Neotropical Migratory Bird Monitoring Study at Marine Corps Base Camp Pendleton, California

Final Report: Case Springs Station, 1995-1999

Prepared for:

U.S. Marine Corps Base Camp Pendleton
Assistant Chief of Staff, Environmental Security

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

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By Barbara E. Kus and Peter P. Beck

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Introduction

This report is the final report summarizing the activities of one of three MAPS stations at Marine Corps Base Camp Pendleton. MAPS, or "Monitoring Avian Productivity and Survival", is an international program designed to monitor through capture and banding basic demographic parameters of migratory species, many of which are imperiled regionally and even globally (DeSante et al. 1993). Age- and sex-specific data on annual survival, reproduction, and recruitment can be gathered and compared across stations to identify population trends for species of interest, and can be used to identify factors responsible for trends; in particular, negative trends. In turn, information obtained from long-term monitoring of bird populations can be used to guide management activities intended to maintain or re-establish viable populations throughout the species' ranges.

Two MAPS stations were established at Camp Pendleton in 1995 and operated annually thereafter: one in riparian habitat along De Luz Creek, and the other in an oak woodland near Case Springs in a mountainous region of the Base. A third station was established in 1998 in riparian habitat along the Santa Margarita River west of Ysidora Basin, at the site of the former settling ponds. These stations were established as part of a long-term study of the status of neotropical migratory birds at Camp Pendleton, and are being operated in a manner consistent with other banding stations participating in an effort to monitor birds world-wide. Operation of the Case Springs station was ceased after the 1999 season as a result of consistently low capture rates. The following report summarizes the results from this station.

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Methods

Field Data Collection

Following the standardized MAPS protocol (DeSante et al. 1993), the Case Springs banding station was operated once during every 10-day period between April 1 and August 31, 1995-1999, for a total of 15 days per year. Ten mist-nets were erected at the site in fixed locations (Figure 1). Nets were opened at dawn and run until late morning, typically between 1100 and noon. Nets were not operated during inclement weather (rain, extreme heat or cold), and any netting time missed as a result was compensated for by netting on the next available day, starting at the time the netting ended on the previous day. Nets were checked every 15-30 minutes by observers working circuits. All birds except hummingbirds, game birds (California quail (*Callipepla californica*), doves) and raptors were removed from nets, held in mesh bags labeled with the net number and time of capture, and taken to a central processing location where they were banded with USGS numbered aluminum or steel leg bands. Data recorded for each individual caught included age, sex, breeding condition, weight, wing chord, fat deposition, feather wear, and molt status. After processing, birds were released in the vicinity of the net in

