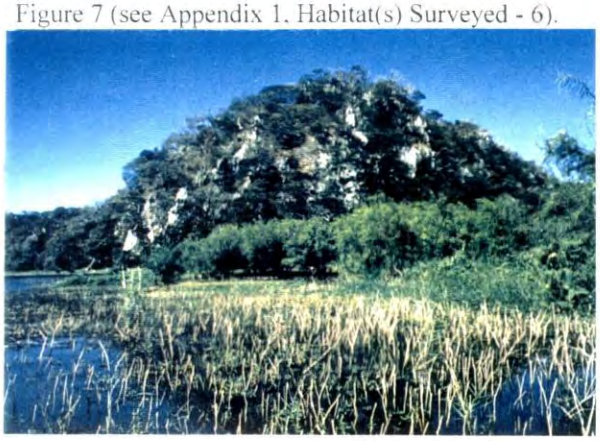


Figure 8 (see Appendix 1, Habitat(s) Surveyed - 7).

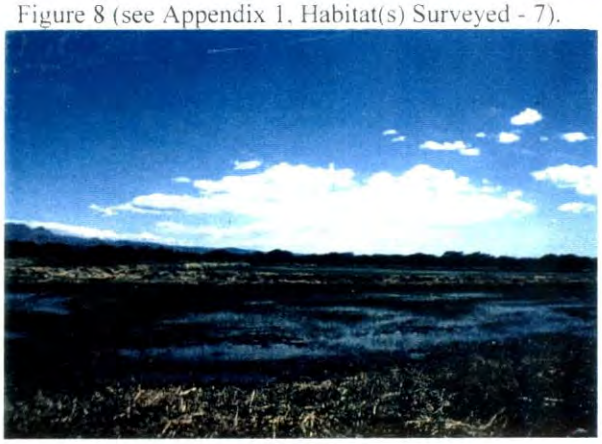


Figure 9 (see Appendix 1, Habitat(s) Surveyed - 8).

Figure 10 (see Appendix 1, Habitat(s) Surveyed - 9).

Figure 11 (see Appendix 1, Habitat(s) Surveyed - 10).

Willow Flycatcher Detections

We detected wintering willow flycatchers at 12 of the 18 survey locations; Tempate, Bolsón, Puerto Humo, Santa Cruz, Solimar, Chomes, Tárcoles/Agujas, Punta Piedra, Rio Palo Seco, Coto 44, and Puerto Jiménez (Table 4). In total, we found 201 willow flycatchers, with between 1 and 54 flycatchers detected at each site (Table 4). At all sites revisited, we found the same number of flycatchers during each survey, distributed very similarly.

Table 4. Summary of willow flycatcher detections during 1999 surveys in Costa Rica from 4 Jan. to 21 March.

Detection location	Number of willow flycatchers detected	Dates of detection(s)
Tempate	1	24 Jan.; 18 March
Bolsón	26	11,13,16, 17, 23, 25 Jan; 12 Feb.; and 19 March
Puerto Humo	1	27 Jan.
Santa Cruz	26	10 - 13, 23 Jan.; 12 Feb.; and 18 March
Solimar	54	8, 9, 28 Jan.
Chomes	28	7 - 10 Jan.; 11 Feb.; 17, 21 March
Boca de Barranca	9	20 Jan.
Tarcoles/Agujas	3	31 Jan.
Punta Piedra	8	26 Jan.
Rio Palo Seco	26	29 - 31 Jan.
Coto Colorado	10	14, 15 Jan.; 5 - 7 Feb.
Puerto Jimenez	9	8, 9 Feb.
TOTAL DETECTIONS	**201**	

Habitat Descriptions for Detection Areas

Following is a *descriptive* summary of the habitat at each detection site. Emphasis has been placed on capturing the general gestalt of the detection sites in order to better identify occupied or potential habitat in the future. No quantitative vegetation analysis was conducted. These descriptions were recorded at the time of detection, in the immediate vicinity of the willow flycatcher(s). Details regarding detection site locations and land use can be found in the noted appendices (Appendices 2 through 13).

Tempate, Guanacaste

The Temapte willow flycatcher site consists of the terminus of a sluggish *quebrada* (stream) and an open muddy area, with the patch only approx. 20 m x 20 m (Figures 12). The northern and eastern portion of the patch which borders the *quebrada* consists primarily of evergreen and deciduous forest (avg. height 9-12 m with a relatively dense understory), with palms being a major component of the vegetation. The west side of the *quebrada* is bordered by an open muddy area with patches of dense woody shrubs, *Mimosa* sp.(app. 1-3 m in height), scattered about the periphery. To the south and west lie extensive areas of fallow and heavily used pasture. It is suspected that standing water and muddy areas are present year round (Appendix 2).

Bolsón, Guanacaste

The Bolsón willow flycatcher sites consist of a series of *lagunas* (intermittent fresh water wetlands), seasonally flooded savanna-woodland edge and pasture, *esteros* (meandering oxbow waterways), and muddy seeps (Figures 13 and 14). The *lagunas* (varying in size but averaging approx. 200 m x 300 m) are bordered by patches and stringers of forest (avg. height 9-13 m with a relatively open understory) and dense woody shrubs, *Mimosa* sp. (avg. height 1-2 m), which extend into the wetlands in the driest areas. Areas of standing water choked with aquatic grasses and swamp herbs, Marantacea (avg. height 1-2 m), are scattered throughout the *lagunas*. The *esteros* and muddy seeps which lie adjacent to the *lagunas* are bordered by patches of trees and forested areas (avg. height 10-13 m with moderately dense understory), and dense woody *Mimosa* sp. and herbaceous shrubs (avg. height 1-2 m). Rooted aquatic vegetation is scattered throughout the waterways. Areas of heavily grazed pasture and savanna (approx. 200-300 m wide) lie adjacent to the *lagunas* and *esteros*. Standing water is present within the *lagunas* and parts of the *esteros* year round, but large areas flooded during the rainy season progressively dry up as the dry season advances. Approx. 1 km from the Rio Tempisque, the entire area is strongly influenced by seasonal inundation, with the highest water levels occurring in November when the Tempisque floods its banks (Appendix 3).

Puerto Humo, Guanacaste

The Puerto Humo willow flycatcher site consists of a patch of gallery forest (approx. 7 m in height), only approx. 20 m x 20 m, which lies on a sluggish river (Figures 15). To the east the gallery forest has been recently removed, with sparse woody second growth only beginning to appear. The western edge of the patch progressively transitions into an impenetrable tangle of woody shrubs and vines (avg. height 1-2 m), growing on muddy soil. To the north and south the patch is completely surrounded by large areas of rice plantation (Appendix 4).

Santa Cruz, Guanacaste

The Santa Cruz willow flycatcher sites consist of a series of *lagunas* (intermittent fresh water wetlands), seasonally flooded savanna-woodland edge and pasture, sluggish, meandering waterways, and muddy seeps (Figures 16 and 17). The *lagunas* (approx. 200 m x 200 m) are bordered by patches and stringers of forest (avg. height 6-10 m with relatively open understory)

and dense woody shrubs, *Mimosa* sp. (avg. height 1-2 m), which extend into the wetlands in the driest areas. Areas of standing water choked with aquatic grasses and swamp herbs, Marantacea (avg. height 1-2 m), are scattered throughout the *lagunas*. A "maze" of sluggish, meandering waterways, and muddy seeps branch off of a major river as it makes its way through flat lowlands. These sluggish, braided waterways and muddy seeps are bordered by patches of trees and forested areas (avg. height 9-11 m with moderately dense understories), dense woody growth entangled with vines (avg. height 1-3 m), and herbaceous shrubs (avg. height 1 m). Rooted aquatic vegetation is scattered throughout the waterways. Areas of heavily grazed pasture and savanna (approx. 200-300 m wide) lie adjacent to the *lagunas* and sluggish waterways. Standing water is present within the *lagunas* and parts of the waterways year round, but large areas flooded during the rainy season progressively dry up as the dry season advances (Appendix 5).

Solimar, Guanacaste

The Solimar willow flycatcher sites consist of a series of *lagunas* (intermittent fresh water wetlands), seasonally flooded savanna-woodland edge and pasture, and muddy seeps (Figure 18). The *lagunas* (varying in size but averaging approx. 200 m x 200 m) are bordered by patches and stringers of forest (avg. height 10-12 m with relatively open understories) and dense woody shrubs, *Mimosa* sp. (avg. height 1-2 m), which extend into the wetlands in the driest areas. Areas of standing water choked with aquatic grasses and swamp herbs, Marantacea (avg. height 1-2 m), are scattered throughout the *lagunas*. Some of the forested area which borders the largest *laguna* and muddy seeps is undisturbed and consists of very large trees (some reaching approx. 30 m in height) with spiny palms being a major component of the vegetation. Seasonally flooded savanna-woodland edge and pasture are scattered throughout the areas. Standing water is present within the *lagunas* and and some of the seeps year round, but large areas flooded during the rainy season progressively dry up as the dry season advances (Appendix 6).

Chomes, Guanacaste

The Chomes willow flycatcher site consists of a two *lagunas* (intermittent fresh water wetlands), seasonally flooded savanna-woodland edge and pasture, and muddy seeps (Figure 19). The two *lagunas* (approx. 1000 m x 800 m and 200 m x 100 m) are divided by a patch of heavily disturbed forest and scattered woody shrubs, approx. 150 m wide. Vegetation composition and structure are similar, with both *lagunas* bordered by patches and stringers of forest (avg. height 10-13 m with highly variable understories) and dense woody shrubs, *Mimosa* sp. (avg. height 1-2 m), which extend into the driest areas of the wetlands. Areas of standing water choked with aquatic grasses and swamp herbs, Marantacea (avg. height 1-2 m), are scattered throughout both wetlands. Lying adjacent to both lagunas are areas of seasonally inundated short grass pasture scattered with short trees and shrubs (avg. height 2-3 m). The largest *laguna* is fed by a muddy waterway to the northeast, which drains adjacent uplands. Direction of flow of the wetland is to the south/southwest, with a seep draining the *laguna*. This seep, choked with emergent aquatic vegetation, is the wettest area of the *laguna* and is bordered by a stringer of tall tropical evergreen forest (avg. height 15 m with a highly variable understory). Although no waterway feeds the smaller laguna, it is suspected that during the height of the rainy season the larger laguna overflows and empties into adjacent areas. Standing water is present year round at both lagunas, with large areas drying up as the dry season advances (Appendix 7).

Boca de Barranca, Puntarenas

The Boca de Barranca willow flycatcher site consists of a single *laguna* (intermittent fresh water wetland) approx. 1 square km in size bordered by patches and stringers of forest (avg. height 8-10 m with relatively dense understories) and dense woody shrubs, *Mimosa* sp. (avg. height 1-2 m), which extend into the wetland in the driest areas (Figure 20). Areas of standing water choked with aquatic grasses and swamp herbs, Marantacea (avg. height 1-2 m), are scattered throughout the *laguna*, primarily along the edges. Seasonally flooded savanna-woodland edge and short grass pasture surround the site with muddy areas remaining year round (Appendix 8).

Tárcoles/Agujas, Puntarenas

The Tárcoles/Agujas willow flycatcher site consists of a single *laguna* (intermittent fresh water wetland) approx. 1 square km in size bordered by patches and stringers of forest (avg. height 10-12 m with relatively dense understories) and dense woody shrubs, *Mimosa* sp. (avg. height 1-2 m), which extend into the wetland in the driest areas (Figure 21). Areas of standing water choked with aquatic grasses and swamp herbs, Marantacea (avg. height 1-2 m), are scattered throughout the *laguna*, primarily along the edges (Appendix 9).

Caletas, Guanacaste

The Caletas willow flycatcher site consists of a series of *lagunas* (intermittent fresh water wetlands), seasonally flooded savanna-woodland edge and pasture, and muddy seeps (Figure 22). The *lagunas* (varying in size but averaging approx. 200 m x 200 m) are bordered by patches and stringers of forest (avg. height 12-15 m with relatively open understories) and dense woody shrubs, *Mimosa* sp. (avg. height 1-2 m), which extend into the wetlands in the driest areas. Areas of standing water choked with aquatic grasses and swamp herbs, Marantacea (avg. height 1-2 m), are scattered throughout the *lagunas*. Muddy areas and seasonally flooded savanna-woodland edge and pasture are interspersed throughout the wetlands. Standing water is present year round at both lagunas, with large areas drying up as the dry season advances (Appendix 10).

Rio Palo Seco, Puntarenas

The Rio Palo Seco willow flycatcher site consists of a large patchwork of *lagunas* (intermittent fresh water wetlands), seasonally flooded savanna-woodland edge and pasture, and muddy seeps scattered about relatively hilly terrain (Figure 23). The site encompasses an area approx. 4 square kms. The *lagunas* (varying in size but averaging approx. 200 m x 200 m) are bordered by patches and stringers of trees and forest (avg. height 10-15 m with highly variable understories) consisting of planted groves of teak and African oil palm, bamboo, palms, and secondary growth forest. Dense woody shrubs entangled with vines, large patches of *Heliconia* spp., *Cassia* sp., and *Mimosa* sp. (all averaging approx.1-3 m in height) border and extend into the wetlands in the drier areas. Areas of standing water choked with aquatic grasses, sedges and swamp herbs (avg. height 1-3 m), are scattered throughout the *lagunas*. Standing water and muddy seeps are present year round, with large areas drying up as the dry season advances (Appendix 11).

Coto 44, Puntarenas

The Coto 44 willow flycatcher site consists of a large patchwork of seasonally flooded woodland edge and pasture, and muddy seeps scattered about an area that at one time was a *laguna* wetland (Figure 24). The seasonally flooded woodlands, pastures, and muddy seeps (varying in size but averaging approx. 40 m x 40 m) consist primarily of scattered patches of trees (avg. height 8 m with highly variable understories) and dense woody shrubs, *Cassia* sp. (avg. height 1-2 m). It appears that standing water and muddy seeps are present year round at this heavily disturbed site, with large areas drying up as the dry season advances (Appendix 12).

Puerto Jiménez, Puntarenas

The Puerto Jiménez willow flycatcher sites consist of a sluggish *quebrada* (stream) bordered by open muddy areas, and seasonally flooded woodland edge and pastures (Figures 25). The *quebrada* is bordered by dense woody shrubs, *Cassia* sp., covered with tangles of vines (avg. height 1-2 m), and patches of tress (approx. 7 m in heigh) scattered about the area. On all sides it is bordered by heavily grazed short grass pasture. The seasonally flooded pastures consist of patches of dense woody shrubs, *Mimosa* sp. (approx. 1-2 m in height), completely surrounded by areas of short grass pasture with trees scattered about the periphery. Although all areas are flooded during the rainy season, large areas dry up as the dry season advances with muddy soil remaining throughout the year (Appendix 13).

Figure 12. Willow flycatcher detection site at Quebrada Zapote in Tempate, Costa Rica. Habitat consists of a patch of forest and dense woody shrubs (*Mimosa* sp.) along a sluggish, meandering stream. Two sides of the patch are bordered by pasture, the other small patches of heavily disturbed gallery forest.
Figure 13. Sitio Delicias, a willow flycatcher detection site in Bolsón, Costa Rica. The flycatchers were seen using the wetland/forest interface (background).
Figure 14. A sluggish, meandering backwater at Sitio Delicias, Bolsón, Costa Rica. Willow flycatchers were seen using the dense vegetation along the edge of the this backwater. Water levels here are greatly effected as the dry season advances.
Figure 15. Willow flycatcher detection area along the Rio San Lazaro near Puerto Humo, Costa Rica. This small patch along a sluggish river is bordered by extensive agriculture on all sides. One willow flycatcher was detected here, using the vegetation shown bordering the Rio.
Figure 16. Willow flycatcher detection area along the Rio Cañas, Santa Cruz, Costa Rica. Flycatchers were seen primarily along the edge of this sluggish river, which is bordered on one side by heavily grazed pasture, the other side patches of dense gallery forest.
Figure 17. Laguna Monticillo, a willow flycatcher detection area near Santa Cruz, Costa Rica. Willow flycatchers were seen using the dense woody shrubs bordering the patches and stringers of trees shown.
Figure 18. A large *laguna* in Solimar, Costa Rica where willow flycatchers were detected. Flycatchers were seen primarily along the edge of the forest, where it meets with the wetland vegetation shown.
Figure 19. Laguna Argentina, a large wetland in Chomes, Costa Rica where 28 willow flycatchers were found. Shown is the southwest corner of the *laguna* where dense wetland vegetation meets a stringer of open woodland, the most commonly used vegetation at the site.
Figure 20. Laguna Sapo near Boca de Barranca, Costa Rica where nine willow flycatchers were found. Shown is a stringer of trees adjoining dense wetland vegetation, the most frequently used habitat by willow flycatchers at the site.
Figure 21. Laguna Coyote near Tarcoles, Costa Rica where three willow flycatchers were found. Shown is the wetland adjoining a stringer of forest (left background) meeting heavily grazed pasture (foreground).
Figure 22. A seasonally inundated savanna wetland near Playa Calletas, west of Punta Piedra, Costa Rica, where eight willow flycatchers were found. Dense patches of woody shrubs (*Mimosa* sp.) was the most commonly used vegetation at the site (center of photo).
Figure 23. Laguna Ortega, a large wetland area northwest of the Rio Palo Seco, Costa Rica. Shown is a patch where two willow flycatchers were detected (background). Habitat consists of tall aquatic herbs, sedges and grasses, adjoining isolated patches of trees, the most commonly used vegetation in the wetland.

Figure 24. A heavily disturbed wetland, Laguna Colorado, near Coto de Colorado, Costa Rica. Ten willow flycatchers were found here using the isolated patches of trees and woody shrubs shown.
Figure 25. A willow flycatcher detection site near Puerto Jiménez, Costa Rica. A single willow flycatcher was found here using an isolated patch of woody shrubs (*Mimosa* sp.) bordered on all sides by heavily grazed pasture. This patch was bulldozed some time later, near the end of our surveys

Figure 12 (see Appendix 1, Habitat(s) Surveyed - 2, 3, 4, 9 for additional information on habitat structure).

Figure 13 (see Appendix 1, Habitat(s) Surveyed - 2, 3, 5, 9 for additional information on habitat structure).

Figure 14 (see Appendix 1, Habitat(s) Surveyed - 2, 3, 5, 9 for additional information on habitat structure).

Figure 15 (see Appendix 1, Habitat(s) Surveyed - 2, 3, 4, 9 for additional information on habitat structure).

Figure 16 (see Appendix 1, Habitat(s) Surveyed - 2, 3, 4, 9 for additional information on habitat structure).

Figure 17 (see Appendix 1, Habitat(s) Surveyed - 3, 4, 5, 9 for additional information on habitat structure).

Figure 18 (see Appendix 1, Habitat(s) Surveyed -2, 3, 5, 9 for additional information on habitat structure).

Figure 19 (see Appendix 1, Habitat(s) Surveyed - 2, 3, 5, 9 for additional information on habitat structure).

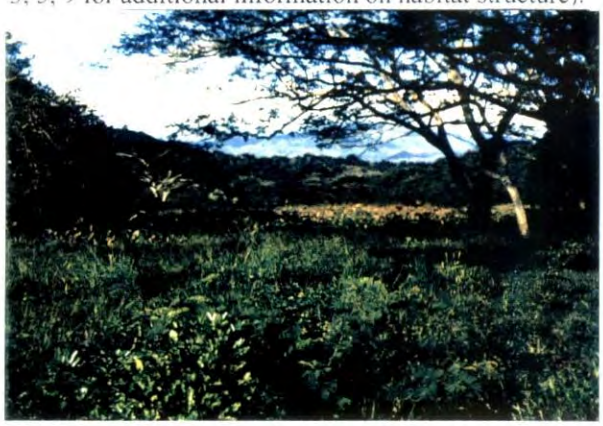


Figure 20 (see Appendix 1, Habitat(s) Surveyed - 3, 4, 5, 9 for additional information on habitat structure).

Figure 21 (see Appendix 1, Habitat(s) Surveyed - 3, 4, 5, 9 for additional information on habitat structure).

Figure 22 (see Appendix 1, Habitat(s) Surveyed - 3, 4, 5, 9 for additional information on habitat structure).

Figure 23 (see Appendix 1, Habitat(s) Surveyed - 3, 4, 5, 10 for additional information on habitat structure).

Figure 24 (see Appendix 1, Habitat(s) Surveyed - 3, 4, 5, 10 for additional information on habitat structure).

Figure 25 (see Appendix 1, Habitat(s) Surveyed - 3, 4, 5, 10 for additional information on habitat structure).

Willow Flycatcher Response to Surveys

Response to Tape Broadcast

We heard five different willow flycatcher vocalizations during our surveys; *fitz-bew*s, *whitts, wheeps, creets/breets,* and *churr/kitter*s. The descriptions above and below use the vocalization terminology of Stein (1963), Gorski (1969), Unitt (1987) and McCabe (1991).

All of the willow flycatchers detected responded to the tape-broadcast surveys by giving either the typical *fitz-bew* song, *whitts*, or *wheeps*, alerting surveyors of their presence. Thirty percent of the willow flycatchers detected first responded to our tape by giving the typical *fitz-bew* song. The remaining 70% initially responded with *whitts* or *wheeps*. If surveyors continued to broadcast vocalizations in immediate proximity of flycatchers for longer periods of time (apparently agitating the birds), approx. 60% of the flycatchers that initially responded with *whits* and *wheeps* eventually *fitz-bew*ed. Thus, overall, 70% of the detected willow flycatchers sang in response to the tape playback. No willow flycatchers were heard giving the *wee-oo* vocalization, which is given most often by willow flycatchers arriving on the breeding grounds and during nesting. The *churr/kitter* vocalization, often accompanied by the *creet/breet* vocalization, raised crest and rapid tail pumping, was heard only after prolonged tape broadcast at eight of the twelve detection locations. Apparently, the *churr/kitter* vocalization appears to be an agitation call given by wintering willow flycatchers.

During the breeding season, territorial willow flycatchers that respond to tape playback often fly closer to surveyors, sometimes flying to an exposed perch from which to sing. During our winter surveys, approx. 50% of the responding willow flycatchers flew toward the surveyors, often coming to within 3 to 6 m and sometimes perched directly overhead. In other instances, willow flycatchers remained at a distance and sang or called from where they were first detected. It is interesting to note that on several occasions willow flycatchers could be heard responding up to 100 m away from the point of broadcast.

Willow flycatchers did not always immediately respond to the first tape play. During late afternoon and early evening surveys, flycatchers responded only after the third or fourth playing of the tape. The most immediate responses were during early morning surveys (prior to 1000 hours).

To build upon the wintering survey methods conducted by Koronkiewicz et. al. (1998), surveyors were given recordings of *all* known willow flycatcher vocalizations. These additional vocalizations were used to compliment the standard "survey tape" (which consists of *fitz-bew*s and *creets/breets* only) used by Koronkiewicz et. al. (1998) in northwest Costa Rica and commonly used during breeding ground surveys (Sogge et. al. 1997). These additional vocalizations included: a variety of *whitt* vocalizations, varying in cadence and tone; *creets/breets*, varying in cadence and tone; *wee-oos*; *churr/kitter* vocalizations; and a set of *interaction calls* given by a mated pair of willow flycatchers. These additional vocalizations were used by surveyors primarily to elicit song from willow flycatchers only calling. On four separate occasions, at three sites, four individual willow flycatchers responded only with the atypical *wheep* call when the "survey tape" was broadcast. In order to confirm identification, surveyors played the *interaction calls* in the immediate proximity of the birds, eliciting *fitz-bew*s from all four flycatchers.

Overall, we have found that wintering willow flycatchers do respond well to tape playback surveys, and they respond strongly. Wintering willow flycatchers do sing and call, and at times continue to sing and call well after tape play has stopped. We have found tape playback surveys to be an effective, necessary tool in locating willow flycatchers on the wintering grounds.

Willow Flycatcher Behavioral Observations

Habitat Use

During our surveys, the most commonly used vegetation at all of the detection sites was patches of dense woody shrubs (*Mimosa* sp. and/or *Cassia* sp. Family Fabacea), impenetrable brambles, and tangles of vines approx. 1-4 m in height, bordering and extending into wet areas, or areas with saturated soil (Figures 26 and 27). Willow flycatchers most often used the patches of dense woody shrubs adjoining clusters or stringers of trees approx. 5 to 10 m in height, closest to the wettest areas. Willow flycatchers were seen perched in the tops of woody shrubs, as well as in the lower, denser areas of the foliage.

Willow flycatchers were also found in trees bordering the most open areas of wetlands, sluggish meandering waterways, muddy seeps, and seasonally inundated savannas/pastures. When in trees, flycatchers were usually 3 to 12 m above ground in the branches and foliage closest to the edge of the forest patch. They were seen most often just overhead, in the most open areas of the foliage. The patches of trees where we found willow flycatchers were not extensive, dense tracts, but rather isolated stringers or clusters bordered by either a wetland, a sluggish meandering waterway, an open muddy area, dense woody second growth or seasonally flooded savanna like pasture. Understory density of the patches of trees were most often moderately open.

On several occasions, willow flycatchers were seen in small trees and woody shrubs scattered throughout relatively open, short grass savanna/pasture. These savanna/pastures lie immediately adjacent to the wetland areas, and they are most often connected to them by patches of trees and dense woody shrubs.

Foraging

We observed willow flycatchers foraging on numerous occasions and describe their foraging techniques below, using the terminology of Fitzpatrick (1980). The most commonly used foraging technique used by willow flycatchers was *aerial hawking*, flying from the tops of dense woody shrubs and in open areas at the tops of trees to capture insects in flight (Figures 28 and 29). Small flying insects, too small to identify, appeared to be the most common prey item, but on several occasions we saw flycatchers aerial hawk large (approx. 2.5 to 5 cm) "green insects" and butterflies, and return to perches to eat them.

