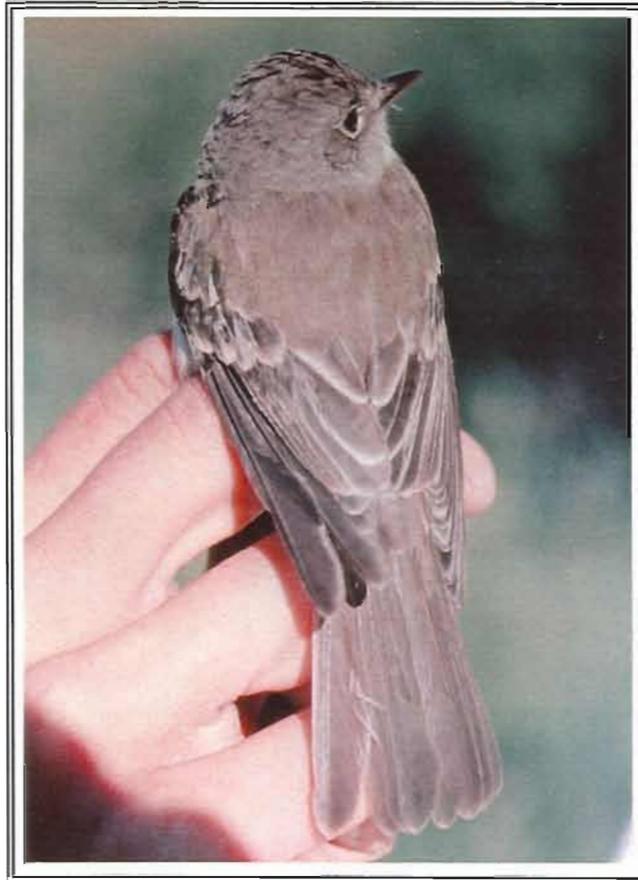


Banding and Genetic Sampling of Willow Flycatchers in Utah: 1997 and 1998



Prepared by: Suzanne M. Langridge and Mark K. Sogge, USGS Biological Resources Division, Forest and Rangeland Ecosystem Science Center, Colorado Plateau Field Station, Northern Arizona University, Flagstaff, AZ. September 1998

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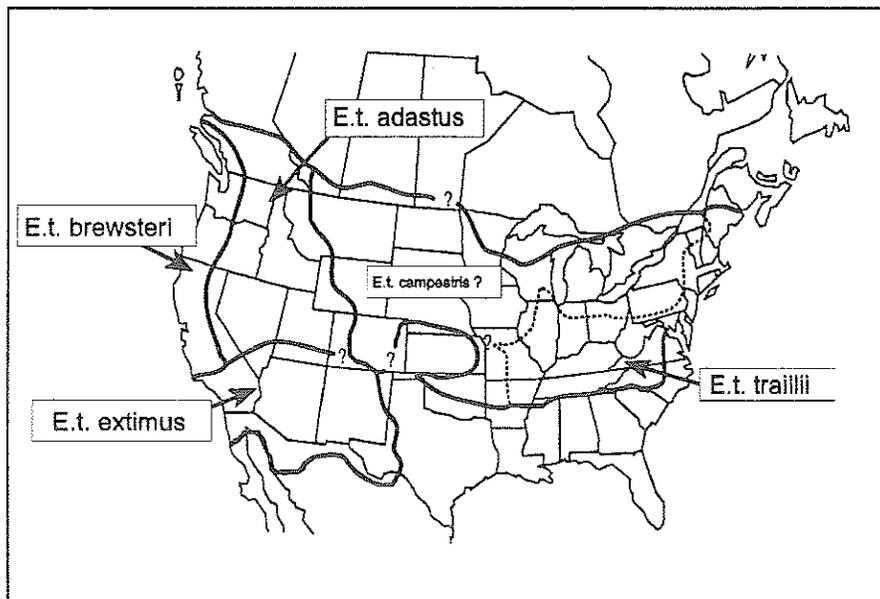
INTRODUCTION

Willow flycatcher taxonomy, status and distribution in Utah

The willow flycatcher (*Empidonax traillii*) is a small passerine bird widely distributed across much of North America. A neotropical migrant, it spends only three to five months each year on its breeding grounds, with the remainder of the year spent in migration and on wintering areas in Central America and (possibly) northern South America (USFWS 1993). Willow flycatchers are relatively late spring migrants, with many individuals still migrating northward as late as mid-June. Southbound migrants may depart their breeding areas as early as late July. During these same periods, other individuals are already actively nesting and raising young on their breeding territories. Therefore, spring and fall migrants may be found in the same river systems, and sometimes even the same habitat patches, as territorial breeders during all but a relatively short period of the summer (from roughly 15 June through 20 July; Unitt 1987). This potential co-occurrence and overlap of breeding and migrating flycatchers often confuses the local status of the species in many areas.

Four (Unitt 1987) or five (Phillips 1948, Browning 1993) subspecies of the willow flycatcher are currently recognized (Figure 1). The subspecies taxonomy of the willow flycatcher is based on examination of subtle differences in morphology and coloration, primarily from museum specimens. The absence and/or limited number of available museum specimens from some regions, coupled with the difficulty in separating breeders from migrants and the subtle nature of the differences themselves, complicates efforts at characterizing the subspecies boundary ranges. However, the taxonomic validity of the subspecies *E.t. extimus* and *E.t. adastus* are widely accepted (USFWS 1993) and have been recently confirmed (Phillips 1948, Aldrich 1951, Unitt 1987, Browning 1993)

Figure 1. The breeding range distribution of the subspecies of the willow flycatcher (*Empidonax traillii*). Based on Unitt (1988) and Browning (1993), with modifications based on unpublished USFWS data.



The subspecies believed to breed in the extreme northern portion of Utah is *E.t. adastus* (Behle 1981). This classification is based on the more brown and grey coloring on the flycatchers' dorsal side and the measurements of bill size intermediate between the *E.t. traillii* and *E.t. brewsteri* subspecies. Several authors have described the flycatchers from the Raft River Mountains in northwestern Utah as the subspecies *adastus* (Phillips 1948, Aldrich 1951), and designate the subspecies *adastus* as a bird of the northern Great Basin. Snyder (1953) examined specimens from northeastern Utah and recognized them as *extimus*, although Twomey (1942) and Behle (1985) described several collected and observed willow flycatchers in the same area as *adastus*. Specimens collected from Provo area (Utah County) have also been classified as *adastus*, and are considered the most southern specimens designated as pure *adastus* (Behle 1985).

Few current and historical records exist of breeding willow flycatchers between Utah County and the extreme southern part of Utah. This section of its range has been described as an intergrade of *adastus* and *extimus* (Behle 1985, Unitt 1987). Behle (1985) describes a cline between *adastus* and the southwestern subspecies *extimus* that runs from the north to the south, and states that intergrades as far south as Moab are more closely related to *adastus*, with pure *extimus* confined to extreme southern Utah. Although the historic and current core range of the southwestern subspecies is based in Arizona, New Mexico, and California, the exact range limits within southern Utah are unclear. Phillips (1948) examined specimens from the Virgin River Valley of southwestern Utah and found them to be *extimus*. Behle and Higgins (1959) describe three *extimus* specimens from the southern section of the Colorado River (San Juan County) and describe *extimus* as common along the length of Glen Canyon. Between the southern counties of Washington, Kane and San Juan, and the northern counties of Utah and Uintah there are very few historical and current records confirming either the subspecies boundary or a clear intergrade of the *extimus* and *adastus* subspecies.

More recent work provides at best only limited clarification on the range limits of *extimus* and *adastus*. Unitt's (1987) review of flycatcher taxonomy and status describes the gradual intergradation between *extimus* and *adastus*, but does not clarify any range limits for the two subspecies. Browning's (1993) review of willow flycatcher taxonomy discusses some of the difficulties in determining the subspecies' ranges in this region. He concludes that a gradual cline could not be demonstrated because of the 100-200 mile lack of specimens between the extreme southern and northernmost collection sites (Figure 2).

In short, the taxonomic status of willow flycatchers breeding in southern and south-central Utah is still unclear, and furthermore there are few verified willow flycatcher breeding records in these areas. However, the U.S. Fish and Wildlife Service (USFWS) is including southwestern and central-eastern Utah as part of the proposed habitat division line between *extimus* and *adastus* (Figure 3). The USFWS (1995) also ruled that the northern range of *E.t. extimus* in Utah consists of Garfield, Kane, San Juan, Washington and Wayne counties, encompassing the southern quarter of the state. This designation has focused attention on the need to survey for suitable breeding habitat, document current breeding sites, and continue investigations of the subspecies range boundaries in Utah.

Figure 2. Historical willow flycatcher collection sites in Utah. Many of these collections were made during the migrant period and therefore this map should not be used in subspecies designation. Subspecies designations for specimens may change with further examination. Detailed collection information is listed in Appendix 6.

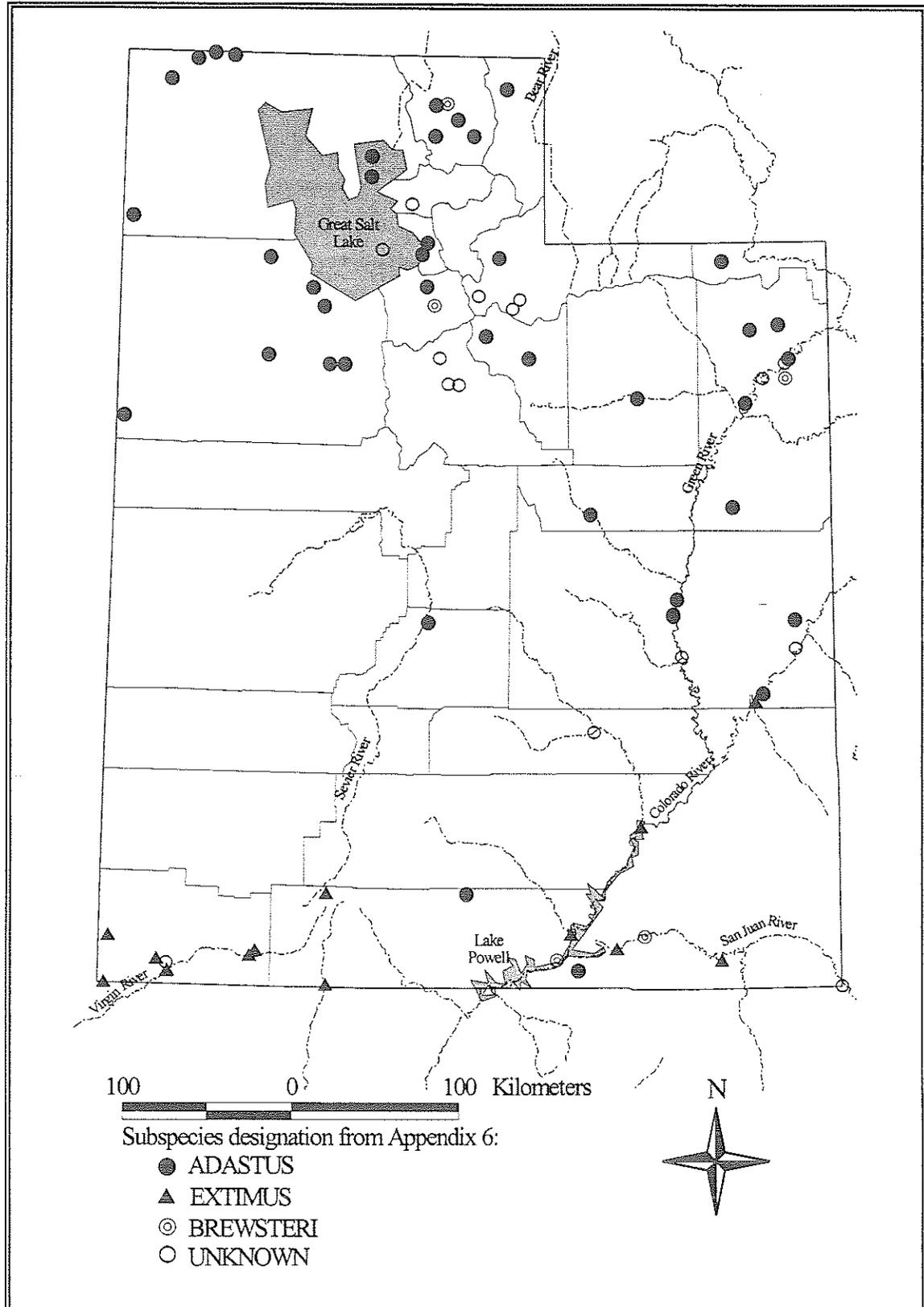
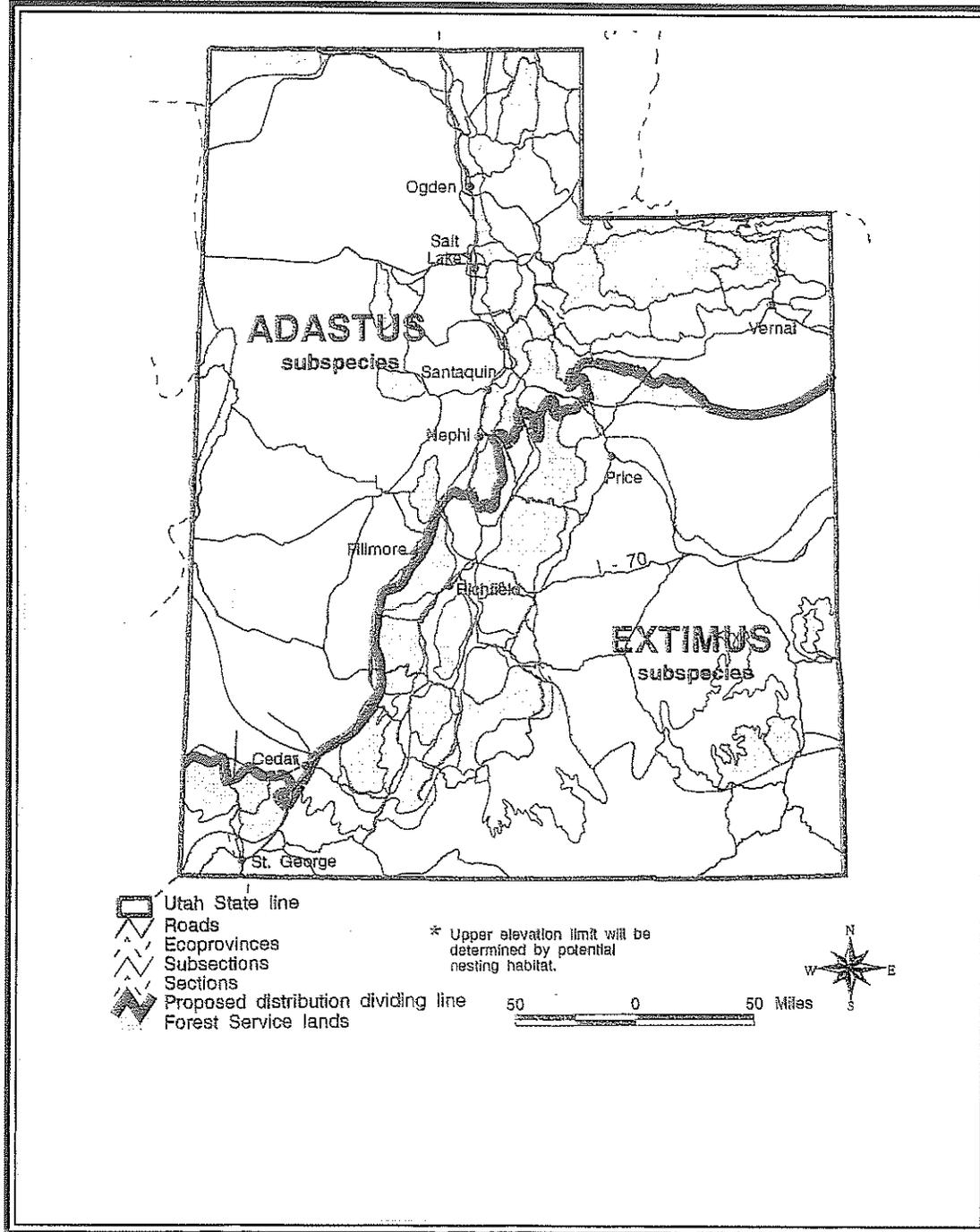


Figure 3. Proposed habitat division line between subspecies of the willow flycatcher in Utah, including provinces sections and subsections, major roads, and United States Forest Service land (USFWS *in litt*).



Uncertain range boundaries between the southwestern and "Great Basin" subspecies of willow flycatcher and genetic variability within the subspecies' could effect management decisions regarding the endangered southwestern race. The southwestern willow flycatcher has suffered serious declines as suitably dense, wet riparian habitats have been lost or modified (USFWS 1993), and therefore has been listed as a federal endangered species (USFWS 1995). Range-wide, *extimus* has an estimated breeding population of approximately 500 pairs, scattered among approximately 80 breeding areas (Sogge et al. 1997a). The vast majority of breeding sites include five or fewer breeding territories, and many sites are in small remnant patches of suitable riparian habitat (Sferra et al. 1997, Cooper 1997, USFWS unpublished data). Thus, the current southwestern willow flycatcher breeding population consists primarily of widely scattered, small breeding groups.

Management and conservation of the southwestern willow flycatcher must take into account the challenges posed by such small, potentially isolated breeding groups. Small breeding groups, particularly those in small habitat patches, face increased risk of extirpation by stochastic events (such as fire or flooding). Flycatchers breeding in small habitat patches may also be at greater risk to predation or cowbird parasitism (Robinson et al. 1995). Another significant concern is the nature and degree of genetic diversity and isolation within and between the breeding groups. Preservation of genetic variability is important, in that genetic diversity may be correlated with productivity, the frequency of detrimental alleles, and the ability to adapt to future environmental changes (Nevo 1978, Weins et al. 1989, Seitz and Loeschcke 1991). Differences in genetic variability can also tell us whether the flycatchers at the different breeding sites are genetically isolated (and hence distinct subpopulations), or whether there is genetic mixing between the breeding sites.

Furthermore, the willow flycatcher in Utah is classified as a sensitive species with a declining population and limited range or habitat (Atwood 1994). Although the populations within northern Utah have been described as common summer residents as recently as 1981 (Behle 1981), no surveys targeting willow flycatchers in their northern range have been conducted. Information describing genetic variation between and within the northern populations will demonstrate whether populations in northern Utah are experiencing reproductive fragmentation or isolation. This genetic information will also allow for comparisons with other populations throughout the flycatcher's range.

Purpose of this report:

This report summarizes the willow flycatcher banding and site reconnaissance activities that we conducted in Utah during 1997 and 1998. Although genetics is an important component of this project, DNA analysis will not be completed until the summer of 1999 and will therefore be reported at that time. Given the management and conservation value of the information from the survey and banding component of this study, we felt it worthwhile to summarize this information and make it available at this time.

Project Objectives:

This project began as a result of numerous meetings and workshops with researchers, resource and land managers, and regulatory biologists throughout the southwest. It became clear that management actions were being evaluated and carried out despite having little or no detailed information on the local status, distribution, and ecology of the willow flycatcher. In northern Utah it was assumed that populations were stable, yet little was known about the number, location, and extent of willow flycatcher breeding sites. Furthermore, virtually nothing was known regarding the genetic characteristics of known or suspected breeding groups, or how the northern and southern populations compared.

In 1997, the USGS Colorado Plateau Field Station (CPFS) at Northern Arizona University began preliminary flycatcher survey and research efforts in Utah. In 1998, the U.S. Bureau of Reclamation in Salt Lake City provided funding that allowed full-scale banding and molecular genetic analysis of flycatchers at selected breeding sites in Utah. The objectives of these efforts are listed below.

Banding component:

Capture and band willow flycatchers in order to:

- (1) collect blood samples for genetic analysis (see below); and
- (2) look for physiological evidence of breeding condition (such as cloacal protuberances in males, and brood patches in females) that could provide verification of breeding at a site.

Genetics component:

Use DNA fingerprinting techniques to analyze the current genetic characteristics of the willow flycatcher, with emphasis on:

- (1) estimating the degree of genetic variation within willow flycatcher breeding groups in northern Utah, and comparing similarity/dissimilarity among different subpopulations;
- (2) comparing the northern Utah breeding groups as a genetic subspecies outgroup to the southern Utah and other southwestern willow flycatcher populations; and
- (3) evaluating conservation and management options with respect to preserving genetic diversity within the willow flycatcher.

Study Areas:

A primary objective of our work was to capture, band, and sample as many willow flycatchers as possible at sites throughout northern Utah. The study sites selected are listed below (see also Figure 4), including areas where we detected flycatchers but did not take genetic samples (indicated by an asterisk).