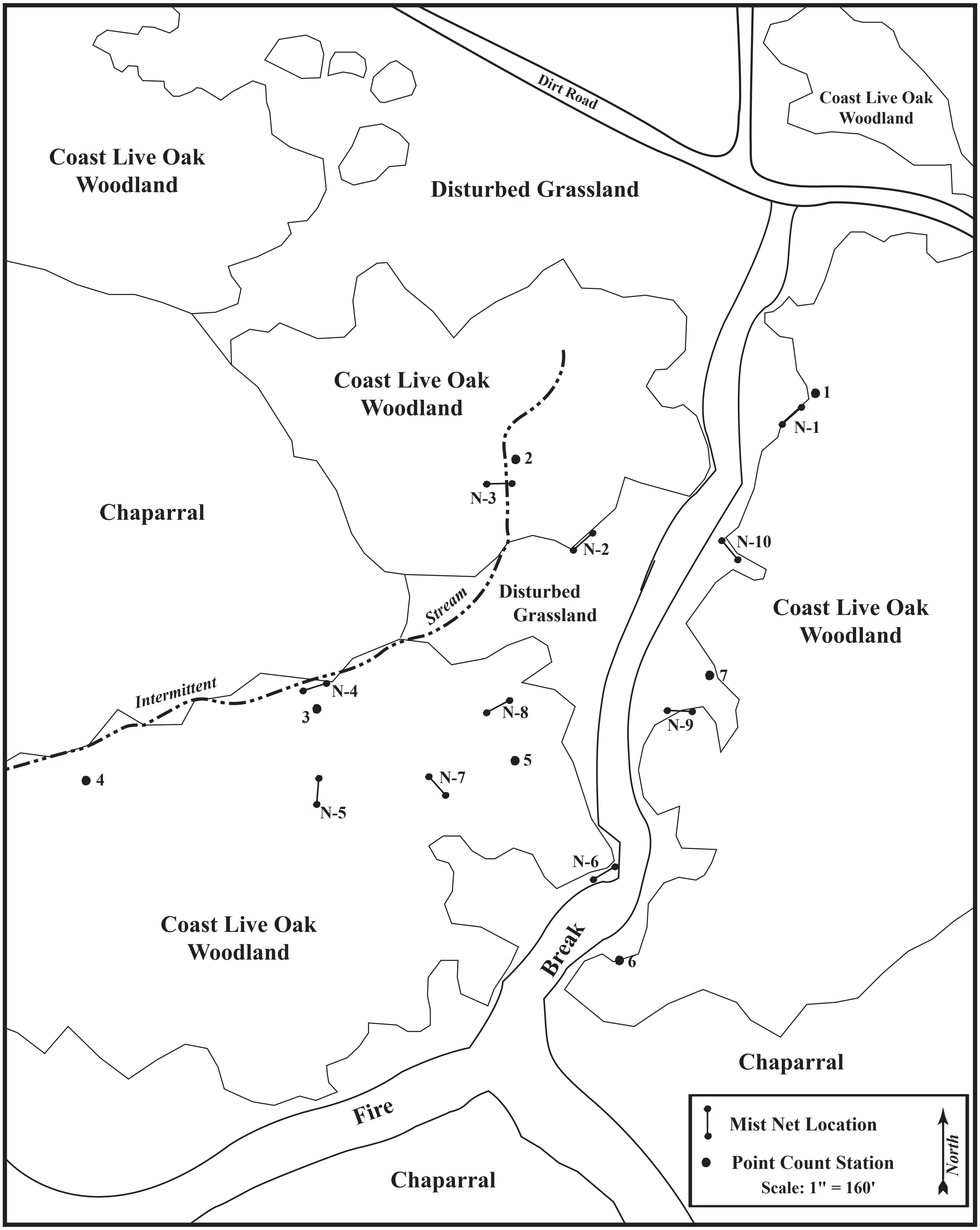


Figure 1. Case Springs MAPS Station, Marine Corps Base Camp Pendleton.

which they had been captured. Hummingbirds, game birds and raptors were not banded, but were identified to species, age, and sex when possible, and released immediately at the capture site. Supplemental lists of all species detected at the site during the operation of the station were compiled at the end of each day. In 1996-1997, 10-minute 50-meter radius bird detection point counts were conducted at seven points dispersed throughout the station (Figure 1), with the counts replicated on four dates spanning four different station operation periods from late April through late May. Typically, two field personnel operated the Case Springs station. Fieldwork was conducted by Peter Beck, Jason Bennett, Michelle Caruana, Deborah Parker-Chapman, Christine Collier, Paul Galvin, Barbara Kus, Karen Schenck, Jennifer Turnbull, and Jeff Wells.

Analyses

Identity of individual birds was established based on unique numbers imprinted on each USGS band applied. Analyses of mist-netting results used either “total captures” (all captures, including multiple captures of individuals) or “individuals captured” (all individuals captured, not counting multiple captures) where appropriate. “Total captures” was used for determining relative capture rates, while “individuals captured” was used for determining population demographics and trends. Generally, non-banded captures (hummingbirds, etc.) were not included among analyses of “individuals captured” because individual identity could not be established without bands; where non-banded captures were included among “individuals captured” (for age and sex proportions), we made the assumption that all of these non-banded captures represented individual birds.

Breeding status for each species detected at the site was determined annually based on the standardized MAPS criteria (DeSante and Burton 1997), and was inferred by the presence of developed breeding characteristics (cloacal protuberance or brood patch) among captured adults, captures of recently fledged juveniles, and/or persistence at the site over the duration of the breeding season (as determined by captures and the supplemental species lists). Within a season, species were classified as “breeders” (assumed to breed at the site), “transients” (not breeding at the site, but known to breed locally outside of the site), or “migrants” (not breeding at the site, and not known to breed locally). Breeding status across all years of the study was based on annual breeding status lists, with species classified as “regular breeders” (assumed to breed at the site in all years of the study), “usual breeders” (assumed to breed in > two years of the study), “occasional breeders” (assumed to breed in ≤ two years of the study), transients, or migrants. For some analyses, usual breeders and occasional breeders are combined as “irregular breeders”, while regular breeders and irregular breeders were combined as “all breeders”.

Results

Overview of Total Captures

Nine hundred and seventy-one total captures of 849 individuals belonging to 54 species were made during 3,788 net-hours in 1995-99 (Table 1; see appendix 1 for A.O.U. codes,