Willow flycatchers were seen *perch to ground sallying* from small trees and shrubs that were interspersed throughout relatively open, short grass savannas/pastures (Figure 30). The birds sallied from exposed perches approx. 1 m high down to the tops of short grasses, caught very small insects, and then returned to original perches or a nearby trees or shrubs. Small insects, too small to identify, appeared to be the most common prey item. Often, more than one willow flycatcher was seen ground sallying in the same area, and the flycatchers often *whitted* softly and stayed approx. 10 m apart while moving from perch to perch.

We observed *sally gleaning* on several occasions, where willow flycatchers in moderately dense woody shrubs and open areas of trees flew upward from a perch and pulled small insects from leaves, branches, and the boles of trees. Small insects, too small to identify, appeared to be the most common prey item, but on one occasion we saw a willow flycatcher sally glean a grub approx. 4 cm in length from the bark of a tree, perch on a nearby branch, beat the grub on the perch, and proceed to eat the grub. We have found sally gleaning to be the most difficult foraging technique to observe, as most often it is done from the densest areas of foliage.

On one occasion a willow flycatcher was observed eating small, reddish/purple fruits approx. 0.75 cm in diameter. With an *upward hover strike* at the hanging fruits growing on a vine, the bird plucked a fruit, landed on a branch approx. 1 m away, threw its head back slightly and swallowed the fruit. Shortly after, this flycatcher was captured and a fecal sample containing fruit was collected.

Figure 26. A dense patch of *Cassia* sp. (Family Fabacea) at a willow flycatcher detection area near Coto 44, Costa Rica. Dense patches of woody shrubs such as these were the most commonly used vegetation at all detection sites.
Figure 27. A dense patch of *Mimosa* sp. (Family Fabaceae) at a willow flycatcher detection site in Chomes, Costa Rica. Dense patches of woody shrubs were the most commonly used vegetation at all detection sites.
Figure 28. A willow flycatcher observed in a dense patch of *Mimosa* sp. aerial hawking small insects (Bolsón, Costa Rica).
Figure 29. A tree approx. 21 m in height from which a willow flycatcher was observed aerial hawking small insects (Solimar, Costa Rica).
Figure 30. Two willow flycatchers were observed perch to ground sallying small insects in this short grass pasture which borders gallery forest along the Rio Cañas, Santa Cruz, Costa Rica.

Figure 26.

Figure 27.

Figure 28.

Figure 29.

Figure 30.

Seasonal Site Fidelity and Territoriality on the Winter Grounds

Due to the short duration and scope of this project, we could not conduct in-depth behavioral studies to determine conclusively if willow flycatchers are territorial on the wintering grounds. However, we have found that wintering willow flycatchers exhibit seasonal site fidelity during the middle part of winter. We have also found that willow flycatchers demonstrate certain behaviors that can be interpreted as territorial. These behaviors include:

- aggressive responses to broadcast of vocalizations recorded on the breeding grounds
- aggressive responses to an *Empidonax* taxidermy mount
- aggressive interactions between willow flycatchers
- spontaneous song
- and counter singing

Spacial Distribution and Site Fidelity on the Winter Grounds

Seventeen color banded willow flycatchers were resighted on different days, at the same sites, occupying the same areas for up to 90 days at three different locations from 18 December through 22 March (Table 5). All color banded individuals were resighted using the same areas, which were similar in size to breeding territories.

Table 5. Summary of re-sight effort of color banded willow flycatchers at three sites in Costa Rica. Included is color band combination, site and date banded, re-sight dates, and total days on territory.

Color band combination and site	Date captured and color banded	Dates re-sighted in territory/area	Duration (days) on territory
KY:N, Chomes	18 Dec.1998	6, 10 Jan.; 11 Feb.; 17 March 1999	90
RW:N, Chomes	18 Dec. 1998	6, 11 Jan; 17 March 1999	90
DW:N, Chomes	18 Dec. 1998	7, 11 Jan. 1999	26
WW:N, Chomes	2 Jan. 1999	11 Feb.; 17 March 1999	74
RK:N, Chomes	2 Jan. 1999	11 Feb.; 17 March 1999	74
RD:N, Chomes	2 Jan. 1999	8 Jan.; 11 Feb.; 17, 22 March 1999	79
YV:N, Chomes	2 Jan. 1999	3 Jan.; 11 Feb.; 17 March 1999	74
WR:N, Chomes	3 Jan. 1999	11 Feb. 1999	39
WK:N, Chomes	7 Jan. 1999	11 Feb.; 17 March 1999	69
YK:X, Santa Cruz	12 Jan. 1999	23 Jan.	12
N:DD, Santa Cruz	12 Jan. 1999	23 Jan.; 18 March 1999	65
N:VV, Santa Cruz	12 Jan. 1999	23 Jan.; 18 March 1999	65
N:DW, Santa Cruz	12 Jan. 1999	23 Jan.; 18 March 1999	65
WD: N, Bolsón	16 Jan. 1999	12 Feb.; 19 March 1999	62
KD: N, Bolsón	16 Jan. 1999	23, 25 Jan.; 12 Feb.; 19 March 1999	62
KW: N, Bolsón	17 Jan. 1999	12 Feb.; 19 March 1999	61
DR: N, Bolsón	17 Jan. 1999	25, 12 Feb. 1999	26
N = bronze; K = black; Y = yellow; R = red; W = white; D = blue; V = violet			

Response to Broadcast of Vocalizations Recorded on the Breeding Grounds

Aggressive and agitated responses by willow flycatchers to broadcast of vocalizations recorded on the breeding grounds are highly suggestive that winter territories are maintained. A total of 40 willow flycatchers at six sites were exposed to two speakers, approx. 3 to 5 m apart, broadcasting vocalizations recorded on the breeding grounds. The speakers were placed in an area determined to be the area of greatest activity by an individual willow flycatcher. Thirty eight, 95%, of the 40 willow flycatchers exhibited behaviors suggesting aggressiveness and agitation (Appendix 22). These behaviors included:

- emphatic, rapid *fitz-bews*;
- *fitz-bew* song flights;
- bill snapping;
- raised crest and rapid tail pumping;
- *brrr/kitter* vocalizations accompanied by wing flutters;
- rapid *whitts*.

Thirty four, 85%, of the 40 willow flycatchers flew back and forth between the speakers displaying aggressive or agitated behavior while trying to locate the source of the broadcast. The other six flew into the mist net in less than one minute so flying back and forth between speakers could not be observed. However, it could be said that these six willow flycatchers were exhibiting an aggressive or agitated response in that they did come in immediately to the speaker area. Overall, all willow flycatchers exposed to broadcast of vocalizations recorded on the breeding grounds exhibited some form of aggressiveness and/or agitation (Appendix 22). Interestingly, all of these behaviors are similar to the responses of breeding willow flycatchers exposed to speakers broadcasting vocalizations recorded on the breeding grounds (Koronkiewicz *unpublished data*).

Response to an Empidonax Taxidermy Mount

A total of 34 willow flycatchers were exposed to an *Empidonax* taxidermy mount placed between two speakers broadcasting vocalizations recorded on the breeding grounds. Eleven, 32%, of the 34 flycatchers hovered within inches of the taxidermy mount or made physical contact with the mount. Seven flew into the mist net in less than one minute so no response to the mount could be observed. However, three out of these seven willow flycatchers hit the mist net in direct line with the decoy. Thus, overall, 41% exposed to the mount exhibited an aggressive response (Appendix 22).

One of the birds that made physical contact hit the mount so hard with a direct flight that the pole the mount was attached to continued to sway for about one minute. The other bird initially hovered in front of the mount, but eventually landed on it and proceeded to "peck" at it. All of these behaviors are similar to the responses of breeding willow flycatchers exposed to an *Empidonax* taxidermy mount placed between two speakers broadcasting vocalizations recorded on the breeding grounds (Koronkiewicz *unpublished data*).

Interactions Between Willow Flycatchers

On two occasions at two sites we observed aggressive interactions between wintering willow flycatchers. At Chomes, on 10 January, we observed a color-banded willow flycatcher fight and chase an unbanded flycatcher from an area which it had been occupying for a total 24 days. The interaction between the two birds involved bill snapping and *fitz-bew* song flights, but which bird was doing what could not be determined. The color-banded willow flycatcher was later observed occupying this particular area, approx. 20 m by 28 m, at the site for a total 90 days. The other observation of aggressive interactions between willow flycatchers occurred at the Bolsón site on 19 March. Upon release of a willow flycatcher captured for color-banding, it immediately encountered another flycatcher, which chased the color-banded bird from the area. The interaction between the two birds involved bill snapping and *interaction calls*, but which bird was doing what could not be determined.

Spontaneous Song

In order to determine if spontaneous singing is common among wintering willow flycatchers, surveyors revisiting willow flycatcher detection sites often began surveys without the aide of tape playback. Spontaneous calling (*whitting*) was heard at six of the twelve detection locations on eight different mornings. At three sites, Chomes, Bolsón and Solimar, six individual willow

flycatchers were heard spontaneously *fitz-bewing* on four different mornings. Five of these observations were heard prior to 0900 hours, the sixth at 1125 hours. During all three of these observations, other nearby flycatchers were heard spontaneously *whitting*. At a survey site in Puerto Jiménez, where no surveys had been conducted previously, the surveyor heard spontaneous *fitz-bews* from a single willow flycatcher before tape play had begun, at approx. 0700 hours.

Overall, we have found that spontaneous song (*fitz-bews*) from wintering willow flycatchers is not common during the middle of the winter period, and that spontaneous calling (*whitting*) is slightly more common than spontaneous song. Whether or not spontaneous song occurs more frequently at other times during winter, e.g. upon arrival or departure, is in need of further study.

Counter Singing

At all of the detection sites where more than one willow flycatcher was found, vocalizations from the first responding willow flycatcher often initiated singing and/or calling from other, nearby willow flycatchers. At times up to four willow flycatchers were vocalizing at the same time. This simultaneous singing was observed on numerous occasions, most often before 0900 hours.

DISCUSSION

Habitat Characteristics

Willow Flycatcher Habitat throughout the Pacific lowlands of Costa Rica

Although we searched a variety of habitats (Appendix 1), we found wintering willow flycatchers only in wet Pacific lowland habitats closely associated with standing water and/or saturated soils, with all of the detection sites profoundly influenced by seasonal inundation. The overall size, shape and species composition of the wetland areas vary, but gross habitat structure and vegetative composition is similar at all detection sites. Habitat at all of the willow flycatcher detection sites throughout the Pacific lowlands of Costa Rica consisted of four main components:

- ***standing water and/or saturated soils with associated wetland flora***

  Wintering willow flycatchers are strongly associated with standing water and/or saturated soils. All willow flycatchers detected were at locations in immediate proximity of standing water and/or saturated soils early in the season.

- ***patches of dense woody shrubs***

  These include impenetrable brambles, dense thorny/woody shrubs and tangles of vines.

- ***patches and/or stringers of trees***

  These patches and stringers are not continuous, dense forest, but rather isolated groves.

- ***open to semi-open areas***

  These areas were dry or held standing water, and are part of the habitat matrix.

Interestingly, all of the above components are similar to breeding habitat, and we did not find wintering willow flycatchers in habitats lacking any one of these components.

Habitats where we found wintering willow flycatchers include:

- ***lagunas and intermittent fresh water wetlands***
- ***muddy seeps***
- ***seasonally inundated savanna/pasture***
- ***and sluggish rivers, meandering waterways and oxbows***

We did not find wintering willow flycatchers along large or fast flowing rivers.

In comparison to the extensive agricultural areas and pastures which dominate the landscape throughout the Pacific lowlands, low lying wetlands and sluggish rivers support a diverse avifauna. These wetlands and rivers may provide more insects than do the dominant dry and heavily

disturbed areas, and the relative abundance of insects may be a factor in willow flycatcher use of these areas.

Even though we found wintering willow flycatchers only in habitats associated with low lying wetlands and sluggish rivers, future surveys should not be limited to these types of habitats. We focused this study on only relatively small areas within the flycatcher's winter range, and looked in those areas most likely to support wintering flycatchers. This study should not be considered an exhaustive survey of all habitats even within our survey areas. Therefore, wintering willow flycatchers may use other habitat types. Further work throughout the Pacific lowlands of Costa Rica in tropical dry and wet forest, savanna/pasture, low elevation woodlands, and wetland areas is needed to refine the winter habitat descriptions and to augment our understanding of willow flycatcher winter ecology.

Seasonal Inundation of Low Lying Areas throughout the Pacific Lowlands of Costa Rica

Pacific lowland Costa Rica has two very pronounced seasons of the year. During the five to six month dry season or *verano*, from the middle of November to the middle of April, the lowlands receive very little rain. The rainy season or *invierno*, usually from the end of April until about the beginning of November, provides the Pacific lowlands with almost their total annual precipitation.

Low lying areas closely associated with major rivers and/or streams are greatly affected by seasonal inundation during the rainy season. During the height of the rainy season, major rivers flood their banks, streams that drain uplands turn into rivers and low lying areas become inundated. Highest water levels occur in November and depending on the magnitude of flooding, areas of standing water may remain until the rains begin again in April. This seasonal inundation greatly affects vegetation composition and structure, and influences the distribution of the unique woodland and shrub habitats in the wetlands where we found flycatchers. Two examples of seasonally inundated wetlands in northwest Costa Rica are Laguna Argentina in Chomes and Sitio Jacinta in Bolsón.

Laguna Argentina, Chomes. The Chomes willow flycatcher site is strongly influenced by seasonal inundation, with standing water remaining in some areas year round. Although Chomes does not lie adjacent to a major river, there are two waterways that flow out of the adjacent uplands and empty into the *laguna* to the north. Direction of flow of the wetland is to the south/southwest, with a seep draining the *laguna*.

When willow flycatchers were first detected at Chomes in mid December, at the end of the rainy season, all of the detection areas within the site held much more standing water than in mid March, at the time of our last surveys (Figures 31 and 32).

Figure 31. Northern area of the Chomes willow flycatcher detection site, looking west. Photograph taken in mid-December. The laguna, flycatcher detection area, is the low lying area in the center of the photograph.

Figure 32. Northern area of the Chomes willow flycatcher detection site, looking east. Photograph taken in mid-March. The laguna, flycatcher detection area, is the low lying area in the center of the photograph.

Referring to Figures 31 and 32, it is obvious that much of the northern area of the Chomes willow detection site dried up from mid December to mid March. With the advance of the dry season the vegetation turned brown, and by mid March areas of standing remain only in the southern portion of the detection site. Interestingly, although the northern area of the Chomes detection site had completely dried up, the distribution and number of willow flycatchers remained constant for a three month period of time.

Sitio Jacinta, Bolsón. The Bolsón willow flycatcher site on the upper stretches of the Tempisque River is greatly affected by seasonal inundation. Although the Tempisque basin lies within the driest area of Costa Rica, heavy rains caused by Pacific storms in September and October result in annual flooding with moist standing water areas remaining in adjacent areas until March (Hartshorn 1983). The amount of standing water still present during our surveys, conducted during the height of the dry season, and communication with locals suggest that these wetlands at Bolsón hold standing water in some areas throughout the year.

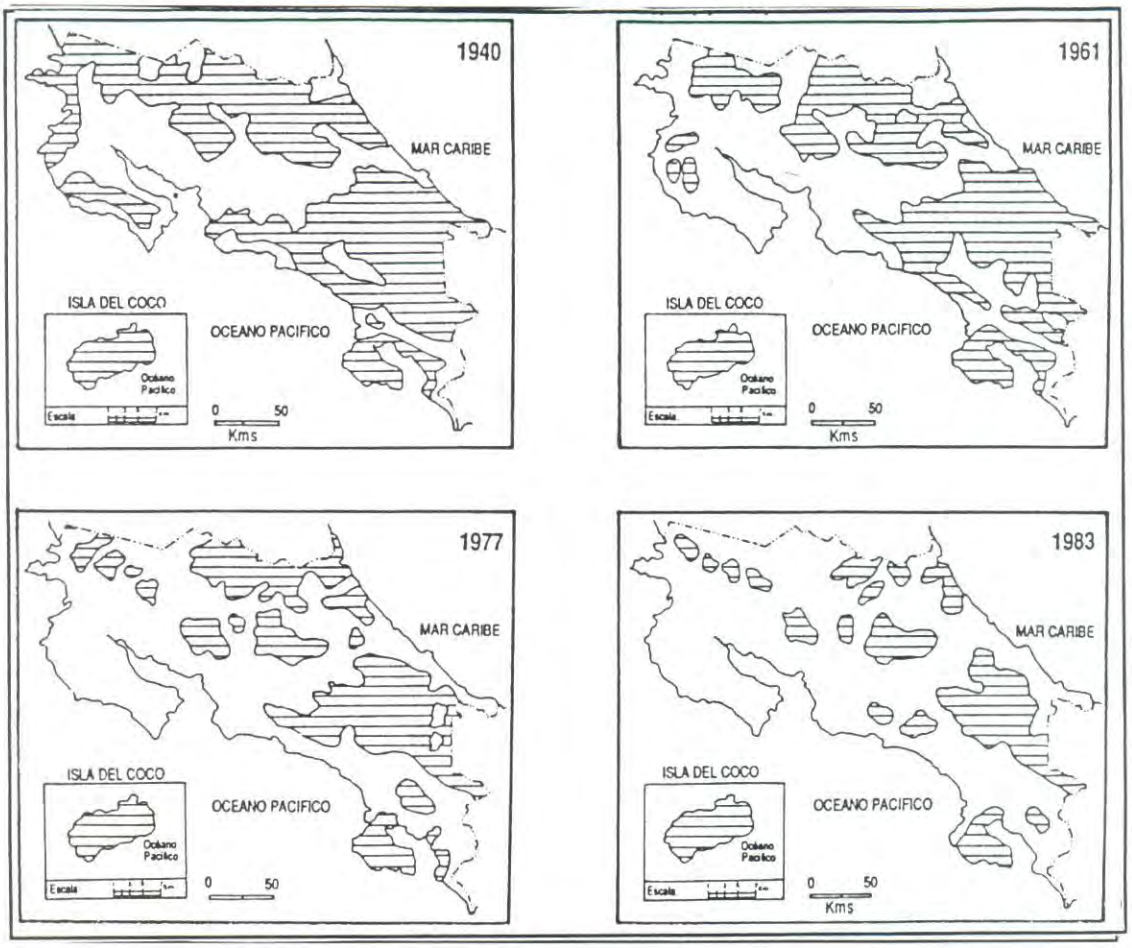
We found willow flycatchers only in areas with standing or very slow moving water. This was true even when habitat was similar to occupied sites but had no water. For example, at Bolsón , a large, open, muddy area had vegetation structure and composition nearly identical to that of where the flycatchers were found, except there was no longer any standing water. No flycatchers were found here, even though it was only about 300 m west of the occupied site.

Such observations raise important management and conservation questions as to whether the winter distribution the willow flycatcher is influenced by, or dependent upon, the presence of such surface water. Are flycatchers more widely distributed (on a local scale) early in the winter when surface water is more widespread? Does flycatcher distribution decrease or shift to match the changing distribution of surface water? If so, progressively less suitable habitat is available for flycatchers as the dry season advances, and late in the dry season the amount of available habitat may be limiting. Furthermore, if wintering willow flycatchers are restricted to these wet lowlands, any changes or impacts to these relatively scarce wetlands could have profound effects on a large proportion of flycatchers. The results of our study can not answer these questions. Additional research is needed to determine if winter willow flycatcher movement and distribution is closely linked to changes in surface water as the dry season advances.

Historical Changes and Current Threats

Costa Rica's long agricultural history, combined with the large scale production of cattle, sugar, rice, cotton, bananas, oil palm and others crops of today, have transformed a once extensively forested region to an area consisting primarily of man made savanna/pasture and agricultural land interspersed with growing population centers (Figure 33). Between 1950 and 1984, the area of natural forest in Costa Rica decreased at a rate of 40,000 to 50,000 hectares annually, mainly to establish pasture land for cattle (Tosi 1975, Solórzano et. al. 1991). All of the predesignated survey locations that we visited have been altered by historical and current human activity with associated drastic habitat changes over time.

Figure 33. Retrospective vision of the process of deforestation in Costa Rica (from the Department de Mapas de Jiménez & Tanzi Ltda. 1996). Forested areas are represented by horizontal lines.



Regional Settlement History and Habitat Change

Northern Pacific Lowlands

Northwest Costa Rica, now the Province of Guanacaste, has a very long history of agrarian cultures, dating as far back as pre-Columbian times (Boucher et al. 1983). After the Spanish Conquest, which began in the 1560's in Costa Rica, populations of native peoples were reduced by as much as 95% (Boucher et al. 1983), forests were removed and the early colonial Spanish way of life dominated the northwest. It is thought that by 1800 much of northwestern Costa Rica was extensively deforested as large cattle ranches were established and valuable timber was in high demand (Boucher et al.1983). Boat transport from Puntarenas to the mouth of the Tempisque River was established, and as a consequence, much larger areas were converted to man made savannas. Shortly after the turn of this century the region's native grasses were replaced with exotic, fire resistant and nutrient rich West African species which are more favorable for the raising of cattle (Boucher et al. 1983) and now dominate the savannas of Guanacaste.

More recently, extensive cattle ranching along with large scale plantations have destroyed almost all of the natural areas in the northern pacific lowlands, permanently changing these areas into "agro-ecosystems". During the 1950's Guanacaste Province produced more than 50% of Costa

Rica's rice, and in the 1960's rice production extended southward along the Pacific Coast (Stout 1983). Also during the 1960's, after the United States reassigned Cuba's sugar import quota to other countries, sugar cane production increased dramatically in Costa Rica, with the provinces of Guanacaste and Puntarenas being the number one production areas (Boucher et al.1983). Sugar cane and rice plantations are now a dominant part of the landscape throughout the northwestern lowlands of Costa Rica, making natural areas very scarce.

Southern Pacific Lowlands

The southern Pacific coast, settled later than the northwest, has also had a long history of settlement. The southern Pacific lowlands were settled mostly by pioneers who raised cattle and practiced slash and burn agriculture. Although small scale agriculture does have an effect on natural areas, it is mostly large scale plantations and cattle ranches that transformed this once extensively forested region to an area almost completely devoid of natural areas.

The central and southern pacific lowlands of Costa Rica have historically suffered the worst devastations of its forests because of its seasonal climate, the high value of its forest species, and the development of extensive cattle ranching (Watson et. al. 1998). Over two-thirds of agricultural land (and 40 percent of Costa Rica's national territory) was pasture in 1994 (Biesanz et. al. 1999).

Because southern Pacific coastal lowlands would be unfertile if not drained (Biesanz et. al. 1999), entire wetlands have been permanently removed and channeled into canals to make room for large plantations. Mostly planted with rice and African oil palm, largely by the United Fruit Company as banana profits dropped during the 1960's, the southern Pacific coast became one of the richest agricultural areas in all of Costa Rica (Biesanz et. al. 1999).

Current Threats to Willow Flycatcher Winter Habitat throughout the Pacific Lowlands

There have been and continue to be substantial human threats to the wet lowland habitats where we found wintering willow flycatchers. Fresh water wetlands along the Pacific coast of Costa Rica are *very* scarce, and human activity has reduced their extent even more. Based on our experience, the principle threats to wet lowland habitats (flycatcher habitat) in Costa Rica are the complete loss or draining of low lying wetland areas, and subsequent removal of associated wetland flora for agriculture, the use of agrochemicals, and extensive cattle ranching (Figures 34 and 35).

Figure 34. A 10,000 acre sugar and rice plantation in Bebedero, Costa Rica. At one time this area was Laguna Corralillo, a wetland area approx. 3 square km in area.

Figure 35. A wetland area near Valle de Coto Colorado, Costa Rica. Cattle have trampled much of the wetland flora around this laguna.

Figure 36. A willow detection site along the Rio Corozal in Puerto Jiménez, Costa Rica. All of the flycatcher habitat was removed and converted to short grass pasture (bulldozer left) during the course of this study.

Figure 34.

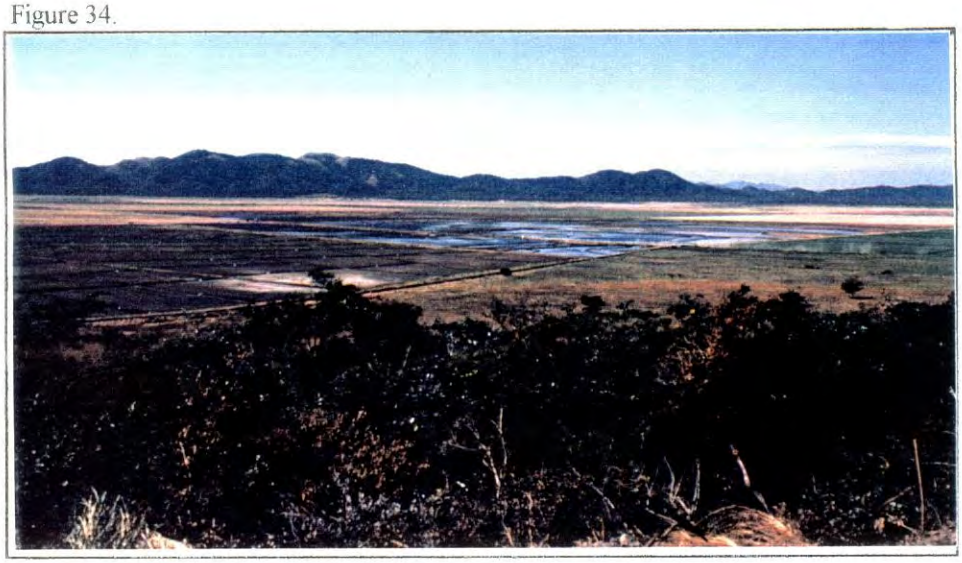
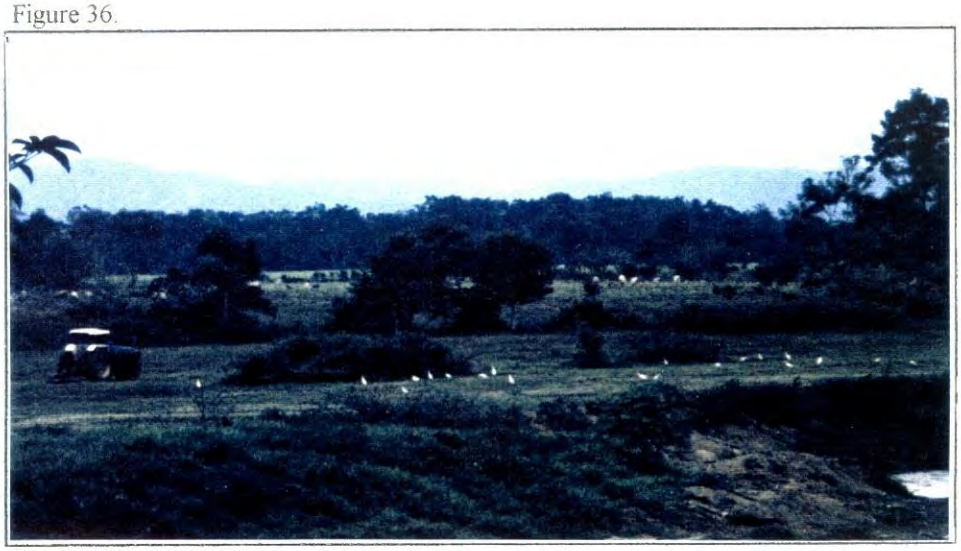


Figure 35.