Sites within potential *E.t. adastus* range:

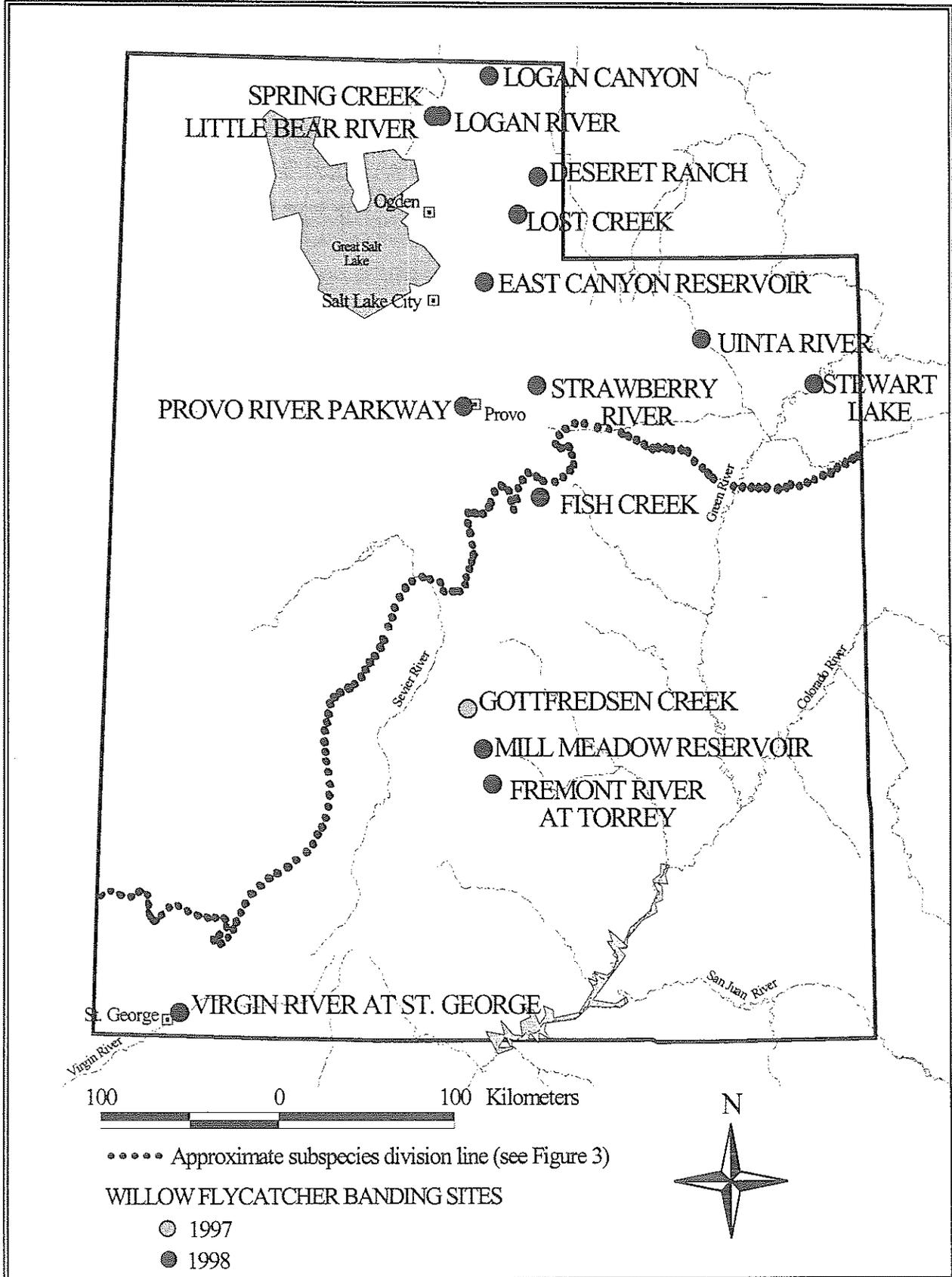
Logan River (Cache County)
Spring Creek (Cache County)
Little Bear River (Cache County)
Logan Canyon (Cache County)
Lost Creek (Morgan County)
East Canyon Reservoir (Morgan County)
Deseret Ranch House (Rich County)
Provo River Parkway (Utah County)
Strawberry River (Wasatch County)
Stewart Lake (Uintah County)
Uinta River (Duchesne County)
Bear River at Tremonton (Box Elder County)*

Sites within potential *E.t. extimus* range

Fish Creek (Carbon County)
Fremont River at Torrey (Wayne County)
Mill Meadow Reservoir (Wayne County)
Virgin River at St. George (Washington County)
Gottfredsen Creek (Sevier County)
Travois Springs (Sevier County)*

These sites span a broad geographic and elevational range, and include areas on both sides of the boundary line between the northern subspecies (*E.t. adastus*) and the southern subspecies (*E.t. extimus*).

Figure 4. Location of willow flycatcher banding and genetics sampling sites, 1997 and 1998.



METHODS

Locating Breeding Sites

Prior to our fieldwork in Utah we spoke with representatives of state and federal agencies, local birding organizations, and private land owners to locate and obtain access permission to willow flycatcher breeding sites. We chose a suite of sites that included a range of diverse habitats across a large elevational gradient within the northern section of the state. We also visited sites with confirmed residents in the southern part of the state. Due to the large number of sites found, we spent as little as one morning in most areas. Our main objective was to catch at least five individuals in each area. No willow flycatcher surveys had been conducted in northern Utah outside of the proposed *extimus* habitat, so few breeding sites were known and there was often no information on the precise location of flycatcher territories within a site. Some areas had only historical records of breeding flycatchers (Appendix 6). Prior to banding, we visited each site and located territorial flycatchers by using tape playback method (Sogge et al. 1997a). When we detected a flycatcher we would return later that day or the next morning to band. Banding was the critical aspect of our project, so we spent little or no time observing the birds and gaining demographic information at most sites. Confirmation of nesting for at least one pair was attempted at each site.

As noted in the introduction, except during a short period each summer, willow flycatchers detected at a site could be breeders, migrants, or both. Timing of sampling, physiological condition, and multiple visits to a site can assure that captured flycatchers are residents, rather than migrants. For the one site where we banded flycatchers before mid-June we returned to verify residency at that site. From mid-June to July (the non-migrant period) we concentrated on areas that we could visit only once, but could be sure that all captured flycatchers were residents. Throughout the season, many captured flycatchers had cloacal protuberances or brood patches, which immediately verified their breeding status (see below).

Banding

We captured and banded flycatchers in 1997 and 1998. All willow flycatchers were captured using mist nets. Once we found a flycatcher defending an area, we set up mist nets and lured the birds in by using willow flycatcher vocalizations broadcast from a compact disc. In some situations we also used an *Empidonax* flycatcher decoy mount to complement the vocalization playbacks. Nets were continuously monitored and willow flycatchers removed immediately after they entered the net. Each captured flycatcher was banded with a numbered USFWS aluminum band. For each flycatcher, we measured wing chord, tail length, culmen length (tip of bill to the anterior end of nostril), bill width at anterior end of nostril, weight, and fat level. Gender of adult flycatchers was determined by the presence of a cloacal protuberance (an external bulb in which male passerines store sperm) or a brood patch (area on the female which loses feathers to provide skin contact for egg incubation). Brood patches begin 3-5 days before egg laying and recede once the fledglings have left the nest.

Genetics Sampling

DNA was obtained from blood taken from living birds by clipping the tip of a toenail when birds were captured and handled for banding. This technique works well for obtaining one to two drops of blood from small passerines, with no discernable negative effects (Super and van Riper 1995, Paxton and Sogge 1996). Blood was drawn from the toenail directly into a 0.5 ml microtube, then stabilized with buffer. Samples were placed in a cooler while in the field and then frozen in the lab until the DNA was extracted.

Only DNA samples taken from flycatchers known to be residents, either through timing of sampling, physiological condition or resighting, will be analyzed. DNA will be extracted from blood using standard DNA extraction protocols. Purified nuclear DNA is currently being subjected to amplified fragment length polymorphism (AFLP) analysis (Vos et al. 1996), a newly-developed genetic procedure that characterizes the amount of genetic variability within individuals and populations, and evaluates the relatedness between breeding groups. The mitochondrial DNA cytochrome b gene will be amplified using the polymerase chain reaction (PCR: Hoelzel and Green 1992). Amplified DNA will be sequenced and we will compare sample DNA sequences to determine within-and between-subpopulation variation. Sequences will be edited and aligned using the DNASTAR computer program. Phylogenetic analyses will be carried out using MANTEL-STRUCT (Miller in press). The reliability of phylogenetic branch points will be estimated using bootstrap analysis (Felsenstein 1985).

RESULTS

Overall Summary

The Colorado Plateau Field Station's (CPFS) banding crew spent 17 days at 16 different sites banding 57 adult willow flycatchers in 1998, and two days at two sites banding two adults in 1997. During the two field seasons we located territorial flycatchers at 12 sites within northern Utah, outside of the range USFWS is administering as potential *extimus*, and at six sites within the *extimus* subspecies range (Table 1).

We conclusively verified breeding at nine sites, six of which were in the *adastus* range and three of which were in the *extimus* range. At five of those sites we discovered active willow flycatcher nests, four containing eggs and one being constructed. A brown-headed cowbird egg was discovered in one of these nests at a site where cowbirds were abundant. The other three nests contained only willow flycatcher eggs.

Although this was not a formal flycatcher survey project, and so did not include repeated standardized surveys (eg. per the Sogge et al. 1997a protocol), we recorded the actual number of individuals and pairs found at each site (Table 1). Formal bird surveys (although not necessarily specific to willow flycatchers) were conducted at some sites within the USFWS proposed *extimus* range including Fish Creek, Virgin River at St. George, Mill Meadow Reservoir, Gottfredsen Creek and Travois Spring, although this summary only reports territories observed by CPFS. In total, we found 18 territories within the potential *extimus* subspecies range and 31 territories within the *adastus* subspecies range during 1997 and 1998.

We collected blood samples at 16 sites, with blood taken from all 59 flycatchers banded in Utah during 1997 and 1998. Our goal was to obtain at least five genetic samples from each area that we visited. We achieved this goal at seven of the 16 sites sampled. We were unable to do this at eight other sites because there were no more than four flycatchers detected at those sites. We will complete detailed analyses of the DNA samples during the winter and spring of 1999, and results will be presented in a separate report no later than June 1999.

In the remainder of the results section, we present specific information for each of the 18 study sites, in the order listed in Table 1. Each site description includes location, habitat, flycatcher abundance, and breeding status information. Topographic maps of the sites are presented in Appendix 2 and photographs of all sites (except Spring Creek and Strawberry River) are presented in Appendix 3. Also included in each site description is a notation of brown-headed cowbird abundance using the following terms:

- Abundant* - at least one cowbird was seen at each territory;
- Common* - cowbirds were seen in the majority of territories;
- Uncommon* - rarely saw a cowbird; and
- None* - no cowbirds seen at site

Table 1. Summary of the 1997 and 1998 Utah willow flycatcher project including site, estimated number of territories, total flycatchers detected at each site, number of days spent at each site, number of flycatchers banded, whether birds were confirmed residents, and whether any birds at the site were nesting (coded by BP=brood patch, NEST=found nest, NC=no nesting confirmed).

SITE	# of Estimated Territories	# of Flycatchers Detected	Total Days at Site	# of Birds Banded	Sites with Confirmed Residency?	Sites with Confirmed Nesting?
Sites within <i>E.t. adastus</i> range						
Logan River-1998	5	6	1	5	NO	NC
Spring Creek-1998	1	2	1	2	YES	BP
Little Bear River-1998	1	1	1	1	NO	NC
Logan Canyon-1998	3	6	1	6	YES	BP,NEST
Lost Creek-1998	4	6	1	6	YES	BP,NEST
Deseret Ranch House-1998	1	1	1	1	NO	NC
East Canyon Reservoir-1998	5	6	2	6	YES	NC
Provo River Parkway-1998	3	4	1	4	YES	BP
Stewart Lake-1998	3	6	1	5	-YES	BP,NEST
Strawberry River-1998	3	5	1	5	YES	BP
Uinta River-1998	1	1	1	1	NO	NC
Bear River at Tremonton-1998	1	3	2	0	NO	NC
Sites within proposed Fish and Wildlife Service <i>extimus</i> range (see Figure 2)						
Fish Creek-1998	8	11	2	8	YES	BP,NEST
Fremont River at Torrey-1998	3	3	1	2	NO	NC
Mill Meadow Reservoir-1998	1	1	1	1	NO	NC
Virgin River at St. George-1998	4	5	1	4	YES	BP
Gottfredsen Creek-1997	1	2	2	2	YES	BP,NEST
Travois Spring-1997	1	2	1	0	NO	NC
TOTAL	49	71	22	59	10 Sites Confirmed Residents	9 Sites Confirmed Breeding

Logan River (Cache County)

Elevation 1,400 meters

This site is located along the Logan River west of the city of Logan. The Logan River originates in Idaho within the Franklin Basin and flows approximately 60 km to the Cache Valley. Within the Cache Valley the river meanders through agricultural fields and small strips of willow dominated habitat. Five km beyond the banding site, the river spills into a series of wetlands and Cutler Reservoir. The habitat at the banding site consists of mixed native broadleaf vegetation, dominated by willows (*Salix spp.*), scattered thickets of red-osier dogwood (*Cornus stolonifera*), wild rose (*Rosa spp.*) understory, and several large cottonwoods (*Populus spp.*) closer to the main riverflow. The habitat is inundated with water and surrounded by agricultural fields and roads. The patch on the south side of the road is a "U" shape approximately 30 m long and 20 m wide, following the river upstream. The understory vegetation height is 2-5 m with an overstory of 10-15 m. The main strip of willows and dogwood is 3-5 m wide and was surrounded by smaller willows and cattails (*Typha spp.*) and an agricultural field. The patch on the north side of the road is approximately 20 m long and 10 m wide, although the habitat continues upstream along the river. Flycatchers have been detected along the Logan River for several years by local birders in the Cache Valley (B. Dixon *pers. comm.*).

We detected six birds at this site (Table 2). Five territories were located within 30 m of the road. Four territories were on the south side of the road, including one pair and three unpaired birds. The pair was utilizing a strip of willow and a dogwood thicket adjacent to an agricultural field. The other three flycatchers were utilizing willows, dogwood, and cottonwoods closer to the river flow. The flycatcher on the north side of the road was captured within 10 m of the road and appeared to be unpaired.

Brown-headed Cowbirds: Common

DATE	USFWS BAND NUMBER	AGE	SEX	GENETIC SAMPLE TAKEN?
19 JUNE 98	1740-91909	AHY	M	YES
19 JUNE 98	1740-91910	AHY	M	YES
19 JUNE 98	1740-91911	AHY	U	YES
19 JUNE 98	1740-91912	AHY	U	YES
19 JUNE 98	1590-97385	AHY	U	YES

AGE: AHY=ADULT; SEX: M=MALE, U=UNKNOWN

Spring Creek (Cache County)

Elevation 1,400 meters

This site is located within Spring Creek Waterfowl Management Area in the Cache Valley west of Logan City. Spring Creek runs from a spring approximately 5 km east of this site within Cache Valley and spills into the Little Bear River approximately 1 km to the west. Within Cache Valley, Spring Creek meanders through agricultural fields and patches of willow dominated habitat. We detected flycatchers in a patch of willows formed where the creek takes a 180 degree turn. The patch is approximately 75 m long and 50 m wide with a variable height from 2-15 m tall. The banding site is comprised of a mixed broadleaf native vegetation of willows, cottonwood and wild rose. A marsh borders the east side of the patch, a road borders the south and west sides, and a strip of willows runs northeast and upstream of the creek. Standing water as deep as one meter existed throughout the site.

The two flycatchers detected at this site (Table 3) were both captured next to a rose thicket within the marsh on the east side of the willow patch. The male was also observed singing on willow trees east and west along the creek. The female was observed singing from the rose thicket while the male flycatcher was captured. The two birds exhibited pair behavior, interacting and calling to each other, and the female was observed with a brood patch, therefore confirming breeding at this site.

Brown-headed Cowbirds: Common

Table 3. Willow flycatchers banded and sampled at Spring Creek, including the date banded, USFWS band number, age, sex and whether a genetic sample was obtained.				
DATE	USFWS BAND NUMBER	AGE	SEX	GENETIC SAMPLE TAKEN?
18 JUNE 98	1740-91907	AHY	F	YES
18 JUNE 98	1740-91908	AHY	U	YES

AGE: AHY=ADULT; SEX: U=UNKNOWN, F=FEMALE

Little Bear River (Cache County)

Elevation 1,400 meters

This site is located 500 m east of the Spring Creek site along the Little Bear River. The patch is approximately 30 m wide and 30 m long where the river crosses under a road and flows northwest toward Cutler Reservoir. The habitat structure is variable in height from 2-10 m, and is mixed broadleaf vegetation with willows, cottonwood and wild rose. Standing water as deep as one meter existed throughout the site. We detected and captured one flycatcher at this site (Table 4).

Brown-headed cowbirds: Common

Table 4. Willow flycatchers banded and sampled at Little Bear River, including the date banded, USFWS band number, age, sex and whether a genetic sample was obtained.				
DATE	USFWS BAND NUMBER	AGE	SEX	GENETIC SAMPLE TAKEN?
18 JUNE 98	1590-97384	AHY	U	YES
AGE: AHY=ADULT; SEX: U=UNKNOWN				

Logan Canyon (Cache County)

Elevation 2,000 meters

This site is located north of the Red Banks campground within Wasatch-Cache National Forest and adjacent state land along the Logan River, northeast of Logan. We visited two locations approximately 2 km apart, where we detected and captured a total of six flycatchers (Table 5). The first location north of the campground consists of an aspen (*Populus tremuloides*) grove surrounding a small patch of willows not more than 5 m from the road and approximately 100 m from the Logan River. Standing water existed throughout the site. One pair was detected at this site and both flycatchers in the pair were captured. The female was observed with a brood patch, therefore confirming breeding at this site.

The second location is adjacent to the Logan River and is composed of willow dominated vegetation. The site is inundated by several beaver ponds with the Logan River channel no more than 10 m from the banding sites. The area surveyed was approximately 300 m long and 100 m wide with a patch height of 2-3 m, although the habitat continued downstream from where the flycatchers were discovered. Two pairs were detected at this site. The first pair was captured in a willow thicket adjacent to a beaver pond. The male was observed singing from perches on all sides of the beaver pond in a circle approximately 50 m in diameter. A nest containing four willow flycatcher eggs was located 1 m above the ground in a 3 m tall willow tree. A second pair was detected approximately 150 m downstream from the first pair, in another series of beaver ponds with interspersed thickets of willow trees. The female of this pair had a brood patch. The active nest and the females with observed brood patches confirm nesting at this site.

Brown-headed Cowbirds: None detected

DATE	USFWS BAND NUMBER	AGE	SEX	GENETIC SAMPLE TAKEN?
10 JULY 98	1590-97399	AHY	U	YES
10 JULY 98	1590-97400	AHY	F	YES
10 JULY 98	1740-91934	AHY	M	YES
10 JULY 98	1740-91935	AHY	F	YES
10 JULY 98	1740-91936	AHY	M	YES
10 JULY 98	1740-91938	AHY	F	YES

AGE: AHY=ADULT; SEX: M=MALE, F=FEMALE, U=UNKNOWN

Lost Creek (Morgan County)

Elevation 1,900 meters

Lost Creek originates along Horse Ridge and flows approximately 15 km downstream to spill into Lost Creek Reservoir. The banding site was located on lower Lost Creek at the confluence with Killfoil Creek, privately owned land approximately 1 km above the Lost Creek Reservoir. We surveyed approximately 3 km of habitat, but only detected flycatchers along a 700 m section. The banding site was composed of a patch 50-100 m wide and 700 meters long, with a vegetation height of 2-5 m. The vegetation was mixed native broadleaf and included willows, cottonwood, red osier dogwood, western water birch (*Betula occidentalis*), mountain alder (*Alnus incana*), and chokecherry (*Prunus virginiana*). Willow flycatchers have been detected at this site via breeding bird surveys since 1993 (M. Stackhouse *pers. comm.*).

Figure 5. Willow flycatcher nest in alder, Lost Creek



We detected eight flycatchers, three paired and two unpaired, and captured a total of six birds (Table 6). The territories were approximately 30-50 m apart. We located a nest containing one flycatcher egg (Figure 5) and captured the female from that nest. That female had a bulge in her lower reproductive tract, indicating that she would soon be laying another egg. The nest was approximately 0.5 m above the ground in an alder sapling 1 m high. Breeding was therefore confirmed at this site.

Brown-headed cowbirds: None detected

Table 6. Willow flycatchers banded and sampled at Lost Creek, including the date banded, USFWS band number, age, sex and whether a genetic sample was obtained.

DATE	BAND NUMBER	AGE	SEX	GENETIC SAMPLE TAKEN?
25 JUNE 98	1590-97386	AHY	U	YES
25 JUNE 98	1590-97387	AHY	U	YES
25 JUNE 98	1590-97388	AHY	U	YES
25 JUNE 98	1740-91914	AHY	U	YES
25 JUNE 98	1740-91915	AHY	F	YES
25 JUNE 98	1740-91916	AHY	M	YES

AGE: AHY=ADULT, SEX: M=MALE, F=FEMALE, U=UNKNOWN

Deseret Ranch (Rich County)

Elevation 1,950 meters

The site at the Deseret Ranch runs along Home Creek just outside of a complex of houses (called the Home Ranch) on a privately owned ranch. Home Creek originates along the Wasatch Ridge approximately 10 km west of the Home Ranch. The creek at the Home Ranch consists of many small springs that eventually flow into Big Meadow, a natural meadow larger than 25 ha, east of the Home Ranch. The banding site is comprised of a small pond that is connected to a spring. The pond is surrounded by 1 ha of tall (20-30 m high) Fremont cottonwoods (*Populus fremontii*), narrowleaf cottonwoods (*P. angustifolia*), lanceleaf cottonwoods (*P. acuminata*), and willows, with a scanty wild rose understory and thick herbaceous ground cover. Another strip of willows and cottonwoods is located approximately 70 m across an open field. There is one large cottonwood tree in the middle of this open area. This strip of vegetation borders another arm of Home Creek and is 20 m long and 10 m wide. These two patches of habitat are surrounded by open meadow, housing and a sagebrush (*Artemisia spp.*) covered hillside, a virtual island of habitat.

The one willow flycatcher detected and captured at this site (Table 7) was singing in several large cottonwoods within the patch as well as singing in a lone cottonwood tree in the open field, and flying to the small strip of willow along the other arm of Home Creek. At least one flycatcher has been detected at the Ranch House since 1993 and flycatchers have been observed feeding young in past years (M. Stackhouse *pers. comm.*).