Table 1. Total Captures and Total Individuals Captured, Case Springs, 1995-1999

Species	Year 1995		1996		1997		1998		1999		Total		Years Species Captured
	Captures[a]	Individuals[b]	Captures[a]	Individuals[b]	Captures[a]	Individuals[b]	Captures[a]	Individuals[b]	Captures[a]	Individuals[b]	Captures[a]	Individuals[b,c]	
ACWO	15 (1)	12	5 (0)	5	13 (0)	11	8 (0)	7	3 (0)	3	44 (1)	31	5
ALHU	4 (4)	4	0 (0)	0	1 (1)	1	2 (2)	2	0 (0)	0	7 (7)	7	3
ANHU	15 (15)	15	16 (16)	16	13 (13)	13	16 (16)	16	17 (17)	17	77 (77)	77	5
ATFL	5 (0)	4	2 (0)	2	7 (0)	7	6 (0)	5	5 (0)	5	25 (0)	17	5
AUWA	0 (0)	0	0 (0)	0	0 (0)	0	1 (0)	1	0 (0)	0	1 (0)	1	1
BCHU	0 (0)	0	1 (1)	1	0 (0)	0	0 (0)	0	4 (4)	4	5 (5)	5	2
BCSP	0 (0)	0	0 (0)	0	1 (0)	1	0 (0)	0	0 (0)	0	1 (0)	1	1
BEWR	1 (0)	1	2 (1)	2	2 (0)	2	0 (0)	0	4 (0)	4	9 (1)	9	4
BHGR	12 (0)	11	3 (0)	3	11 (0)	11	12 (0)	12	8 (0)	8	46 (0)	42	5
BTYW	1 (0)	1	0 (0)	0	0 (0)	0	1 (1)	1	1 (0)	1	3 (1)	3	3
BUSH	2 (0)	2	2 (0)	2	5 (0)	5	1 (0)	1	12 (0)	9	22 (0)	19	5
CALT	21 (2)	18	13 (3)	11	15 (0)	13	15 (2)	15	11 (0)	10	75 (7)	55	5
CATH	0 (0)	0	0 (0)	0	0 (0)	0	1 (0)	1	0 (0)	0	1 (0)	1	1
CAVI	0 (0)	0	0 (0)	0	0 (0)	0	1 (0)	1	0 (0)	0	1 (0)	1	1
CHSP	14 (0)	14	2 (0)	2	1 (0)	1	2 (0)	2	1 (0)	1	20 (0)	20	5
COHU	2 (2)	2	3 (3)	3	0 (0)	0	4 (4)	4	3 (3)	3	12 (12)	12	4
COYE	0 (0)	0	0 (0)	0	1 (0)	1	0 (0)	0	1 (0)	1	2 (0)	2	2
DEJU	6 (0)	6	0 (0)	0	2 (0)	2	5 (0)	5	10 (1)	10	23 (1)	23	4
EUST	0 (0)	0	1 (0)	1	0 (0)	0	0 (0)	0	0 (0)	0	1 (0)	1	1
GCSP	0 (0)	0	2 (0)	2	3 (1)	3	1 (0)	1	0 (0)	0	6 (1)	6	3
HAFL	2 (0)	2	0 (0)	0	0 (0)	0	0 (0)	0	0 (0)	0	2 (0)	2	1
HETH	1 (0)	1	0 (0)	0	0 (0)	0	2 (0)	2	0 (0)	0	3 (0)	3	2
HEWA	2 (0)	2	1 (0)	1	0 (0)	0	0 (0)	0	1 (0)	1	4 (0)	4	3
HOFI	0 (0)	0	0 (0)	0	0 (0)	0	1 (0)	1	0 (0)	0	1 (0)	1	1
HOWR	11 (0)	8	9 (0)	9	10 (1)	9	14 (3)	12	18 (0)	14	62 (4)	47	5
HUVI	0 (0)	0	0 (0)	0	1 (0)	1	2 (0)	2	0 (0)	0	3 (0)	3	2
LASP	6 (0)	6	1 (0)	1	2 (0)	2	1 (0)	1	1 (0)	1	11 (0)	11	5
LAZB	9 (0)	9	2 (0)	2	1 (0)	1	0 (0)	0	0 (0)	0	12 (0)	12	3
LEGO	25 (0)	24	24 (0)	24	8 (0)	8	69 (5)	69	20 (0)	20	146 (5)	145	5
MODO	0 (0)	0	0 (0)	0	0 (0)	0	1 (1)	1	0 (0)	0	1 (1)	1	1
NUWO	1 (0)	1	1 (0)	1	1 (0)	1	2 (0)	2	1 (0)	1	6 (0)	6	5
OATI	24 (1)	17	10 (0)	8	24 (0)	18	6 (0)	4	11 (0)	8	75 (1)	46	5
OCWA	3 (0)	3	1 (0)	1	2 (0)	2	1 (0)	1	1 (0)	1	8 (0)	8	5
PHAI	0 (0)	0	1 (0)	1	4 (0)	4	0 (0)	0	0 (0)	0	5 (0)	5	2
PSFL	9 (0)	9	7 (0)	7	12 (0)	12	13 (0)	13	14 (0)	14	55 (0)	55	5
RCSP	3 (0)	3	1 (0)	1	0 (0)	0	0 (0)	0	0 (0)	0	4 (0)	4	2
RSFL	2 (1)	2	1 (0)	1	1 (0)	1	4 (0)	3	5 (0)	4	13 (1)	9	5
RSHA	0 (0)	0	1 (1)	1	0 (0)	0	0 (0)	0	0 (0)	0	1 (1)	1	1
SOSP	0 (0)	0	1 (0)	1	0 (0)	0	0 (0)	0	0 (0)	0	1 (0)	1	1
SPTO	5 (1)	5	4 (1)	4	7 (0)	7	12 (0)	11	7 (0)	6	35 (2)	27	5
SWTH	16 (0)	16	0 (0)	0	0 (0)	0	1 (0)	1	1 (0)	1	18 (0)	18	3
TOWA	3 (0)	3	0 (0)	0	0 (0)	0	1 (0)	1	3 (0)	3	7 (0)	7	3
UNHU	2 (2)	2	2 (2)	2	6 (6)	6	4 (4)	4	0 (0)	0	14 (14)	14	4
VGSW	0 (0)	0	0 (0)	0	1 (0)	1	0 (0)	0	0 (0)	0	1 (0)	1	1
WAVI	1 (0)	1	1 (0)	1	0 (0)	0	0 (0)	0	0 (0)	0	2 (0)	2	2
WBNU	12 (0)	9	5 (0)	4	13 (0)	9	8 (0)	7	2 (0)	2	40 (0)	24	5
WCSP	0 (0)	0	0 (0)	0	2 (0)	2	0 (0)	0	2 (0)	2	4 (0)	4	2
WEBL	4 (0)	4	4 (0)	4	7 (0)	7	3 (0)	2	1 (0)	1	19 (0)	18	5
WESJ	3 (0)	3	3 (0)	3	0 (0)	0	1 (0)	1	0 (0)	0	7 (0)	7	3
WETA	1 (0)	1	3 (0)	3	3 (0)	3	1 (0)	1	0 (0)	0	8 (0)	8	4
WEWP	2 (0)	2	0 (0)	0	1 (0)	1	0 (0)	0	1 (0)	1	4 (0)	4	3
WIFL	0 (0)	0	0 (0)	0	0 (0)	0	0 (0)	0	1 (0)	1	1 (0)	1	1
WIWA	3 (0)	3	0 (0)	0	1 (0)	1	1 (0)	1	2 (0)	2	7 (0)	7	4
WREN	0 (0)	0	1 (0)	1	1 (0)	1	2 (0)	2	2 (0)	2	6 (0)	6	4
YWAR	3 (0)	3	0 (0)	0	0 (0)	0	1 (1)	1	0 (0)	0	4 (1)	4	2
Total	**251 (29)**	**229**	**136 (28)**	**131**	**183 (22)**	**168**	**227 (39)**	**217**	**174 (25)**	**161**	**971 (143)**	**849**	
Species	**36**		**33**		**33**		**37**		**32**		**54**		