Figure 36.



The lowland wet areas where we found wintering willow flycatchers are relatively small areas ranging from 35 m x 40 m to approx. 1 square km. Such wet areas have attracted and continue to attract human use in a region that experiences a pronounced dry season, particularly the Guanacaste area which often experiences drought (Boucher et al. 1983).

To illustrate this, two sites where we found willow flycatchers during our surveys are now gone. One was bulldozed shortly after we left, and one was being cut while we were mist- netting (Figure 36). Both of these sites have been converted to short grass pasture. If these wet areas are indeed an integral part of willow flycatcher wintering habitat, alteration or elimination of these habitats may limit willow flycatcher populations and their distribution within Costa Rica.

Dating as far back as colonial times, cattle ranchers in northwest Costa Rica moved their herds each wet season from the seasonally inundated, lower elevations to the slopes of the surrounding mountains (Boucher et al. 1983). During the middle part of this century, with land in increasing demand, this practice was abandoned and permanent cattle pastures expanded into the seasonally inundated lowland wet areas. Small scale farmers moved into wet forested areas, cut down the forest, grew crops for a few years and then moved on when their yields dropped. Large scale cattle ranchers then moved in and established exotic pasture grasses in and around these wet lowland areas (Boucher et al. 1983). The result was a complete alteration of many of the seasonally wet lowland habitats. These alterations, primarily the clearing of forests for pasture land, can be readily seen at all of the sites where we found willow flycatchers.

All of the wetlands where we found willow flycatchers are bordered by extensive pasture land that almost completely surrounds and extends into the wetland areas. Ranchers use these wetlands to provide water for their cattle during the dry season. Cattle were present in and around all of the willow flycatcher detection areas, and the effects of grazing on areas immediately adjacent to the wetlands were obvious. Numerous cattle trails penetrate the area and the vegetation in large areas is trampled and heavily grazed.

Extensive and intensive agriculture may be posing a threat to Costa Rica's wetlands in a number of other ways. Activities such as the diversion of water from wetlands to agricultural areas is a major concern and may affect the distribution, size and vegetational composition of wetland habitats. We observed such water diversions at numerous willow flycatcher detection sites.

Agricultural run-off and/or leaching may also pose a threat to the flora and fauna of wetland habitats. Where agriculture areas are located such that they facilitate leaching and/or run-off into the wetlands, chemical accumulation (although not monitored at this time) may have profound repercussions on wintering birds and their habitats.

Some agricultural activities result in the development of habitat totally unsuitable to flycatchers and most other birds. For example, where rivers and streams can be utilized for the development of irrigation systems, large scale sugar and rice plantations are established. As a result, enormous areas become dominated by an agricultural monoculture. The willow flycatcher sites in Guanacaste, particularly the Bebedero/Cañas area and the Coto Colorado area, are almost completely surrounded by intensive agriculture.

The effects of extensive monoculture, manipulation and diversion of natural water systems and severe alteration of vegetation structure and composition are immediately apparent at the willow flycatcher detection sites and historical wintering areas. What is not so apparent are the effects that pesticides and fertilizers may be having on the flora and fauna, particularly in low lying areas surrounded by extensive agriculture. Although the government of Costa Rica is attempting to develop disease-resistant varieties of rice, the largest plantations (located in Guanacaste) make extensive use of pesticides and fertilizers (Stout 1983). The potential threat is illustrated by the fact that the major irrigation canals that route through the extensive sugar, rice and oil palm plantations in Bebedero, Cañas and Coto 44 are marked along the roadway with signs that read "No Swimming - Contaminated."

The upper interior areas of the Golfo de Nicoya in and around the mouth of the Tempisque River are suspected to have high levels of fertilizers and agricultural pesticides derived from the intensively agricultured Tempisque and Bebedero drainages (Kapetsky et al. 1987; Appendix 15), but river waters are not monitored. Given that we found five willow flycatcher wintering areas in and around these two drainages (Figure 1), chemical contamination may be posing a threat to wintering flycatchers. Although the flycatchers that we found are almost certainly exposed to agrochemicals, the nature and degree to which chemical accumulation actually occurs on the wintering grounds requires further investigation.

Although the overall picture regarding habitat degradation and threats to wintering willow flycatchers may appear grim, some recent developments suggest that more people may be realizing the importance of protecting seasonally wet lowland areas. Costa Rica, more so than any other Central American county, has an extensive national park and preserve system that protects some large tracts of native, natural habitats. Eco-tourism has and continues to be an integral part of the nation's economy.

Smaller scale conservation efforts also occur at a more local level. For example, the willow flycatchers at Bolsón are located in a 750 ha cooperative restoration area consisting of flood lands adjacent to the Tempisque River. This restoration area was established through a cooperative effort between the municipalities of Bolsón and nearby Ortega. Much of the land in and around Ortega has been converted to extensive sugar cane plantations and large areas of cattle pasture, and the restoration area was established to prevent further encroachment and conversion to sugar cane. Part of a willow flycatcher site in Santa Cruz is also located on a "preserve" consisting of flood lands adjacent to the Rio Cañas. The willow flycatcher detection site in Solimar is owned by Oscar Pechenco whose family for generations has been known for their efforts in preserving natural areas. Restoration areas are not necessarily free of human impacts; there are areas of sugar cane within the restoration area of Bolsón, and cattle are present at the sites in Solimar, Santa Cruz and Bolsón. However, comparatively speaking, such restoration areas may help preserve or restore some wetlands and associated low-lying savannas, and certainly provide for more habitat potential than do sugar cane monocultures.

Another recent development with potential positive benefits to wintering flycatcher habitat is the reduction of beef prices in Costa Rica. As a result, many cattle pastures have been abandoned throughout the Pacific lowlands, and over the last few years due to a decrease in profits, there has been strong natural regeneration of secondary forests (Watson et. al. 1998). Whether this has or will have a substantial effect on the regeneration of habitats within Costa Rica, particularly the

seasonally wet lowland areas that support wintering willow flycatchers and many other species, is not known at this time. Fluctuation of beef prices may be cyclical, and rising prices may result in abandoned pastures being cleared again in the future.

Willow Flycatcher Winter Surveys

Timing of Surveys

Gorski (1969) found willow flycatchers responded to tape broadcast relatively early in the winter (December and January), Koronkiewicz et. al. (1998) found flycatchers responded to tape late in the winter (February), and we found wintering flycatchers responded to tape play until at least mid March. We suspect that wintering willow flycatchers will respond to tape playback surveys throughout the winter period. Gorski (1969) and Koronkiewicz et. al. (1998) also suggested that wintering willow flycatchers respond most reliably to tape broadcast in the morning, before 1000 hrs. Although approx. 90% of our willow flycatcher detections occurred before 1000 hrs (when the majority of our surveys were conducted), some flycatchers did respond to the tape throughout the day. However, given that prolonged tape play was required to elicit willow flycatcher response during the afternoon, we concur with Gorski (1969) and Koronkiewicz et. al. (1998) that surveys be conducted primarily prior to 1000 hrs. Such surveys have the best chance to most accurately determine the total number of willow flycatchers present. Environmental considerations also favor early morning surveys. At these tropical latitudes (between 10° and 9° north lat.) the sun moves directly overhead very quickly and relatively early in the morning. Flycatcher activity greatly diminishes when direct sun and high temperatures prevail. Furthermore, the strong winds that often occur during afternoons greatly hinder surveys.

Vocalizations of Responding Flycatchers

Wintering willow flycatchers reacted vocally to tape broadcast surveys. However, 30% of the flycatchers we found responded only with a series of *whitt* or *wheep* calls. It is therefore crucial that future winter surveyors know the *whitt* and *wheep* call notes of willow flycatchers, and distinguish them from other similar call notes of other birds.

We recommend that future surveys use tape broadcast to locate willow flycatchers and that surveyors work slowly through the habitat and play the tape repeatedly throughout a survey site. We also recommend that the 1-3 minute listening period after tape play be increased to 2-4 minutes. Although some willow flycatchers responded immediately to the tape, others vocalized only after prolonged tape broadcast. These individuals might not have been detected at all if only cursory surveys were conducted. Overall, our conclusion is that tape playback is a useful, if not essential, tool for conducting wintering flycatcher surveys.

Territoriality and Seasonal Site Fidelity on the Winter Grounds

A territory is generally considered as a defended area, from which an individual excludes some or all individuals of the same (and sometimes other) species (Brown 1969). A bird simply using an area, but not defending it, can not be considered territorial. Passerine birds such as the willow flycatcher typically defend breeding territories by songs, calls, visual displays and (less frequently) by direct physical interactions. Although it was once commonly thought that neotropical migratory birds were nonterritorial wanderers during their winter stay, recent research has shown that a number of species do indeed maintain winter territories (Rappole 1995). Unpublished research on wintering alder flycatchers (*Empidonax alnorum*) has found that they establish winter territories, and maintain them in part by singing (M. Foster, *pers. comm.*).

We have found strong evidence indicating willow flycatchers are territorial, thus the number of individuals inhabiting a wintering site could be limited by territory size requirements. Evidence we have found that is highly suggestive of winter territoriality is as follows:

- 95% of willow flycatchers exposed to speakers broadcasting vocalizations recorded on the breeding grounds exhibited aggressive behaviors (Appendix 22)
- 41% of willow flycatchers exposed to an *Empidonax* taxidermy mount exhibited an aggressive response, including physical contact with the mount (Appendix 22)
- observations of aggressive interactions between willow flycatchers

These territorial behaviors exhibited within an area used exclusively by an individual bird over a relatively long period of time are highly suggestive that winter territories are maintained by willow flycatchers.

Although we have observed spontaneous singing and calling, and counter singing by wintering willow flycatchers, this behavior alone is not sufficient evidence to conclude that the birds are territorial on the winter grounds. Counter singing and calling may serve other purposes as well such as communication of food sources or alerting others of their kind to predators. But given that wintering willow flycatchers exhibit seasonal site fidelity, exhibit aggressive responses to broadcast of vocalizations, an *Empidonax* taxidermy mount, and other willow flycatchers, spontaneous song and calling may be attributed to winter territoriality.

We have also found willow flycatchers show a high degree of seasonal site fidelity during the middle period of winter. Seventeen willow flycatchers exclusively occupied the same area within a site for up to 90 days at three different sites. They remained or lingered at a site even when habitat conditions changed.

The question of whether willow flycatchers hold winter territories has conservation and research implications. Territoriality may favor increased between-year site fidelity, with wintering flycatchers returning to the same patch and/or territory each year. If willow flycatchers do return to the same patch or territory each year this would make wintering areas even more critical to their survival. Resighting color banded birds between years would answer this important question.

Empidonax traillii extimus in northwest Costa Rica

In order to monitor willow flycatcher movements within a site and record behaviors of individual birds, we uniquely color banded a total 38 willow flycatchers at six sites in Costa Rica. One of the willow flycatchers captured in Santa Cruz, Guanacaste was a "re-capture", already possessing a uniquely numbered U.S.F.W.S service band. The U.S. Geological Survey Bird Banding Lab was contacted and informed us that this flycatcher was previously captured and banded in July 1998 at Ash Meadows National Wildlife Refuge in southern NV, a location within the identified breeding range of *extimus*. Over the course of the breeding season of 1999, this flycatcher was re-sighted twice on two separate occasions on territory at Ash Meadows National Wildlife Refuge. Interestingly, Unitt (1997) had identified the museum specimen of *E. traillii* collected from the this *exact* location (Mohal, 12 Dec. 1950) in Santa Cruz as *extimus*. This rare re-capture occurrence has resulted in the first recent confirmed wintering site of *Empidonax traillii extimus*.

Recommendations for Future Studies

Expanded surveys

Although our project successfully located wintering willow flycatchers and provided useful preliminary information regarding their winter habitat use, much remains to be known. Tape playback provides an effective tool for expanded winter willow surveys. Additional surveys are needed throughout Central America (including Costa Rica), South America and Mexico where willow flycatchers have been seen or collected, or where potential wintering habitat occurs. Such surveys can provide critical data on the winter distributional patterns and winter habitat requirements of willow flycatchers. Conducting repeated surveys during successive winters will also help determine whether flycatchers show between season fidelity to particular sites.

The relationship between wintering flycatchers and surface water

As noted above, the relationship between wintering flycatchers and surface water is an important management issue. All of our detections in throughout the Pacific lowlands of Costa Rica were within habitats associated with surface water. Repeated surveys and detailed behavioral studies could determine whether these wet habitats are a requirement for wintering willow flycatchers, and how drought, agriculture, or other habitat impacts could affect wintering birds.

Territoriality on the Wintering Grounds

Although we have found strong evidence indicating willow flycatchers are territorial on the winter grounds, there are additional questions fundamental to the understanding of habitat use and winter ecology. What is the size of a territory, and how does territory size relate to different habitats? Are the same territory boundaries maintained throughout the winter, or do they change over the season? Do the sexes have different types of territories, or are territories shared? Are territories associated with water? These and many other related questions are worthy of additional study. If

willow flycatchers do return to the same patch or territory each year this would make wintering areas even more critical to their survival.

Between Season Site Fidelity

Although we have found that willow flycatchers exhibit seasonal site fidelity, we do not know if willow flycatchers exhibit between-season site fidelity. If willow flycatchers do return to the same patch or territory each year, this would make specific wintering areas even more critical to their survival. Re-sighting color banded birds between years would answer this important question.

Diet Studies

Almost nothing is known regarding the diet of wintering willow flycatchers. Although sometimes difficult to conduct, a quantitative diet study could be based on analysis of fecal sacs obtained during a winter banding project, and incorporated with behavioral observations of banded birds.

Subspecies Identification on the Wintering Grounds

Distinguishing among subspecies would be very useful in determining potential impacts to the subspecies of concern (primarily *E.t. extimus*), and in guiding winter conservation strategies. However, as noted in the Introduction, general field surveys and research can not differentiate between the different willow flycatcher subspecies. However, it may be possible to identify subspecies by genetic analysis. Blood samples taken while banding and analyzed in the laboratory may help pinpoint wintering individuals or populations of a particular subspecies. Morphological analysis by taxonomic experts, which compares captured individuals with known voucher specimens, may do the same.

Patterns of Land Use and Impacts, and Conservation Potential, on the Wintering Grounds

Research on the patterns and trends in land use and human activities can identify areas and activities of concern. This will be particularly valuable once there is a more thorough understanding of the habitat requirements of wintering willow flycatchers. A better understanding of land use, impacts and threats will also aide in identifying potential conservation areas and developing useful conservation measures.

WILLOW FLYCATCHER SURVEYS AND ASSESSMENT OF POTENTIAL WINTER HABITAT IN PANAMÁ

INTRODUCTION

This part of the study was designed as a short pilot project to set the stage for future intensive willow flycatcher surveys. It was undertaken primarily to assess potential willow flycatcher habitat at historical wintering sites in western Panamá, and to document the working conditions and logistics in these areas. At the time we initiated this pilot project, detailed logistical information was not available for these areas.

Specific objectives of this part of the project were to:

- physically locate historical willow flycatcher wintering sites in western Panamá and document the logistics of working in these areas;
- describe and photograph the habitats found at historical sites, and in the process survey for willow flycatchers;
- and document threats or impacts to wintering areas.

METHODS

Study Area

We conducted our studies in western Panamá at historical willow flycatcher collection locations. These locations occur primarily in low lying areas along the Pacific coast, and are scattered from central Panamá westward to the Costa Rica border and are located from 7° 25' to 8° 30' N latitude and from 80° to 82° W longitude. The entire area lies within an region of Central America that has two pronounced seasons of the year. During the five to six month dry season or *verano*, from December to April, the coastal lowlands receive very little rain. The rainy season or *invierno*, usually from April until the end of November, provides the pacific lowlands with almost their total annual precipitation.

Survey Site Selection in Western Panamá

Based on Unitt's study (1997), eight willow flycatcher specimens (one identified as *extimus*) have been collected in western Panamá during winter months, at four sites: Tonosí, Pesé, Paris, and San Félix. We focused our field studies at these four sites (Figure 37; Table 5).

Table 6. Locations in western Panamá where willow flycatchers were collected, including number of flycatchers, date collected and subspecies identification (Unitt 1997).

Location	Number of Willow Flycatchers Collected	Date Collected	Subspecies Identification
Tonosi	3	23, 24 and 26 March 1957	undetermined
Pesé	2	29 and 30 March 1948	undetermined, *adastus*
Paris	1	24 February 1948	*adastus*
San Félix	2	21 and 23 February 1956	*extimus* and *adastus*

Timing of Field Studies

Field studies were conducted from 16 February through 27 February 1999. Three surveyors spent a total 12 days working the area. Surveyors worked the selected sites and surrounding areas simultaneously and split up on survey days to cover as much area as possible.

RESULTS

Logistics in Western Panamá

Because of international presence for close to one hundred years, all major roadways in and around Panamá City and throughout western Panamá are in excellent condition making travel safe and swift. Improvements to infrastructure throughout the country continue to take place and road improvements have been a priority for the last three presidents. Surveyors noted road travel as excellent from Panamá City west to the Costa Rica border, and surveyors easily found accommodations in and around all of the predesignated survey areas. Surveyors found all of the predesignated survey areas to be relatively safe, and the locals very friendly.

Survey Effort

We surveyed 14 sites at the predesignated survey locations in western Panamá (Table 6). We spent a total 41 survey hours conducting 15 surveys between 16 February and 27 February 1999 (Appendix 16).

Table 8. Summary of survey effort during 1999 winter willow flycatcher surveys in Panamá.

Survey Location	Number of Sites/Patches Surveyed	Number of Surveys	Survey Hours
San Félix	3	4	11.0
Paris	3	3	13.0
Pesé	5	5	8.8
Tonosí	3	3	9.0
TOTAL	**14**	**15**	**41.8**

Habitats Surveyed

The vast majority of lands in and around the historical and present willow flycatcher wintering areas in western Panamá have been profoundly altered by man. Large scale cattle ranches have transformed many of the survey locations, and much of western Panamá, into man made savannas and pasture lands. Agricultural areas, particularly extensive sugar and rice plantations, dominate many of the survey locations.

Although we did conduct surveys in a variety of habitats (Appendix 16), field personal focused their surveys in habitats most likely to hold wintering willow flycatchers. These habitats included:

- lagunas and intermittent fresh water wetlands;
- muddy seeps;
- seasonally inundated savanna/pasture;
- and sluggish rivers, meandering waterways and oxbows.

Willow Flycatcher Detections

We detected willow flycatchers at three of the four survey locations; San Félix, Pesé and Tonosí. In total, we found 19 willow flycatchers (Table 7), with between two and nine flycatchers detected at each site.

Table 7. Summary of willow flycatcher detections during 1999 survey s in western Panamá from 16 February and 27 February 1999.

Detection location	# of willow flycatchers detected	Dates of detection(s)
San Félix	5	25 and 26 Feb.
Pesé	5	22 Feb.
Tonosí	9	23 Feb.
TOTAL DETECTIONS	**19**	

Habitat Descriptions for Detection Areas

Following is a brief summary of the habitat at each detection site. These descriptions were recorded at the time of detection, in the immediate vicinity of the willow flycatcher(s).

San Felix, Chiriqui

The San Felix willow flycatcher sites consist of a series of *lagunas* (intermittent fresh water wetlands), seasonally flooded savanna-woodland edge and pasture, and sluggish, meandering oxbow waterways and muddy seeps that branch off of a major river (Figures 38 and 39). The *lagunas* (varying in size but averaging approx. 100 m x 100 m) are bordered by patches and stringers of forest (avg. height 8-12 m with highly variable understories) and dense woody shrubs, *Mimosa* sp. (avg. height 1-2 m), which extend into the wetlands in the driest areas. Areas of standing water choked with aquatic grasses and swamp herbs, Marantacea (avg. height 1-2 m), are scattered throughout the *lagunas*. The oxbow waterways and muddy seeps are bordered by forested areas (avg. height 9-11 m with dense understories), dense woody growth entangled with vines (avg. height 2-5 m), and herbaceous shrubs (avg. height 1 m). Rooted aquatic vegetation and grasses are scattered throughout the waterways. Seasonally flooded savanna-woodland edge and pasture are scattered throughout the areas. Standing water is present within the *lagunas* and waterways year round, but large areas flooded during the rainy season progressively dry up as the dry season advances (Appendix 17).

Pesé, Herrera

The Pesé willow flycatcher site consists of a patch of gallery forest (approx. 12 m in height with a highly variable understory), approx. 20 m x 60 m in size which lies on a sluggish river (Figure 40). The banks of the river are bordered by herbaceous and woody shrubs entangled with vines (approx. 2-4 m in height). The entire patch is completely surrounded by sugar cane plantation. Standing water is present year round with patches of muddy soil scattered throughout the

vegetation (Appendix 18).

Tonosí, Herrera

The Tonosí willow flycatcher sites consist of *lagunas* (intermittent fresh water wetlands), seasonally flooded savanna-woodland edge and pasture, and sluggish, meandering *quebradas* (streams) and seeps (Figures 41 and 42). The *lagunas* (varying in size but averaging approx. 200 m x 200 m) are bordered by patches and stringers of forest (avg. heights 8-12 m with highly variable understories) and dense woody shrubs, *Mimosa* sp. and *Cassia* sp. (avg. height 2-3 m), which extend into the wetlands in the driest areas. One of the *lagunas* has an undisturbed island of very tall trees up to 30 m. Areas of standing water choked with aquatic grasses and swamp herbs, Marantacea (avg. height 1-2 m), are scattered throughout the *lagunas*. The *quebradas* and muddy seeps are bordered by patches of trees (avg. heights 9-11 m with relatively open understories), and dense woody growth entangled with vines and herbaceous shrubs (avg. height 2-3 m). Seasonally flooded savanna-woodland edge and pasture are scattered throughout the areas. Standing water is present within the *lagunas* and *quebradas* year round, but large areas flooded during the rainy season progressively dry up as the dry season advances (Appendix 19).

Figure 38. Willow flycatcher detection area at Quebrada Mamey near San Felix, Panamá. Willow flycatchers were found using the dense woody shrubs and trees along this waterway (left).
Figure 39. Willow flycatcher detection area at the Las Lajas wetlands near San Felix, Panamá. Willow flycatchers were found using the dense woody shrubs and trees interfacing with the wetland area (background).
Figure 40. Willow flycatcher detection area on Quebrada Pesé near Pesé, Panamá. Willow flycatchers were found using the vegetation on both sides of this waterway.
Figure 41. Willow flycatcher detection area at Laguna Catalina near Tonosí, Panamá. Willow flycatchers were found using the woody shrubs and trees shown here.
Figure 42. Willow flycatcher detection area at Laguna Naranja near Tonosí, Panamá. Willow flycatchers were found using the dense woody shrubs and trees interfacing with the wetland area (background), as well as the aquatic vegetation (foreground)

Figure 38.

Figure 39.

Figure 40

Figure 41.

Figure 42.

Habitat Characteristics

We found five wintering willow flycatcher sites at three different locations in western Panamá characterized by a standing water area with patches of floating and emergent aquatic vegetation bordered by seasonally inundated savanna, dense woody shrubs, patches or stringers of trees and open grassy areas. At several of these sites areas of saturated soil were also present. The overall size and shape of the wet areas vary, but gross habitat structure and vegetative composition was similar at all detection sites. Willow flycatchers were most frequently observed along the edges of the wet areas, often in dense woody shrubs which border and extend into the drier portions of the patches, and in forest edge along the most open areas of the wetlands. The habitats where we found wintering willow flycatchers are similar to occupied habitats in Costa Rica, with the overall size and shape of the wet areas varying, but gross habitat structure and vegetative composition similar.

Current Threats to Winter Habitat

Based on our preliminary assessment of habitats at historical and present wintering willow flycatcher sites in western Panamá, we have found there to be *substantial* human threats to flycatcher habitat. In fact, habitat loss and threats appear more widespread than in Costa Rica. The vast majority of lands throughout the Pacific lowlands of western Panamá have been profoundly altered by man. Large scale cattle ranches have transformed many of the survey locations, and much of the Pacific lowlands, into a featureless landscape consisting primarily of man-made savannas and pasture lands. Agricultural areas, particularly extensive sugar and rice plantations, dominate many of the survey locations. Based on our experience, the principle threats to flycatcher habitat in western Panamá are the complete removal of natural areas for agriculture and subsequent widespread use of agrochemicals, and extensive cattle ranching (Figures 43 and 44).