Brown-headed cowbirds: Common

Table 7. Willow flycatchers banded and sampled at Deseret Ranch, including the date banded, USFWS band number, age, sex and whether a genetic sample was obtained.				
DATE	USFWS BAND NUMBER	AGE	SEX	GENETIC SAMPLE TAKEN?
24 June 1998	1740-91904	AHY	U	YES
AGE: AHY = ADULT; SEX: U=UNKNOWN				

East Canyon Reservoir (Morgan County)

Elevation 1,750 meters

This site is located on the south end of East Canyon Reservoir along East Canyon Creek. The creek originates in the Wasatch Mountains approximately 25 km south of the Reservoir. The site is surrounded by sagebrush, campgrounds, and a private resort. The flycatchers were detected in both the reservoir overflow area and along the creek south of the reservoir. The two sections of habitat, within the reservoir overflow and along the creek, are continuous but differ in patch structure. The location along the creek consists primarily of a linear strip of willows adjacent to the creek with scattered red-osier dogwood, cottonwoods, water birch and an understory of wild rose. This patch is 20-30 m wide and approximately 100 m long with a vegetation height of 3-10 m. The reservoir overflow location is dominated by willows 1-3 m tall with scattered cottonwoods 10-15 m tall along the edge of the patch. Although the length of the entire section of willows in the reservoir overflow reaches over 200 m, the individual willow patches vary in size from single trees to areas 10 m wide and 20 m long, some of which are inundated with water over 2 m deep.

Six willow flycatchers were detected and captured during two visits to this site (Table 8). All six flycatchers were detected within different territories and none showed any sign of breeding or appeared to be paired. On June 13, five flycatchers were detected, three along the creek and two in the reservoir overflow. The three flycatchers detected along the creek were captured and banded. We returned to this site on June 26 and five flycatchers were detected again. The two flycatchers detected in the reservoir overflow and a third unbanded flycatcher detected along the creek were captured. Two of the three flycatchers that were banded on June 13 were detected again, the third was not detected in the area and was possibly a migrant moving through.

Brown-headed Cowbirds: Common

Table 8. Willow flycatchers banded and sampled at East Canyon Reservoir, including the date banded, USFWS band number, age, sex, and whether a genetic sample was obtained.

DATE	USFWS BAND NUMBER	AGE	SEX	GENETIC SAMPLE TAKEN?
13 JUNE 1998	1740-91904	AHY	U	YES
13 JUNE 1998	1740-91905	AHY	U	YES
13 JUNE 1998	1740-91906	AHY	U	YES
26 JUNE 1998	1740-91917	AHY	U	YES
26 JUNE 1998	1740-91918	AHY	M	YES
26 JUNE 1998	1590-97389	AHY	M	YES

AGE: AHY=ADULT; SEX: M=MALE, U=UNKNOWN SEX

Provo River Parkway (Utah County)

Elevation 1,375 meters

This site is located approximately 4 km west of the city of Provo, along the Provo River Parkway, a paved recreation pathway maintained by Utah County. The Provo River originates in the Uinta Mountains approximately 100 km northeast of the banding site, and spills into Utah Lake 1 km west of the site. The willow flycatchers were found in a thin patch of habitat adjacent to the paved pathway where it forms a loop that follows the river oxbow. The Provo River runs on the outside of the loop along the west side and agricultural fields run along the east and north side. On the inside of the paved loop is a stagnant oxbow of the river with a small island in the middle. We detected flycatchers in a thin strip on either side of the pathway and in a small patch on the island. The patch height was 2-4 m with an overstory of 10-15 m. The vegetation consisted of mixed native and exotic species, including willows, alder (*Alnus spp.*), box elder (*Acer negundo*), Russian olive (*Elaeagnus angustifolia*), Fremont cottonwood, and herbaceous ground cover up to 2 m tall.

We detected and captured four willow flycatchers at this site (Table 9). We caught one flycatcher in a thin (2 m wide) patch of willows and tall herbaceous ground cover, bordered on either side by the recreation trail and the Provo River. This bird appeared to be unpaired although it repeatedly flew across the Provo River to another patch of willows which we were unable to survey. A pair was captured approximately 30 m from this site in a strip of inundated willows 10 m wide next to a large cottonwood. This patch was also bordered by the Provo River and the recreation trail. The male of this pair had already been captured across the recreation trail 10 m away (where a male brown-headed cowbird was also captured). A fourth flycatcher was captured approximately 20 m away from this pair in a thin strip of willow bordered by the stagnant oxbow, the recreation trail, and agricultural fields. This flycatcher was observed singing both in the willows where it was captured and in a cottonwood tree across the oxbow on the island. It appeared to be unpaired, but we were unable to get to the island where it was spending the majority of its time. Nesting was confirmed by capturing the female with a brood patch.

Brown-headed Cowbirds: Abundant

DATE	USFWS BAND NUMBER	AGE	SEX	GENETIC SAMPLE TAKEN?
9 JULY 98	1740-91930	AHY	U	YES
9 JULY 98	1740-91931	AHY	U	YES
9 JULY 98	1740-91932	AHY	F	YES
9 JULY 98	1740-91933	AHY	M	YES

AGE: AHY=ADULT; SEX: M=MALE, F=FEMALE, U=UNKNOWN

Stewart Lake (Uintah County)

Elevation 1,450 meters

This site is located within Stewart Lake Waterfowl Management Area 1 km south of the town of Jensen. The site consists of a thin strip of monotypic tamarisk (*Tamarix ramosissima*) that runs along the Green River where Ashley Creek enters the river. The flycatchers were detected in a strip of tamarisk just upstream of a diversion ditch, with a width of 5-12 m, a length of 500 m and a vegetation height of 1-4 m. The site where flycatchers were detected did not contain standing water, although the Green River flowed adjacent to the site, and a series of marshes and diversion ditches were 20-50 m from the banding site.

Figure 6. Willow flycatcher nest in tamarisk, Stewart Lake.



Three pairs were detected at this site. The pairs were each located approximately 100 m apart along the strip of tamarisk. We captured five of the six flycatchers (Table 10). A nest was discovered in a tamarisk tree approximately 2 m high (Figure 6). The nest was placed 1 m above the ground and contained one brown-headed cowbird egg and two flycatcher eggs. We removed the cowbird egg and left the willow flycatcher eggs intact. The flycatchers were utilizing both the larger (approximately 3 m tall) tamarisk and the shorter new growth. Observations of two females with brood patches and an active nest confirm breeding at this site.

Brown-headed Cowbirds: Abundant

Table 10. Willow flycatchers banded and sampled at Stewart Lake, including the date banded, USFWS band number, age, sex and whether a genetic sample was obtained.				
DATE	USFWS BAND NUMBER	AGE	SEX	GENETIC SAMPLE TAKEN?
1 JULY 98	1740-91924	AHY	F	YES
1 JULY 98	1740-91925	AHY	M	YES
1 JULY 98	1740-91926	AHY	M	YES
1 JULY 98	1590-97354	AHY	F	YES
1 JULY 98	1590-97355	AHY	M	YES

AGE: AHY=ADULT. SEX: M=MALE. F=FEMALE

Strawberry River (Wasatch County)

Elevation 2,750 meters

This site was located along the Strawberry River in a canyon 15 km upstream from Strawberry Reservoir. We surveyed 3 km of potential habitat and detected flycatchers along a 700 m section of the river. The flycatcher habitat consisted of monotypic high elevation willow with dense willow growth approximately 3 m high and an understory of stinging nettle. The patch where the flycatchers were detected was approximately 120 m wide and 700 m long. The Strawberry River meanders through the habitat and was no more than 10 m from where we captured the flycatchers, although the habitat was not inundated with water.

We detected and captured five flycatchers at this site (Table 11), three territories each approximately 200 m apart. We observed bulges from eggs in the lower reproductive tract of both females, indicating that they would soon be laying eggs, and therefore confirming breeding at this site.

Brown-headed Cowbirds: None detected

DATE	USFWS BAND NUMBER	AGE	SEX	GENETIC SAMPLE TAKEN?
2 JULY 98	1740-91928	AHY	F	YES
2 JULY 98	1740-91929	AHY	M	YES
2 JULY 98	1590-97396	AHY	U	YES
2 JULY 98	1590-97397	AHY	U	YES
2 JULY 98	1590-97398	AHY	F	YES

AGE: AHY=ADULT. SEX: M=MALE, F=FEMALE, U=UNKNOWN

Uinta River (Duchesne County)

Elevation 2,450 meters

This site is located along the Uinta River approximately 25 km south of where it originates in the central Uinta Mountains. The banding site is a willow patch approximately 30 m in diameter and dominated of Geyer willows (*Salix geyeriana*) bordered on the west by extensive patches of alder and ponderosa pine (*Pinus ponderosa*). The willow patch is surrounded by a pond, summer homes, roads, and the Uinta River. The patch is inundated with water, although the main channel of the Uinta River runs approximately 50 m away with small channels running through the alders closer to the patch. The willows are approximately 3 m tall, and are separated by channels of standing water. There is another patch of willows north of the pond, which we surveyed but did not detect any flycatchers.

The one bird detected and captured at this site (Table 12) was singing constantly through the duration of our visit in the middle of the afternoon. It was captured immediately after we played the vocalization, began singing again directly after it was released, and continued to sing until we left the site approximately 15 minutes later. This bird was in full breeding condition.

Brown-headed Cowbirds: None detected

Table 12. Willow flycatchers banded and sampled at Uinta River, including the date banded, USFWS band number, age, sex and whether a genetic sample was obtained..				
DATE	USFWS BAND NUMBER	AGE	SEX	GENETIC SAMPLE TAKEN?
1 JULY 98	1740-91927	AHY	M	YES
AGE: AHY=ADULT. SEX: M=MALE				

Bear River at Tremonton (Box Elder)

Elevation 1,300 meters

This site is located approximately 3 km northeast of the city of Tremonton. Flycatchers were detected in three different locations along a section of the Bear River 0.5 km long. The habitat is a native/exotic mixed stand of willow and Russian olive with interspersed cottonwoods and box elder. Standing water is present in these patches in the form of muddy bogs and overflow from the Bear River. This site was purchased by the USFWS in 1992 as a conservation easement (Vicky Roy *pers. comm.*).

Three flycatchers were detected at this site. One was detected on June 6 within a strip of willows, cottonwoods and Russian olive approximately 15 m long and 3-10 m wide within the floodplain of the Bear River and along an adjacent slope. This flycatcher was also singing from an island of willows approximately 15 m across the Bear River. The second location where a flycatcher was observed on June 6 was approximately 250 m downstream in a section of willows, Russian olive and box elder in the floodplain of the river. This patch was approximately 200 m long and ranged from 5-20 m wide, although we observed the flycatcher utilizing only a 20 m long section of the patch. Both flycatchers were observed on our first visit to this site on June 6, singing and acting territorial but were not detected when we returned to the site on June 17. The third flycatcher was detected on both visits singing from an island of willows approximately 20 m across the Bear River. This bird sang extensively during both visits but would not fly across the river in response to our playback vocalizations.

We were unable to catch any flycatchers at this site. Most likely, the two birds we detected on June 6 and did not detect on the second visit were migrants. The third bird appeared to be a resident on the willow island. Breeding has been documented at this site through the capture of a willow flycatcher with a brood patch by USFWS personnel in 1994 near the upstream site where a flycatcher was observed this year (Vicky Roy *pers. comm.*).

Brown-headed Cowbirds: Abundant

Fish Creek (Caribou County)

Elevation 2,350 meters

This site is located along Fish Creek approximately 2 km west of Scofield Reservoir. The creek originates in the Manti La Sal National Forest and runs approximately 30 km east until it enters reservoir. The habitat consists of a >10 km stretch of willows dominated by Booth's willow (*Salix boothii*), and is bisected by Fish Creek, with sections of standing water within the willows. Willow flycatchers were detected here for the first time in 1998 through surveys conducted by the Utah Department of Wildlife Resources (UDWR) and the Manti La Sal National Forest (F. Howe pers. comm.).

We detected eleven willow flycatchers within a 5 km section of the creek, beginning 2 km upstream of Scofield Reservoir. We captured eight birds at five different territories (Table 13). Three different females were captured approximately 100 m apart with the same male captured or observed at all three territories, suggesting possible polygyny. Two other pairs were captured upstream of these territories, one on the north side of the river and one on the south side approximately 200 m apart. Two flycatchers at these two territories were observed in an area 200 m wide, singing from perches throughout the area. All females captured had brood patches and one female was observed building a nest, confirming breeding at this site. Three additional flycatchers were observed 2 km upstream of these territories, but no capture attempts were made.

Brown headed cowbirds: Uncommon

Table 13. Willow flycatchers banded and sampled at Fish Creek, including the date banded, USFWS band number, age, sex and whether a genetic sample was obtained.

DATE	BAND NUMBER	AGE	SEX	GENETIC SAMPLE TAKEN?
27 JUNE 98	1740-91919	AHY	M	YES
27 JUNE 98	1590-97390	AHY	U	YES
27 JUNE 98	1590-97391	AHY	F	YES
28 JUNE 98	1740-91921	AHY	F	YES
28 JUNE 98	1740-91922	AHY	M	YES
28 JUNE 98	1740-91923	AHY	F	YES
28 JUNE 98	1590-97392	AHY	F	YES
28 JUNE 98	1590-97393	AHY	F	YES

AGE: AHY=ADULT; SEX: M=MALE, F=FEMALE, U=UNKNOWN SEX

Fremont River at Torrey (Wayne County)

Elevation 2,150 meters

The Fremont River originates at Johnson Valley Reservoir in the Fishlake National Forest northwest of the town of Torrey. This site is located along the Fremont River in a patch of mixed riparian habitat approximately 300 m long and 100 m wide. The site was composed of mixed willow, longleaf buffaloberry (*Sherpherdia argentea*), water birch, squaw bush (*Rhus spp.*), current (*Ribes spp.*), and Russian olive. The Fremont River runs through the site with two irrigation ditches on either side of the habitat patch, and sections of standing water within the patch. This stretch of habitat is privately owned, surrounded by private and federal lands.

We detected three flycatchers at this site in late July. Two of those flycatchers were captured approximately 50 m apart (Table 14). The third flycatcher was another 50 m from these flycatchers, and was observed singing in a water birch, but would not fly low enough to be captured. There was no evidence of pairing or breeding during our visit, although surveyors believe there was at least one pair at this site during the season and flycatchers have been detected at this site during the non-migratory season for several years (A. Schmierer *pers. comm.*).

Brown-headed Cowbirds: Common

DATE	USFWS BAND NUMBER	AGE	SEX	GENETIC SAMPLE TAKEN?
18 JULY 98	1740-91951	AHY	M	YES
18 JULY 98	1740-91952	AHY	M	YES

AGE: AHY=ADULT; SEX: M=MALE

Mill Meadow Reservoir (Wayne County)

Elevation 2,200 meters

This site is approximately 1 km below the south end of Mill Meadow Reservoir in a canyon formed by the Fremont River. The river downstream of the reservoir is surrounded by mixed broadleaf habitat with scattered conifers. The flycatcher was detected in a willow patch approximately 20 m wide and 10 m long. The vegetation consisted of a willow patch on a hillside to the southeast, and a small patch of willow, cottonwood, and squawbush that runs northwest to the river, and is flanked by tall douglas firs (*Pseudotsuga menziesii*) and cottonwoods. Although broadleaf habitat continues down the river, the bird was only observed using this 10 m long swath. The patch was on the southeast side of the river with a small area of standing water where the willows slopes uphill.

One flycatcher was detected and captured at this site (Table 15). It was observed singing from the willows up the slope down to the edge of the river approximately 20 m away. The surveyor who discovered the flycatchers at this site observed two flycatchers interacting and exhibiting pair behavior earlier in the season (A. Schmierer *pers. comm.*).

Brown-headed cowbirds: Uncommon (although a pair of cowbirds was observed earlier in the season perched in a tree near the flycatchers [A. Schmierer *pers. comm.*])

Table 15. Willow flycatchers banded and sampled at Mill Meadow Reservoir, including the date banded, USFWS band number, age, sex and whether a genetic sample was obtained.				
DATE	USFWS BAND NUMBER	AGE	SEX	GENETIC SAMPLE TAKEN?
19 JULY 98	1740-91953	AHY	U	YES
AGE: AHY=ADULT; SEX: U=UNKNOWN				

Virgin River at St. George (Washington County)

Elevation 750 meters

This site is located on private land along the Virgin River approximately 3 km east of the city of St. George. The site is in the Virgin River floodplain surrounded by agricultural fields and housing developments. We visited two locations that were approximately 300 m apart in a complex of ponds caused by beaver and human activity. The upstream site, called Seegmiller Pond, consisted of a thick but uneven canopy ranging from 3-6 m high of tamarisk, willow, cottonwood and Russian olive. This site was adjacent to several agricultural fields and a periodically flooded marsh containing scattered cattails. The main channel of the Virgin River was approximately 100 m from this location. The second location, known as Paul's Pond, was also variable in canopy height and was adjacent to a beaver pond, agricultural fields, and a new housing development. The existing main channel of the Virgin River ran on the west side of this habitat patch. The vegetation within the patch was dominated by tamarisk, with scattered Russian olive, cottonwood and willow.

The Seegmiller Pond site had been surveyed through the season by UDWR who had detected five flycatchers at this site (M. St. Germain *pers. comm.*). When we visited this site late in the season we detected and captured a pair of flycatchers (Table 16). The female of this pair had a brood patch, therefore confirming breeding at this site. The Paul's Pond site had also been surveyed through the season by UDWR and four birds had been detected. We detected three unpaired birds at this location and captured two (Table 16). The third flycatcher acted territorial, but bounced out of the net twice and was thereafter uncapturable.

Brown-headed Cowbirds: Uncommon (we were at the site very late in the season, and therefore did not detect many cowbirds, though they are abundant earlier in the breeding season [Keith Day *pers. comm.*])

DATE	USFWS BAND NUMBER	AGE	SEX	GENETIC SAMPLE TAKEN?
5 AUGUST 98	1740-91954	AHY	F	YES
5 AUGUST 98	1740-91955	AHY	U	YES
5 AUGUST 98	1740-91956	AHY	U	YES
5 AUGUST 98	1740-91957	AHY	U	YES

AGE: AHY=ADULT; SEX: F=FEMALE, U=UNKNOWN

Gottfredsen Creek (Sevier County)
Elevation 2,900 meters

This site is located approximately 7 km upstream of Johnson Valley Reservoir along Seven Mile Creek. The site is a monotypic high elevation willow patch approximately 100 m long and 100 m wide. Coyote willow (*Salix exigua*) was the dominant species at this site forming a patch of trees 3-4 m high, with an understory of wild rose. Cattle trails were present throughout the patch. A shorter willow patch continued for approximately 500 m southeast, although flycatchers were not observed in this patch.

Two flycatchers were detected and captured at this site (Table 17), including a female with a brood patch. An active nest containing three willow flycatcher eggs was discovered approximately 1 m above the ground in a 3 m tall willow (Figure 7), therefore confirming breeding activity at this site. The second flycatcher was captured approximately 30 m from where the female was caught.

Brown-headed Cowbirds: None detected

Figure 7. Willow flycatcher nest in willow, Gottfredsen Creek



Table 17. Willow flycatchers banded and sampled at Gottfredsen Creek, including the date banded, USFWS band number, age, sex and whether a genetic sample was obtained.

DATE	USFWS BAND NUMBER	AGE	SEX	GENETIC SAMPLE TAKEN?
25 JULY 97	1590-97470	AHY	U	YES
26 JULY 97	1590-97471	AHY	F	YES

AGE: AHY=ADULT; SEX: F=FEMALE, UNKNOWN

Travois Springs (Sevier County)
Elevation 2,800 meters

This site is located approximately 5 km downstream of Gottfredsen Creek along Sevenmile Creek at Travois Springs. The site consists of a patch of coyote willow approximately 300 m long and 50 m wide, with a height of approximately 4 m. The creek runs on one side of the patch which is inundated with water from extensive beaver ponds. The site is fenced to exclude cattle and has a dense understory of wild rose. We detected at least one pair at this site on the southeast end of the patch near a beaver pond. We also had some evidence of a third flycatcher *whitting* and *breeding*, but were unable to confirm this. We were unable to capture any flycatchers at this site.

Brown-headed cowbirds: None detected (although an inactive nest was discovered that contained a buried cowbird egg)

DISCUSSION

Banding Success

Our overall sampling success was high, with a total of 59 individuals captured and banded, distributed among 18 sites where we attempted banding. This represents 83% of the individuals that we detected at the banding sites. We did not meet our specific goal of at least five individuals at each site, but, excepting one site, this occurred only at sites with fewer than five detected flycatchers. At the one site where five flycatchers were detected and only four were captured, the fifth flycatcher was territorial and bounced out of the net twice. Thereafter it stayed within one meter from the net.

Timing and capture techniques are important considerations for the successful banding of willow flycatchers. Flycatchers were captured using variable sized mist-nets depending on the type of habitat and capture method. If the nets were more visible because of wind or sun, two nets were set up in a "L" shape in order to capture the flycatchers when they avoided one of the nets. We utilized compact disc recordings of several willow flycatcher vocalizations from several states. The recordings included *fitz-bew* (from three different states), *breet*, *wee-oh*, *whitt*, interaction calls and distress calls. An interaction call of a flycatcher chasing a cowbird from its nest was usually the most successful recording, although the flycatchers often responded differently to the recordings, depending on the sex of the bird and timing in the breeding cycle. Only at the Bear River site (where the birds appeared to be migrants), did the flycatchers respond to the playback vocalizations with heightened activity and calling, but did not fly directly at the net where the vocalization was broadcast.

During the beginning of the breeding season, the flycatchers were much more vocal and easier to detect. As the breeding season progressed, the flycatchers became less vocal earlier in the day, although unpaired males at the Virgin River site were heard singing after 0900 hrs as late as August 5. As flycatchers became less reactive to the survey tape later in the season we used the vocalization of a willow flycatcher chasing a cowbird to elicit a response from flycatchers during surveys. The flycatchers would respond to the interaction call with *whitting* and sometimes the *fitz-bew* song.

Genetic Sampling

We succeeded in collecting blood samples (via toe-nail clip) from all 59 willow flycatchers that we banded. Nuclear DNA from these samples is in the process of being extracted and amplified and awaits further analysis. AFLP work has also begun, and the technique works well for the willow flycatcher nuclear DNA. We have been successful in our development and utilization of the cytochrome-b sequencing (Sogge et al. 1998), and are also developing our own mitochondrial DNA d-loop primers specific to the willow flycatcher. These primers are being tested, and mitochondrial DNA amplification and sequencing will be carried out during the winter and spring of 1999.