[a] Number of birds captured but not banded in parentheses
[b] Non-banded captures treated as unique individuals
[c] May not be additive across years because of multiple captures of individuals across years

common names, and taxonomic species names). Excluding hummingbirds, raptors, and game species (117 captures), 97 percent (828/854) of all captures were banded (new or recaptured); the remainder (26 captures) either escaped prior to banding or were not banded for other reasons. Captures averaged 181.2 (± 40.8) individuals and 34.2 (± 2.2) species per year. The highest number of individuals captured was in 1995 (229), while the lowest number captured was in 1996 (131). The highest number of species captured was in 1998 (37), while the lowest number captured was in 1999 (32). Capture rates of individuals and species at Case Springs were much lower than at the De Luz Creek site (0 = 426.0 ± 18.2 individuals and 39.2 ± 2.7 species per year) during the same period (Kus 1995, 1996; Kus and Beck 1997, 1998, 1999).

The most abundant species at the station was lesser goldfinch (*Carduelis psaltria*; 29 individuals/year), which was almost twice as abundant as the next most common species, Anna's hummingbird (*Calypte anna*; 15.4 captures/year, Figure 2). Although high goldfinch captures in 1998 (69) were partly responsible for the high average capture rate, this was still the most commonly captured species when 1998 data were excluded from calculations (19 individuals/year). Also abundant were California towhee (*Pipilo crissalis*), oak titmouse (*Baeolophus inornatus*), Pacific-slope flycatcher (*Empidonax difficilis*), house wren (*Troglodytes aedon*), black-headed grosbeak (*Pheucticus melanocephalus*), acorn woodpecker (*Melanerpes formicivorus*), spotted towhee (*Pipilo maculates*), and white-breasted nuthatch (*Sitta carolinensis*); together, these ten species comprised 67 percent of individuals captured at the station (excluding unidentified hummingbirds).

The sex ratio of birds of known sex ranged from 48:52 females to males in 1995 to 56:44 females to males in 1998 (Table 2), but in no year did the female to male ratio significantly deviate from the 50:50 sex ratio expected in a wild population (Chi-square goodness-of-fit test: all years $\chi^2 < 2.2$, $p > 0.10$). Age composition fluctuated across years, with the proportion of juvenile birds in the population ranging from a high of 46 percent in1998 to a low of 17 percent in 1999 (Table 3). The high proportion of juveniles in 1998 was mainly a function of high juvenile lesser goldfinch captures (57), and excluding lesser goldfinch resulted in a juvenile capture proportion (26 percent) in 1998 that was similar to other years. Species with the highest captures of juvenile birds included lesser goldfinch, Anna's hummingbird, Pacific-slope flycatcher, California towhee, oak titmouse, and western bluebird (*Sialia mexicana*; Figure 3).

Overall capture rates by net ranged from five (net 2) to 50 (net 4) captures per 100 net-hours, for an overall average capture rate of 26 captures per 100 net-hours (Table 4). This capture rate was less than half the average rate at the De Luz Creek site (67 captures / 100 net hours, 1995–1999; Kus 1995, 1996; Kus and Beck 1997, 1998, 1999) and less than a fifth of that at the Santa Margarita River station (154 captures / 100 net-hours, 1998–1999; Kus and Beck 1998, 1999) during comparable periods. The relatively high capture rate at net 4 (Figure 4) was likely influenced by the persistence of water in the stream adjacent to this net. Water probably attracted birds during drier periods in late summer, as evidenced by peak capture rates in August, particularly of lesser goldfinch (Table 5). Discounting lesser goldfinch captures, captures peaked in May, coinciding with the time of peak movement through the site by migrants.