Figure 43. Heavily grazed and trampled landscape on the Azuero Peninsula, Panamá. A common site throughout western Panamá, this type of land use results in a severe alteration of natural habitats, particularly changing relatively wet areas into man made, hard packed savannas.

Figure 44. Sugar cane plantation adjacent to a willow flycatcher site in Pesé, Panamá. Huge areas of sugar cane monoculture are a common site throughout western Panamá, particularly the areas in and around Pesé where it is grown for the distilled drink *guaro*.

Conclusions

Overall, we found the logistics of conducting field studies in and around historical and present willow flycatcher sites in western Panamá to be relatively straightforward. Roads are in excellent condition, accommodations can be found at all major towns, and all of our predesignated survey areas were relatively safe. Although our willow flycatcher surveys focused on habitats most likely to support wintering flycatchers, we have found occupied willow flycatcher habitat to be closely associated with standing water and saturated soils, much as in Costa Rica. Also as in Costa Rica and most likely throughout the willow flycatcher's winter range, historical and present willow flycatcher sites in western Panamá have and continue to be threatened by substantial human threats.

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Appendix 1. Details of 1999 willow flycatcher survey effort in Costa Rica. Surveys during which willow flycatchers were detected are shaded.

Habitat(s) Surveyed

1 = patches or stringers of trees (deciduous, semi-deciduous, and evergreen) and/or woody shrubs, bordered by savannas and pasture lands
2 = gallery forest consisting of patches or stringers of trees (deciduous, semi-deciduous, and evergreen) and/or woody shrubs, bordered by savannas and pasture lands
3 = riparian areas with associated vegetation of varying heights, densities and under story composition
4 = riparian areas and adjacent savannas and pasture lands
5 = *lagunas* (intermittent fresh water wetlands), seasonally inundated savanna and seeps
6 = *lagunas* (intermittent fresh water wetlands) and seasonally inundated savanna with *Parkinsonia spp.* ("Palo Verde") being the dominant vegetation type
7 = agricultural areas
8 = tidal lowlands (vegetation composed primarily of *Rhizophora spp.* ("mangrove"))
9 = patches/areas of tropical dry forest (employing the World Life Zone-System Ecological Classification of L.R. Holdridge 1967)
10 = patches/areas of tropical wet forest (employing the World Life Zone-System Ecological Classification of L.R. Holdridge 1967)

Surveyor(s): TK = Thomas J. Koronkiewicz, SL = Suzanne M. Langridge, PH = Philip B. Heavin, KE = Kristen M. Enos, JH = Jan V. Hart, MW = Mary J. Whitfield, MH = Mary D. Halterman, RN = Rene Netter

N/A = coordinates not available; N/A_1 = due to dense canopy, unable to obtain coordinates; N/A_2 = area surveyed < 200 linear meters;

Survey Location	Date	Coordinates Start	Coordinates Stop	Timing of Surveys	Survey Hours	Habitat(s) Surveyed	Surveyor(s)
Parque Nacional Santa Rosa, Guanacaste	25 Jan.	N 10° 51.10' W 85° 36.88'	N/A_1	0615 to 1015 hours	4.0	2,3,4	RN
		N 10° 58.06' W 85° 33.46'	N 10° 57.52' W 85° 32.77'	0630 to 1130 hours	5.0	1,2,3	KE
		N 10° 51.10' W 85° 36.88'	N 10° 52.18' W 85° 36.47'	0600 to1030 hours	4.5	3,9	SL
	27 Jan.	N 10° 46.78' W 85° 39.85'	N 10° 47.70' W 85° 39.43'	0600 to1000 hours	4.0	8,9	RN
		N 10° 46.78' W 85° 39.85'	N 10° 46.29' W 85° 38.68'	0600 to 1000 hours	4.0	3,4,5	SL
Bebedero/ Cañas, Guanacaste	29 Jan.	N 10° 21.21' W 85° 5.96'	N 10° 21.32' W 85° 5.17'	0618 to 1318 hours	7.0	1,2,6	TK
		N 10° 21.21' W 85° 5.96'	N 10° 20.93' W 85° 5.69'	0618 to 1330 hours	6.8	1,2	PH
Tempate, Guanacaste	23 Jan.	N 10° 21.59' W 85° 42.23'	N 10° 21.92' W 85° 42.87'	0554 to 1105 hours	5.2	1,2,3,4,5	TK
		N 10° 21.59' W 85° 42.23'	N 10° 22.00' W 85° 42.18'	0600 to 1030 hours	4.5	1,2,3,4,5	PH
	24 Jan.	N 10° 24.73' W 85° 43.07'	N 10° 22.10' W 85° 43.18'	0600 to 1310 hours	7.2	1,2,3,4	TK
		N 10° 21.85' W 85° 42.97'	N 10° 22.10' W 85° 43.18'	0645 to 1300 hours	6.3	1,2,3,4	PH

Appendix 1. Continued

Survey Location	Date	Coordinates Start	Coordinates Stop	Timing of Surveys	Survey Hours	Habitat(s) Surveyed	Surveyor(s)
Parque Nacional Palo Verde, Guanacaste	19 Jan.	N 10° 20.90' W 85° 16.92'	N/A_1	0700 to 1100 hours	4.0	4,6,9	TK
		N 10° 20.88' W 85° 16.83'	N 10° 21.43' W 85° 15.88'	0700 to 1200 hours	5.0	4,6,9	PH
	20 Jan.	N 10° 20.63' W 85° 20.58'	N/A_1	0605 to 1100 hours	4.9	1,4,6,9	TK
		N 10° 20.62' W 85° 20.59'	N/A	0600 to 1030 hours	4.5	1,4,6,9	PH
	21 Jan.	N 10° 19.40' W 85° 13.51'	N 10° 19.55' W 85° 13.04'	0700 to 1100 hours	4.0	1,3,5,6,9	TK, PH
Bolsón, Guanacaste	11 Jan.	N 10° 21.37' W 85° 25.03'	N/A_2	1553 to 1830 hours	2.6	1,3,4,5,9	TK, PH
	13 Jan.	N 10° 21.45' W 85° 24.97'	N 10° 21.30' W 85° 25.05'	0548 to 1048 hours	5.0	1,4,5,7,9	TK
		N 10° 21.45' W 85° 24.97'	N 10° 21.45' W 85° 24.97'	0600 to 1100 hours	5.0	1,4,5,7,9	PH
	16 Jan.	N 10° 21.12' W 85° 25.35'	N 10° 20.62' W 85° 25.55'	0600 to 1100 hours	5.0	1,4,5,9	TK, PH
	17 Jan.	N 10° 21.12' W 85° 25.35'	N/A_2	0600 to 1030 hours	4.5	1,4,5,9	TK
	17 Jan.	N 10° 21.45' W 85° 24.97'	N/A_2	0600 to 0900 hours	3.0	1,4,5,7	PH
	17 Jan.	N 10° 21.45' W 85° 24.97'	N/A_2	1600 to 1800 hours	2.0	1,4,5,7	TK, PH
	23 Jan.	N 10° 21.12' W 85° 25.35'	N/A_2	1500 to 1730 hours	2.5	1,4,5,9	TK, MW, JH, PH, MH
	25 Jan.	N 10° 21.19' W 85° 25.47'	N 10° 21.45' W 85° 24.97'	0600 to 1200 hours	6.0	1,3,4,5,9	TK
		N 10° 21.12' W 85° 25.35'	N 10° 20.62' W 85° 25.55'	0600 to 1230 hours	6.5	1,4,5,9	PH
	12 Feb.	N 10° 21.12' W 85° 25.35'	N/A_2	1300 to 1416 hours	1.3	1,4,5,9	TK
Puerto Humo, Guanacaste	27 Jan.	N 10° 17.49' W 85° 25.91'	N 10° 17.97' W 85° 24.98'	0640 to 1330 hours	6.8	1,3,4,5,7,9	TK
		N 10° 17.62' W 85° 25.87'	N 10° 7.03' W 85° 26.51'	0700 to 1300 hours	6.0	1,3,7,9	PH

Appendix 1. Continued.

Survey Location	Date	Coordinates Start	Coordinates Stop	Timing of Surveys	Survey Hours	Habitat(s) Surveyed	Surveyor(s)
Santa Cruz, Guanacaste	10 Jan.	N 10° 18.84' W 85° 42.77'	N 10° 19.37' W 85° 42.36'	1040 to 1230 hours	1.8	3,4,9	SL, KE
	11 Jan.	N 10° 18.98' W 85° 39.56'	N 10° 19.44' W 85° 39.12'	0600 to 1030 hours	4.5	3,9	KE
	12 Jan.	N 10° 19.74' W 85° 38.97'	N/A_2	0530 to 1200 hours	6.5	1,3	TK, PH, SL, KE
	13 Jan.	N 10° 18.93' W 85° 42.36'	N 10° 18.58' W 85° 42.00'	0600 to 1030 hours	4.5	1,3,5,9	SL
		N 10° 19.47' W 85° 39.23'	N 10° 19.74' W 85° 38.97'	0600 to 1100 hours	5.0	1,3,4,5,9	KE
	23 Jan.	N 10° 19.44' W 85° 39.12'	N 10° 19.58' N/A	0545 to 1100 hours	5.3	1,3,4,5,9	KE, MW
		N 10° 18.86' W 85° 39.60'	N 10° 19.18' W 85° 39.15'	0735 to 1035 hours	3.0	1,3,4,5,9	JH
	12 Feb	N 10° 18.98' W 85° 39.56'	N/A_2	0600 to 1000 hours	4.0	1,3,9	TK
Solimar, Guanacaste	8 Jan.	N 10° 17.46' W 85° 9.94'	N 10° 17.35' W 85° 10.04'	0830 to 1000 hours	1.5	1,3,4,5,9	KE, SL
		N 10° 17.46' W 85° 9.94'	N/A_2	1000 to 1200 hours	2.0	1,3,4,5,9	SL
	9 Jan.	N 10° 16.51' W 85° 8.87'	N 10° 16.51' W 85° 9.00'	0654 to 1000 hours	3.1	1,2,5,9	KE, SL
	28 Jan.	N 10° 17.46' W 85° 9.94'	N/A_2	0600 to 1300 hours	7.0	1,3,4,5,9	TK, SL
		N 10° 16.54' W 85° 8.80'	N 9° 44.17' W 84° 36.40'	0630 to 1020 hours	3.8	1,3,4,5,9	KE
		N 10° 16.54' W 85° 8.80'	N/A	0645 to 1050 hours	4.1	1,3,4,5,9	MW

Appendix 1. Continued

Survey Location	Date	Coordinates Start	Coordinates Stop	Timing of Surveys	Survey Hours	Habitat(s) Surveyed	Surveyor(s)
Chomes, Puntarenas	7 Jan.	N 10° 4.61' W 84° 53.42'	N/A_2	1600 to 1720 hours	1.3	1,3,4,5,9	TK
		N 10° 4.14' W 84° 54.02'	N 10° 4.79' W 84° 53.97'	0600 to 1020 hours	4.3	1,2,5	SL, KE
	8 Jan.	N 10° 4.48' W 84° 53.56'	N 10° 4.61' W 84° 53.42'	0745 to 1018 hours	2.6	1,3,5,9	PH
		N 10° 4.46' W 84° 53.74'	N 10° 4.61' W 84° 53.42'	0726 to 1018 hours	2.9	1,3,4,5,9	TK
	9 Jan.	N 10° 4.71' W 84° 53.58'	N 10° 5.10' W 84° 53.68'	0646 to 1259 hours	6.2	1,3,4,5,9	TK, PH
	10 Jan.	N 10° 4.14' W 84° 54.02'	N/A_2	1600 to 1800 hours	2.0	1,3,4,5,9	TK
	11 Feb	N 10° 4.14' W 84° 54.02'	N 10° 4.61' W 84° 53.42'	0616 to 1000 hours	3.7	1,3,4,5,9	TK
Boca de Barranca, Puntarenas	20 Jan.	N 9° 54.08' W 84° 40.09'	N 9° 53.51' W 84° 40.55'	0600 to 1130 hours	5.5	2,4,5,9	SL
	20 Jan.	N 9° 53.42' W 84° 40.75'	N 9° 53.25' W 84° 39.85'	0600 to 1130 hours	5.5	1,2,4,5,9	KE
	21 Jan.	N 9° 58.13' W 84° 44.28'	N 9° 58.63' W 84° 44.55'	0530 to 0730 hours	2.0	1,4,5,9	SL, KE
		N 9° 59.48' W 84° 42.33'	N 9° 59.02' W 84° 42.68'	0730 to 0930 hours	2.0	2	SL, KE
Tárcoles/ Agujas, Puntarenas	22 Jan.	N/A	N 9° 48.54' W 84° 34.57'	0600 to 1000 hours	4.0	3,10	SL, KE
	30 Jan.	N 9° 44.66' W 84° 37.71'	N 9° 44.19' W 84° 36.41'	0600 to 0930 hours	3.5	2,10	KE
		N 9° 43.33' W 84° 39.12'	N 9° 42.98' W 84° 37.10'	0600 to 1000 hours	4.0	3,4,10	SL
	31 Jan.	N 9° 51.05' W 84° 33.90'	N 9° 51.03' W 84° 33.63'	0600 to 1000 hours	4.0	1,3,4,5,10	SL
	1 Feb.	N 9° 46.43' W 84° 37.67'	N 9° 46.64' W 84° 37.73'	0630 to 0830 hours	2.0	1,4,5,10	KE
		N 9° 47.06' W 84° 37.59'	N/A_2	0900 to 0945 hours	0.8	3	KE

Appendix 1. Continued

Survey Location	Date	Coordinates Start	Coordinates Stop	Timing of Surveys	Survey Hours	Habitat(s) Surveyed	Surveyor(s)
Punta Piedra, Guanacaste	25 Jan.	N/A	N/A	1000 to 1100 hours	1.0	2	MH
	26 Jan.	N 9° 45.54' W 85° 15.96'	N 9° 45.10' W 85° 15.16'	0700 to 1100 hours	4.0	1,5,9	MW
		N 9° 45.59' W 85° 16.07'	N 9° 45.66' W 85° 14.86'	0730 to 1050 hours	3.3	1,4,5,9	JH
		N 9° 45.36' W 85° 12.92'	N 9° 45.49' W 85° 12.51'	0730 to 0900 hours	1.5	1,4,9	MH
Rio Palo Seco, Puntarenas	29 Jan.	N 9° 34.58' W 84° 18.52'	N 9° 34.32' W 84° 18.58'	0710 to 1010 hours	3.0	1,4,5,7,10	JH
		N 9° 34.51' W 84° 18.38'	N 9° 34.27' W 84° 18.47'	0730 to 1000 hours	2.5	1,4,5,7,10	RN
		N 9° 34.51' W 84° 18.38'	N 9° 34.58' W 84° 18.10'	0730 to 0956 hours	2.4	1,4,5,7,10	MH
	30 Jan.	N 9° 34.33' W 84° 18.49'	N 9° 34.27' W 84° 18.59'	0700 to 1000 hours	3.0	1,4,5,7,10	RN
		N 9° 34.35' W 84° 18.70'	N 9° 34.17' W 84° 18.77'	0720 to 1000 hours	2.7	1,4,5,7,10	JH
		N 9° 34.76' W 84° 18.27'	N 9° 34.81' W 84° 18.02'	0640 to 0940 hours	3.0	1,4,5,7,10	MH
	31 Jan.	N 9° 34.51' W 84° 18.38'	N/A_2	0600 to 1000 hours	4.0	1,4,5,7,10	TK, RN
		N 9° 34.62' W 84° 17.99'	N 9° 34.62' W 84° 17.99'	0710 to 1110 hours	4.0	1,4,5,7,10	JH
		N 9° 34.77' W 84° 17.86'	N 9° 34.99' W 84° 17.86'	0830 to 1030 hours	2.0	1,4,5,7,10	MH

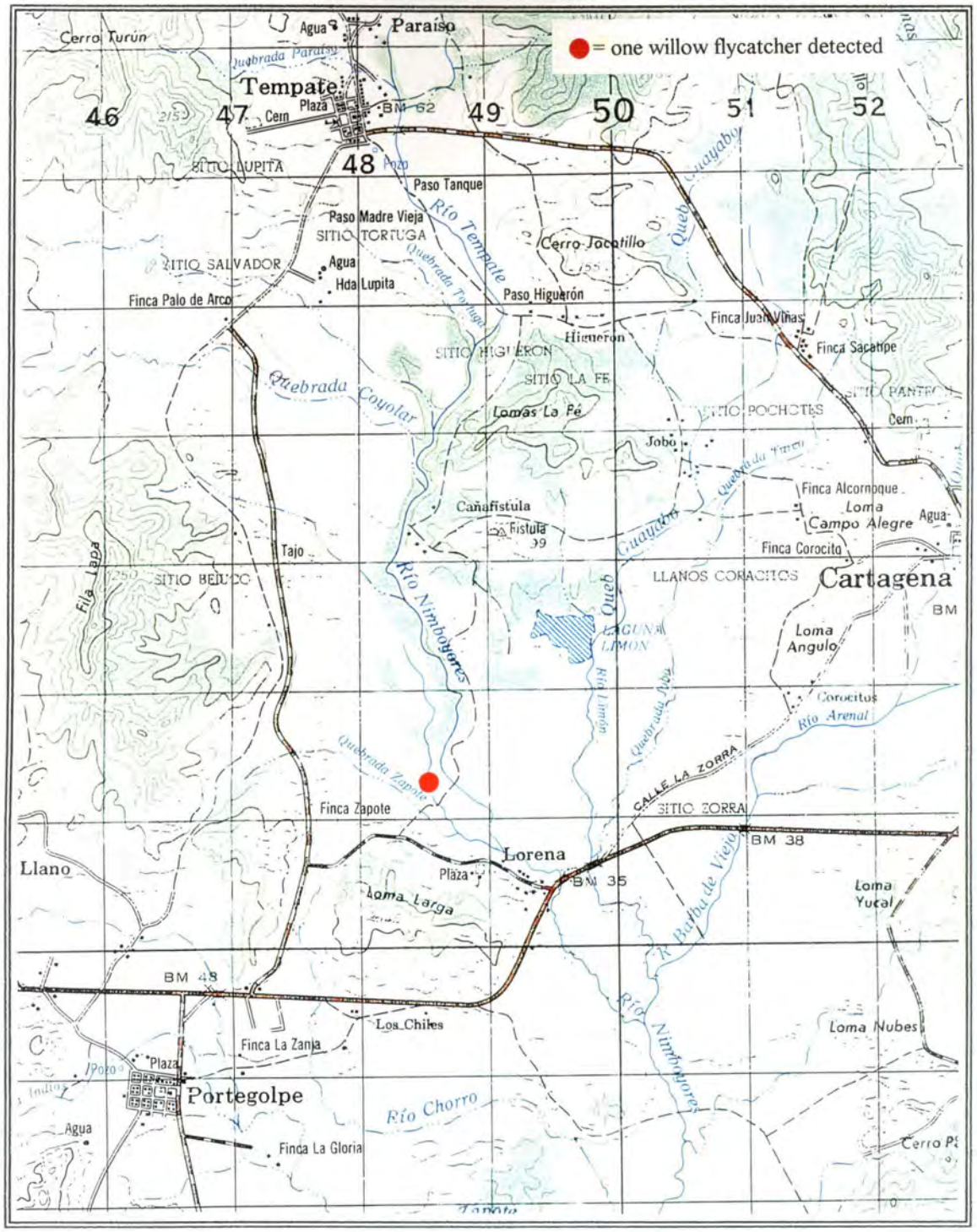
Appendix 1. Continued

Survey Location	Date	Coordinates Start	Coordinates Stop	Timing of Surveys	Survey Hours	Habitat(s) Surveyed	Surveyor(s)
Buenos Aires, Animas, Puntarenas	9 Jan.	N 9° 6.65' W 83° 20.55'	N 9° 6.49' W 83° 20.32'	0610 to 0905 hours	2.9	1,4,7,10	MW
		N 9° 6.68' W 83° 20.46'	N 9° 6.50' W 83° 20.41'	0710 to 0915 hours	2.1	1,4,10	JH
	10 Jan.	N 9° 0.70' W 83° 9.94'	N 9° 1.19' W 83° 8.74'	0620 to 1100 hours	4.7	1,3,10	MW
		N 9° 0.66' W 83° 10.03'	N 9° 0.37' W 83° 9.59'	0634 to 0830 hours	1.9	1,2	JH
		N 9° 0.66' W 83° 10.03'	N 9° 0.54' W 83° 10.17'	1000 to 1100 hours	1.0	1,2,10	JH
	12 Jan.	N/A	N/A	0630 to 0745 hours	1.3	1,5,7,10	MW
	13 Jan.	N 8° 49.65' W 82° 57.04'	N 8° 49.67' W 82° 57.20'	0730 to 1000 hours	2.5	1,5,7,10	JH
		N 8° 47.26' W 82° 59.36'	N 8° 47.39' W 82° 59.29'	0645 to 0840 hours	1.9	4,5,10	MW
	21 Jan.	N 9° 20.98' W 83° 40.16'	N 9° 20.85' W 83° 39.91'	0630 to 1000 hours	3.5	1,3,10	MW, MH
		N 9° 20.75' W 83° 39.94'	N 9° 19.83' W 83° 39.87'	0630 to 1000 hours	3.5	1,7,10,	JH
	5 Feb.	N/A	N 9° 9.25' W 83° 22.02'	0732 to 0845 hours	1.2	1,3,7	MH
		N/A	N/A	1000 to 1025 hours	0.4	2,5,10	MH
		N/A	N/A	0735 to 0845 hours	1.2	3,4,7	JH
		N/A	N/A	0930 to 1050 hours	1.3	3,4,7	JH
	6 Feb.	N/A	N/A	0629 to 0800 hours	1.5	2,7	MH
		N/A	N 9° 10.53' W 83° 21.24'	0835 to 0920 hours	0.8	3	MH
		N/A	N 9° 10.99' W 83° 20.97'	0630 to 0800 hours	1.5	1,2	JH
		N/A	N 9° 10.94' W 83° 20.80'	0835 to 0950 hours	1.3	1,2	JH

Appendix 1. Continued

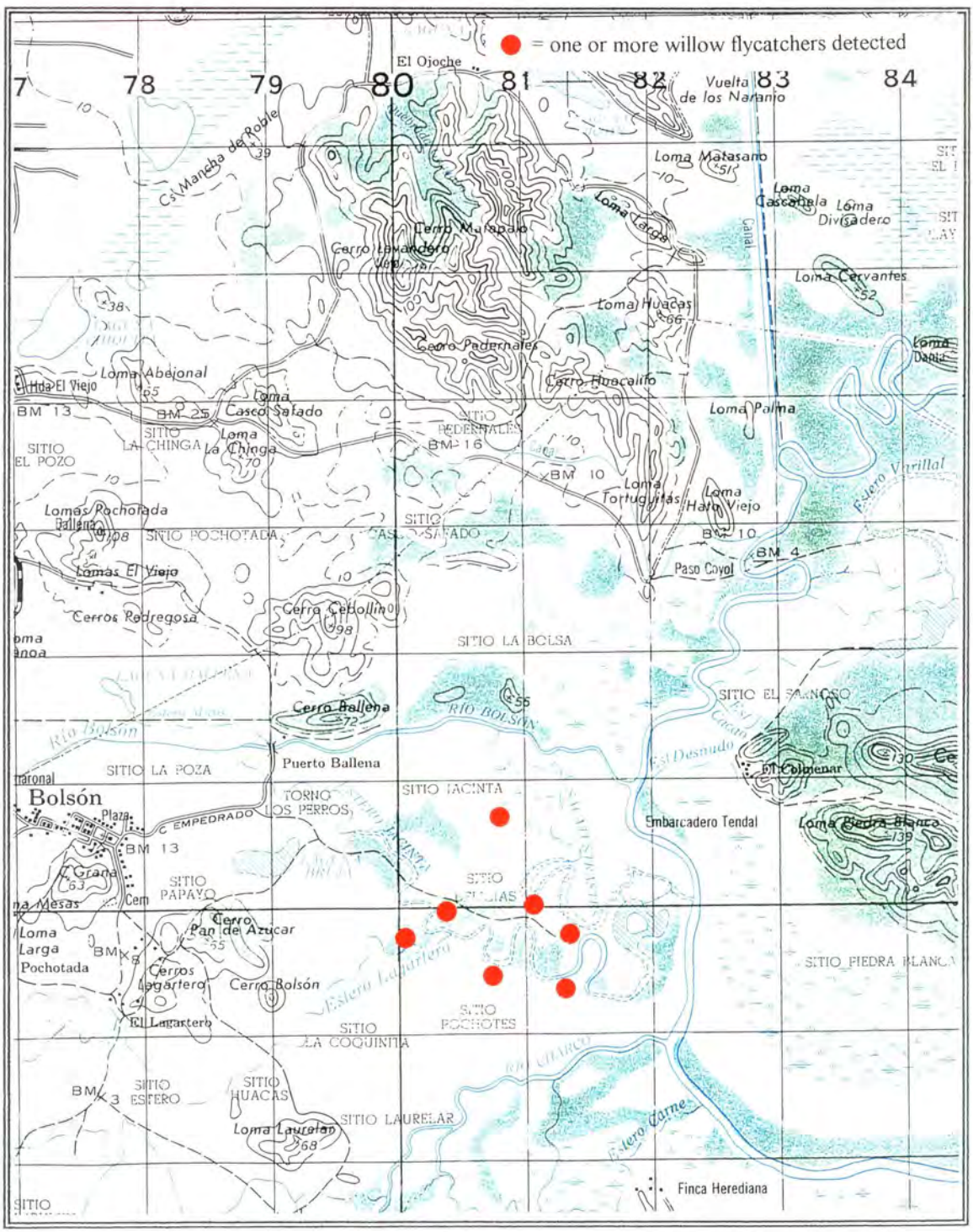
Survey Location	Date	Coordinates Start	Coordinates Stop	Timing of Surveys	Survey Hours	Habitat(s) Surveyed	Surveyor(s)
Coto 44, Puntarenas	14 Jan.	N 8° 34.47' W 82° 58.68'	N 8° 34.87' W 82° 58.37'	0700 to 0800 hours	1.0	1,4,7,10	MW
	15 Jan.	N 8° 33.00' W 83° 58.57'	N 8° 32.57' W 83° 58.86'	0603 to 0811 hours	2.1	1,3,5,7,10	MW
		N 8° 34.56' W 83° 0.52'	N 8° 33.83' W 83° 1.33'	0630 to 0745 hours	1.3	1,3,5,7,10	JH
		N 8° 34.56' W 83° 0.52'	N 8° 33.83' W 83° 1.33'	0905 to 1050 hours	1.8	1,3,5,7,10	JH
	5 Feb.	N 8° 32.41' W 83° 2.34'	N/A	0600 to 1130 hours	5.5	3,5,10	TK
		N 8° 32.41' W 83° 2.34'	N 8° 32.41' W 83° 2.63'	0600 to 0900 hours	3.0	1,3,5,10	PH
		N 8° 33.72' W 82° 57.47'	N 8° 33.62' W 82° 58.87'	0600 to 1000 hours	4.0	1,4,5,10	SL
	6 Feb.	N 8° 32.49' W 83° 2.31'	N 8° 32.90' W 83° 2.28'	0621 to 0900 hours	2.7	3,5,10	PH
		N 8° 33.72' W 82° 57.47'	N/A_2	0600 to 1100 hours	5.0	1,4,5,10	TK, SL
	7 Feb.	N 8° 33.72' W 82° 57.47'	N/A_2	0600 to 1200 hours	6.0	1,4,5,10	TK, SL, PH
Puerto Jiménez, Puntarenas	8 Feb.	N 8° 33.85' W 83° 23.18'	N 8° 34.80' W 83° 22.86'	0600 to 1100 hours	5.0	1,2,4,8,10	TK
		N 8° 30.93' W 83° 17.65'	N/A_2	1630 to 1730 hours	1.0	1,4,10	TK, SL
		N 8° 35.57' W 83° 25.30'	N 8° 36.53' W 83° 25.13'	0600 to 1030 hours	4.5	1,2,7,10	PH
		N 8° 26.77' W 83° 17.11'	N 8° 26.98' W 83° 17.51'	0600 to 1000 hours	4.0	1,4,5,10	SL
		N/A	N 8° 28.89' W 83° 18.27'	0530 to 1030 hours	5.0	1,4,5,10	KE
		N 8° 30.93' W 83° 17.65'	N 8° 31.02' W 83° 17.82'	0740 to 0955 hours	2.3	1,4,10	JH
		N/A	N/A	0630 to 1030 hours	4.0	1,4,10	MH
	9 Feb.	N 8° 34.13' W 83° 24.25'	N 8° 34.37' W 83° 24.59'	0619 to 0930 hours	3.2	1,7,10	PH
		N 8° 30.82' W 83° 18.54'	N/A_2	0600 to 0900 hours	3.0	1,4	TK, SL
		N 8° 30.93' W 83° 17.65'	N/A_2	0930 to 1100 hours	1.5	1,4,10	TK, SL

Appendix 2. Topographic map of the Tempate area. Base map is from the 1:50,000 scale Belen, Costa Rica quad, Instituto Geographico Nacional, San Jose, Costa Rica. Major and auxiliary contour lines are 20 and 10 meters, respectively.