The number and geographic locations of samples collected will yield important information on genetic variation within and among willow flycatcher breeding groups. We have selected nine

sites with four or more blood samples for comparison of genetic diversity within and among populations. We will also compare the genetic variation at these nine sites to four sites within Colorado.

The genetic information yielded from this study will also provide data for comparison of breeding populations outside of the *extimus* range. This data can also be used collectively with other samples already acquired throughout the United States to evaluate the taxonomic classification of the willow flycatcher, a study funded by Bureau of Reclamation, to be completed in 1999.

Characteristics of Breeding Habitat

Willow flycatchers were found across a wide elevational range, from 750 m at the Virgin River near St. George to 2,900 m at Gottfredsen Creek. The sites sampled within the *adustus* subspecies range were found from 1,300 m (Bear River at Tremonton) to 2,750 m (Strawberry Creek) in elevation. Within the *extimus* subspecies range, five of the sites were above 2,000 m, with two sites above 2,800 m including Travois Spring (2,800 m) and Gottfredsen Creek (2,900 m). One of the sites within the *extimus* range was also the lowest in elevation at 750 m (Virgin River at St. George). The sites at Gottfredsen Creek, Travois Spring and Strawberry River are higher than the highest currently occupied flycatcher sites in Arizona (McCarthy et al. 1998) and New Mexico (Cooper 1997, Langridge and Sogge 1997a), but are similar in height to the Clear Creek and Gothic sites in Colorado (Owen and Sogge 1997).

The habitat at the majority of the breeding sites was composed primarily of willow with secondary tree species including cottonwood, red-osier dogwood, mountain alder, box elder, and water birch. Several sites contained extensive tracts of willow dominated habitat at least 100 m wide and more than 500 m long, usually more than 1 km long. These sites include Fish Creek, Lost Creek, Strawberry River, and Gottfredsen Creek. Although portions of the habitat were less than 2 m high, the majority of the willows at these sites averaged 2-4 m high, and the flycatchers at these sites were observed utilizing the taller willows. The nature and structure of these willow habitats match Utah breeding habitat descriptions from northeastern Utah (Behle 1981) and descriptions from several other states including Colorado (Bailey and Niedrach 1965, Andrews and Righter 1992), Arizona (Sferra et al. 1997, Langridge and Sogge 1997b), and New Mexico (Cooper 1997).

Several of the sites were also comprised primarily of willows, but consisted of smaller patches surrounded by mixed conifer or agricultural lands. These sites include Spring Creek, Little Bear River, Logan River, Uinta River, and Mill Meadow Reservoir. At the Uinta River site a small patch of willows was surrounded by mixed conifer forest and stands of alder trees. A willow flycatcher was observed at this site singing from the top of a ponderosa pine approximately 15 m high. Within the Cache Valley (Logan River, Spring Creek, and Little Bear River) the habitat is disturbed by agricultural and livestock use, and the rivers are bordered by remnant patches of willow habitat. These sites are similar to high elevation remnant willow patches described in Arizona (Langridge and Sogge 1997b) and New Mexico (Langridge and Sogge 1997a).

Although the majority of the sites were dominated by willow, the Stewart Lake site was composed entirely of monotypic tamarisk vegetation. An active nest was located in a small

tamarisk tree at this site. Willow flycatchers have been documented nesting in tamarisk in Arizona (McCarthy et al. 1998), Nevada (McKernan and Braden 1998), Colorado (Owen and Sogge 1997), New Mexico (Cooper 1997) and southern Utah (Peterson et al. 1998). Other sites with exotic vegetation include the Bear River site which consisted of patches of Russian olive intermixed with willow. The site at Provo River Parkway also contained patches of Russian olive, although the paired flycatchers were only observed in the willows and cottonwoods. Although Russian olive is not used by willow flycatchers as extensively as tamarisk, flycatchers have been documented nesting in Russian olive in New Mexico (Cooper 1997). Within the *extimus* subspecies range, the Virgin River site was dominated by tamarisk and Russian olive, although the vegetation also included young willows and cottonwoods.

Surface water was present at all Utah sites, usually in the form of a river, stream, lake, beaver ponds, or spring runoff. Although the species will breed in drier, shrubby sites in other portions of its range (McCabe 1990), water has been identified as an important component of willow flycatcher habitat in the southwest (USFWS 1993, Cooper 1997, Sferra et al. 1997, Sogge et al. 1997a). Willow flycatchers within northern Utah also appeared to prefer sites with surface water.

Current Distribution and Status of the Willow Flycatcher

This project covered a wide geographic and elevational range of willow flycatcher habitat within northern Utah. Before this study, no research or surveys specific to the willow flycatcher had been conducted in northern Utah. Limited current records exist of willow flycatchers from breeding bird surveys and riparian surveys conducted by UDWR, and many of these records are from possible migrants (Howe 1993, 1994, 1996, UDWR unpublished data). Beyond these general surveys, an avian study that was conducted along riparian systems in northern Utah has a few records of nesting willow flycatchers (Blakesley and Reese 1988).

Although our work did not include a formal flycatcher survey (per Sogge et al. 1997a) or extensive surveys of each site, we were generally able to make a rough estimate of the population size for the general area in which we were working (Table 1). Based on these estimates, the willow flycatcher breeding groups we located in northern Utah are generally small (8 or fewer territories), as is the case in the remainder of the southwest (Sferra et al. 1997, Cooper 1997, USFWS unpublished data).

Within the areas we surveyed in northern Utah, distribution of flycatcher populations appeared less extensive than expected from communications with biologists, birders and historical records. Willow flycatchers in northern Utah have been described as common breeding residents in willows and other low shrubs near water (Hayward et al. 1976, Behle 1981). Much of this information appears to be based on historical collections from possible migrants, including many specimens collected outside of the non-migratory period (Henshaw 1875, Behle 1981).

Recent breeding bird surveys (formal BBS routes) have detected willow flycatchers at several sites during the past 20 years, but these surveys have often been conducted at the beginning of June when migrants are likely to be present and singing (F. Howe *pers. comm.*). Thus, BBS surveys may overestimate the abundance and distribution of local willow flycatcher populations. The Utah Division of Wildlife Resources' (UDWR) riparian bird surveys have recorded only one willow flycatcher (during 1995) through surveys in 1992, 1993, and 1995 (Howe 1993, 1994,

1996). Furthermore, avian surveys conducted during 1995 and 1996 along riparian systems within the Jordan River, Provo River, Ogden River, and Weber River detected only 12 individuals during the non-migratory period at 130 bird survey points within willow habitat (Norvell 1997). Although these various surveys did not target willow flycatchers, the paucity of flycatcher detections concurs with the results of our preliminary surveys which indicate that the willow flycatcher is not as common in willow and shrub habitat as is indicated in historical records.

The relative scarcity of willow flycatchers is at least in part a function of the loss and modification of the dense riparian habitats upon which they depend. Native Americans were present in northern Utah before the arrival of the pioneers, although modification of the land was minimal because of smaller populations and non-intensive irrigation farming (Kendrick 1989). Pioneers settled in northern Utah in the mid 1800's and by the end of the 19th century most of the major drainages coming out of the Uinta Mountains were managed for irrigation farming (Kendrick 1989). The first irrigation ditch along the Provo River was dug in 1849 (Kendrick 1989) and by the early 1900's over 250,000 acres of land were irrigated (Worster 1985). The Cache Valley has records of irrigation projects from the 1860's (Wydoski and Helm 1980) and the Uinta Basin in northeastern Utah has records from the 1870's (Kendrick 1989). These practices have reduced and altered the riparian zones within northern Utah for over a century. More recently, the human population has grown at a phenomenal rate, causing urban development and recreation to alter and disturb extensive tracts of riparian habitat, particularly within the Wasatch Front, Heber Valley, Cache Valley, and the mountains surrounding each of these areas. Consequently, past and current human activities have reduced the availability of riparian habitats, thereby affecting the populations of willow flycatchers within the region.

Even where riparian habitat is present, most areas we observed were currently affected by human activities. The majority of the sites we visited showed evidence of one or more potential threats to the riparian habitat. These potential threats included water management practices, agriculture, grazing, recreation, invasion of exotic plant species and urban development (see Table 18). All of these land use practices have been shown to have deleterious effects on various species of birds (Aitchison 1977, Anderson et al. 1977, Beissinger and Osborne 1982, Rosenberg et al. 1991, Rodenhouse 1993, Ohmart 1994, Saab et al. 1995, Blair 1996, Marzluff 1997). Several studies have also examined the negative impacts of grazing (Taylor and Littlefield 1986, Valentine et al. 1988), recreation (Blakesley and Reese 1988), and water management (Ohmart 1994) specific to the willow flycatcher.

Cowbirds

We detected cowbirds at twelve sites. Given the limited amount of time we spent at many areas, cowbirds should not be considered completely absent simply because we did not detect them on our visit.

No studies have been conducted on the cowbirds within willow flycatcher populations in Utah, so the nature and extent of cowbird impacts are unknown. However, cowbird abundance is often considered an indicator of cowbird parasitism pressure (Robinson et al. 1995). Cowbirds have been shown to significantly decrease flycatcher nesting success and productivity elsewhere in the southwest (Whitfield and Enos 1996, Sogge et al. 1997b), and may also be impacting sites in Utah.

Table 18. Potential threats to willow flycatcher sites, current and historical, including site, number of willow flycatcher territories detected at that site, and potential threats (water management, urban development, grazing, agriculture, recreation, exotic species). A "NS" in territories detected indicates no survey conducted. A blank in observed potential threats indicates potential threat not observed.

SITE	NUMBER OF TERRITORIES DETECTED	OBSERVED POTENTIAL THREATS*					
		Water Management	Urban Development	Grazing	Agriculture	Recreation	Exotic Species
CURRENT WILLOW FLYCATCHER SITES 1997 AND 1998							
Logan River	5	X	X	X	X	X	
Spring Creek	1	X	X	X	X		
Little Bear River	1	X	X	X	X	X	
Logan Canyon	3			X		X	
Lost Creek	4					X	
Deseret Ranch	1	X		X			
East Canyon Reservoir	5	X				X	
Provo River Parkway	3	X	X	X	X	X	X
Stewart Lake	3	X	X		X		X
Strawberry River	3					X	
Uinta River	1	X				X	
Bear River at Tremonton	1	X		X	X		X
Fish Creek	8			X		X	
Fremont River at Torrey	3	X			X		X
Mill Meadow Reservoir	1	X					
Virgin River at St. George	4	X	X	X	X	X	X
Gottfredsen Creek	1			X		X	
Travois Spring	1						X
HISTORICAL WILLOW FLYCATCHER SITES VISITED 1998							
Logan	5	X	X	X	X	X	
Blacksmiths Fork/South Blacksmiths Fork	0	X		X		X	
Mouth of Birch Creek Canyon	NS			X	X		
Parleys Park	NS		X	X		X	
Ogden	NS	X	X	X	X		X
Wasatch Mountains	3	X	X	X		X	
Green River at the Mouth of Ashley Creek	3	X	X		X		X
Brush Creek	NS	X		X	X		X
Horshoe Bend of the Green River	0	X		X			X
Merkley Park, 10 miles north of Vernal	0	X	X	X	X		
Ouray National Wildlife Refuge	NS	X		X	X		X
Three miles West of Provo, Near Utah Lake	3	X	X	X	X	X	X
Kamas	NS	X	X	X	X		
Springdale	0		X			X	
South Willow Canyon, Stansbury Mountains	0			X		X	

*X=potential threat observed

MANAGEMENT CONSIDERATIONS

Because available willow flycatcher breeding habitat appears to be rare and fragmented, and many such areas are subject to a suite of potential threats, efforts should be taken to eliminate or reduce potential threats that may further degrade riparian habitats. This is especially true for sites known to be currently occupied by breeding willow flycatchers. Furthermore, land managers should consider rehabilitating and restoring riparian habitats that do exist. As with habitat protection, it may be best to focus initial riparian restoration efforts at or near sites with breeding flycatchers.

Clearly, additional quantitative data are important in determining if current willow flycatcher populations in northern and central Utah are of concern. Therefore, resource managers and resource agencies should continue monitoring programs that target riparian-dependent birds, and increase willow flycatcher survey effort throughout the state in order to better determine the current status and distribution of all subspecies. Such flycatcher surveys will be most efficient and cost-effective if they are conducted in a cooperative and coordinated manner, such as occurs in Arizona (see McCarthey et al. 1998).

It is crucial to remember that protection, improvement, and expansion of riparian habitats will not only benefit the willow flycatcher, but also a large number of other bird species. Furthermore, proper riparian management can provide benefits for other wildlife and fish species, agriculture, and people (University of Colorado 1997).

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APPENDIX 1

Table of banding information for all willow flycatchers banded in Utah 1997 and 1998, in sequential band number order. AHY=adult, M=male, F=female, U=Unknown.

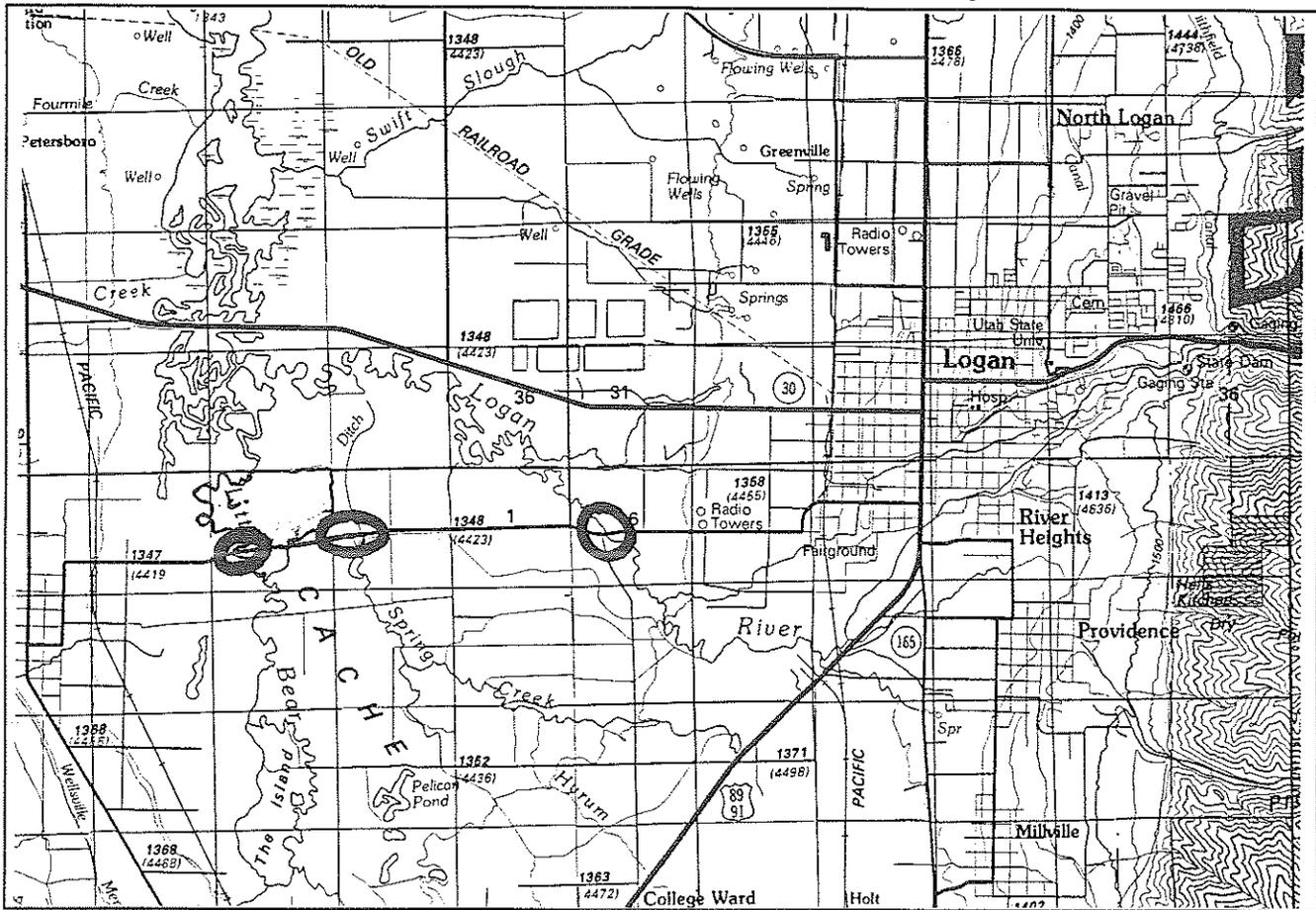
DATE BANDED	SITE	COUNTY	USFWS BAND NUMBER	SEX	AGE
WILLOW FLYCATCHERS BANDED IN 1997					
26 JULY 97	GOTTFREDSSEN CREEK	SEVIER	1590-97470	U	AHY
26 JULY 97	GOTTFREDSSEN CREEK	SEVIER	1590-97471	F	AHY
WILLOW FLYCATCHERS BANDED IN 1998					
16 JUNE 98	LITTLE BEAR RIVER	CACHE	1590-97384	U	AHY
19 JUNE 98	LOGAN RIVER	CACHE	1590-97385	U	AHY
25 JUNE 98	LOST CREEK	MORGAN	1590-97386	U	AHY
25 JUNE 98	LOST CREEK	MORGAN	1590-97387	M	AHY
25 JUNE 98	LOST CREEK	MORGAN	1590-97388	U	AHY
26 JUNE 98	EAST CANYON RESERVOIR	MORGAN	1590-97389	M	AHY
27 JUNE 98	FISH CREEK	CARBON	1590-97390	U	AHY
27 JUNE 98	FISH CREEK	CARBON	1590-97391	F	AHY
28 JUNE 98	FISH CREEK	CARBON	1590-97392	F	AHY
28 JUNE 98	FISH CREEK	CARBON	1590-97393	F	AHY
1 JULY 98	STEWART LAKE	UINTAH	1590-97394	F	AHY
1 JULY 98	STEWART LAKE	UINTAH	1590-97395	M	AHY
2 JULY 98	STRAWBERRY RIVER	WASATCH	1590-97396	U	AHY
2 JULY 98	STRAWBERRY RIVER	WASATCH	1590-97397	U	AHY
2 JULY 98	STRAWBERRY RIVER	WASATCH	1590-97398	F	AHY
11 JULY 98	LOGAN CANYON	CACHE	1590-97399	U	AHY
11 JULY 98	LOGAN CANYON	CACHE	1590-97400	F	AHY
13 JUNE 98	EAST CANYON RESERVOIR	MORGAN	1740-91904	U	AHY
13 JUNE 98	EAST CANYON RESERVOIR	MORGAN	1740-91905	U	AHY
13 JUNE 98	EAST CANYON RESERVOIR	MORGAN	1740-91906	U	AHY
18 JUNE 98	SPRING CREEK	CACHE	1740-91907	F	AHY
18 JUNE 98	SPRING CREEK	CACHE	1740-91908	U	AHY
19 JUNE 98	LOGAN RIVER	CACHE	1740-91909	M	AHY
19 JUNE 98	LOGAN RIVER	CACHE	1740-91910	M	AHY
19 JUNE 98	LOGAN RIVER	CACHE	1740-91911	U	AHY
19 JUNE 98	LOGAN RIVER	CACHE	1740-91912	U	AHY
24 JUNE 98	DESERET RANCH	RICH	1740-91913	U	AHY
25 JUNE 98	LOST CREEK	MORGAN	1740-91914	U	AHY
25 JUNE 98	LOST CREEK	MORGAN	1740-91915	F	AHY
25 JUNE 98	LOST CREEK	MORGAN	1740-91916	M	AHY
26 JUNE 98	EAST CANYON RESERVOIR	MORGAN	1740-91917	U	AHY
26 JUNE 98	EAST CANYON RESERVOIR	MORGAN	1740-91918	M	AHY
28 JUNE 98	FISH CREEK	CARBON	1740-91919	M	AHY

DATE BANDED	SITE	COUNTY	USFWS BAND NUMBER	SEX	AGE
28 JUNE 98	FISH CREEK	CARBON	1740-91921	F	AHY
28 JUNE 98	FISH CREEK	CARBON	1740-91922	M	AHY
28 JUNE 98	FISH CREEK	CARBON	1740-91923	F	AHY
1 JULY 98	STEWART LAKE	UINTAH	1740-91924	F	AHY
1 JULY 98	STEWART LAKE	UINTAH	1740-91925	M	AHY
1 JULY 98	STEWART LAKE	UINTAH	1740-91926	M	AHY
1 JULY 98	UINTA RIVER	DUCHESNE	1740-91927	M	AHY
2 JULY 98	STRAWBERRY RIVER	WASATCH	1740-91928	F	AHY
2 JULY 98	STRAWBERRY RIVER	WASATCH	1740-91929	M	AHY
9 JULY 98	PROVO RIVER PARKWAY	UTAH	1740-91930	U	AHY
9 JULY 98	PROVO RIVER PARKWAY	UTAH	1740-91931	U	AHY
9 JULY 98	PROVO RIVER PARKWAY	UTAH	1740-91932	F	AHY
9 JULY 98	PROVO RIVER PARKWAY	UTAH	1740-91933	M	AHY
10 JULY 98	LOGAN CANYON	CACHE	1740-91934	M	AHY
10 JULY 98	LOGAN CANYON	CACHE	1740-91935	F	AHY
10 JULY 98	LOGAN CANYON	CACHE	1740-91936	M	AHY
10 JULY 98	LOGAN CANYON	CACHE	1740-91938	F	AHY
18 JULY 98	FREMONT RIVER	WAYNE	1740-91951	M	AHY
18 JULY 98	FREMONT RIVER	WAYNE	1740-91952	M	AHY
19 JULY 98	MILL MEADOW RESERVOIR	WAYNE	1740-91953	U	AHY
5 AUGUST 98	VIRGIN RIVER AT ST GEORGE	WASHINGTON	1740-91954	F	AHY
5 AUGUST 98	VIRGIN RIVER AT ST GEORGE	WASHINGTON	1740-91955	U	AHY
5 AUGUST 98	VIRGIN RIVER AT ST GEORGE	WASHINGTON	1740-91956	U	AHY
5 AUGUST 98	VIRGIN RIVER AT ST GEORGE	WASHINGTON	1740-91957	U	AHY