Figure 2. Mean (+ standard deviation) Individuals Captured by Species, Case Springs, 1995 - 1999

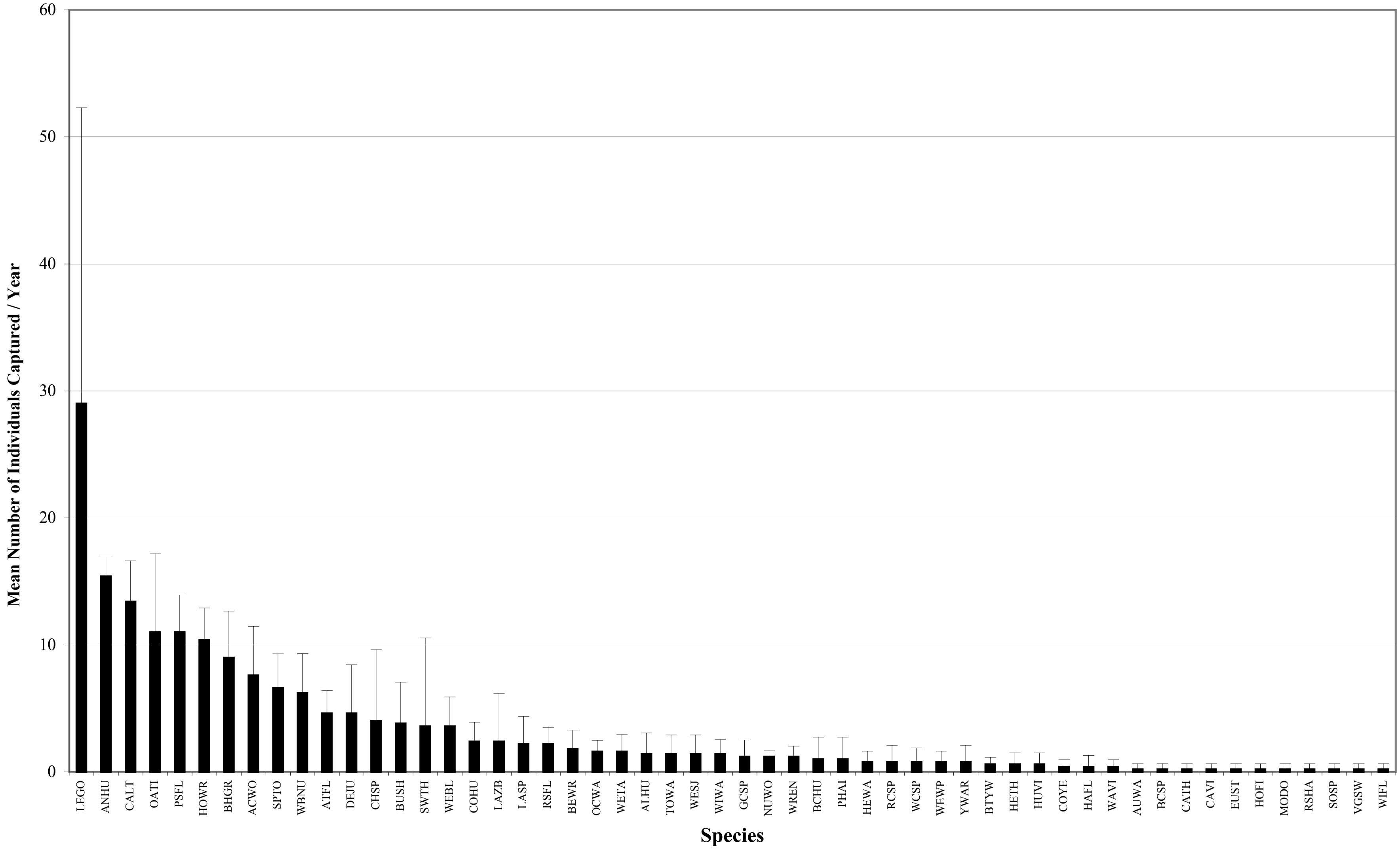


Table 2. Sex of Individuals Captured, Case Springs, 1995-1999

	1995				1996				1997				1998				1999				All Years Combined[b]			
Species[a]	F	M	U	Total	F	M	U	Total	F	M	U	Total	F	M	U	Total	F	M	U	Total	F	M	U	Total
ACWO	2	9	1	12	1	4	0	5	2	9	0	11	2	5	0	7	2	1	0	3	9	21	1	31
ALHU	0	2	2	4	0	0	0	0	0	1	0	1	0	0	2	2	0	0	0	0	0	3	4	7
ANHU	3	5	7	15	9	3	4	16	7	3	3	13	8	3	5	16	9	5	3	17	36	19	22	77
ATFL	3	1	0	4	2	0	0	2	3	0	4	7	0	1	4	5	1	1	3	5	7	1	9	17
AUWA	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1
BCHU	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	4	0	4	0	5	0	5
BCSP	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
BEWR	0	0	1	1	0	0	2	2	1	0	1	2	0	0	0	0	1	0	3	4	2	0	7	9
BHGR	6	5	0	11	0	3	0	3	3	8	0	11	6	6	0	12	5	2	1	8	18	23	1	42
BTYW	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	1	1	1	3
BUSH	0	1	1	2	1	0	1	2	1	1	3	5	1	0	0	1	4	5	0	9	7	7	5	19
CALT	3	6	9	18	2	2	7	11	3	5	5	13	2	6	7	15	0	4	6	10	7	17	31	55
CATH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
CAVI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
CHSP	2	0	12	14	0	0	2	2	0	0	1	1	0	0	2	2	0	1	0	1	2	1	17	20
COHU	0	2	0	2	0	3	0	3	0	0	0	0	0	3	1	4	2	1	0	3	2	9	1	12
COYE	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	2	0	2
DEJU	2	1	3	6	0	0	0	0	1	0	1	2	0	0	5	5	6	1	3	10	9	2	12	23
EUST	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
GCSP	0	0	0	0	0	0	2	2	1	0	2	3	0	0	1	1	0	0	0	0	1	0	5	6
HAFL	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
HETH	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	3	3
HEWA	1	1	0	2	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	3	1	0	4
HOFI	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1
HOWR	2	6	0	8	3	2	4	9	2	4	3	9	3	2	7	12	3	2	9	14	12	12	23	47
HUVI	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	2	0	0	0	0	1	0	2	3
LASP	0	5	1	6	1	0	0	1	1	1	0	2	1	0	0	1	1	0	0	1	4	6	1	11
LAZB	4	4	1	9	0	1	1	2	0	0	1	1	0	0	0	0	0	0	0	0	4	5	3	12