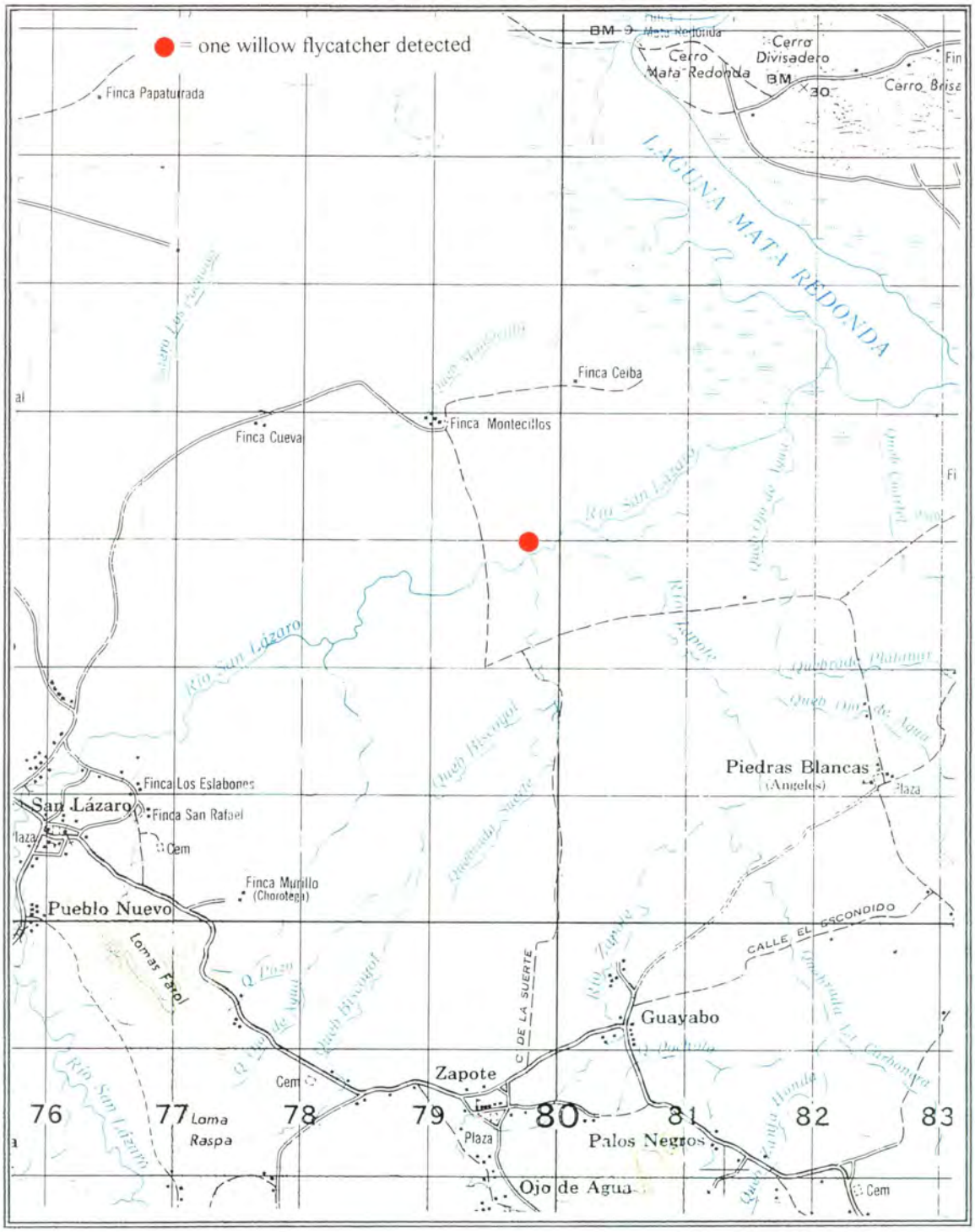
Detection site - Quebrada Zapote
Number of willow flycatchers detected - 1
Mileage/direction to nearest landmark - approx. 5 km south of the village of Tempate
Detection coordinates - N 10° 22.10' W 85° 43.18'
Land use - Heavily grazed pastures surround the detection area (cows and horses). Locals fish at the site.

Appendix 3. Topographic map of the Bolsón area. Base map is from the 1:50,000 scale Tempisque, Costa Rica quad, Instituto Geographico Nacional, San Jose, Costa Rica. Major and auxiliary contour lines are 20 and 10 meters, respectively.



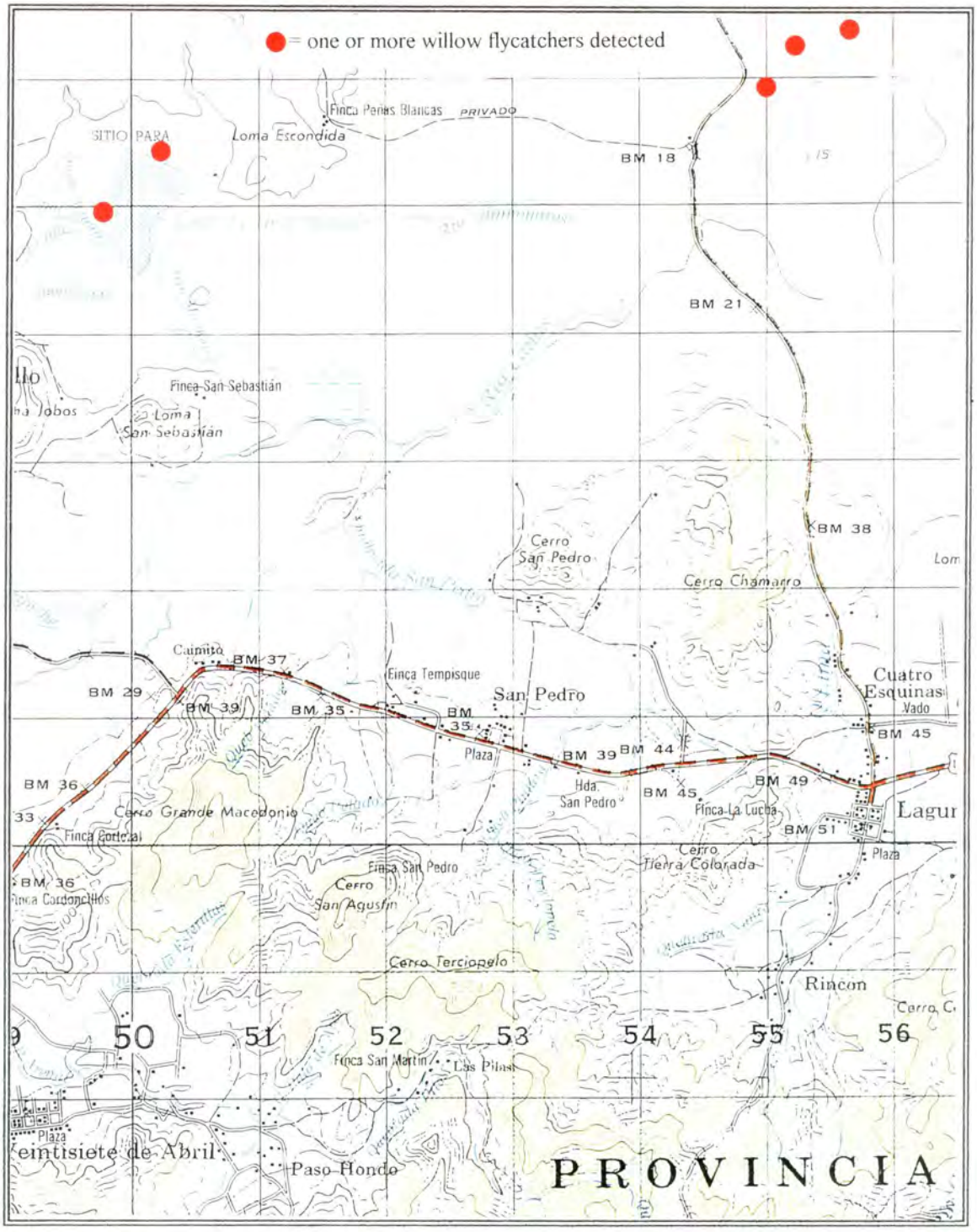
Detection Sites - Restauracion Humedal La Jacinta (Sitio Delicias, Laguna Pachote, Estero Jacinta)
Number of willow flycatchers detected - 26
Mileage/direction to nearest landmark - 0.6 km east of the village of Bolsón
Detection coordinates - N 10° 21.31' W 85° 25.17' (*laguna* area), N 10° 21.26' W 85° 24.72' (*estero* area)
Land use - Cattle within detection area. Sugar cane plantations to the northwest. Locals do hunt within the area.
Additional notes- Area where willow flycatchers detected is a restoration area developed by the cooperative efforts of the village of Bolsón and nearby Ortega.

Appendix 4. Topographic map of the Puerto Humo area. Base map is from the 1:50,000 scale Talolinga, Costa Rica quad, Instituto Geographico Nacional, San Jose, Costa Rica. Major and auxiliary contour lines are 20 and 10 meters, respectively.



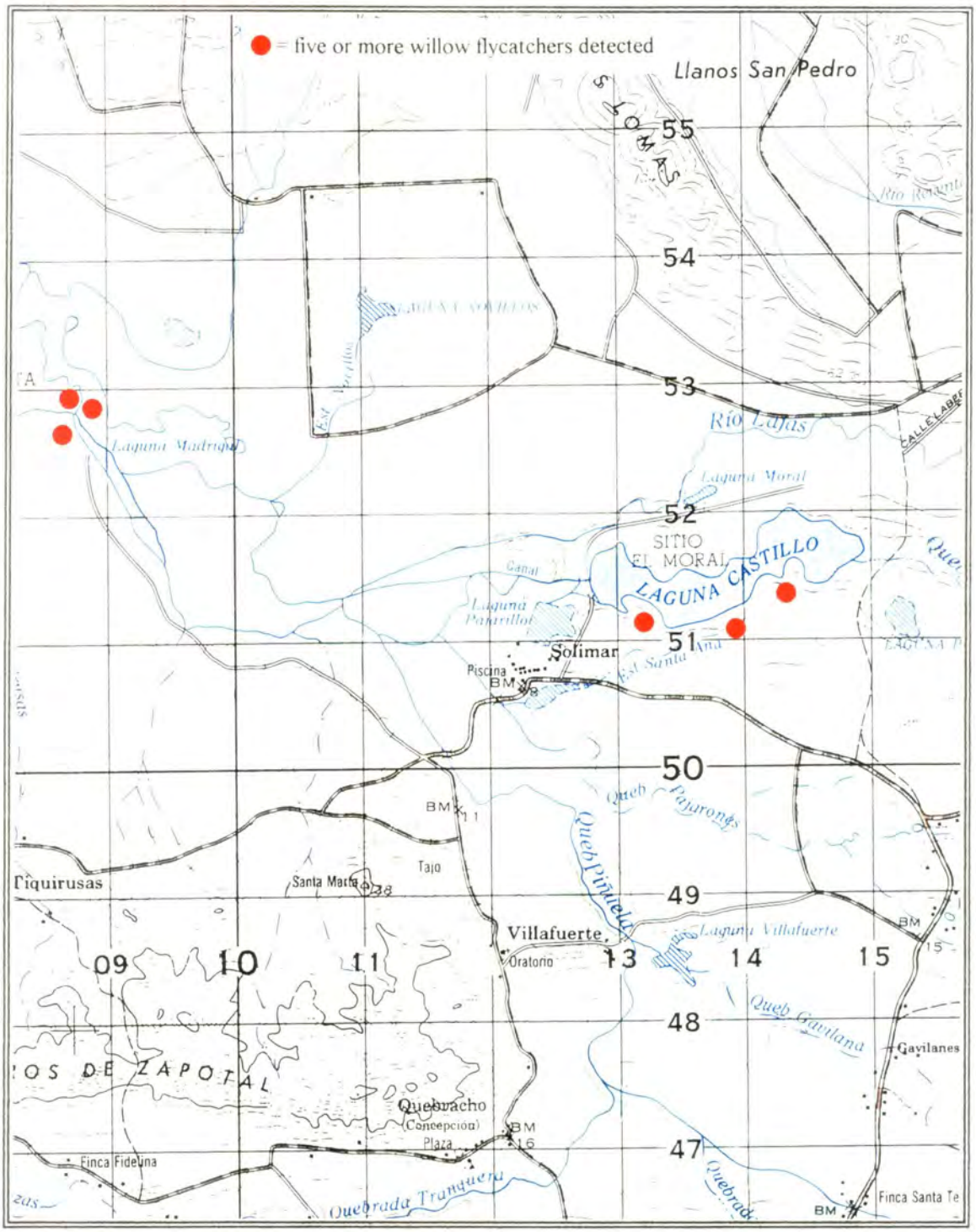
Detection Site - Fina Montecillo, Rio San Lázaro
Number of willow flycatchers detected - 1
Mileage direction to nearest landmark - approx. 5 km NE of San Lázaro
Detection coordinates - N 10° 17.97' W 85° 24.98'
Land use - Extensive rice plantations completely surround the area
Additional notes- Need lander owner permission to access.

Appendix 5. Topographic map of the Santa Cruz area. Base map is from the 1:50,000 scale Diria, Costa Rica quad, Instituto Geographico Nacional, San Jose, Costa Rica. Major and auxiliary contour lines are 20 and 10 meters, respectively.



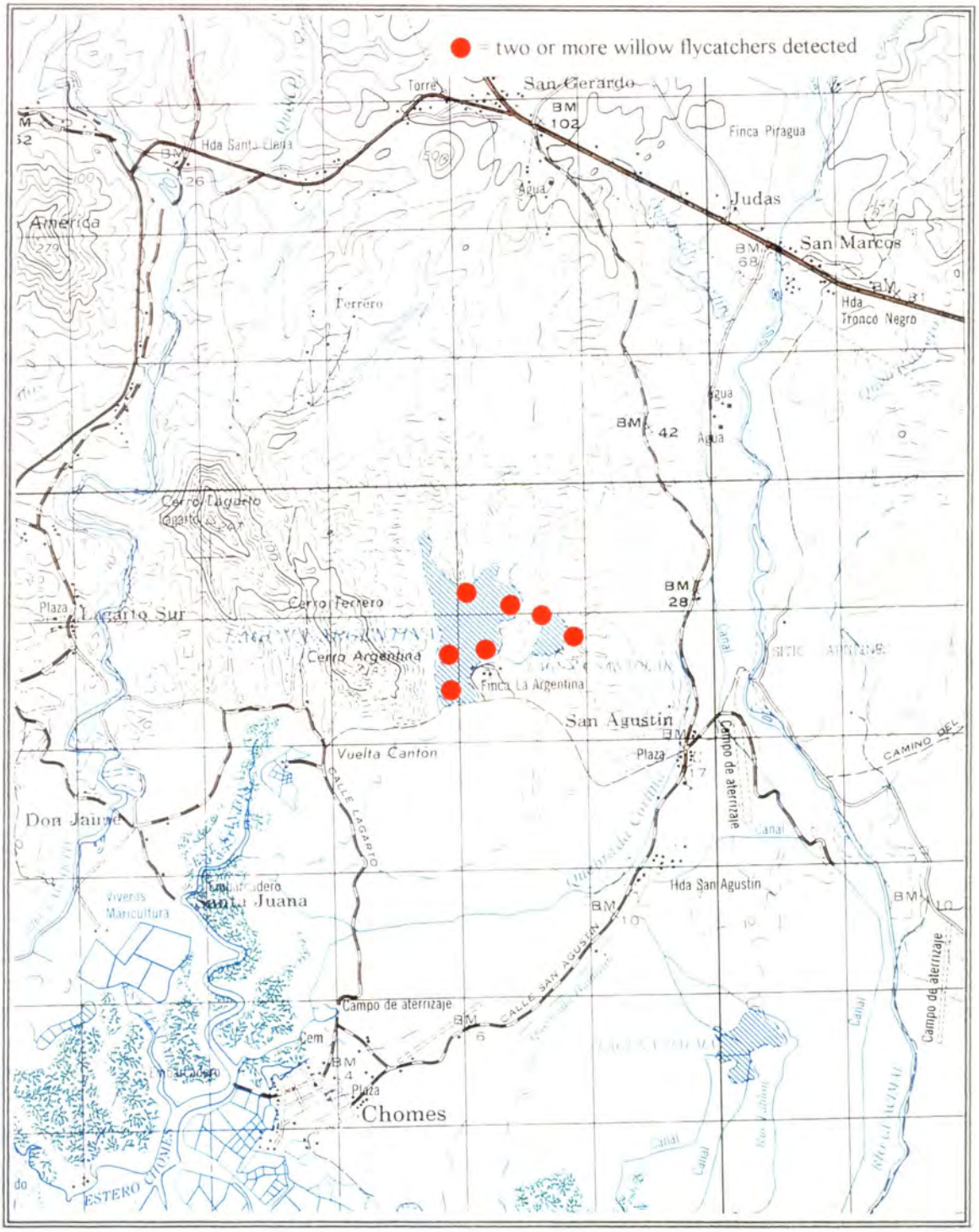
Detection Sites - Rio Cañas, Laguna Montecillo
Number of willow flycatchers detected - 26
Mileage/direction to nearest landmark - Rio Cañas approx. 6 km N of Lagunilla; Laguna Montecillo approx. 1.5 km NE of Hatillo
Detection coordinates - Rio Cañas N 10° 19.74' W 85° 38.97', Laguna Montecillo N 10° 18.93' W 85° 42.36'
Land use - Heavily grazed pastures surround the detection areas.
Additional notes- Part of the Rio Cañas site is on a preserve.

Appendix 6. Topographic map of the Solimar area. Base map is from the 1:50,000 scale Abangares, Costa Rica quad, Instituto Geographico Nacional, San Jose, Costa Rica. Major and auxiliary contour lines are 20 and 10 meters, respectively



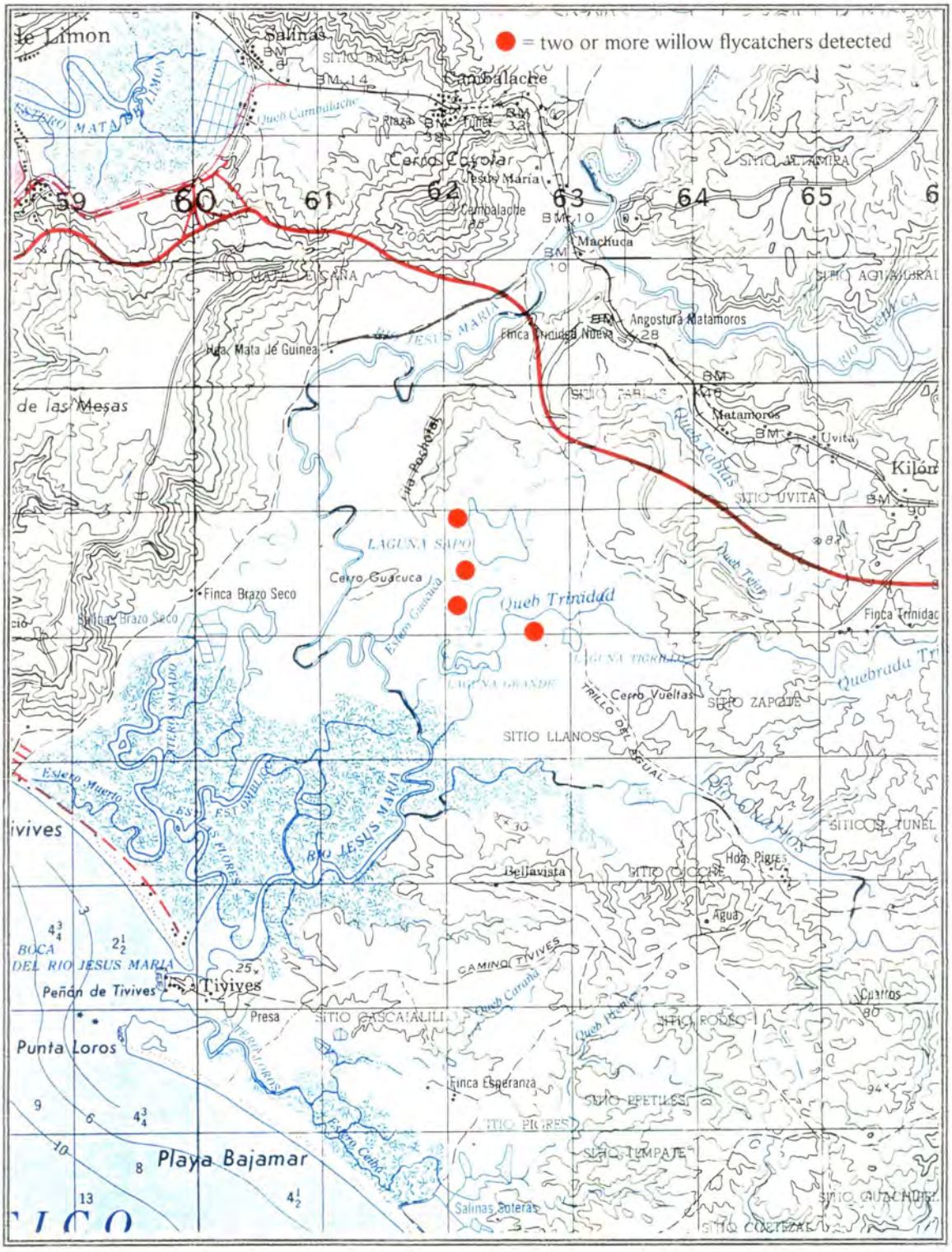
Detection Sites - Laguna Madrigal, Laguna Castillo
Number of willow flycatchers detected - 54
Mileage direction to nearest landmark - Laguna Madrigal approx. 3.5 km NW of Solimar; Laguna Castillo approx. 1 km NE of Solimar
Detection coordinates - Laguna Madrigal N 10° 17.46' W 85° 9.94', Laguna Castillo N 10° 16.54' W 85° 8.80'
Land use - Grazed pastures surround the detection areas.
Additional notes- Need lander owner permission to access, private preserve.

Appendix 7. Topographic map of the Chomes area. Base map is from the 1:50,000 scale Chapernal, Costa Rica quad, Instituto Geographico Nacional, San Jose, Costa Rica. Major and auxiliary contour lines are 20 and 10 meters, respectively.