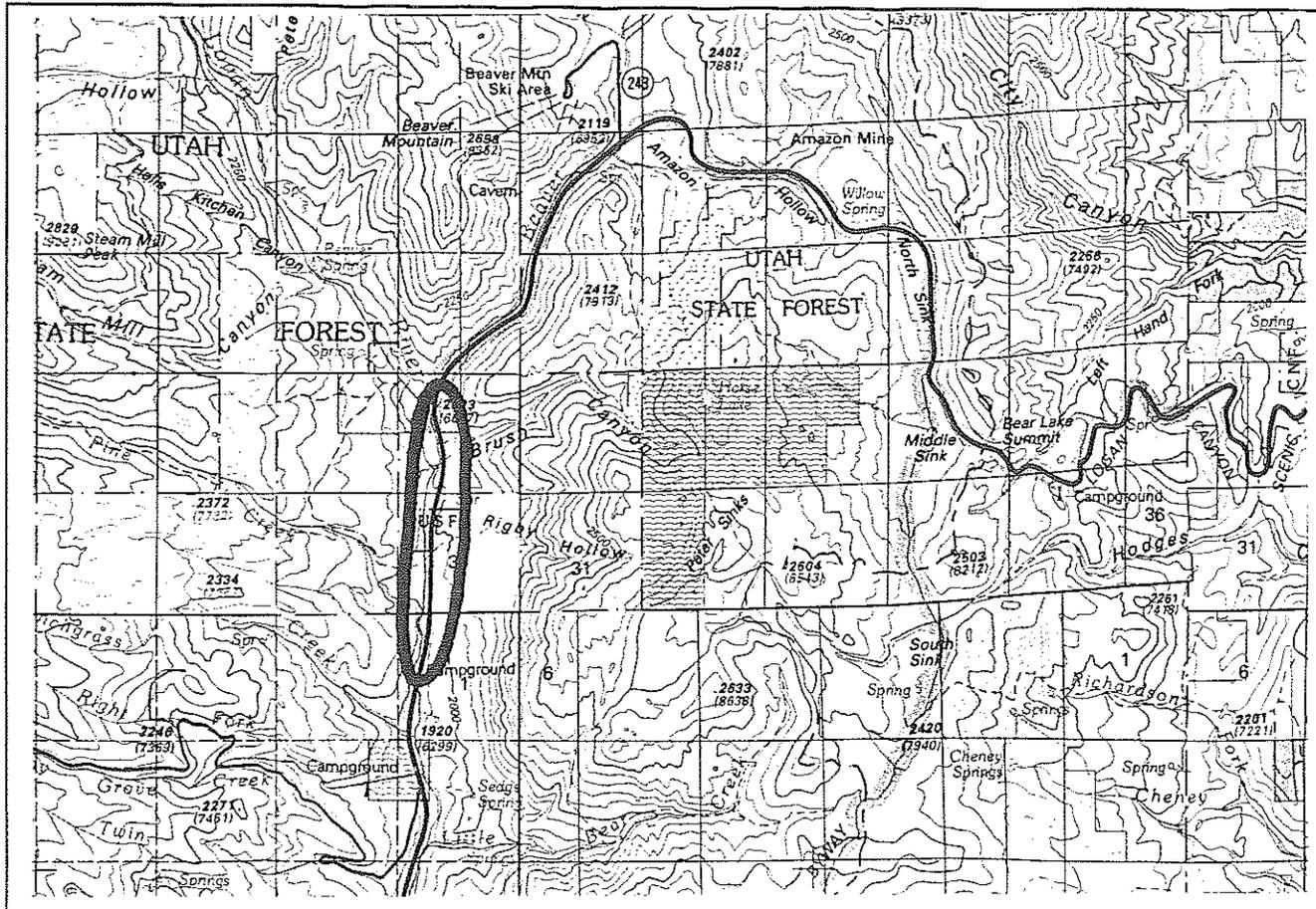
APPENDIX 2

Topographic maps of areas surveyed with occupied willow flycatcher breeding habitat in Utah, 1997 and 1998. Approximate areas surveyed are bordered in a thick black line.

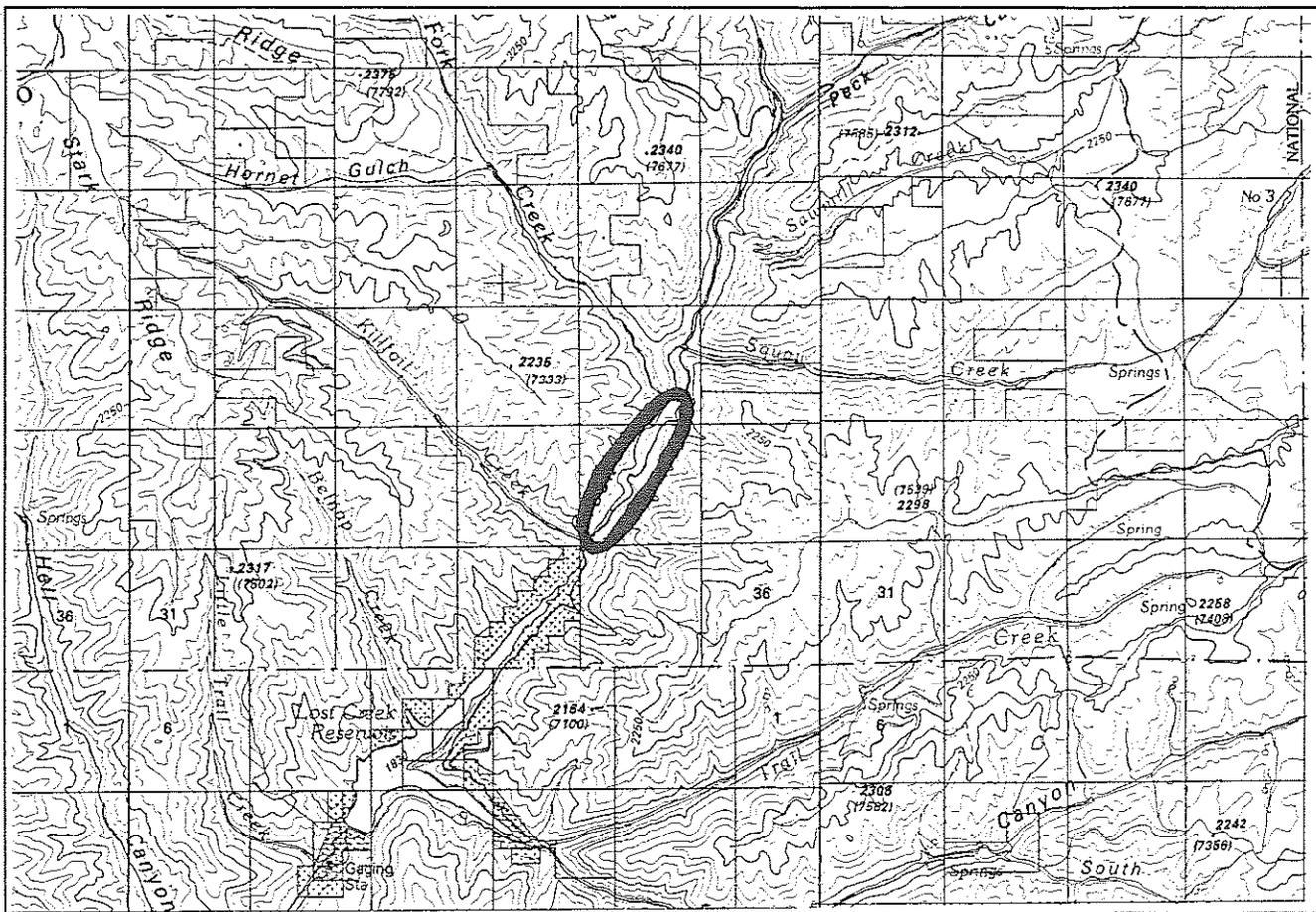
Logan River, Spring Creek, and Little Bear River sites. From Logan BLM Topographic map 1:100,000 series.



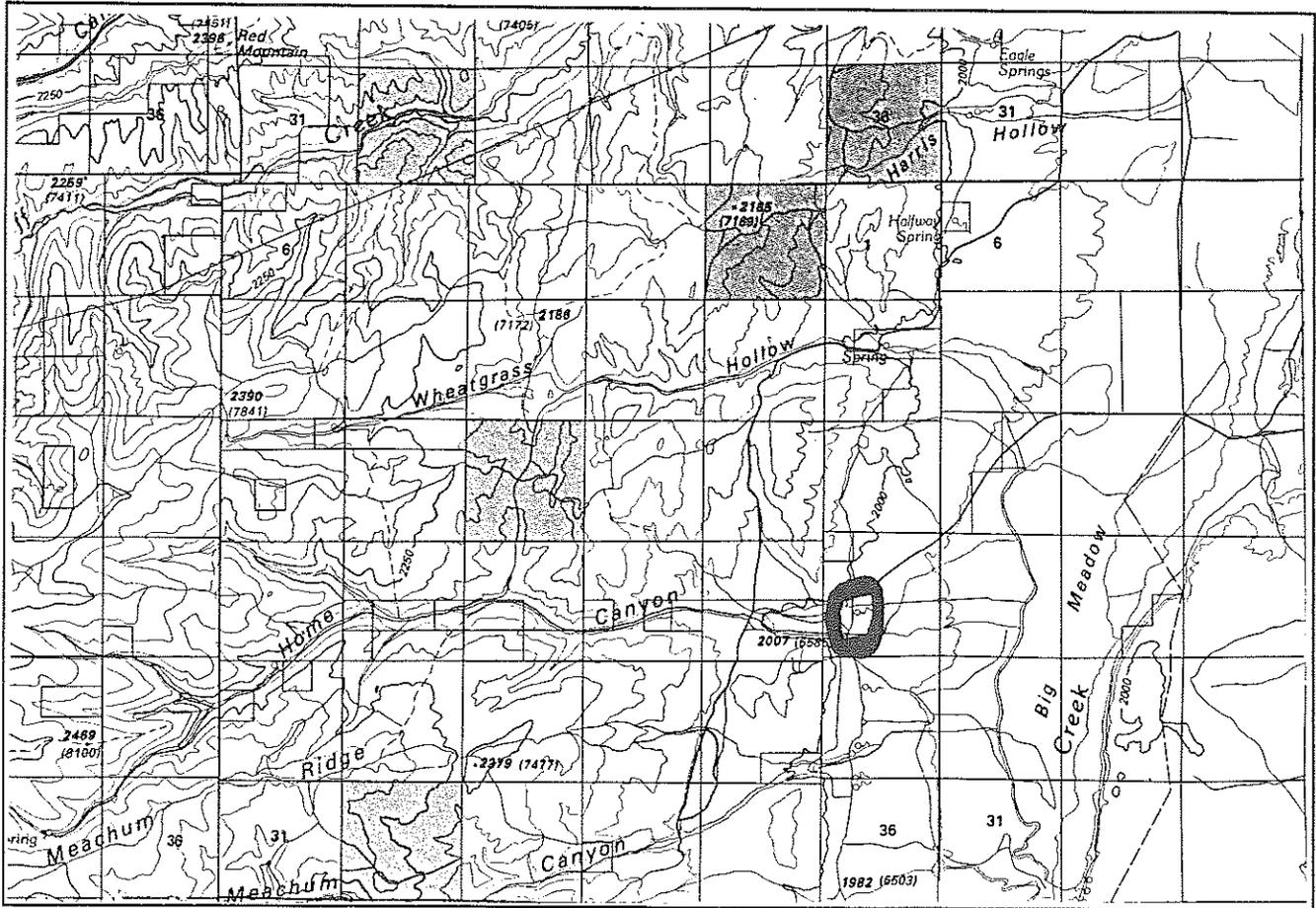
Logan Canyon site. From Logan BLM Topographic map 1:100,000 series.



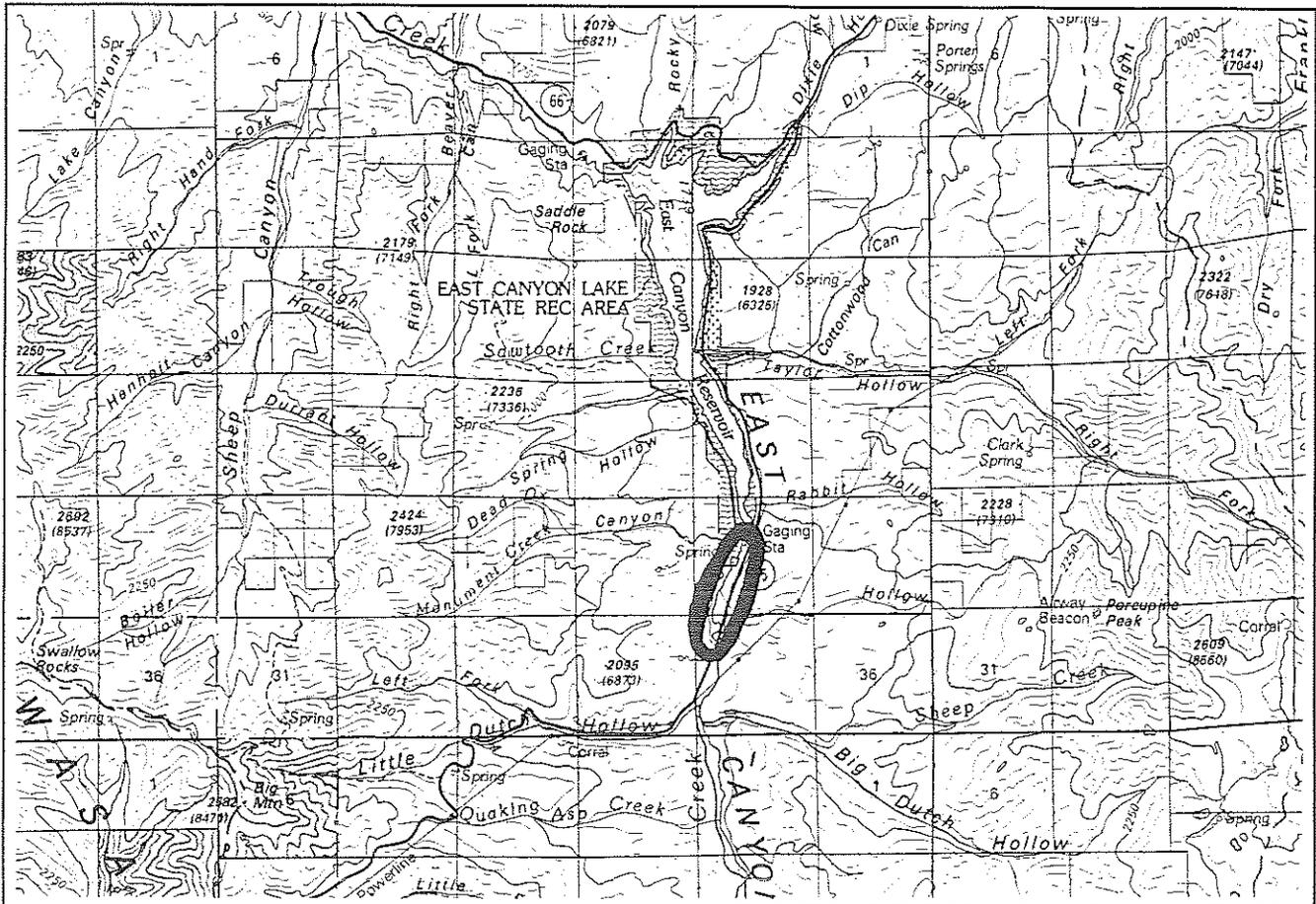
Lost Creek site. From Ogden BLM Topographic map 1:100,000 series.



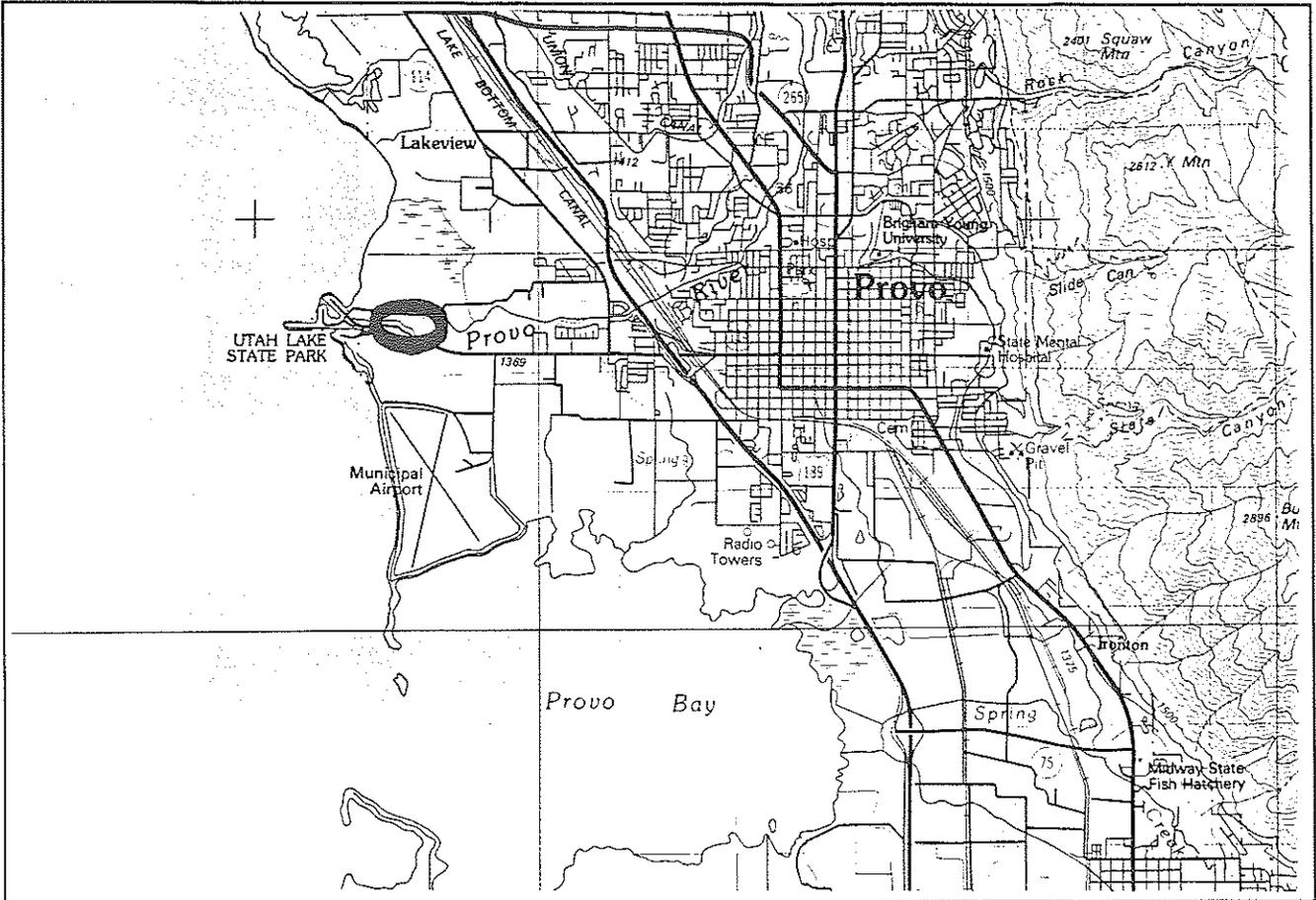
Deseret Ranch site. From Ogden BLM Topographic map 1:100,000 series.



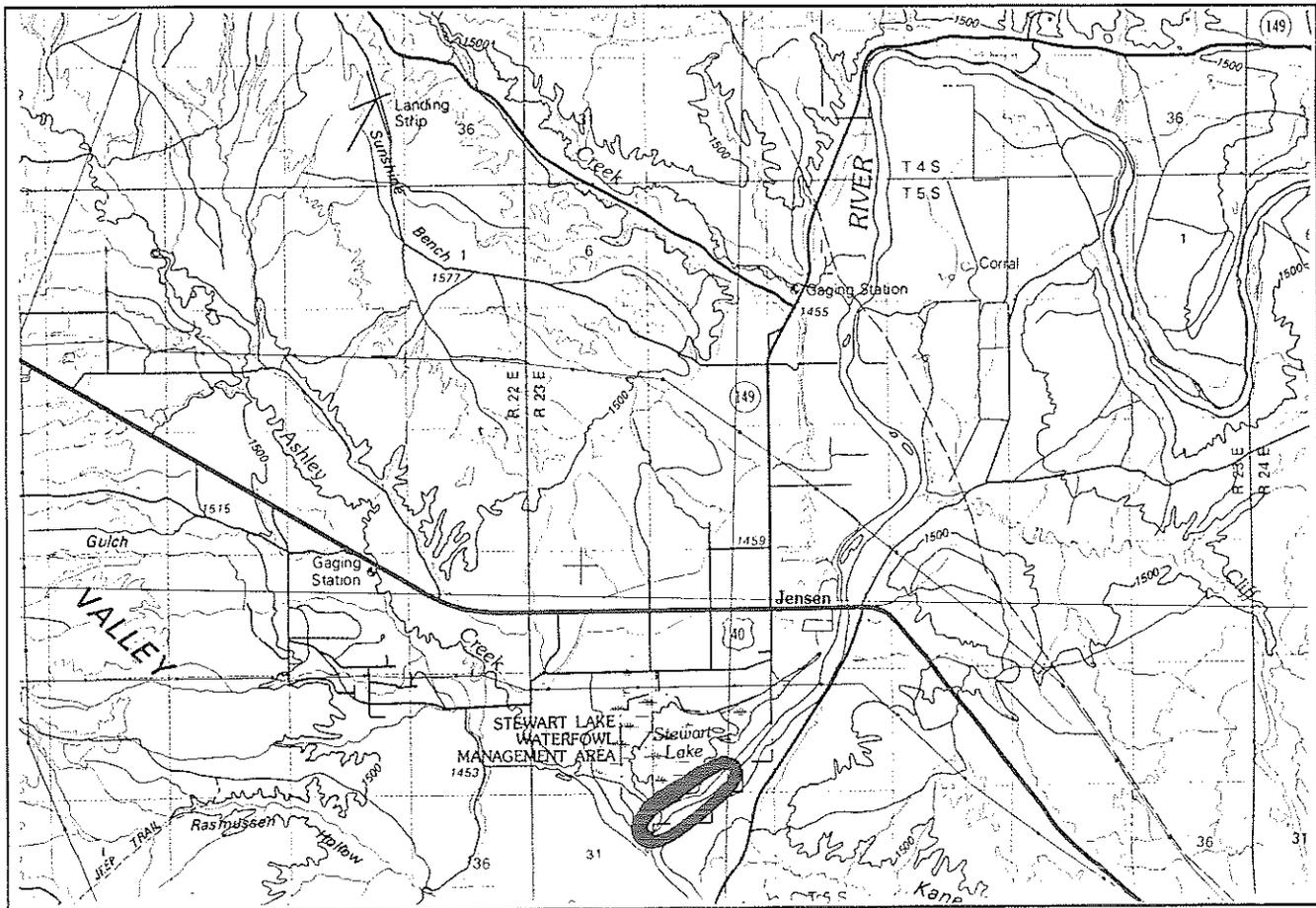
East Canyon Reservoir site. From Salt Lake City BLM Topographic map 1:100,000 series.