LEGO	15	8	1	24	10	13	1	24	6	2	0	8	34	21	14	69	6	8	6	20	71	52	22	145
MODO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
NUWO	0	1	0	1	0	1	0	1	0	1	0	1	1	1	0	2	1	0	0	1	2	4	0	6
OATI	3	2	12	17	2	0	6	8	2	0	16	18	1	0	3	4	2	0	6	8	6	2	38	46
OCWA	1	1	1	3	0	1	0	1	1	1	0	2	1	0	0	1	1	0	0	1	4	3	1	8
PHAI	0	0	0	0	0	1	0	1	2	2	0	4	0	0	0	0	0	0	0	0	2	3	0	5
PSFL	0	0	9	9	1	1	5	7	2	0	10	12	1	0	12	13	2	0	12	14	6	1	48	55
RCSP	1	2	0	3	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	4
RSFL	1	0	1	2	0	1	0	1	0	1	0	1	2	1	0	3	3	1	0	4	6	3	0	9
RSHA	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
SOSP	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
SPTO	2	3	0	5	2	0	2	4	2	2	3	7	5	5	1	11	2	4	0	6	11	10	6	27
SWTH	0	1	15	16	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	1	17	18
TOWA	0	3	0	3	0	0	0	0	0	0	0	0	0	1	0	1	0	3	0	3	0	7	0	7
UNHU	0	0	2	2	1	0	1	2	1	0	5	6	1	0	3	4	0	0	0	0	3	0	11	14
VGSW	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1
WAVI	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
WBNU	7	0	2	9	2	2	0	4	3	3	3	9	2	3	2	7	2	0	0	2	12	6	6	24
WCSP	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	2	2	0	0	4	4
WEBL	2	1	1	4	1	1	2	4	2	2	3	7	1	1	0	2	0	0	1	1	6	5	7	18
WESJ	1	0	2	3	1	0	2	3	0	0	0	0	1	0	0	1	0	0	0	0	3	0	4	7
WETA	0	1	0	1	1	2	0	3	2	1	0	3	1	0	0	1	0	0	0	0	4	4	0	8
WEWP	2	0	0	2	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	1	3	0	1	4
WIFL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
WIWA	1	2	0	3	0	0	0	0	0	1	0	1	1	0	0	1	1	1	0	2	3	4	0	7
WREN	0	0	0	0	0	0	1	1	0	0	1	1	0	0	2	2	0	0	2	2	0	0	6	6
YWAR	2	1	0	3	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	1	1	4
Total	**67**	**74**	**88**	**229**	**42**	**43**	**46**	**131**	**50**	**49**	**69**	**168**	**77**	**60**	**80**	**217**	**55**	**46**	**60**	**161**	**273**	**245**	**331**	**849**

[a] Non-banded captures treated as unique individuals

[b] Not additive across years because of multiple captures of particular individuals; for individuals initially banded as juveniles and recaptured in subsequent years, sex at maturity given