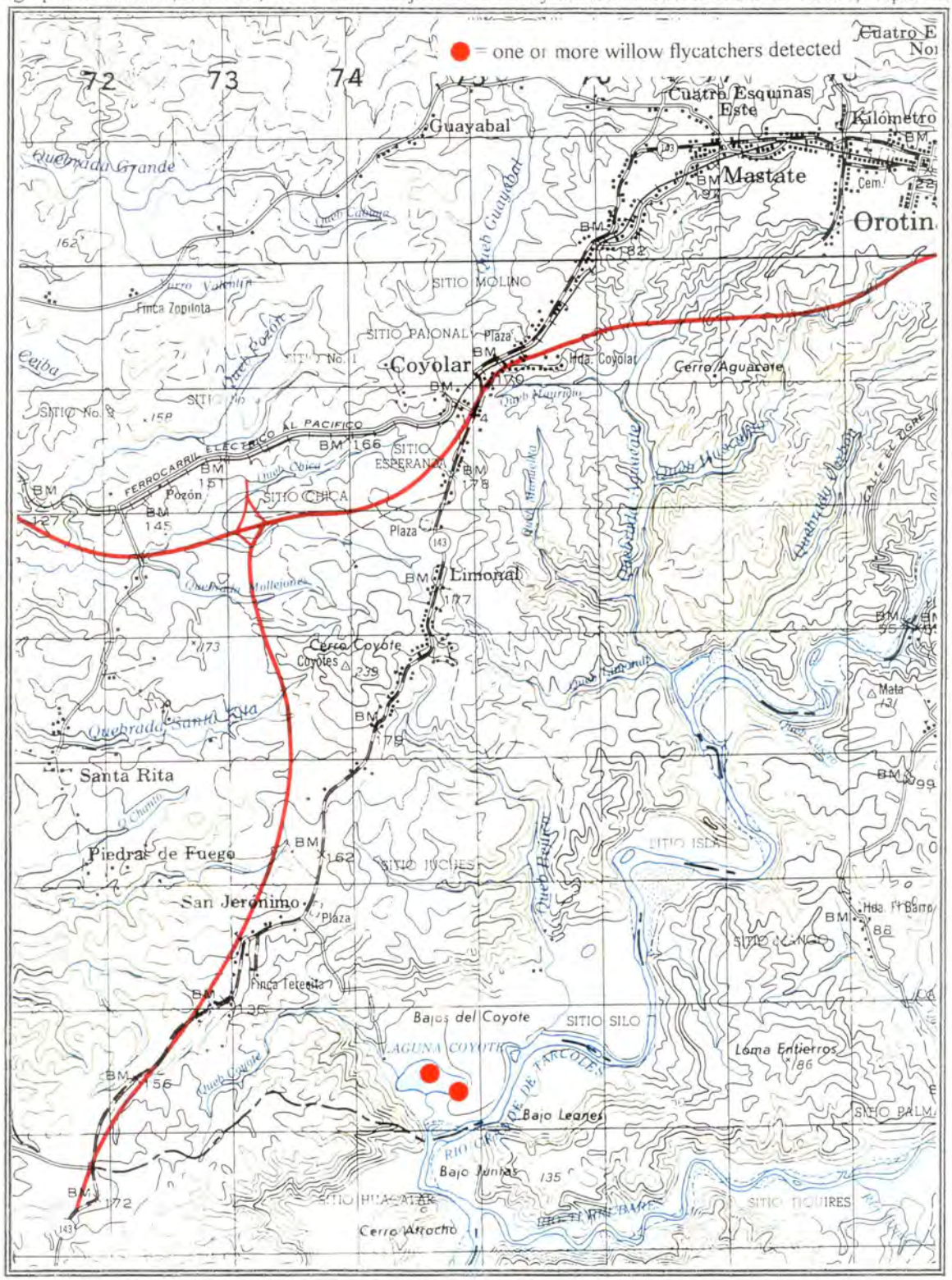
Detection Site - Laguna Argentina
Number of willow flycatchers detected - 28
Mileage direction to nearest landmark - Approx. 10 km south of San Gerado, off of CA1, near Finca La Argentina.
Detection coordinates - N 10° 4.16' W 84° 53.96' (Laguna Argentina), N 10° 4.14' W 84° 54.02' (eastern laguna)
Land use - Cattle within the detection area, extensive pasture surrounds the laguna. Sugar cane plantations to the west.
Additional notes- Need lander owner permission to access.

Appendix 8. Topographic map of the Boca de Barranca area. Base map is from the 1:50,000 scale Barranca, Costa Rica quad, Instituto Geographico Nacional, San Jose, Costa Rica. Major and auxiliary contour lines are 20 and 10 meters, respectively.



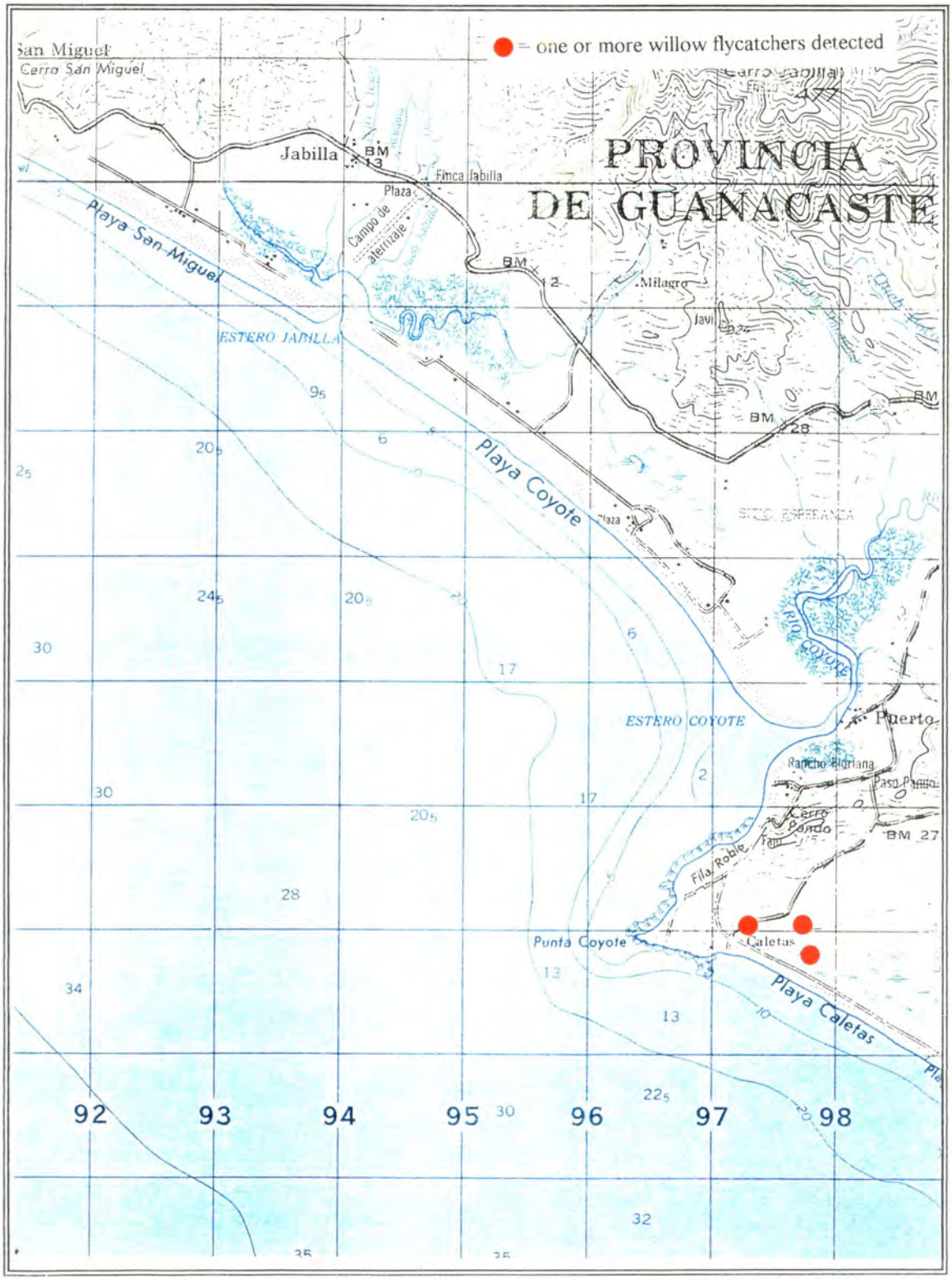
Detection Site - Laguna Sapo
Number of willow flycatchers detected - 9
Mileage direction to nearest landmark - Approx. 5 km SE of Mata de Limon
Detection coordinates - N 9° 53.42' W 84° 40.75'
Land use - Cattle and horses within the detection area; agriculture surrounds the site (melon).

Appendix 9. Topographic map of the Tarcoles/Agujas area. Base map is from the 1:50,000 scale Tarcoles, Costa Rica quad, Instituto Geographico Nacional, San Jose, Costa Rica. Major and auxiliary contour lines are 20 and 10 meters, respectively.



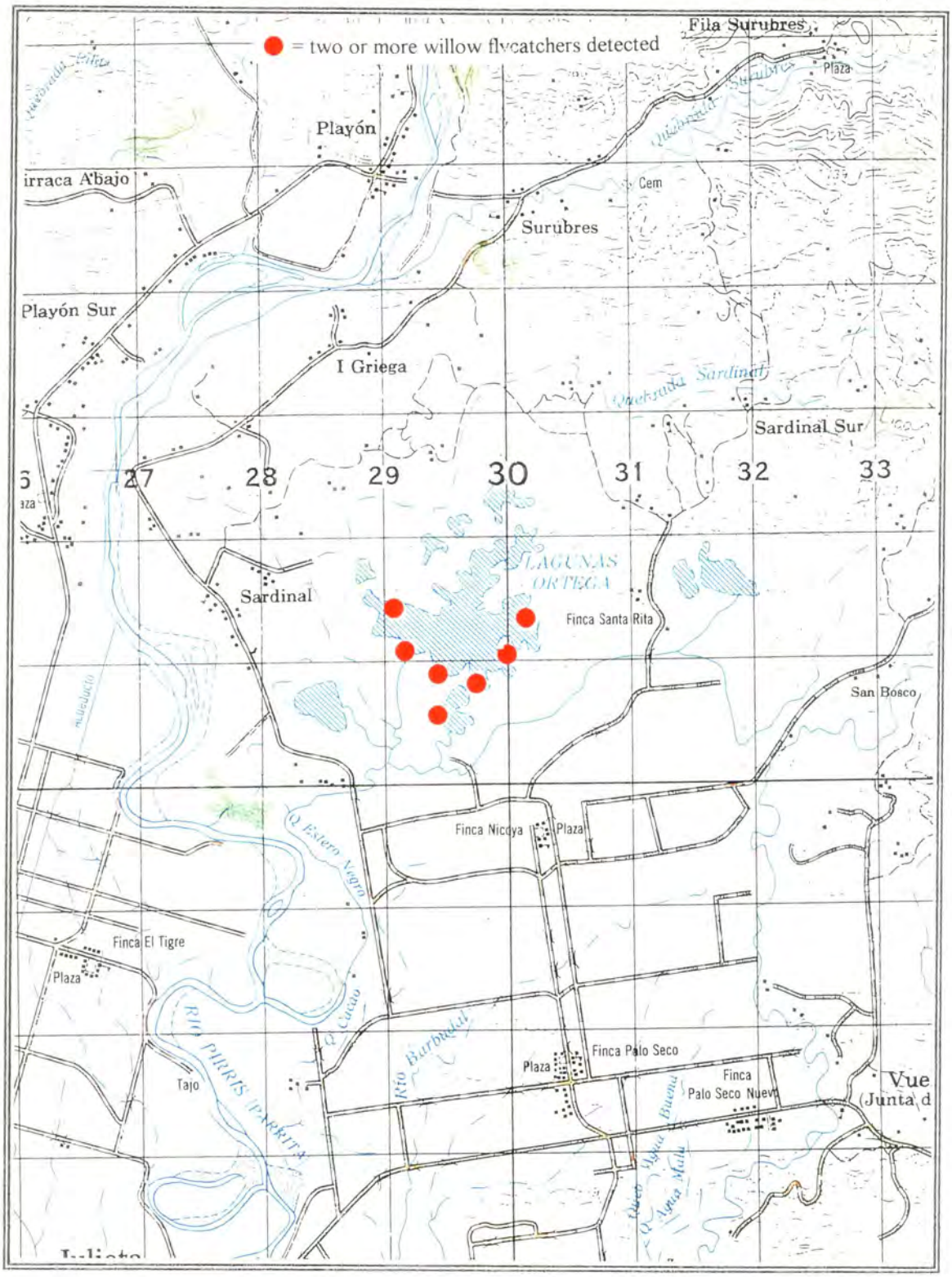
Detection Site - Laguna Coyote
Number of willow flycatchers detected - 3
Mileage/direction to nearest landmark - Approx. 6 km S of Coyalar
Detection coordinates - N 9° 51.05' W 84° 33.90'
Land use - Cattle within the detection area

Appendix 10. Topographic map of the Caletas area. Base map is from the 1:50,000 scale Puerto Coyote, Costa Rica quad, Instituto Geographico Nacional, San Jose, Costa Rica. Major and auxiliary contour lines are 20 and 10 meters, respectively.



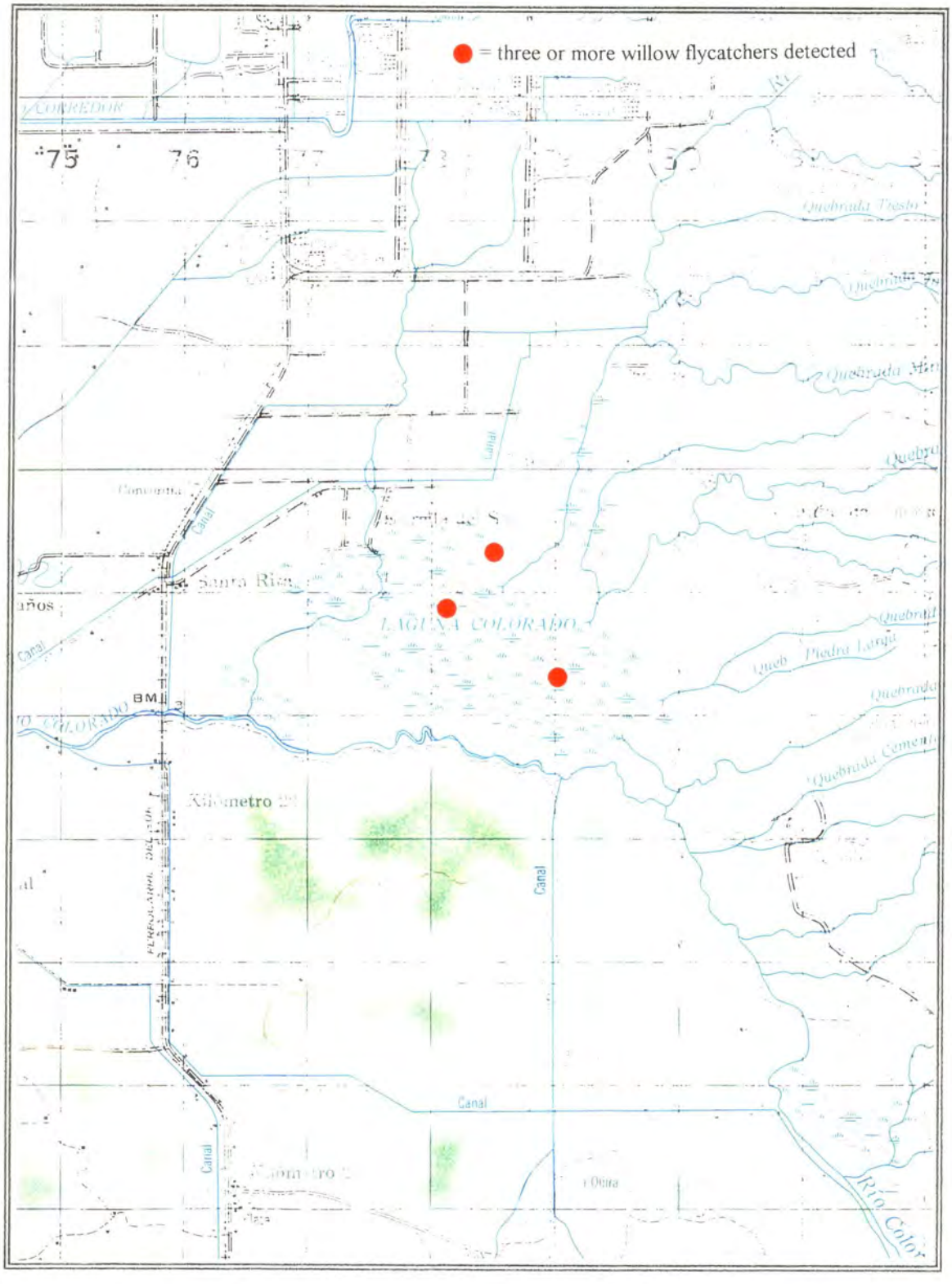
Detection Site - Caletas wetlands
Number of willow flycatchers detected - 8
Mileage direction to nearest landmark - Approx. 2 km S of Puerto Coyote
Detection coordinates - N 9° 45.59' W 85° 16.07'
Land use - Cattle within the detection area

Appendix 11. Topographic map of the Rio Palo Seco area. Base map is from the 1:50,000 scale Parrita, Costa Rica quad, Instituto Geographico Nacional, San Jose, Costa Rica. Major and auxiliary contour lines are 20 and 10 meters, respectively.



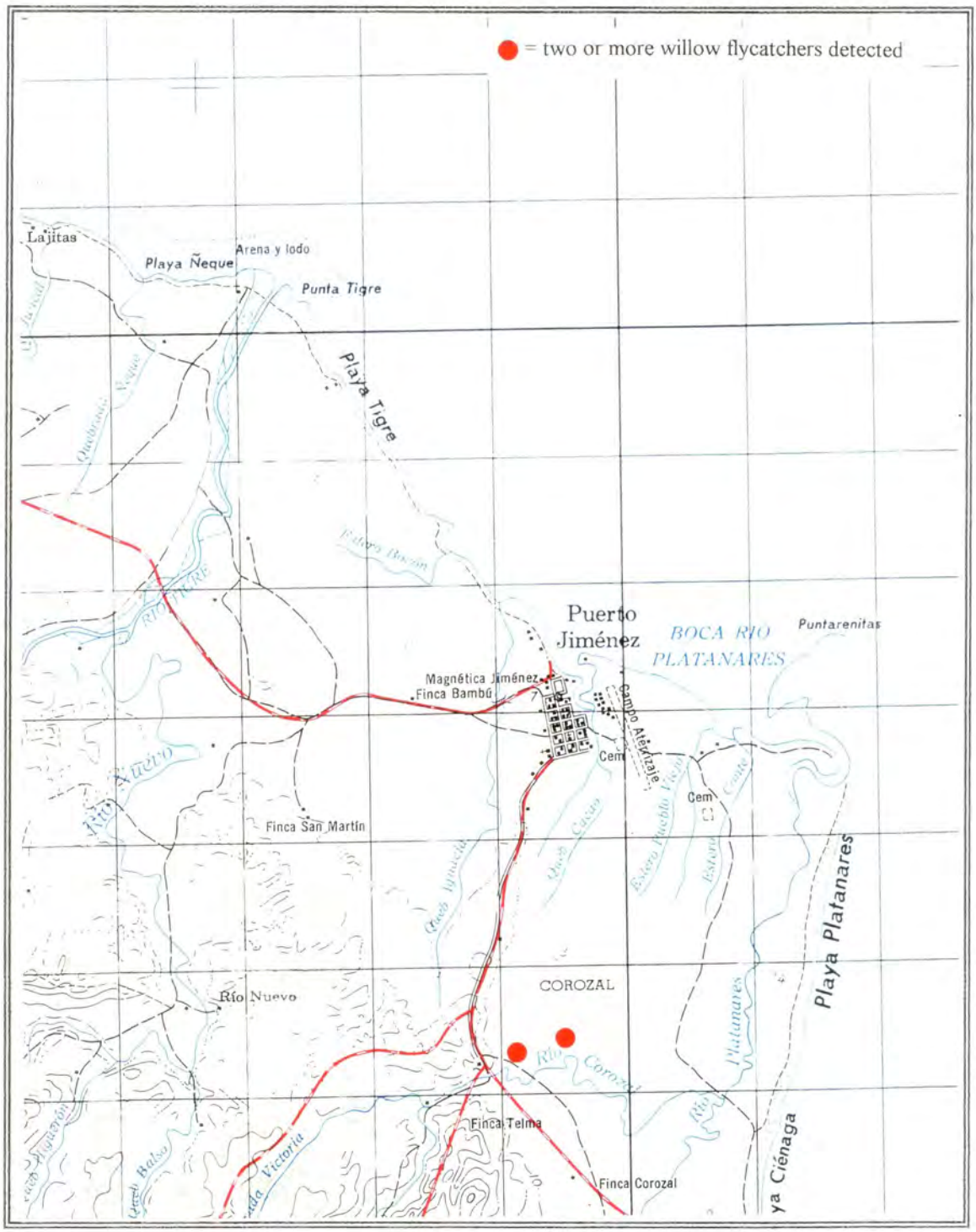
Detection *Site* - Lagunas Ortega
Number of willow flycatchers detected - 26
Mileage/direction to nearest landmark - Approx. 6 km N of Parrita
Detection coordinates - N 9° 34.35' W 84° 18.70'
Land use - Cattle and horses within the detection area; Teak grown within detection area

Appendix 12. Topographic map of the Coto 44 area. Base map is from the 1:50,000 scale Canoas, Costa Rica quad, Instituto Geographico Nacional, San Jose, Costa Rica. Major and auxiliary contour lines are 20 and 10 meters, respectively.



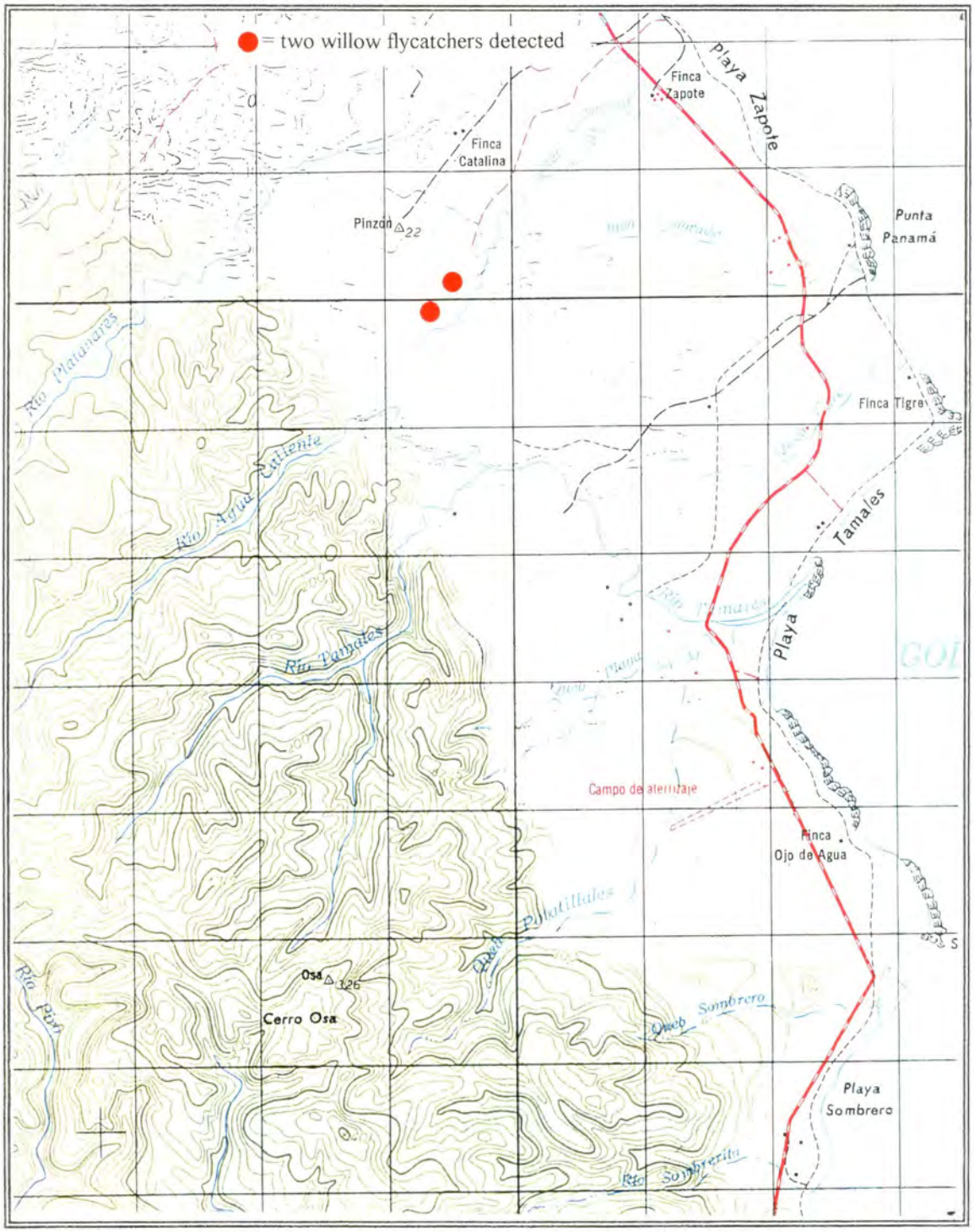
Detection *Site* - Laguna Colorado
Number of willow flycatchers detected - 10
Mileage/direction to nearest landmark - Approx. 11 km S of Neily
Detection coordinates - N 8° 33.72' W 82° 57.47'
Land use - Cattle within the detection area; extensive agriculture surrounds the entire area,

Appendix 13. Topographic map of the Puerto Jiménez area. Base map is from the 1:50,000 scale Golfo Dulce, Costa Rica quad, Instituto Geographico Nacional, San Jose, Costa Rica. Major and auxiliary contour lines are 20 and 10 meters, respectively.