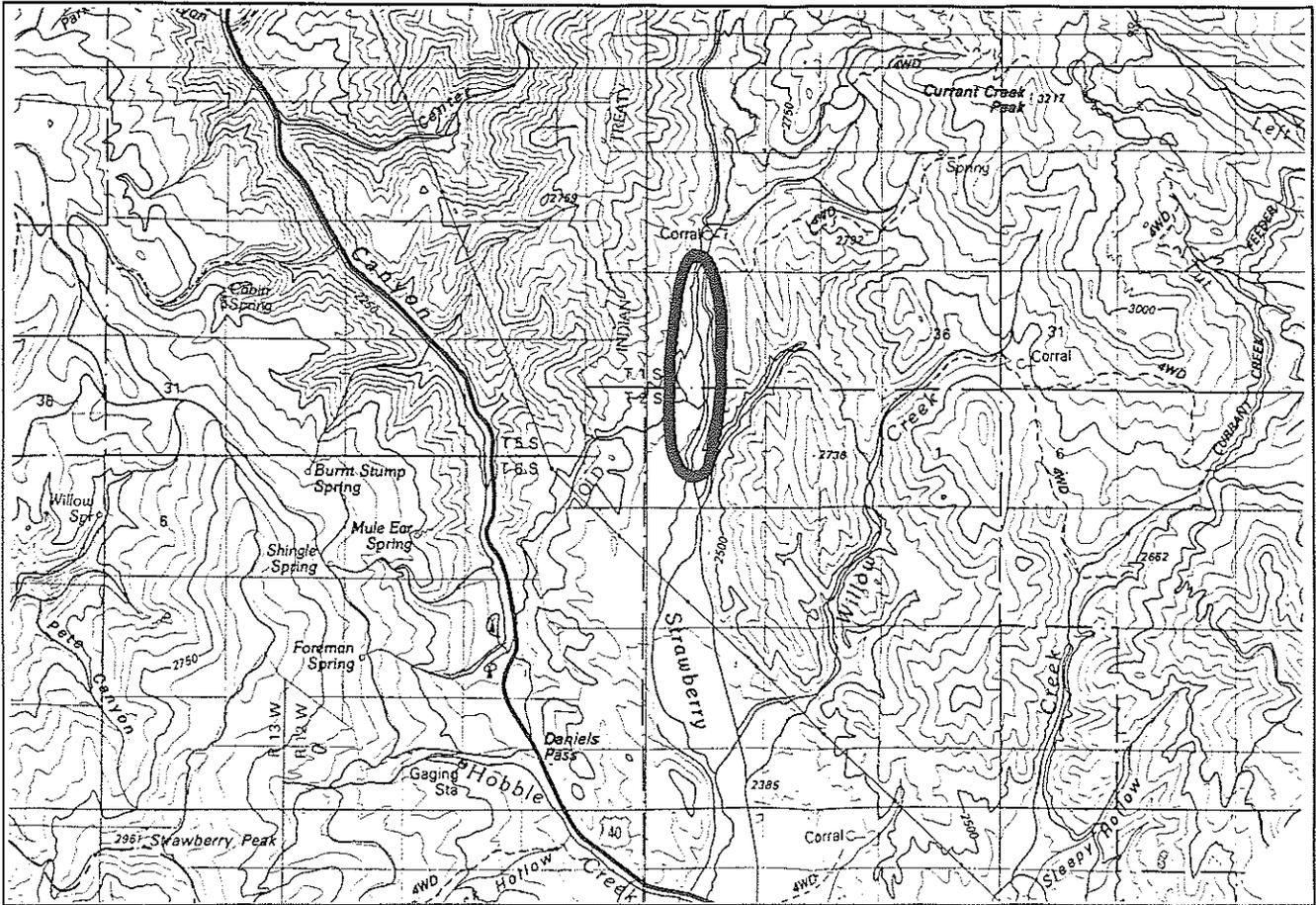
Provo River Parkway site. From Provo USGS Topographic map 1:100,000 series.



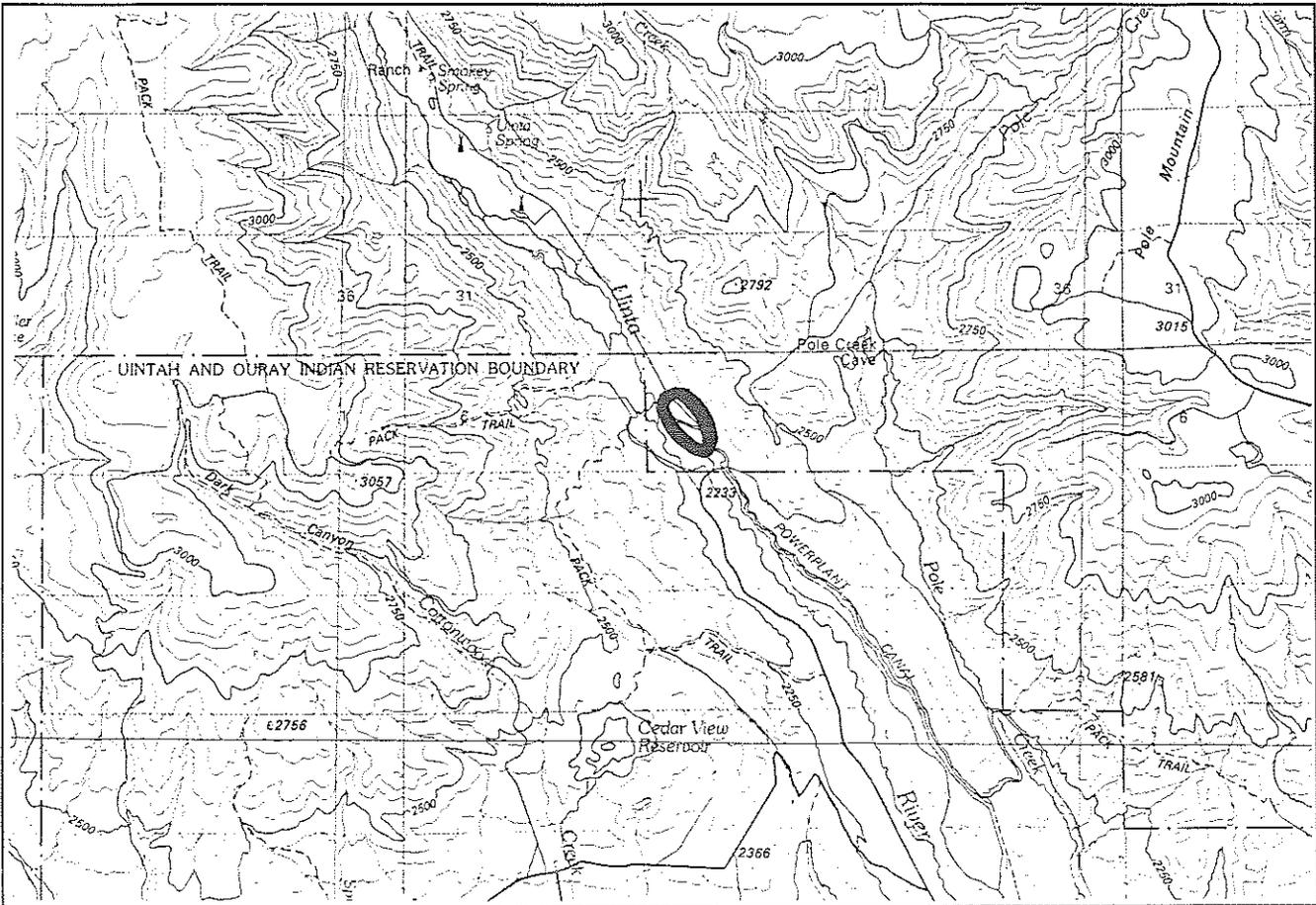
Stewart Lake site. From Vernal USGS Topographic map 1:100,000 series.



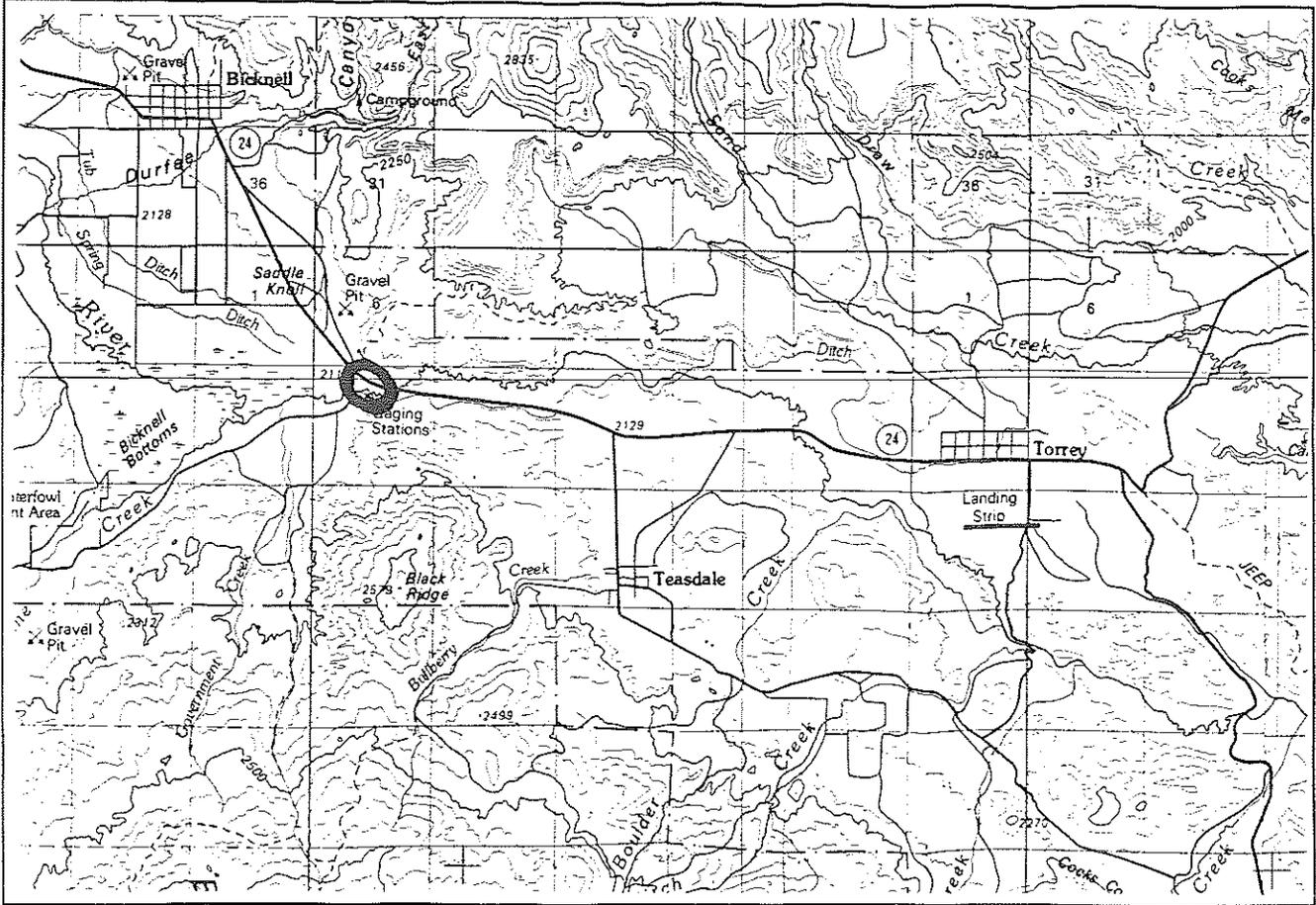
Strawberry River site. From Ogden BLM Topographic map 1:100,000 series.



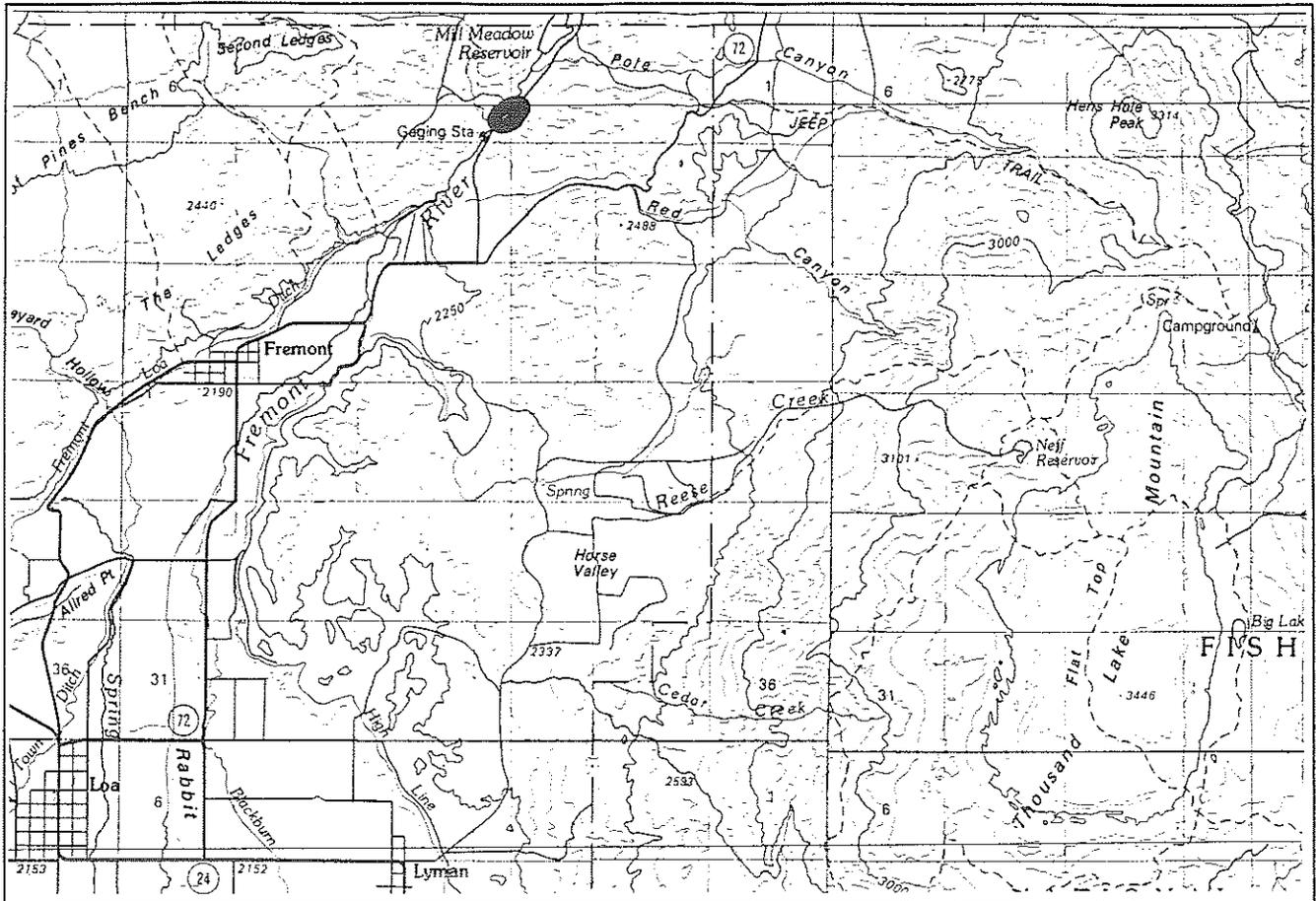
Uinta River site. From Kings Peak USGS Topographic map 1:100,000 series.



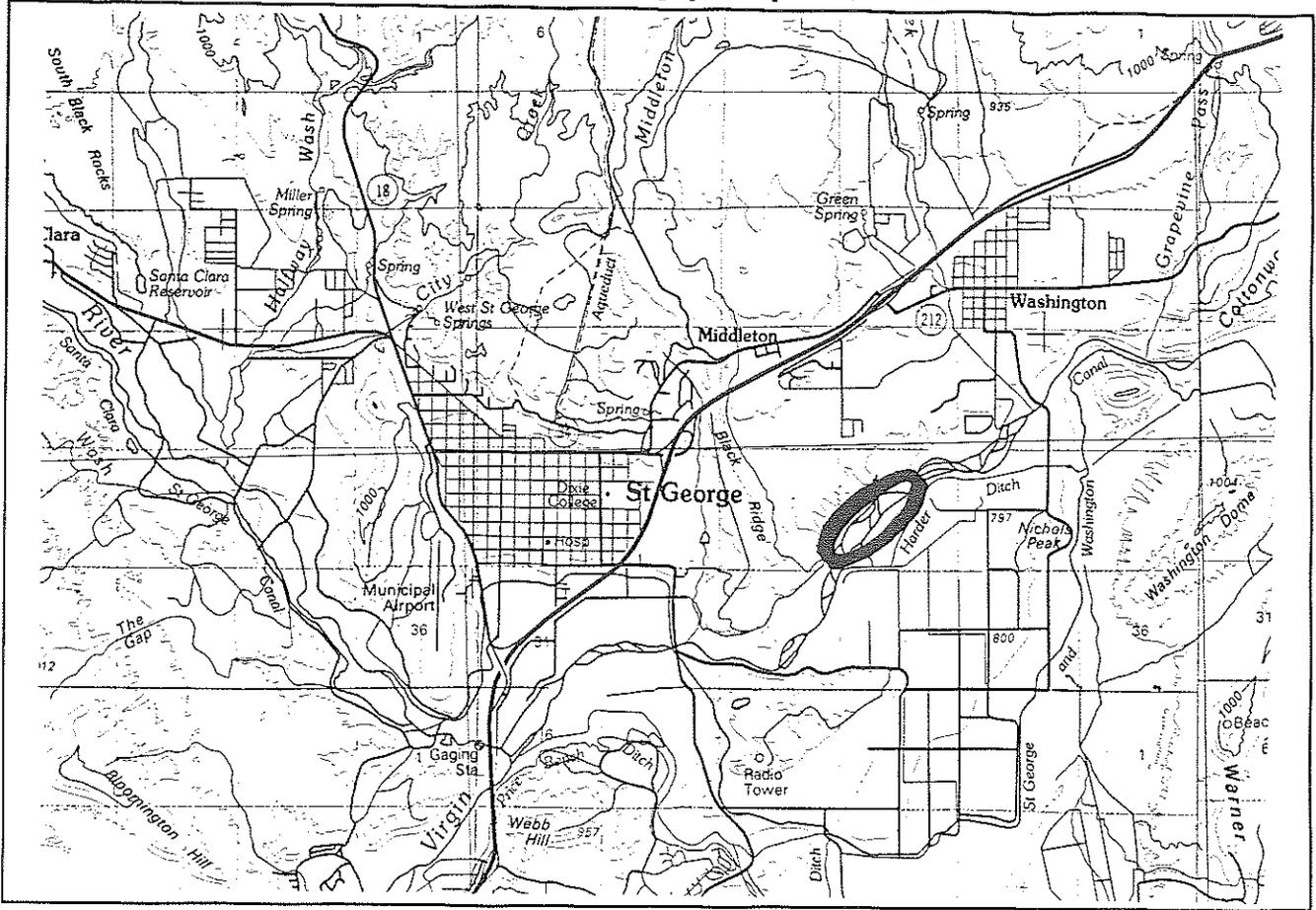
Fremont River at Torrey site. From Loa USGS Topographic map 1:100,000 series.