Table 3. Age of Individuals Captured, Case Springs, 1995-1999

	1995				1996				1997				1998				1999						
	Age[b]				Age[b]				Age[b]				Age[b]				Age[b]				Number of Years Juveniles Captured	Total Juveniles Captured	Number of Juveniles Recaptured as Adults
Species[a]	A	H	U	Total	A	H	U	Total	A	H	U	Total	A	H	U	Total	A	H	U	Total			
ACWO	8	1	3	12	5	0	0	5	5	0	6	11	7	0	0	7	3	0	0	3	1	1	0
ALHU	1	1	2	4	0	0	0	0	1	0	0	1	0	2	0	2	0	0	0	0	2	3	0
ANHU	1	10	4	15	7	4	5	16	6	2	5	13	7	7	2	16	11	5	1	17	5	28	0
ATFL	4	0	0	4	2	0	0	2	5	2	0	7	5	0	0	5	5	0	0	5	1	2	1
AUWA	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
BCHU	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	2	2	0	4	1	2	0
BCSP	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	1	0
BEWR	1	0	0	1	1	1	0	2	1	0	1	2	0	0	0	0	2	1	1	4	2	2	0
BHGR	10	1	0	11	3	0	0	3	11	0	0	11	12	0	0	12	7	1	0	8	2	2	0
BTYW	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	0	0
BUSH	1	0	1	2	1	0	1	2	1	3	1	5	1	0	0	1	8	0	1	9	1	3	0
CALT	11	7	0	18	4	4	3	11	9	3	1	13	11	3	1	15	9	0	1	10	4	17	2
CATH	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0
CAVI	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
CHSP	12	2	0	14	1	1	0	2	1	0	0	1	1	1	0	2	1	0	0	1	3	4	0
COHU	0	2	0	2	1	2	0	3	0	0	0	0	0	3	1	4	3	0	0	3	3	7	0
COYE	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0
DEJU	6	0	0	6	0	0	0	0	2	0	0	2	5	0	0	5	10	0	0	10	0	0	0
EUST	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GCSP	0	0	0	0	2	0	0	2	3	0	0	3	1	0	0	1	0	0	0	0	0	0	0
HAFL	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HETH	1	0	0	1	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0
HEWA	2	0	0	2	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0
HOFI	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
HOWR	8	0	0	8	6	2	1	9	7	0	2	9	7	2	3	12	10	4	0	14	3	8	0
HUVI	0	0	0	0	0	0	0	0	1	0	0	1	2	0	0	2	0	0	0	0	0	0	0
LASP	6	0	0	6	1	0	0	1	2	0	0	2	1	0	0	1	1	0	0	1	0	0	0
LAZB	8	1	0	9	1	1	0	2	0	1	0	1	0	0	0	0	0	0	0	0	3	3	0
LEGO	12	11	1	24	22	2	0	24	8	0	0	8	7	57	5	69	13	4	3	20	4	74	0
MODO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
NUWO	0	0	1	1	0	0	1	1	1	0	0	1	2	0	0	2	1	0	0	1	0	0	0
OATI	7	4	6	17	4	4	0	8	5	6	7	18	3	1	0	4	3	2	3	8	5	17	2
OCWA	3	0	0	3	1	0	0	1	2	0	0	2	1	0	0	1	1	0	0	1	0	0	0
PHAI	0	0	0	0	1	0	0	1	4	0	0	4	0	0	0	0	0	0	0	0	0	0	0
PSFL	6	3	0	9	5	2	0	7	7	5	0	12	4	9	0	13	10	4	0	14	5	23	0
RCSP	3	0	0	3	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
RSFL	1	0	1	2	1	0	0	1	1	0	0	1	3	0	0	3	4	0	0	4	0	0	0
RSHA	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SOSP	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SPTO	5	0	0	5	2	2	0	4	4	3	0	7	10	1	0	11	6	0	0	6	3	6	0
SWTH	16	0	0	16	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	0
TOWA	3	0	0	3	0	0	0	0	0	0	0	0	1	0	0	1	3	0	0	3	0	0	0
UNHU	0	0	2	2	0	0	2	2	1	0	5	6	1	1	2	4	0	0	0	0	1	1	0
VGSW	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
WAVI	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WBNU	6	2	1	9	3	1	0	4	5	3	1	9	5	2	0	7	2	0	0	2	4	8	1
WCSP	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	2	0	0	2	0	0	0
WEBL	1	3	0	4	2	2	0	4	1	6	0	7	1	1	0	2	0	1	0	1	5	13	0
WESJ	2	1	0	3	3	0	0	3	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0
WETA	1	0	0	1	3	0	0	3	2	1	0	3	1	0	0	1	0	0	0	0	1	1	0
WEWP	2	0	0	2	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0
WIFL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
WIWA	3	0	0	3	0	0	0	0	1	0	0	1	1	0	0	1	2	0	0	2	0	0	0
WREN	0	0	0	0	0	0	1	1	0	0	1	1	0	0	2	2	2	0	0	2	0	0	0
YWAR	3	0	0	3	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0
Total	157	49	23	229	88	29	14	131	102	36	30	168	107	92	18	217	126	25	10	161		231	6
Species with Juveniles	14				14				12				14				10					26	4

[a] Non-banded captures treated as unique individuals

[b] Age Key: A = After-hatching year (adult), H = Hatching year (juvenile), U = Unknown age

Figure 3. Mean (+ standard deviation) Number of Adults and Juveniles Captured by Species, Case Springs, 1995 - 1999