Detection *Sites* - Rio Corozal, Rio Plantanares
Number of willow flycatchers detected - 5
Mileage/direction to nearest landmark - Approx. 3 km S of Puerto Jiménez
Detection coordinates - Rio Corozal N 8° 30.93' W 83° 17.65', Rio Plantanares N 8° 30.93' W 83° 17.65'
Land use - Cattle within the detection areas; extensive pasture surrounds the entire area

Appendix 13 continued. Topographic map of the Puerto Jiménez area. Base map is from the 1:50,000 scale Carate, Costa Rica quad, Instituto Geographico Nacional, San Jose, Costa Rica. Major and auxiliary contour lines are 20 and 10 meters, respectively.



Detection *Site* - Quebrada Ciénega
Number of willow flycatchers detected - 4
Mileage/direction to nearest landmark - Approx. 7 km S of Puerto Jiménez
Detection coordinates - N 8° 28.89' W 83° 18.27'
Land use - Cattle within the detection areas; extensive pasture surrounds the entire area

Appendix 14. Summary of U.S., Central and South American ornithologists and naturalists contacted requesting information on the occurrence and distribution of *Empidonax traillii* on the wintering grounds; information they have provided included.

Person/agency contacted, their affiliation, and contact information	*Empidonax traillii* winter ground, migration or other information provided by contact
Giselle Alvarado, Ornithologist Museo Nacional, Costa Rica email: museonac@sol.racsa.co.cr	Contacted on numerous occasions (no reply) regarding the details of his collection of a single *E. traillii* at a *chanochera* (pig farm) at Coto 44, Puntarenas, Costa Rica, 19 May 1997. We detected wintering *E. traillii* nearby this collection area in 1999 (Table 3).
George Angehr, Panamá email: angehrg@tivoli.si.edu	Encountered migrant and wintering *E. traillii* in Panamá - "willow/alder flycatchers are mostly transients in Panama, although some willows over winter in scrubby habitats on the Pacific slope. I am not aware of any specific localities that are better than others" (Angehr *pers. com.*). Recommended contacting Gilles Seutin (see below) for winter information on *E traillii.*
John Arvin, Central America 19200 F. M. 150 West Driftwood, TX 512-858-4974	Encountered and recorded *E. traillii* in Mexico and Panamá - "I have a couple of "records" for you, one tape recorded, the other not (butbased on vocalizations). The tape recorded record is from Singayta (San Blas area), Nayarit. My notes are in storage but I think it was in early November, 1984. The habitat is a forested hillside to the right of a dirt road with an open, but bushy marsh to the left. The bird was actually in a hedgerow of short/medium height trees that divides the road from the marsh. I formerly led birding tours to this region twice each year (late Oct-early Nov and Feb). The general region from Mazatlan southward to San Blas and up the western face of the S. M. Occidental is rich in Empidonax and we always tried to identify (and record if possible) all that we encountered. The non-recorded "record" is from a bushy marsh just outside Volcan, Chiriqui Prov., Panama (el. ca. 1200 m.). The date escapes me but it would have been in January or early February as that is when we did the tour each year. Despite spending roughly half of my life in various parts of Latin America since the mid 60's these are the only two Willow Flycatchers I am sure about" (Arvin *pers. com*). Contact most likely can provide additional information such as logistics for these areas. Koronkiewicz encountered wintering *E. traillii* at or near this site in 1996.
Gilbert Barrantes, Ornithologist Universidad de Costa Rica email: gilbertb@cariari.ucr.ac.cr	Encountered *E. traillii* at La Selva Biological Station, Christmas Bird Count 1999 (see Orlando Vargas below). This site was visited during the 1999 survey period, no *E. traillii* detected. Gilbert graciously assisted with the examination of seven *E. traillii* museum specimens collected by F. Gary Stiles and housed at the Universidad de Costa Rica.
Rafael Campos, Naturalist/Guide Costa Rica 506-444-6752	Sent fax requesting information 21 Oct. 1998. Contact had no information pertaining to *E. traillii.*
Lyann Comrack, Ornithologist PIF Coordinator , CA Dept. Of Fish and Game email: lcomrack@audubon.org	Encountered "Traill's" type flycatchers in Panamá and also provided additional contacts - " While working in Panama on the shade coffee project, I noticed "Traill's" type flycatchers moving through the Chiriqui highlands in late spring. Recommended we contact Lisa Petit (see below).
Dan S. Cooper, Biologist and guide for VENT Dept. of Earth Sciences UC Riverside Riverside, CA 92521 email: dscooper@citrus.ucr.edu (909) 787-3766	E-mailed 30 Oct. 1998. Contact had no information pertaining to *E. traillii.*
Paul Coopmans email: coopman@ecnet.ec	Encountered and recorded a singing willow flycatcher on a river island along the Rio Napo, Eastern Ecuador. Contact most likely can provide additional information such as logistics for this wintering area.

Appendix 14 Continued

Deanna Dawson, Avian Researcher U.S.G.S. email: Deanna_Dawson@usgs.gov	Contact operates an avian monitoring station in Campeche, Mexico. " I checked our database--we've only captured one Traill's Flycatcher at our study area in Campeche (just south of Laguna de Terminos), and that was in mid-May. Recommended contacting Dr. Russell Greenberg and Paul Wood (see below) for additional information.
David Deifik Nashua, NH email: Deif@Prodigy.Net	Encountered *E. traillii* in Ecuador - "in examining my records for willow flycatcher , I found one for Latin America. This was on 2-10-98 for Ecuador. The sighting was on the Rio Napo near the Sancha Lodge on a river island called Anaconda Island. This was during a Field Guides bird tour with Roseanne Rowlett and Mitch Lysinger, so the sighting was confirmed by them. I dont have details listed in my data base on vocalizations, etc." (Deifik *pers. com.*).
Rolando Delgado, naturalist/guide Costa Rica Tel/fax: 506-260-3207	Phoned 1 Nov. 1998, contact no longer at this number.
Richard Garriguez, naturalist/guide Costa Rica Tel/fax. (506) 293 2710	Sent fax 30 Oct. 1998, no reply.
Charlie Gomez, guide with Costa Rica Expeditions 506-272-3876	Encountered *E. traillii* at the following locations in Costa Rica: Chomes, Parque Nacional Palo Verde, the mouth of the Rio Tarcoles, and areas within and adjacent to the Tempisque drainage, Guanacaste. Wintering *E. traillii* were detected in Chomes during 1999 surveys (Table 3) and by Koronkiewicz et al. (1998) during their 1998 surveys; Parque Nacional Palo Verde, surveyed in 1999 (Appendix 1), lists *E. traillii* as occurring within the park (no dates or relative abundance given); *E. traillii* were detected near the Rio Tarcoles in 1999 (Table 3); and there are several known *E. traillii* wintering areas (this report and Koronkiewicz et. al. 1998) found within and adjacent to the Tempisque drainage (see this document and Koronkiewicz et al. 1998).
Dr. Eugenio Gonzales, Director Parque Nacional Palo Verde, Organization For Tropical Studies P.O. Box 676-2050 San Pedro, Costa Rica e-mail: egonza@ns.ots.ac.cr Ph (506) 240-6696, Fax (506) 240-6783	Recommended contacting Ruth Rodriguez (see below) for winter information on *E traillii*.
Dr. Russell Greenberg, Ornithologist Smithsonian Migratory Bird Center email: antbird@erols.com	"Sorry - but I have very little info on these birds. We have seen quite a few Alder flycatchers where we are working in Peru is all" (Greenberg *pers. com.*)

Appendix 14 Continued

Mario Cohn-Haft, Brasil Rua 2 de Agosto, 36 Bairro Uniao Manaus, AM 69050-670 BRASIL email: mario@buriti.com.br, zocohn@lsu.edu, zocohn@lsuvm.scnn.lsu.edu phone/fax [international (011-55-92) or in brazil (092)] 236-9847	Provided information on *E. traillii* and *E. alnorum* in Brasil - "... there is a specimen of e. trailli at the goeldi museum from somewhere in central amazonia (i can't remember the exact locality, near santarem i think) that was i.d.ed by m.a. traylor as e.t.trailli. however, it seems more likely by range that it be alnorum. i believe this specimen is mention in ridgely and tudor's birds of south america, v.2. in any case david oren (oren@amazon.com.br) of the goeldi museum could provide details" (Haft *pers. com.*).
Ed Harper 4855 Cameron Ranch Dr. Sacramento, CA 95841 email: weh_sms@pacbell.net 1 (916) 484-8635	Encountered *E. traillii* in Nayarit, Mexico - "my recollection of the Willow Flycatcher vocalizations along the Singayta Trail near San Blas, Nayarit: a distinct whit note repeated several times during my observations. The birds I have noted have been always foraging along the trail near wet pastures bordered by small trees and shrubs. The birds have always been fairly close to the ground when foraging, never foraging at heights exceeding 3 meters. Mind you this is all recall, not field notes I am reading back to you. On subsequent trips to Latin American birding destinations, I will be very careful to record all observations of Willow Flycatcher (or other empids that I can confidently get down to species) and any details about their behavior and habitat. And yes, I will be alert to any other field notes I may uncover about Willow Flycatchers during various travels in Latin America. (I have checked several trip lists such as one visit to Chiapas, Mexico a decade ago, but did not have any records of Willow Flycatcher. I have a couple of recent sightings that I have documented on recent trips to San Blas, Nayarit, Mexico. According to my records I recorded: 1 Willow Flycatcher, 7 January 1994 on the Singayta Trail 2 Willow Flycatchers, 5 January 1998 on the Singayta Trail. I believe I heard vocalizations helping to confirm the species on both trips. I am thoroughly familiar with the species since it is a common breeder in riparian areas in the Gallatin Valley of Montana (near Bozeman) where I usually spend my summers. I may have other Latin America records, but it would take extensive searching through filed records since I have not put them on my computer. But I hope this little bit of information is helpful. San Blas is heavily birded, so you probably have a number of records from the area. The Singayta Trail seems to still have some good winter habitat available to the species" (Harper *pers. com.*). Contact most likely can provide additional information such as logistics for these wintering areas. Koronkiewicz encountered wintering *E. traillii* at or near this same area in 1996.
Dr. Richard L. Hutto, Ornithologist University of Montana-Missoula email: hutto@selway.umt.edu phone: 406-243-4292	Encountered wintering *E. traillii* at the following locations in western Mexico: Chamela, Jalisco; Rio Cuixmala, Jalisco; Agua Caliente, Jalisco; Paracuaro, Michoacan; Jose Maria Morelos, Jalisco; Villa Madero, ?; Ucareo, ?. "Typically found on the lowland Pacific side of Mexico, in riparian sites with a few in lowland agricultural border strips" (Hutto *pers. com*). Contact most likely can provide additional information such as logistics for these wintering areas.
Ricardo A. Jiménez, Administrador Regional del Ambiente Chirquí Entrega General David, Chirquí República de Panamá phone: 774-6671 fax: 775-3163	No information directly related to wintering *E. traillii*, but 1999 surveyors met with Ricardo to discuss obtaining research permits in Panamá. Ricardo can be met with at his office in David, Panamá in order to obtain research permits.
Dr. James Karr, Ornithologist University of Washington email: jrkarr@u.washington.edu	E-mailed, no reply.

Appendix 14 Continued.

Lloyd Kiff Peregrine Fund 566 W. Flying Hawk Ln. Boise, ID 83709 email: lkiff@peregrinefund.org	Contact had no information related to wintering *E. traillii*.
Dr. Oliver Komar, Ornithologist Department of Ecology and Evolutionary Biology, Division of Ornithology Natural History Museum and Biodiversity Research Center The University of Kansas Lawrence, KS 66045 USA Tel: (785) 864-4065, Fax: (785) 864-5335 Home: (785) 838-3514 E-mail: okomar@ukans.edu	Contact has encountered numerous wintering *E. traillii* in El Salvador - "I have many sightings, including dozens of banded Willow Flycatchers, from the lowlands of El Salvador, where it is one of the commonnest winter visitors. I have heard these birds singing the familiar Fitz-bew. I do not know which subspecies I have seen. However, van Rossem, in Dickey and van Rossem, Birds of El Salvador, 1938, pp. 376-378, reported E. traillii traillii and E. traillii brewsteri in a roughly 1:3 ratio..... the single locality where I have found Willow Flycatcher most abundantly is Laguna El Jocotal, in San Miguel Department, southeastern El Salvador... this area is a National Wildlife Refuge ..... during 1997 I supervised a banding project at five wetlands in El Salvador. I can send you a summary of Empidonax captures from those five sites" (*Komar pers. com.*). Contact should be consulted if *E. traillii* surveys etc... are conducted in El Salvador; an authority on birds of El Salvador (see Komar 1998). Contact most likely can provide additional information such as logistics for wintering areas. There are several historical *E. traillii* collections nearby this wintering area (Unitt 1997).
Tony Leukering Colorado Bird Observatory	Contact works in Mexico and has not encountered *E. traillii* there.
Jim Lewis, guide, Costa Rica Costa Rica Expeditions, Costa Rica email: birdmaster@expeditions.co.cr	E-mailed 19 Oct. 1998. Contact has no information.
Bette A. Loiselle, Ornithologist University of Missouri-St. Louis email: loiselle@toco.umsl.edu	E-mailed 30 Oct. 1998, no reply.
Tim Manolis 808 El Encino Way Sacramento, CA 95864 (916) 485-9009 email: ylightfoot@aol.com	Banded *E. traillii* with Jim Karr in Panama, unfortunately did not specify area or dates.
Wilberto Martinez, Ornithologist email: panabird@sinfo.net Phone: 507-225-7325 Fax: 507-225-7314	Encountered *E. traillii* at several locations within the Chiriquí Province of Panamá, but unfortunately could not recall time of year and exact locations (Martinez *pers. com.*). 1999 surveyors met with Wilberto in Panamá and he informed us that there will be road in the very near future (next year) that connects the major city of Chiriquí Grande with the historical *E. traillii* collection area of Almirante (Unitt 1997 and this report). Until this road is established, plane or boat is the only access to Almirante in Panamá (Almirante can be accessed by road from Costa Rica). Contact should be consulted if *E. traillii* surveys etc... are conducted in Panamá. Wilberto can arrange transportation, lodging and guides (guards) for the remote area of Darién where wintering *E. traillii* have been collected (Unitt 1997) and recently encountered (see Seutin below).

Appendix 14 Continued

Dr. Robert Matlock, Scientific Director La Selva Biological Station Organization for Tropical Studies Puerto Viejo de Sarapiqui, Costa Rica Tel.: (506) 766-6565 Fax: (506) 766-6535 email: rmatlock@sloth.ots.ac.cr	Recommended contacting O. Vargas (see below) for winter information on *E traillii*. Researchers must coordinate with Dr. Matlock in order to conduct research at La Selva Biological Station.
Borja Mila Point Reyes Bird Observatory 4990 Shoreline Hwy. Stinson Beach, CA 94970	Encountered *E. traillii* in Oaxaca, Mexico - "in the Puerto Escondido area, caught 3 willow flycatchers in riparian habitat near large rivers" (Mila *pers. com.*). Unfortunately, no dates given. Contact most likely can provide additional information such as logistics for these areas.
Andy Mitchell Royal Society for the Protection of Birds 5 Hamlet Rd., Chelmsford, Essex CM2 OEU England email: andy@witsend.freeserve.co.uk	Provided information on *E traillii* in Cuba, interesting, but most likely migrants - "willow flycatcher has been recorded in Cuba, which I presume is included in Latin America for your study. The Catalogue of Cuban Birds (1975) refers to two birds collected there. One at Marianao, Havana Province and one at La Vega on the Isle of Youth (Pines). These specimens are housed at the Natural History Museum in Cuba.
Dr. Lisa Petit, Ornithologist Smithsonian Migratory Bird Center email: lpetit@sivm.si.edu	E-mailed on numerous occasions, no reply.
Dr. Noble S. Proctor, Ornithologist and guide with Costa Rica Expeditions, Costa Rica Southern CT State University email: proctor@scsud.ctstateu.edu	Observed wintering and migrating *E. traillii* around the mouth of the Rio Tárcoles and Cañas area, Costa Rica (Proctor *pers. com.*). Wintering willow flycatchers were detected near the Rio Tárcoles area during the 1999 surveys (Table 3). Suggested we contact Charlie Gomez, guide with Costa Rica Expeditions for additional information (see above).
Dr. C. John Ralph, Ornithologist Redwood Sciences Lab, Arcata, CA email: cjralph@humbolt1.com	Contact operates year round avian monitoring station in Tortuguero, Costa Rica and captures fall migrating "Traill's flycatchers" annually. The Caribbean coastal lowlands in and around Tortuguero are used by "Traill's flycatchers" heading southward (Ralph *pers. com.*). During the fall migration period of 1997, Koronkiewicz visited Dr. Ralph's avian monitoring stations in Tortuguero and captured/banded numerous migrant Traill's flycatchers, of which some were confidently identified as *E. traillii*.
Terry Rich, Ornithologist BLM 1387 S. Vinnell Way Boise, ID 83709 email: trich@id.blm.gov	E-mailed 13 Nov. 1998, contact has no information pertaining to *E. traillii*
Ruth Rodriguez, Naturalist/Ornithologist Costa Rica email: aracari@sloth.ots.ac.cr	Suggested contacting the following: Bruce Young, Jim Zook, Rafael Campos, Rolando Delgado and Richard Garriguez. All of these persons were contacted (see above and below).
Raul Rojas, Biologist Las Cruces Biological Station, Costa Rica email: lccruces@ns.ots.ac.cr	E-mailed on numerous occasions, no reply.

Appendix 14 Continued

Julio Sanchez, Curator of Birds Museo Nacional, Costa Rica email: jesornic@sol.racsa.co.cr	Provided numerous contacts regarding *E. traillii* winter information. Also, provided much information on the argro-economy of Costa Rica (see Koronkiewicz et al. 1998). Person to contact to examine museum specimens of *E. traillii* at the Museo Nacional, Costa Rica (see Koronkiewicz et al. 1998, Appendix 5).
Dr. Gilles Seutin, Ornithologist Dept. of Geography, McGill University 805 Sherbrooke W. Montreal, Quebec Canada H3AZK6 email: czcp@musica.mcgill.ca	Contact encountered *E. traillii* in Panamá, Darién Province - "you may remember seeing my name associated with WIFL (allozymes, female songs, morphometrics). That was my MSc. I am still interested in the little green bird, though not too actively... I should be able to dig out records from Panama where I spent 4 years. One place where I remember seeing (sorry, hearing) repeatedly the species in small numbers is around (mainly far end of) the landing strip at El Real in the Darien. I will be there in February and will keep my ears open" (Seutin *pers. com.*). *E. traillii* have been collected at and near this remote area of Panamá - El Real, 25 Jan. 1964; Cerro Pirre, 23 March 1912 (Unitt 1997). Accessing these areas can be worked out by contacting Wilberto Martinez (see above). Contact also recommended additional contacts for Panamá -" you should get in touch with George Angehr (angehrg@tivoli.si.edu) and Dodge and Lorna Engleman (panamadocs@worldnet.att.net)" (Seutin *pers. com.*).
Dr. Thomas Sherry, Ornithologist Dept. of Ecology, Evolution and Organismal Biology 310 Dinwiddie Hall, Tulane Univ. New Orleans, LA 70118 email: tsherry@mailhost.tcs.tulane.edu	Does not recall encountering *E. traillii* in Costa Rica. Recommends contacting F. Gary Stiles (see below).
Annie Simpson Organization for Tropical Studies Apdo. 676-2050 San Jose, Costa Rica email: asgamboa@cro.ots.ac.cr Tel: 506-240-6696 Fax: 506-240-6783	Provides researcher assistance in Costa Rica. Also, provided numerous contacts (too lengthy to list here, but all are included above and below) as to who to contact regarding *E. traillii* winter information. Contact issues research, export and import permits for Costa Rica.
John Sterling Smithsonian Migratory Bird Center, National Zoological Park, Washington, D.C. 20008 email: ani@erols.com	Encountered *E. traillii* in Chiapas, Mexico - "... pacific coastal plain in the Tapachula area - near a river, heard "whits", felt that the flycatchers were winter residents" (Sterling *pers. com.*). Contact most likely can provide additional information such as logistics for this area.
Dr. F. Gary Stiles, Ornithologist Inst. De Ciencias Naturales Universidad de Colombia Apt. 7495, Bogota, DC Colombia email: gstiles@ciencias.ciencias.unal.edu.co	Dr. Stiles was e-mailed on numerous occasions, but unfortunately he did not reply.
Orlando Vargas R., Asistente de Director Cientifico, La Selva, Costa Rica email: ovargas@sloth.ots.ac.cr	Provided Christmas Bird Count Data from La Selva Biological Station, Costa Rica which included *E. traillii* - "I would like to give you some information about this interesting hard bird to identify.....1985 - 4 individuals, 1990 - 3 individuals, and 1995 - 5 individuals. I've been asking to the naturalist guides (excellent birders) how many they've seen lately, non of them have seen any. maybe because is very rare or is hard to tell apart from others (Alder flycatcher)" (Vargas *pers. Com*). Suggested we contact the following - Bruce Young, Jim Zook, Eugenio Gonzales, and Raul Rojas (see above and below). Arrangements to conduct research at La Selva may be made through Orlando.

Appendix 15. Agricultural chemicals known to be used in the Tempisque and Bebedero drainages (compiled by H. Nanne, Ministerio de Agricultura y Ganaderia de Costa Rica, from Kapetsky et al. 1987).

Important Crops	Rice
	Pasture
	Sorghum
	Cotton
Pesticides	Propanil (herbacide)
	2-4 D (herbicide)
	Metamidofos (insecticide)
	Metil paration (insecticide)
	Mancozeb (fungicide)
	Maneb (fungicide)
	Tordon 101 (Picloran with 2-4 D)
	Clorpirifos insecticides
Fertilizers	Nitrogen - in formula 10-30-10 and 12-24-12
	Phosphorus - in formula 10-30-10 and 12-24-12
	Potassium - in formula 10-30-10 and 12-24-12
	Urea with 46% nitrogen

Appendix 16. Details of 1999 willow flycatcher survey effort in Panamá. Surveys during which willow flycatchers were detected are shaded.