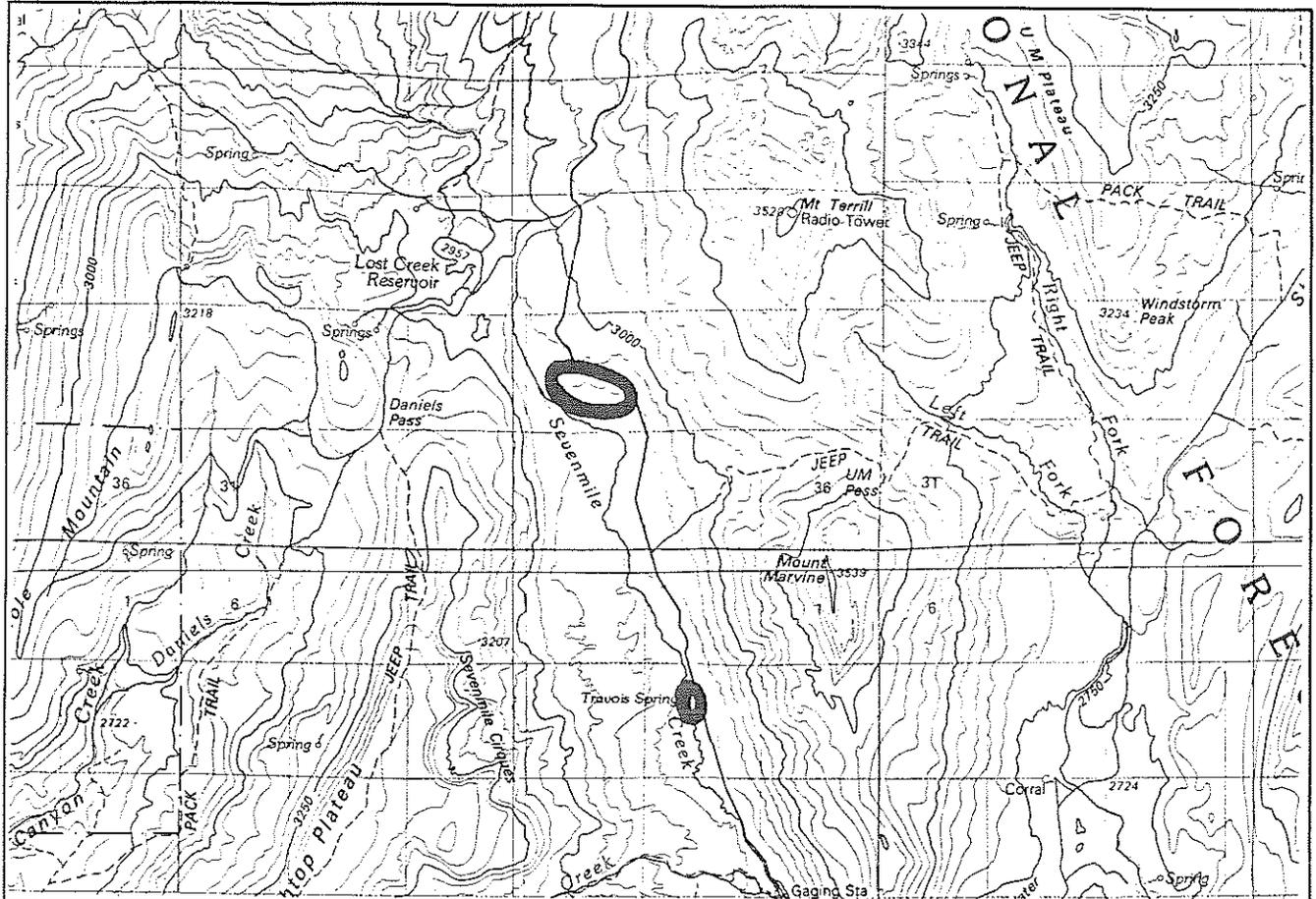
Mill Meadow Reservoir site. From Loa USGS Topographic map 1:100,000 series.



Virgin River at St. George site. From St. George USGS Topographic map 1:100,000 series.



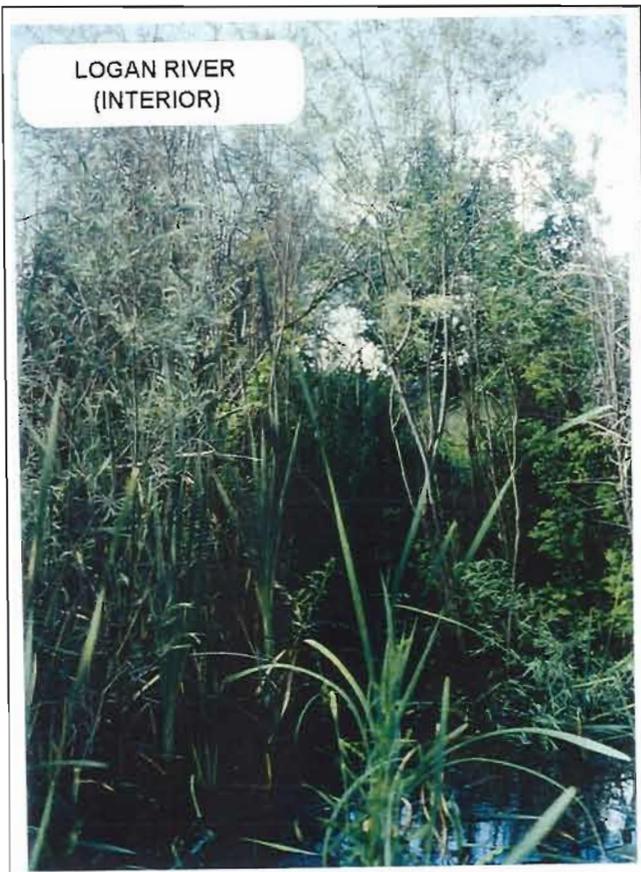
Gottfredsen Creek and Travois Spring sites. From Salina USGS Topographic map 1:100,000 series.

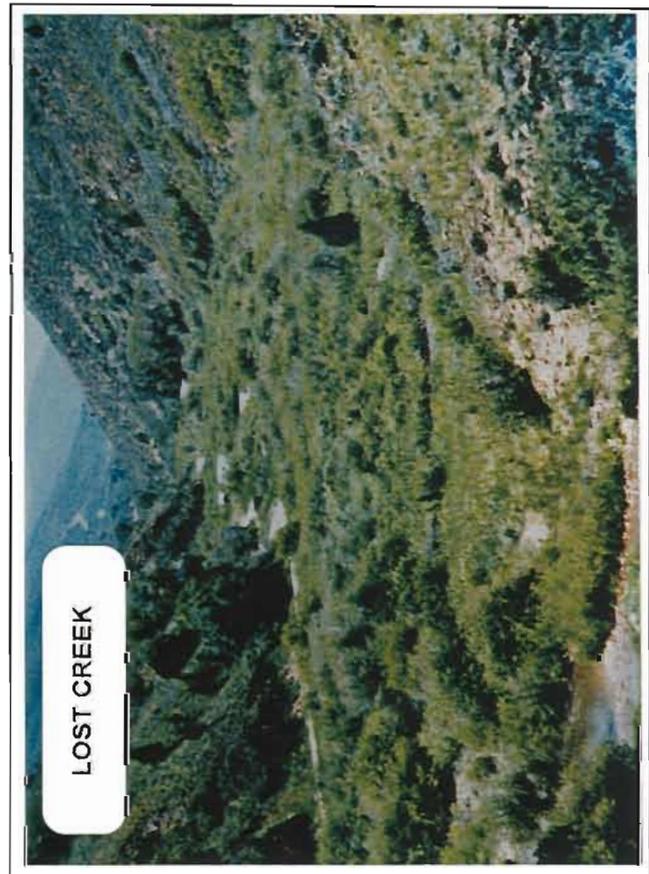
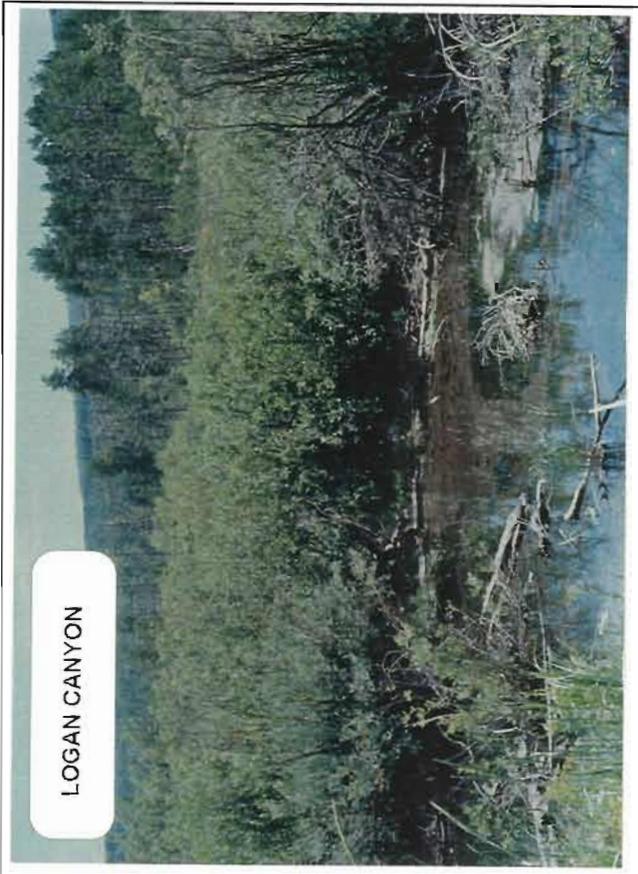


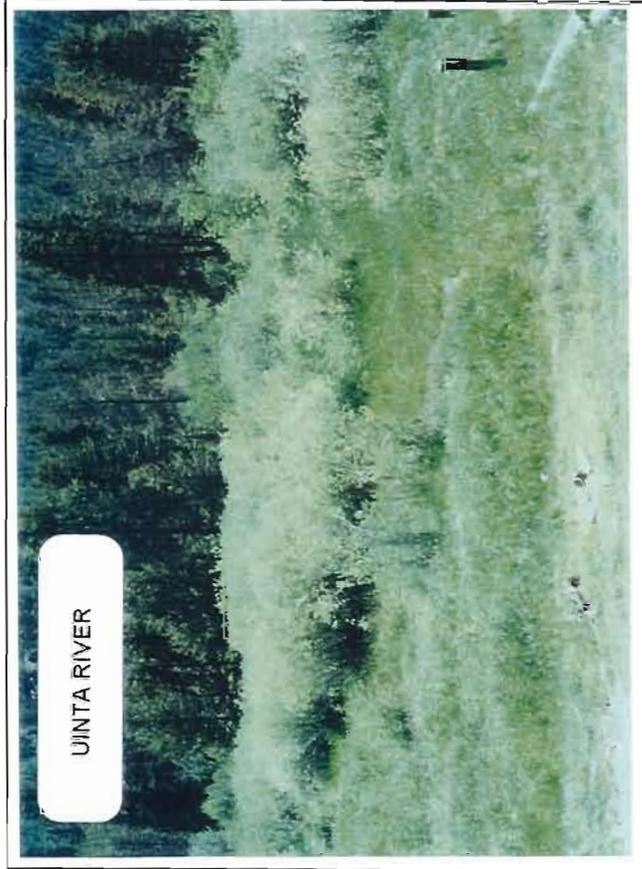
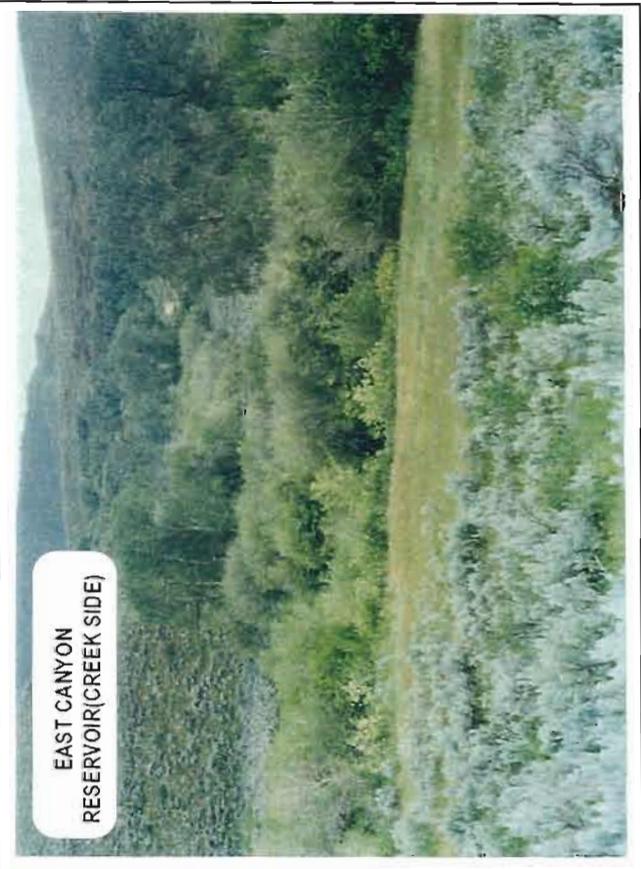
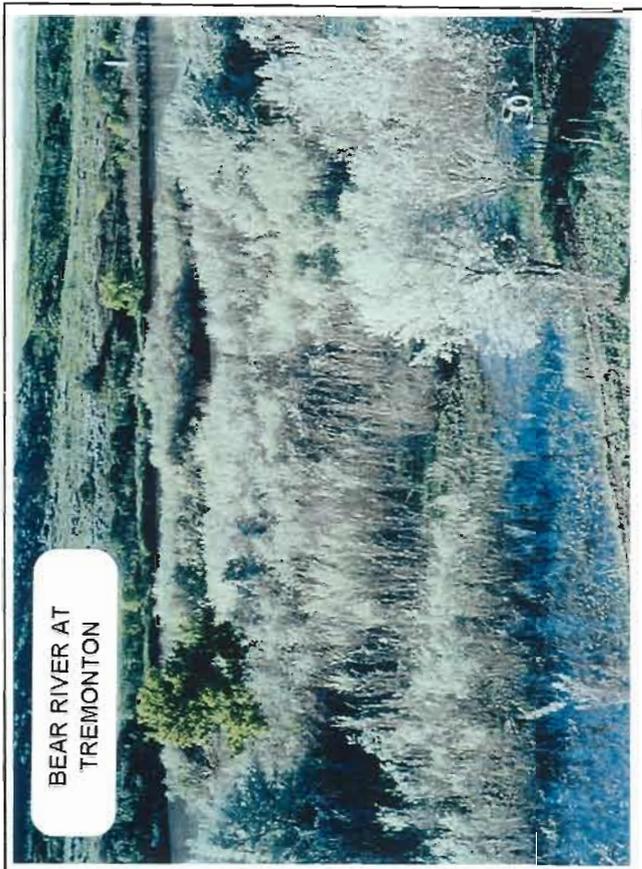
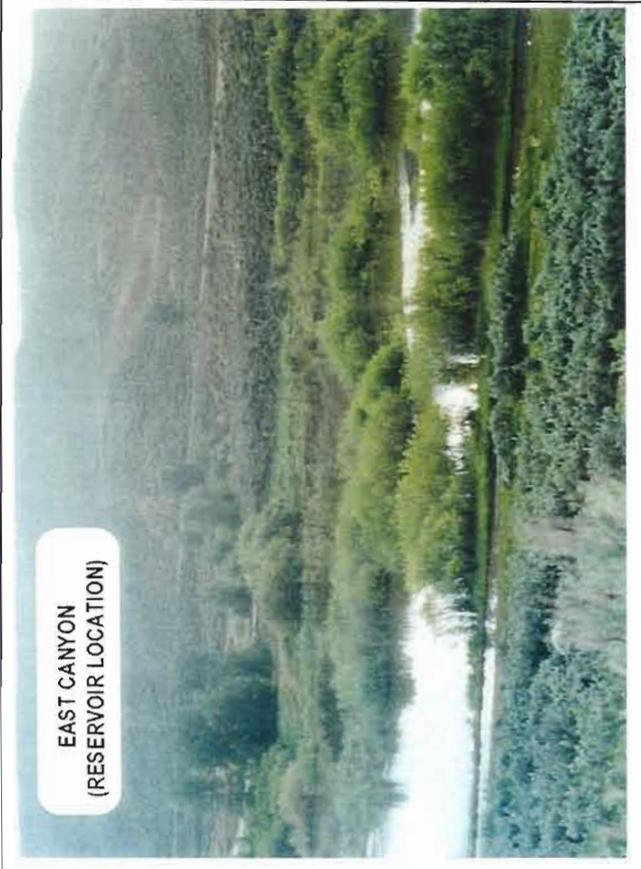
APPENDIX 3

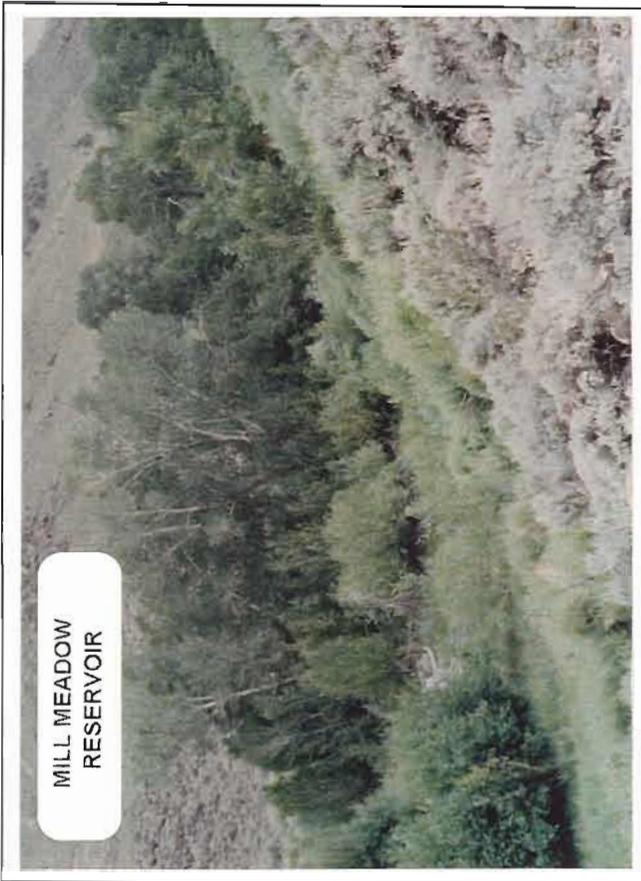
Photographs of occupied willow flycatcher breeding habitat in Utah 1997 and 1998

These photographs are provided in order to show some of the range of vegetation structure and composition at known flycatcher breeding sites in Utah. They are not intended to show, nor do they include, all possible habitat types that breeding willow flycatchers might use. Note that no photograph is available for Spring Creek or Strawberry River sites. Photographs by Suzanne Langridge, Jen Luff and Andy McIntyre.

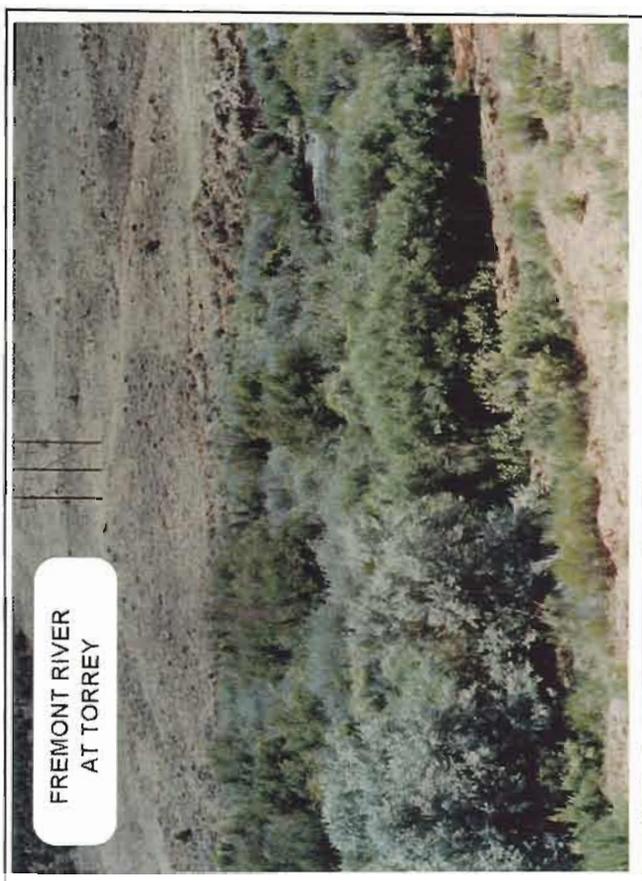




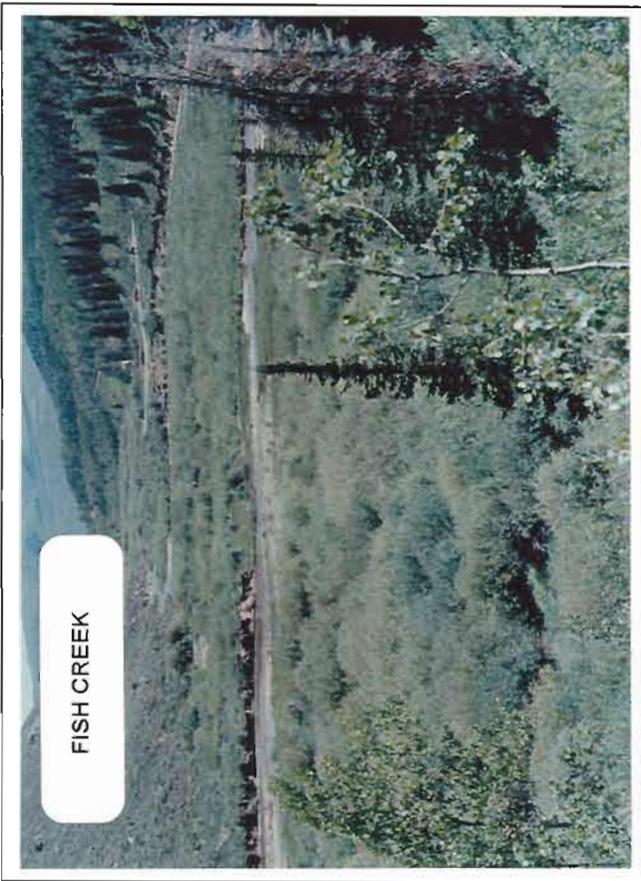




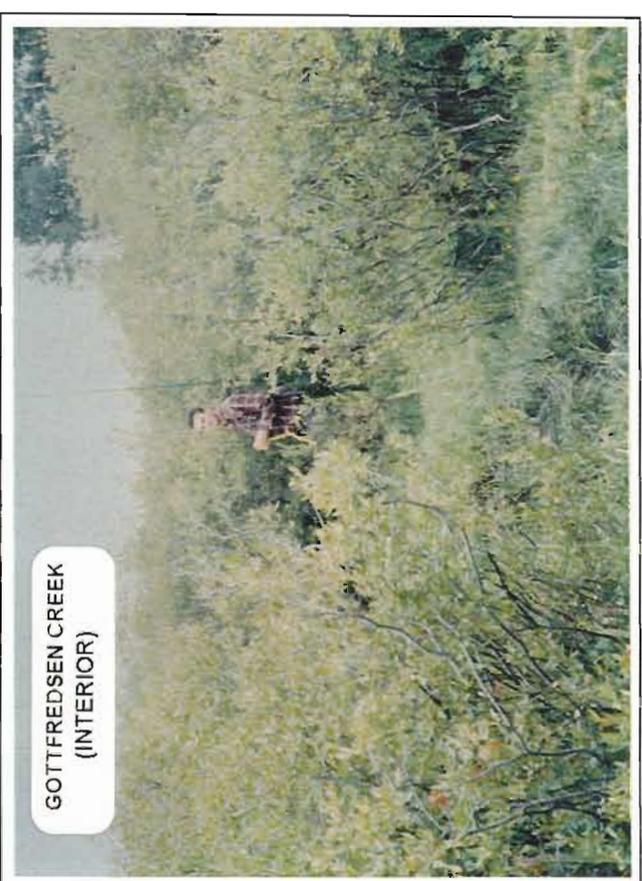
MILL MEADOW
RESERVOIR



FREMONT RIVER
AT TORREY



FISH CREEK



GOTTFREDSEN CREEK
(INTERIOR)

APPENDIX 4

Geographical coordinates of the 1997 and 1998 willow flycatcher banding project sites. Coordinate sources are global positioning system measurements (Garmin GPS 40, estimated ± 100 m accuracy) at detection site, except the Virgin River at St. George and Uinta River sites which were extrapolations from topographic map. UTM is within Zone 12.