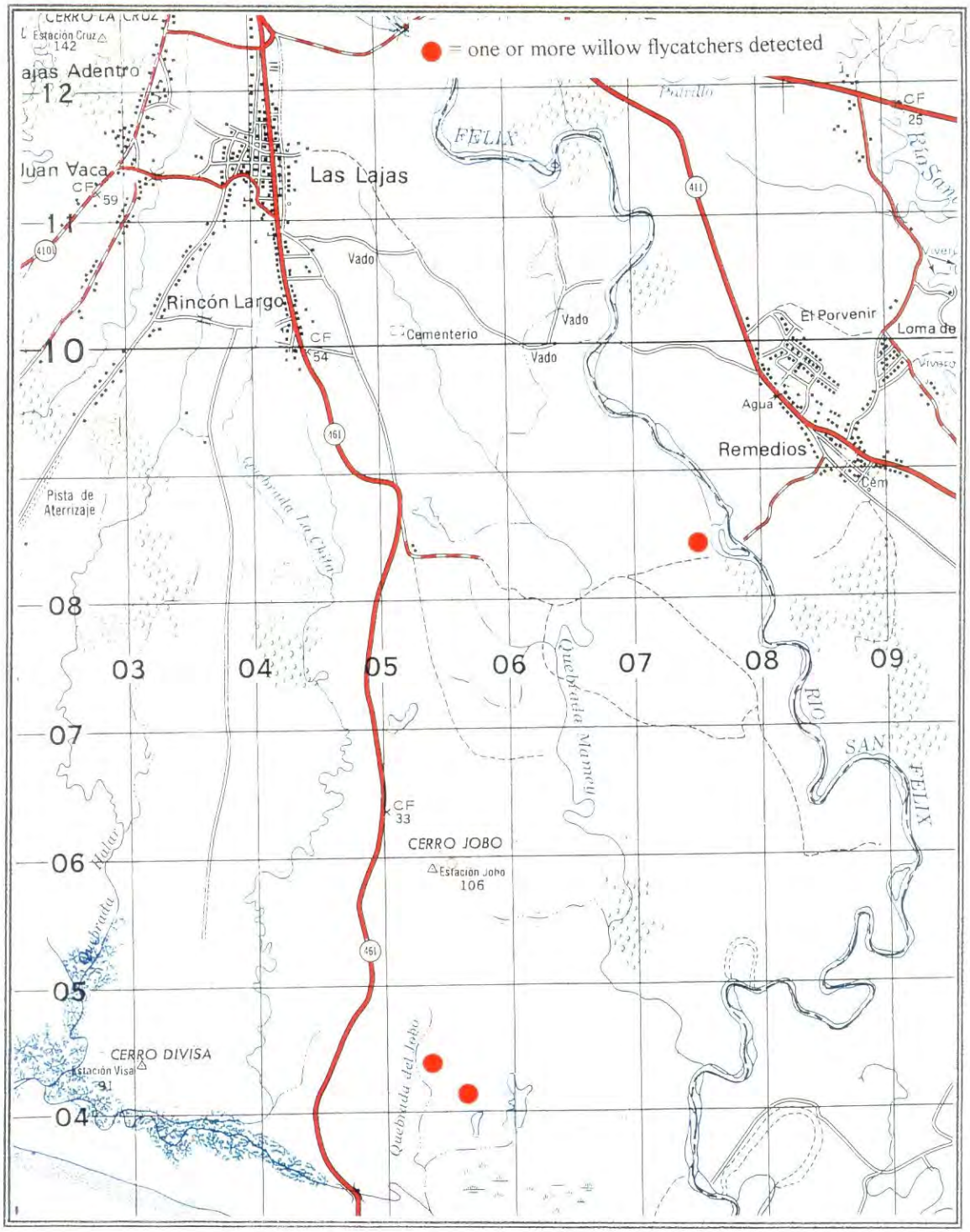
Habitat(s) Surveyed
1 = patches or stringers of trees and/or woody shrubs, bordered by savannas and pasture lands
2 = gallery forest consisting of patches or stringers of trees and/or woody shrubs, bordered by savannas and pasture lands
3 = riparian areas with associated gallery forest of varying heights, densities and under story composition
4 = riparian areas and adjacent savannas and pasture lands
5 = *lagunas* (intermittent wetlands) and seeps
6 = agricultural areas
7 = patches/areas of tropical dry forest (employing the World Life Zone-System Ecological Classification of L.R. Holdridge 1967)

Surveyor(s): TK = Thomas J. Koronkiewicz, SL = Suzanne M. Langridge, PH = Philip B. Heavin, KE = Kristen M. Enos

N/A = coordinates not available; N/A_1 = due to dense canopy, unable to obtain coordinates; N/A_2 = area surveyed < 200 linear meters

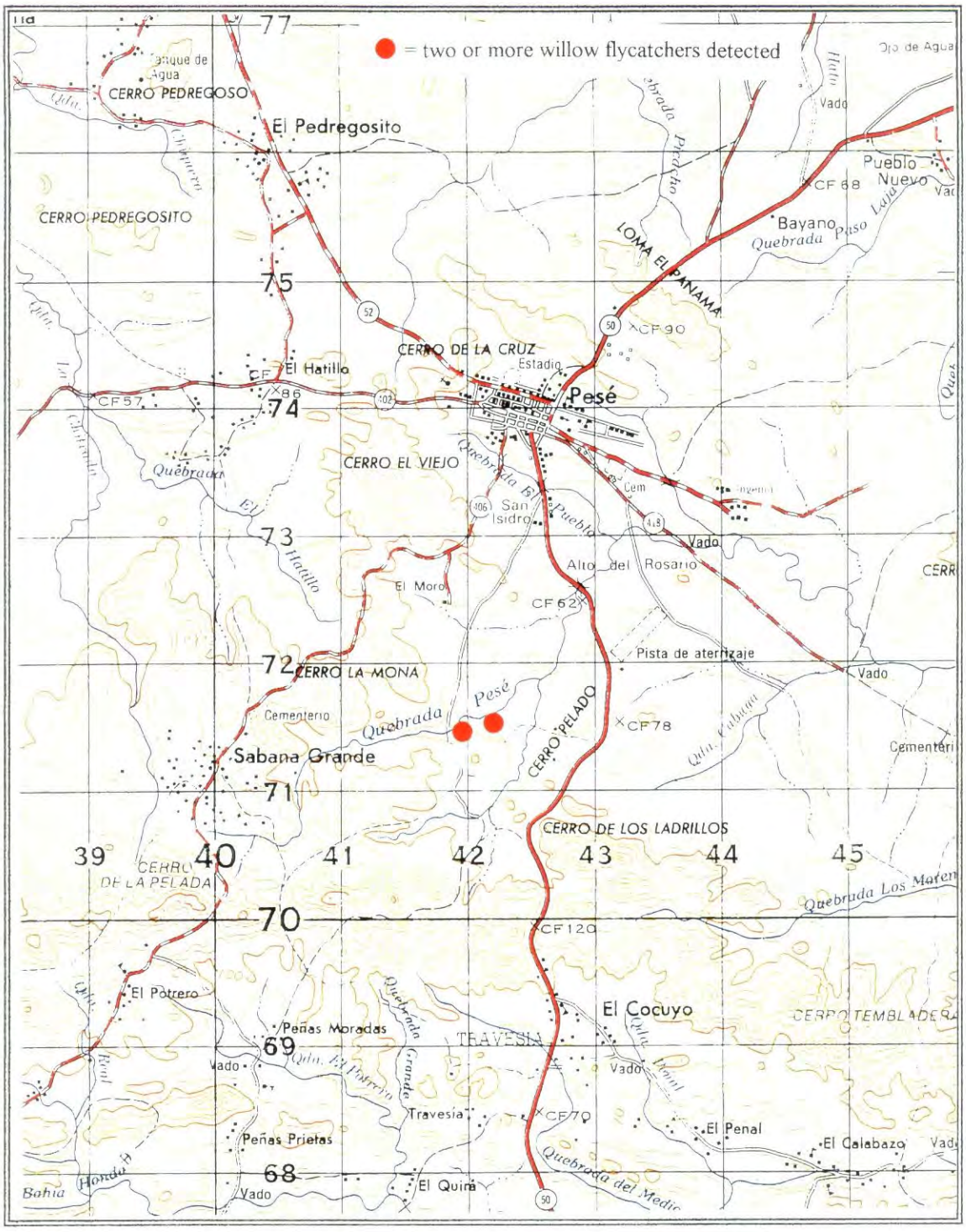
Survey Location	Date	Coordinates Start	Coordinates Stop	Timing of Surveys	Survey Hours	Habitat(s) Surveyed	Surveyor(s)
Paris	21 Feb.	N 8° 6.18' W 80° 34.01'	N 8° 6.30' W 80° 33.46'	0730 to 1130 hours	4.0	1,3,4,7	SL, KE
		N 8° 4.98' W 80° 34.92'	N 8° 4.76' W 80° 34.91'	0700 to 1130 hours	4.5	1,3,4,5,7	PH
		N 8° 4.98' W 80° 34.92'	N 8° 4.73' W 80° 36.11'	0700 to 1130 hours	4.5	1,3,4,5,7	TK
Pesé	22 Feb.	N 7° 58.80' W 80° 34.92'	N/A_2	0615 to 0715 hours	1.0	1,3,5	TK, KE, SL, PH
		N 7° 58.47' W 80° 24.76'	N 7° 58.80' W 80° 24.74'	0800 to 1030 hours	2.5	1,3,5	TK, KE, SL, PH
		N 7° 53.43' W 80° 32.39'	N/A_2	1130 to 1430 hours	3.0	1,2,6,7	TK, KE, SL, PH
		N 7° 54.60' W 80° 38.81'	N/A_2	1500 to 1615 hours	1.3	1,2,6,7	TK, KE, SL, PH
		N 7° 54.13' W 80° 39.71'	N/A_2	1630 to 1730 hours	1.0	1,2,4,6,7	TK, KE, SL, PH
Tonosi	23 Feb.	N 7° 26.98' W 80° 22.27'	N/A_2	1030 to 1330 hours	3.0	1,3,4,5,7	TK,SL,KE
		N 7° 26.91' W 80° 22.32'	N/A_2	1030 to 1330 hours	3.0	1,3,4,5,7	PH
		N/A	N 7° 26.49' W 80° 25.36'	1500 to 1800 hours	3.0	1,2,4,5,6,7	TK, KE, SL, PH
San Félix	25 Feb.	N 8° 10.76' W 81° 52.03'	N 8° 10.61' W 81° 51.63'	0830 to 1230 hours	4.0	1,4,5,7	SL, KE
		N 8° 12.20' W 81° 51.77'	N 8° 12.79' W 81° 51.61'	0800 to 1100 hours	3.0	1,2,6,7	TK, PH
		N 8° 12.93' W 81° 50.90'	N 8° 13.06' W 81° 50.43'	1130 to 1330 hours	2.0	1,2,5,7	TK, PH
	26 Feb.	N 8° 13.11' W 81° 50.42'	N 8° 13.04' W 81° 50.33'	0700 to 0900 hours	2.0	1,2,5,7	TK, PH, KE, SL

Appendix 17. Topographic map of the San Felix area. Base map is from the 1:50,000 scale Las Lajas, Panama quad, Instituto Nacional, Panama. Major and auxiliary contour lines are 20 meters.



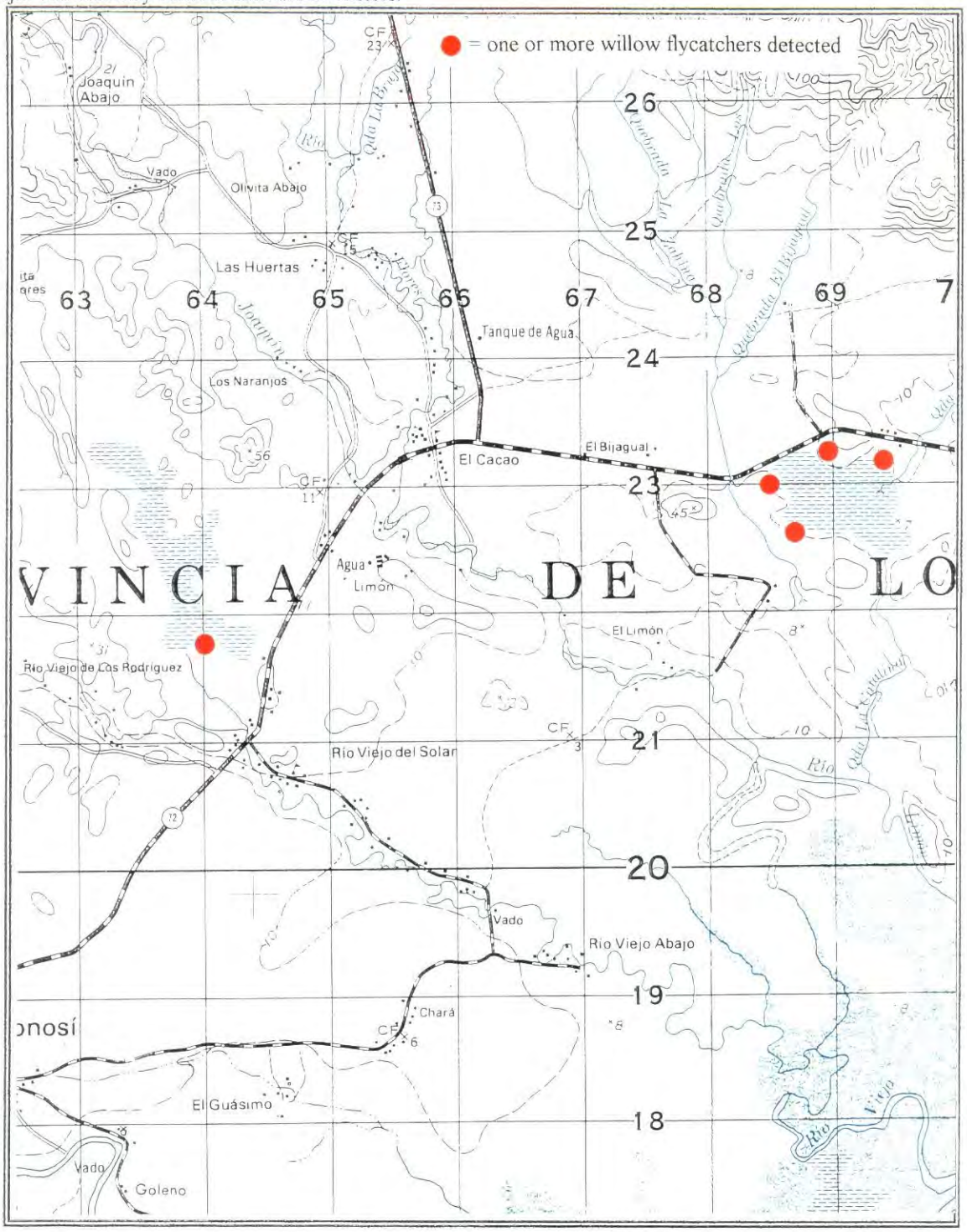
Detection *Sites* - Quebrada del Jobo (Playa de Lajas wetlands), Quebrada Mamey
Number of willow flycatchers detected - 5
Mileage/direction to nearest landmark - Approx. 5 km S of Las Lajas
Detection coordinates - Playa de Lajas wetlands N 8° 10.61' W 81° 51.63', Quebrada Mamey N 8° 13.11' W 81° 50.42'
Land use - Cattle within the detection areas

Appendix 18. Topographic map of the Pese area. Base map is from the 1:50,000 scale Pese, Panama quad, Instituto Nacional, Panama. Major and auxiliary contour lines are 20 and 10 meters, respectively.



Detection *Site* - Quebrada Pese
Number of willow flycatchers detected - 5
Mileage/direction to nearest landmark - Approx. 2 km S of Pese
Detection coordinates - N 7° 53.43' W 80° 32.39'
Land use - Sugar cane plantation completely surrounds detection area

Appendix 19. Topographic map of the Tonosi area. Base map is from the 1:50,000 scale Tonosi, Panama quad, Instituto Nacional, Panama. Major and auxiliary contour lines are 20 meters.



Detection *Sites* - Quebrada/Laguna Catalina; Laguna Naranja
Number of willow flycatchers detected - 9
Mileage/direction to nearest landmark - Approx. 4 km NE of Tonosi
Detection coordinates - Quebrada/Laguna Catalina N 7° 26.98' W 80° 22.27', Laguna Naranja N 7° 26.49' W 80° 25.36'
Land use - Cattle in detection areas.

Appendix 20. 1998-99 willow flycatcher survey form used for winter surveys in Costa Rica.

Willow Flycatcher Winter Survey Form

Site (unique name for each survey within the same area/village, but include village name)_____

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

SURVEY START: Latitude _____ Longitude_____ Elevation _____ (f / m) waypt _____

SURVEY STOP: Latitude _____ Longitude_____ Elevation _____ (f / m)

Length of area surveyed: _____ (specify units, mi, km, m) Ownership/Management: _____

Observer(s)	Date (m/d/y) Survey time	Number of WIFLs Found	Photo numbers	Comments
1 _____ _____	date start stop total hrs _____			
2 _____ _____	date start stop total hrs _____			
Overall Summary Total survey hrs_____				

Habitat Description (topography, vegetation, seral stage): _____

_____

_____

_____

_____

_____

Identify the 2-3 predominant trees/shrubs (if possible)_____

Estimated average height of canopy: _____ (m)

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

_____

_____

Page 1.

Appendix 20 continued.

Describe evidence of human activity, habitat impacts, etc. _____

IF WILLOW FLYCATCHERS ARE DETECTED, FILL OUT A DETECTION FORM !!

Draw a sketch showing details of survey area, important or useful landmarks, vegetation patch shape, approximate height and area of vegetation, survey route in relation to patch, and location of any willow flycatchers detected.

Appendix 21. 1998-99 willow flycatcher detection form used for winter surveys in Costa Rica.

Winter Willow Flycatcher Detection Form

Site (unique name for each detection within the same area/village, but include village name)_____

Date of Detection: _____ (fill out a separate detection form each day a WIFL is found, even if same site)

Time of detection: Begin _____ End_____

Detection Site: Latitude _____ Longitude_____ Elevation _____ (f / m) waypt _____

Photograph numbers: _____

Number of WIFLs detected at this site _____ WIFLs detected before playback? **Yes** **No** Did WIFL(s) respond to tape playback? (circle) **Yes** **No** Initial vocalization(s) of wifl(s) **(for each individual)** _____

(circle) *Whitts* only? *Fitz-bews*? *Whitts* and *Fitz-bews*? *Wee-oos*? *Brrrrs/kitters*? *Breets/Creets?* **(Provide details in field notebook)**

Describe response (did WIFL approach, sing strongly/weakly, etc.)_____

Type of initial detection: **Visual** **Aural** **Both**
Degree of certainty of species ID: **Possible** **Probable** **Positive**
Why? _____
Describe quality/nature of detection (how far, how long, lighting, vocalizations, etc.) _____
_____ **(attach notes)**

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

Describe general habitat at the site (if possible, include names of major tree/shrub dominants, etc.): _____

Surface water at site : **present** **near** **none** Describe_____

Describe evidence of human activities, impacts, threats at the site: _____

Continue comments or notes on back of page

Page 1

Appendix 21 continued.

Draw a sketch of the flycatcher detection site. Show the location of the patch, prominent or 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: _____

_____

_____

Comments:

_____

_____

_____

_____

Appendix 22. Summary of wintering willow flycatcher responses in Costa Rica to an *Empidonax* taxidermy mount/decoy, placed next to a 6.0 m mist net located between two speakers broadcasting willow flycatcher vocalizations recorded on the breeding grounds. Included is capture information and site (N/A = not available).

Willow flycatcher captured? If yes, band combo and site	Date and time of capture	Willow flycatcher response to an *Empidonax* taxidermy mount placed between 2 speakers broadcasting willow flycatcher vocalizations	Willow flycatcher response to 2 speakers broadcasting willow flycatcher vocalizations placed app. 3 - 5 m apart	Agitated/aggressive behaviors exhibited by the willow flycatcher during playback of vocalizations recorded on the breeding grounds	Total tape play time
KY:N, Chomes	12/18/98 0810 hours	hovered at decoy	flew back and forth between the 2 speakers	fitz-bew song flights; rapid whitts; brrr/kitters; raised crest and rapid tail pumping	3-5 min.
RW:N, Chomes	12/18/98 0905 hours	hovered at decoy	flew back and forth between the 2 speakers	emphatic fitz-bews; rapid whitts; brrr/kitters; raised crest and rapid tail pumping	3-5 min.
DW:N, Chomes	12/18/98 1035 hours	no observable response	flew back and forth between the 2 speakers	emphatic fitz-bews; rapid whitts; brrr/kitters; raised crest and rapid tail pumping	3-5 min.
WW:N, Chomes	1/2/99 0615 hours	no decoy used	flew back and forth between the 2 speakers	emphatic fitz-bews; rapid whitts; brrr/kitters; creets/breets; raised crest and rapid tail pumping	10-15 min.
RK:N, Chomes	1/2/99 0830 hours	hovered at decoy	flew back and forth between the 2 speakers	emphatic fitz-bews; creets/breets; brrr/kitters; raised crest and rapid tail pumping	8-10 min.
RD:N, Chomes	1/2/99 0935 hours	no observable response	flew back and forth between the 2 speakers	emphatic fitz-bews; brrr/kitters; raised crest and rapid tail pumping	3-5 min.
YV:N, Chomes	1/2/99 1124 hours	hovered at decoy	flew back and forth between the 2 speakers	emphatic fitz-bews; rapid whitts; brrr/kitters	10-15 min.
WR:N, Chomes	1/3/99 0725 hours	flew in line at decoy	flew into speaker area (see capture time)	rapid whitts	< 1 min.
No capture, Chomes	1/3/99	no observable response	flew back and forth between the 2 speakers	fitz-bews; occasional soft whits; not very agitated	N/A
YR:N, Chomes	1/6/99 0709 hours	no decoy used	flew into speaker area, hovered above speaker (single speaker used)	fitz-bew song flights; rapid whitts; brrr/kitters; creets/breets;	8-10 min.
WK:N, Chomes	1/7/99 0555 hours	no observable response	flew back and forth between the 2 speakers	rapid whitts; raised crest and rapid tail pumping	5-8 min.
X:KK, Chomes	3/21/99 0905 hours	no decoy used	flew back and forth between the 2 speakers	emphatic fitz-bews; rapid whitts; raised crest and rapid tail pumping	8-10 min.
X:GG, Chomes	3/21/99 1110 hours	no decoy used	flew back and forth between the 2 speakers	emphatic fitz-bews; rapid whitts; raised crest and rapid tail pumping	15-20 min.
--:V (USFWS anodized), Chomes	3/22/99 0750 hours	no decoy used	flew back and forth between the 2 speakers	emphatic fitz-bews; rapid whitts; creets/breets; raised crest and rapid tail pumping	3-5 min.
WD:N, Bolsón	1/16/99 0700 hours	no observable response	flew back and forth between the 2 speakers	emphatic fitz-bews; rapid whitts; creets/breets	1-3 min.

Appendix 22 continued.

Willow flycatcher captured? If yes, band combo and site	Date and time of capture	Willow flycatcher response to an *Empidonax* taxidermy mount placed between 2 speakers broadcasting willow flycatcher vocalizations	Willow flycatcher response to 2 speakers broadcasting willow flycatcher vocalizations placed app. 3 - 5 m apart	Agitated/aggressive behaviors exhibited by the willow flycatcher during playback of vocalizations recorded on the breeding grounds	Total tape play time
KD:N, Bolsón	1/16/99 0840 hours	no observable response	flew back and forth between the 2 speakers	emphatic fitz-bews; rapid whitts; brrr/kitters; raised crest and rapid tail pumping	10-15 min.
No capture, Bolsón	1/16/99	no observable response	flew back and forth between the 2 speakers	emphatic fitz-bews; rapid whitts; brrr/kitters; rapid tail pumping	N/A
DR:N, Bolsón	1/17/99 0650 hours	hit decoy in a direct flight	flew back and forth between the 2 speakers	fitz-bew song flights; bill snapping; rapid whitts; brrr/kitters accompanied by wing fluttering; creets/breets; raised crest and rapid tail pumping	1-3 min.
KW:N, Bolsón	1/17/99 0710 hours	hovered at decoy	flew back and forth between the 2 speakers	fitz-bew song flights; rapid whitts; brrr/kitters; rapid tail pumping	1-3 min.
RR:X, Bolsón	3/19/99 0715 hours	no decoy used	flew into speaker area, hovered above speaker (single speaker used)	emphatic fitz-bews; rapid whitts; brrr/kitters; creets/breets	8-10 min.
DD:X, Bolsón	3/19/99 0910 hours	no decoy used	flew back and forth between the 2 speakers	fitz-bew song flights; rapid whitts; brrr/kitters; rapid tail pumping	10-15 min.
X:ZZ, Bolsón	3/19/99 1050 hours	no decoy used	flew back and forth between the 2 speakers	fitz-bews; whits; brrr/kitters; creets/breets	15-20 min.
YK:X, Santa Cruz	1/12/99 0638 hours	no observable response	flew into speaker area (see capture time)	rapid whitts	< 1 min.
N:DD, Santa Cruz	1/12/99 0805 hours	no observable response	flew into speaker area (see capture time)	rapid whitts; rapid tail pumping	< 1 min.
N:VV, Santa Cruz	1/12/99 0935 hours	hovered at decoy	flew back and forth between the 2 speakers	fitz-bew song flights; bill snapping; rapid whitts; brrr/kitters accompanied by wing fluttering; rapid tail pumping	15-20 min.
N:DW, Santa Cruz	1/12/99 1128 hours	no observable response	flew back and forth between the 2 speakers	fitz-bews; bill snapping; rapid whitts; brrr/kitters; rapid tail pumping	15-20 min.
KK:X, Santa Cruz	3/18/99 0627 hours	no observable response	flew back and forth between the 2 speakers	fitz-bews; rapid whitts; brrr/kitters; raised crest and rapid tail pumping	10-15 min.
ZZ:X, Santa Cruz	3/18/99 0830 hours	flew in line at decoy	flew back and forth between the 2 speakers	fitz-bews; rapid whitts; brrr/kitters	8-10 min.
X:RR, Santa Cruz	3/18/99 0955 hours	no observable response	flew back and forth between the 2 speakers	emphatic fitz-bews; rapid whitts; brrr/kitters	8-10 min.
GG:X, Santa Cruz	3/18/99 1025 hours	no observable response	flew back and forth between the 2 speakers	fitz-bews; rapid whitts	5-8 min.
N:RY, Solimar	1/28/99 0640 hours	no observable response	flew back and forth between the 2 speakers	rapid whitts	10-15 min
N:WD, Solimar	1/28/99 1020 hours	no observable response	flew into speaker area (see capture time)	whitts	< 1 min.

Appendix 22 continued.

Willow flycatcher captured? If yes, band combo and site	Date and time of capture	Willow flycatcher response to an *Empidonax* taxidermy mount placed between 2 speakers broadcasting willow flycatcher vocalizations	Willow flycatcher response to 2 speakers broadcasting willow flycatcher vocalizations placed app. 3 - 5 m apart	Agitated/aggressive behaviors exhibited by the willow flycatcher during playback of vocalizations recorded on the breeding grounds	Total tape play time
N:GK, Solimar	1/28/99 1120 hours	no observable response	flew back and forth between the 2 speakers	fitz-bews; rapid whitts; brrr/kitters accompanied by wing fluttering; creets/breets; raised crest and rapid tail pumping	3-5 min.
- - : X, Coto 44	2/6/99 0625 hours	flew in line at decoy	flew back and forth between the 2 speakers	fitz-bew song flights; rapid whitts; brrr/kitters	1-3 min.
- - : X, Coto 44	2/6/99 0715 hours	no observable response	flew back and forth between the 2 speakers	rapid whitts	1-3 min.
- - : X, Coto 44	2/7/99 0730 hours	hovered at decoy, then landed on it with wing flutters	flew back and forth between the 2 speakers	fitz-bews; rapid whitts; brrr/kitters; raised crest and rapid tail pumping	3-5 min.
- - : X, Coto 44	2/7/99 0820 hours	no observable response	flew back and forth between the 2 speakers	fitz-bews; rapid whitts; brrr/kitters	< 1 min.
No capture, Coto 44	2/6/99	no observable response	flew back and forth between the 2 speakers	fitz-bews; rapid whitts	N/A
No capture, Coto 44	2/7/99	no observable response	flew back and forth between the 2 speakers	fitz-bews; rapid whitts; brrr/kitters	N/A
- - : X, Puerto Jiménez	2/9/99 0550 hours	flew in line at decoy	flew into speaker area (see capture time)	fitz-bews; rapid whitts; brrr/kitters	< 1 min.
- - : X, Puerto Jiménez	2/9/99 0630 hours	flew in line at decoy	flew into speaker area (see capture time)	fitz-bews; rapid whitts; brrr/kitters	< 1 min.
- - : X, Puerto Jiménez	2/9/99 1036 hours	no observable response	flew back and forth between the 2 speakers	fitz-bews; rapid whitts; brrr/kitters; raised crest and rapid tail pumping	10-15 min

Key to color band combinations: N = bronze anodized USFWS service band; X = USFWS service band; K = black; Y = yellow; R = red; W = white; D = blue; V = violet; G = green