SITE	COUNTY	LATITUDE-LONGITUDE	UTM	QUAD NAME
DESERET RANCH	RICH	41° 24' 56" N 111° 13' 20" W	X0481422(E) Y4584914(N)	NEPONSET RESERVOIR NW
EAST CANYON RESERVOIR	MORGAN	40° 52' 28" N 111° 35' 02" W	X0450809(E) Y4524972(N)	EAST CANYON RESERVOIR
FISH CREEK	CARBON	39° 46' 30" N 111° 12' 15" W	X0482511(E) Y4402805(N)	SCOFIELD RESERVOIR
FREMONT RIVER AT TORREY	WAYNE	38° 18' 28" N 111° 30' 46" W	X0455170(E) Y4240074(N)	TORREY
GOTTFREDSSEN CREEK	SEVIER	38° 41' 35" N 111° 40' 45" W	X0440925(E) Y4282934(N)	MT TERRILL
LITTLE BEAR RIVER	CACHE	41° 43' 08" N 111° 56' 41" W	X0421426(E) Y4619006(N)	WELLSVILLE
LOGAN CANYON	CACHE	41° 55' 40" N 111° 33' 39" W	X0453485(E) Y4641926(N)	TONY GROVE CREEK
LOGAN RIVER	CACHE	41° 43' 13" N 111° 53' 04" W	X0426431(E) Y4619109(N)	WELLSVILLE
LOST CREEK	MORGAN	41° 13' 19" N 111° 21' 30" W	X0469968(E) Y4563461(N)	FRANCIS CANYON
MILL MEADOW RESERVOIR	WAYNE	38° 29' 10" N 111° 34' 29" W	X0449872(E) Y4259918(N)	LYMAN
PROVO RIVER PARKWAY	UTAH	40° 14' 12" N 111° 43' 09" W	X0438833(E) Y4454268(N)	PROVO
SPRING CREEK	CACHE	41° 43' 11" N 111° 56' 09" W	X0422167(E) Y4619076(N)	WELLSVILLE
STEWART LAKE	UINTAH	40° 20' 46" N 109° 21' 34" W	X0639324(E) Y4467472(N)	JENSEN
STRAWBERRY RIVER	WASATCH	40° 20' 48" N 111° 13' 41" W	X0480645(E) Y4466265(N)	CO-OP CREEK
UINTA RIVER	DUCHESNE	40° 35' N 110° 07' W	X0574692(E) Y4493095(N)	POLE CREEK CAVE
VIRGIN RIVER AT ST GEORGE	WASHINGTON	37° 07' N 113° 30' W	X0317802(E) Y4109985(N)	ST GEORGE

APPENDIX 5

Sites surveyed for willow flycatchers without detections. These are not formal surveys, and covered from 500 m to over 5 km depending on whether habitat appeared appropriate, time constraints, and land ownership. Source of information for survey is from personal communication with biologists (*pers. comm.*), Breeding Bird Surveys (BBS), historical site (H) or no source (NS). Coordinate sources are extrapolated from topographic maps and USGS Geographic Names Information System (GNIS) at <http://mapping.usgs.gov/www/gnis/gnisform.html>.

Site	Source of Information	County	Date Surveyed	Latitude-Longitude	Topographic map 1:1,000,000 series
Pioneer Campground, Blacksmiths Fork	NS	Cache	6/5/98	41°37'42"N 111°41'33"W	Logan
Hardware Range Management Area	NS	Cache	6/5/98	41°37'06"N 111°34'42"W	Logan
Sheep Creek	K. Paulin <i>pers. comm.</i>	Daggett	6/19/98	40°53'44"N 109°56'24"W	Dutch John
Timber Canyon	K. Paulin <i>pers. comm.</i>	Duchesne	7/2/98	40°03'32"N 110°52'28"W	Duchesne
Jordan Narrows	R. Norvell <i>pers. comm.</i>	Salt Lake	6/16/98	40°25'30"N 111°55'17"W	Provo
Big Cottonwood Canyon	M. Stackhouse <i>pers. comm.</i>	Salt Lake	6/6/98	40°38'20"N 111°37'30"W	Salt Lake City
Stillwater Campground	M. Stackhouse <i>pers. comm.</i>	Summit	6/25/98	40°52'07"N 110°50'04"W	Kings Peak
Henry's Fork	F. Edwards <i>pers. comm.</i>	Summit	7/15/98	40°59'55"N 109°39'08"W	Kings Peak
Taylor Fork campground	M. Stackhouse <i>pers. comm.</i>	Summit	6/13/98	40°37'04"N 111°08'01"W	Salt Lake City
South Willow Canyon	H	Tooele	6/16/98	40°31'33"N 112°30'01"W	Tooele/Rush Valley
Horshoe Bend along Green River	H	Uintah	6/30/98	40°15'54"N 109°31'01"W	Vernal
Merkley Park, near Vernal	H	Uintah	7/1/98	40°31'37"N 109°36'12"W	Vernal
Diamond Fork	M. Stackhouse <i>pers. comm.</i>	Utah	6/15/98	40°04'01"N 111°26'19"W	Provo
NE end of Deer Creek Reservoir, Provo River	R. Norvell <i>pers. comm.</i>	Wasatch	6/16/98	40°27'05"N 111°29'11"W	Provo
Willows Campground	NS	Weber	6/2/98	41°17'32"N 111°37'59"W	Ogden
Meadow Campground	NS	Weber	6/2/98	41°17'11"N 111°38'38"W	Ogden
Browns Hole, Ogden River	BBS	Weber	6/3/98	41°19'36"N 111°42'24"W	Ogden
Jefferson Hunt Campground	R. Norvell <i>pers. comm.</i>	Weber	6/3/98	41°15'08"N 111°46'01"W	Ogden
Pineview Nature Park	M. Stackhouse <i>pers. comm.</i>	Weber	6/13/98	41°16'58"N 111°49'12"W	Ogden

APPENDIX 6

Historical collections of willow flycatchers in Utah, including county, location, longitude-latitude, year specimens collected, number of specimens collected (separated by male, female, unknown, or nest), whether the specimen was collected during the non-migratory period or had a nesting record, subspecies (as noted by the collector or museum), and specimen collector. Subspecies designations may vary with further examination. Records are from University of Utah, Denver Museum of Natural History, Royal Ontario Museum, University of Michigan Museum of Zoology, Brigham Young University, Western Foundation of Vertebrate Zoology, California State University at Long Beach, United States National Museum of Natural History, Carnegie Museum of Natural History, University of New Mexico, and Cornell University. Coordinates are from USGS Geographic Names Information System (GNIS) at <http://mapping.usgs.gov/www/gnis/gnisform.html>.

COUNTY	LOCATION	LATITUDE-LONGITUDE	YEAR COLLECTED	NUMBER SPECIMENS			COLLECTED IN NON-MIGRATORY PERIOD OR BREEDING RECORD (YES/NO)	SUBSPECIES	COLLECTOR
				M	F	U			
BOX ELDER	TWO MILES SOUTH OF LYNN RESERVOIR	41°50'56"N 113°43'32"W	1956	2			YES	ADASTUS	GHEISELIN, J.
	CLEAR CREEK, RAFT RIVER MOUNTAINS	41°58'58"N 113°16'48"W	1951	1			YES	ADASTUS	BEHLE, W.H.
	LUCIN	41°20'54"N 112°17'22"W	1961	1	1		NO	ADASTUS	WHITE, C.M.
	MOUTH OF BEAR RIVER	41°27'30"N 112°17'22"W	1933	1			NO	ADASTUS	HULL, A.V.
	ONE MILE SOUTH OF STANDROD	41°59'38"N 113°25'06"W	1949		1		NO	ADASTUS	BEHLE, W.H.
	WARBURTON'S RANCH, 4 MILES EAST PILOT PEAK	41°06'35"N 113°57'56"W	1953		2		NO	ADASTUS	PORTER, R.D.
	YOST	41°57'39"N 113°32'29"W	1949	1			NO	ADASTUS	BEHLE, W.H.
	BLACK SMITH FORK	41°34'17"N 111°33'27"W	1954	1			YES	ADASTUS	PORTER, R.D.
	LOGAN	41°44'08"N 111°50'01"W	1950	2	1		YES	ADASTUS	SELANDER, R.K.
	LOGAN CANYON	41°44'41"N 111°45'00"W	1949			2	YES	BREWSTERI	PEYTON, L.
CACHE	SARDINE CREEK, 1 MILE WEST OF PARADISE	41°34'08"N 111°50'14"W	1932	1			NO	ADASTUS	HULL, A.V.
	SPRING PICNIC AREA, LEFT FORK BLACKSMITH FK	41°39'33"N 111°40'26"W	1961	1			NO	ADASTUS	MUSSER, G.G.
	2 MILES NORTH OF WELLINGTON	39°32'33"N 110°44'05"W	1942	1			NO	ADASTUS	HIGGINS, H.
	MOUTH BIRCH CREEK CANYON, 3 1/2 MI SOUTH WY	40°53'50"N 109°05'37"W	1956	1			YES	ADASTUS	BEHLE, W.H.
	FARMINGTON BAY REFUGE	40°56'04"N 111°55'21"W	1949	3	3		YES	ADASTUS	SELANDER, R.K.
	1 MILE WEST OF FARMINGTON RR STATION	40°59'46"N 111°53'17"W	1949	1	3		YES	ADASTUS	SELANDER, R.K.
	ANTELOPE ISLAND, GREAT SALT LAKE	40°57'29"N 112°12'23"W	1869	1	1		NO	UNKNOWN	RIDGWAY, R.
	DUCHESNE	40°09'48"N 110°24'08"W	1949	1	1		YES	ADASTUS	BEHLE, W.H.
	14 MILES NO. OF GREEN R. ALONG THE GREEN R.	40°09'48"N 110°24'08"W	1947	1			NO	ADASTUS	HIGGINS, H.
	GREEN RIVER	39°00'08"N 110°09'43"W	1956	1			NO	ADASTUS	BEHLE, W.H.
EMERY	JUNCTION OF SAN RAFAEL AND GREEN RIVERS	38°46'31"N 110°06'15"W	1957		1		NO	UNKNOWN	HAYWARD
	MOAB	38°34'24"N 109°32'57"W	1956	4	1		NO	ADASTUS	BEHLE, W.H.
GRAND	1 MILE NORTH OF MOAB	38°34'24"N 109°32'57"W	1961	2			YES	ADASTUS	WHITE, C.M.
	10 MILES SOUTH OF CISCO	38°49'00"N 109°19'11"W	1955	1			NO	UNKNOWN	HAYWARD, C.I.

COUNTY	LOCATION	LATITUDE-LONGITUDE	YEAR COLLECTED	NUMBER SPECIMENS				COLLECTED IN NON-MIGRATORY PERIOD OR BREEDING RECORD (YES/NO)	SUBSPECIES	COLLECTOR
				M	F	U	T			
GRAND	CISCO	38°58'12"N 109°19'12"W	1940	1				NO	ADASTUS	LANDBERG, R.L./TRIPLETT, L.
	JUNCTION OF COLORADO RIVER AND KANE CREEK	38°31'58"N 109°36'07"W	1958	1				NO	EXTIMUS	HIGGINS, H.
	ONE MILE NORTH OF GREEN RIVER CITY	38°59'43"N 110°09'40"W	1947	1				NO	ADASTUS	BEHLE, W.H.
	NR GUNNISON BUTTE, 6.5 MILES N. GREEN R. CITY	39°05'00"N 110°08'00"W	1956	1				NO	ADASTUS	BEHLE, W.H.
KANE	2 MILES SOUTH OF KANAB	37°00'34"N 112°31'32"W	1947	2				YES	EXTIMUS	BEHLE, W.H.
	3 MILES SOUTH OF KANAB	37°30'00"N 112°31'48"W	1947	2				NO	EXTIMUS	BEHLE, W.H.
	BAR ON CO RIVER, 75 MILES ABOVE LEES FERRY	37°51'42"N 110°23'42"W	1938	1				NO	EXTIMUS	WOODBURY, A.M.
	JCT. ESCALANTE & COLORADO RIVERS	37°17'22"N 110°52'17"W	1958	2				NO	EXTIMUS	SMITH, G.R./HIGGINS, H.
	KAIPAROWITS PLATEAU	37°30'00"N 111°35'00"W	1937	1				NO	ADASTUS	WOODBURY, A.M.
	2 MI BELOW MOUTH OF SAN JUAN ON THE CO.R.	37°09'04"N 110°57'51"W	1938	1				NO	BREWSTERI	WOODBURY, A.M.
RICH	LAKETOWN	41°49'32"N 111°19'18"W	1929	1				NO	ADASTUS	HAYWARD, C.L.
	LAKETOWN	41°49'32"N 111°19'18"W	1961	2	1			NO	ADASTUS	WHITE, C.M.
SALT LAKE	1233 E. 800 S., SALT LAKE CITY	40°45'39"N 111°53'25"W	1961	1				NO	ADASTUS	WHITE, C.M.
	SALT LAKE CITY	40°45'39"N 111°53'25"W	1909				1	YES	UNKNOWN	TREGANZA
SAN JUAN	COTTONWOOD	40°39'30"N 111°50'00"W	1912				1	YES	BREWSTERI	SUGDEN, J.W.
	44 MILES UP THE SAN JUAN RIVER	37°16'28"N 110°22'19"W	1938	2			1	YES	BREWSTERI	RUSSELL, H.N.
	6 MI. BELOW TOTEM POLE, EAST GYPSUM CANYON	37°08'43"N 109°51'13"W	1936	1				NO	EXTIMUS	RUSSELL, H.N.
	FOUR CORNERS	36°59'57"N 109°02'42"W	1966				1	NO	UNKNOWN	HAYWARD
SEVIER	NAVAJO MT TRADING POST	37°05'40"N 110°49'22"W	1936	1				NO	ADASTUS	RUSSELL, H.N.
	SAN JUAN RIVER ABOVE NOKAI CANYON	37°12'36"N 110°33'40"W	1938	2				NO	EXTIMUS	RUSSELL, H.N.
	SALINA	38°57'28"N 111°51'33"W	1929	1				NO	ADASTUS	STANFORD, J.S.
	5 MILES EAST OF COALVILLE, ON CHALK CREEK	40°55'03"N 111°22'28"W	1949	1				YES	ADASTUS	BEHLE
SUMMIT	KAMAS	40°38'35" -111 16 48	1930				1	NO	UNKNOWN	HAYWARD
	PARLEY'S PARK	40°42'41"N 111°31'10"W	1869	2	4	3	2	YES	UNKNOWN	RIDGWAY
	SNYDERVILLE	40°41'40"N 111°13'35"W	1892	1				YES	UNKNOWN	UNKNOWN
TOOELE	SHERIDAN RANCH, 2 MILES NORTH IBAPAH	40°02'12"N 113°59'07"W	1942	2				NO	ADASTUS	BEHLE, W.H.
	CEDAR MOUNTAINS, DUGWAY PROVING GROUNDS	40°22'52"N 112°59'40"W	1953	1				NO	ADASTUS	PORTER, R.D.
	JOHNSON PASS SUMMIT, STANSBURY MOUNTAINS	40°20'15"N 112°34'00"W	1953	1				NO	ADASTUS	PORTER, R.D.
	JOSEPA RANCH, SKULL VALLEY	40°44'44"N 112°41'26"W	1953	1				NO	ADASTUS	PORTER, R.D.
	ORR'S RANCH, SKULL VALLEY	40°44'44"N 112°41'26"W	1954	4	7	1		YES	ADASTUS	BUSHMAN, J.
	CLOVER CREEK, CLOVER	40°20'13"N 112°27'38"W	1954	1				NO	ADASTUS	PORTER, R.D.
STANSBURY MOUNTAINS, SOUTH WILLOW CANYON	GOVERNMENT WELL, 4 MILES NE CAMELBACK MNT	40°54'23"N 112°59'40"W	1954	1				NO	ADASTUS	BUSHMAN, J.
	STANSBURY MOUNTAINS, SOUTH WILLOW CANYON	40°38'46"N 112°36'37"W	1955	1				YES	ADASTUS	PORTER, R.D.

COUNTY	LOCATION	LATITUDE- LONGITUDE	YEAR COLLECTED	NUMBER SPECIMENS			COLLECTED IN NON-MIGRATORY PERIOD OR BREEDING RECORD (YES/NO)	SUBSPECIES	COLLECTOR
				M	F	T			
UINTAH	12 MI. SE OF VERNAL, MOUTH ASHLEY CREEK	40°15'54"N 109°21'26"W	1934	2	2	1	NO	BREWSTERI	LLOYD, A.C.
	JENSEN (NEAR), ASHLEY CREEK MARSHES	40°22'11"N 109°20'03"W	1937	8			YES	ADASTUS	TWOMEY, A.C.
	MERKLEY PARK, ASHLEY CREEK, 10 MI. N VERNAL	40°31'37"N 109°36'12"W	1949	1			YES	ADASTUS	BEHLE, W.H.
	20 MI. S VERNAL, HORESHOE BEND, GREEN RIVER	40°15'54"N 109°31'01"W	1934		1		NO	UNKNOWN	LLOYD, A.C.
	BRUSH CREEK, 8 MILES NE OF VERNAL	40°33'09"N 109°24'09"W	1949	1			NO	ADASTUS	BELL, I.L.
	HILL CREEK, EAST TAVAPUTS PLATEAU	39°34'37"N 109°44'31"W	1961		1		NO	ADASTUS	WHITE, C.M.
	OURAY NWR	40°08'00"N 109°38'36"W	1962		1		NO	ADASTUS	FOLKS, F.N.
	2 MILES SOUTH OF JENSEN	40°20'48"N 109°21'35"W	1935	4			YES	UNKNOWN	LLOYD, A.C.
	PROVO (3 MILES WEST, UTAH LAKE)	40°14'17"N 111°44'04"W	1937	1			NO	UNKNOWN	TWOMEY
	PROVO	40°14'02"N 111°39'28"W	1872	13	8		NO	UNKNOWN	HIENSHAW
WASATCH	AMERICAN FORK	40°22'37"N 111°47'42"W	1892			1	YES	UNKNOWN	BRADBURY, W.C.
	MIDWAY FISH HATCHERY	40°29'46"N 111°28'07"W	1944	7	4		NO	ADASTUS	BEHLE, W.H.
	STRAWBERRY VALLEY	40°22'37"N 111°09'55"W	1948	1			YES	ADASTUS	UNITT, P.
	2 MILES SOUTH OF ST. GEORGE	37°04'23"N 113°34'52"W	1961		1		YES	EXTIMUS	LLOYD, A.C.
WASHINGTON	2 MILES SOUTH OF ST. GEORGE	37°04'23"N 113°34'52"W	1940	1			NO	EXTIMUS	HIGGINS, H.
	3 MILES SOUTH OF ST. GEORGE	37°04'00"N 113°35'00"W	1940	3	1		NO	EXTIMUS	BEHLE, W.H.
	VIRGIN RIVER, 3 MILES SOUTH OF ST. GEORGE	37°04'00"N 113°35'00"W	1961	1			YES	EXTIMUS	WHITE, C.M.
	TERRY'S RANCH, BEAVER DAM WASH	37°00'00"N 114°00'00"W	1969	1			NO	EXTIMUS	BEHLE, W.H.
	TERRY'S RANCH, BEAVER DAM WASH	37°00'00"N 114°00'00"W	1972		1		NO	EXTIMUS	PERRY, M.L.
	LYTLE RANCH, BEAVER DAM WASH	37°15'01"N 113°58'52"W	1968		1		NO	EXTIMUS	WHITE, C.M.
	ROCKVILLE	37°09'40"N 113°02'15"W	1926		1		NO	EXTIMUS	COTTAM, C.
	SANTA CLARA, 3 MI. SW ST. GEORGE	37°07'59"N 113°39'12"W	1940	6			NO	EXTIMUS	BEHLE, W.H.
	SPRINGDALE	37°11'20"N 113°00'00"W	1932	1			YES	EXTIMUS	WOODBURY, A.M.
	ST. GEORGE	37°06'41"N 113°35'17"W	1926		1		NO	UNKNOWN	COTTAM, C.
WAYNE	HANKSVILLE	38°22'23"N 110°42'48"W	1959	1			NO	UNKNOWN	BROMLEY, S.C.
WEBER	OGDEN	41°13'23"N 111°58'23"W	1872	2	2		YES	UNKNOWN	MERRIAM, C.H./BLISS, W.A.