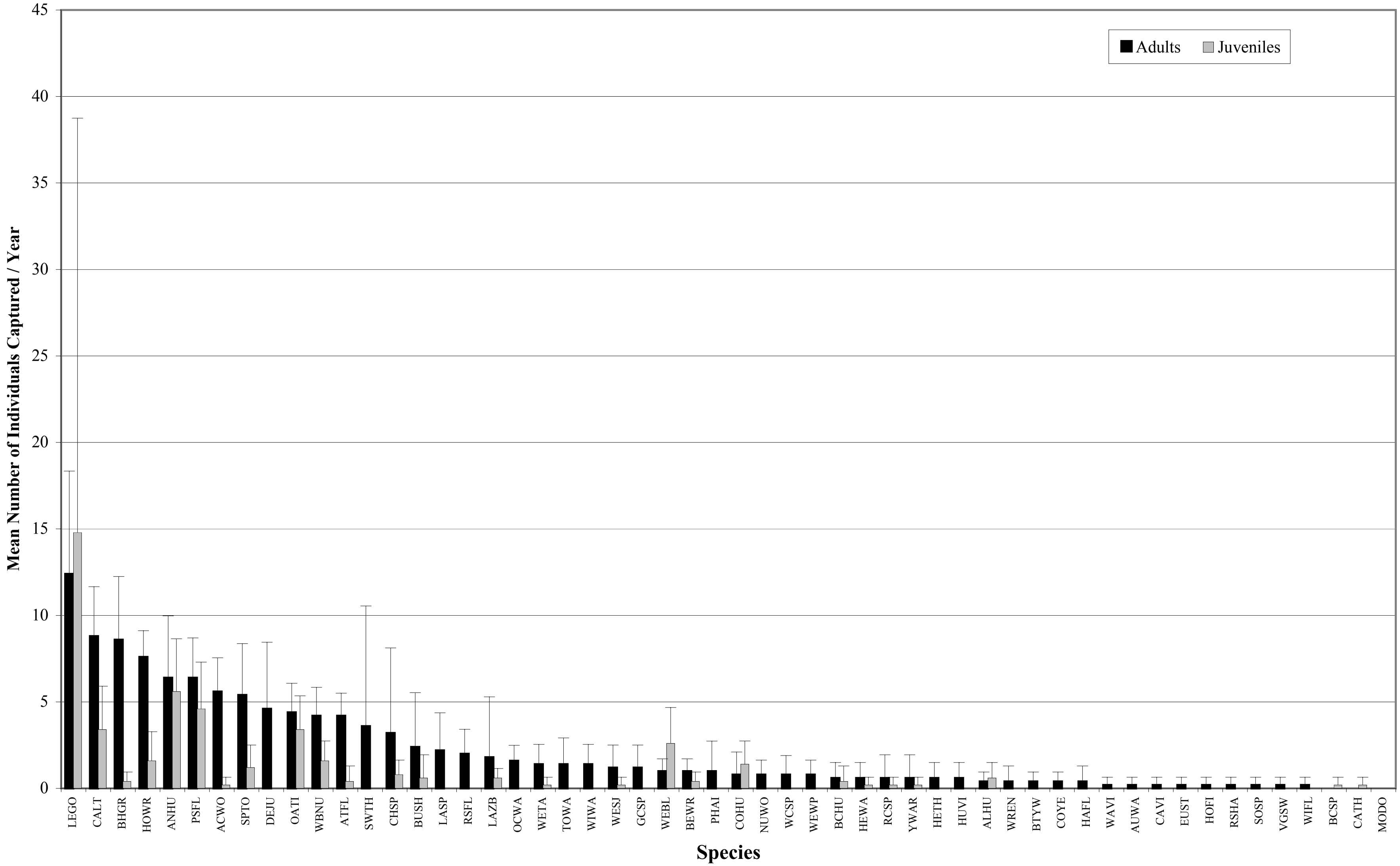


Table 4. Total Captures, Net Hours, and Capture Rates by Net and Period, Case Springs, 1995-1999

Period Date Range	Variable	Net 1	2	3	4	5	6	7	8	9	10	Total
April 1	Net Hours	20:07	20:06	14:41	14:41	18:29	18:52	18:24	18:40	19:17	20:05	183:22
to	Captures	4	1	0	2	1	5	2	6	0	0	21
April 10[a]	Captures/100 Net Hours	20.00	5.00	0.00	14.00	5.00	27.00	11.00	32.00	0.00	0.00	11.00
April 11	Net Hours	25:20	26:10	26:11	26:00	26:00	26:12	25:42	26:15	24:10	25:50	257:50
to	Captures	2	0	5	8	4	13	10	12	6	2	62
April 20	Captures/100 Net Hours	8.00	0.00	19.00	31.00	15.00	50.00	39.00	46.00	25.00	8.00	24.00
April 21	Net Hours	28:15	28:05	27:40	28:00	28:15	28:22	28:38	28:21	27:52	28:18	281:46
to	Captures	2	2	5	5	2	10	7	8	3	1	45
April 30	Captures/100 Net Hours	7.00	7.00	18.00	18.00	7.00	35.00	24.00	28.00	11.00	4.00	16.00
May 1	Net Hours	27:08	26:39	27:00	26:50	26:58	27:52	27:31	27:20	27:22	26:46	271:26
to	Captures	6	1	3	1	3	12	10	12	4	2	54
May 10	Captures/100 Net Hours	22.00	4.00	11.00	4.00	11.00	43.00	36.00	44.00	15.00	7.00	20.00
May 11	Net Hours	16:45	23:05	25:10	24:55	24:45	15:40	24:33	24:04	24:10	24:00	227:07
to	Captures	13	5	7	4	7	11	7	8	8	9	79
May 20	Captures/100 Net Hours	78.00	22.00	28.00	16.00	28.00	70.00	29.00	33.00	33.00	38.00	35.00
May 21	Net Hours	29:56	29:35	29:50	29:20	29:50	24:00	29:56	29:54	30:25	29:53	292:39
to	Captures	14	1	7	1	5	4	5	14	9	5	65
May 30	Captures/100 Net Hours	47.00	3.00	23.00	3.00	17.00	17.00	17.00	47.00	30.00	17.00	22.00
May 31	Net Hours	27:32	26:53	27:41	27:35	27:39	27:24	27:24	27:30	27:21	27:19	274:18
to	Captures	15	3	11	9	5	7	5	9	7	3	74
June 9	Captures/100 Net Hours	54.00	11.00	40.00	33.00	18.00	26.00	18.00	33.00	26.00	11.00	27.00
June 10	Net Hours	26:30	26:43	27:06	26:56	26:56	26:38	27:10	26:56	26:41	25:31	267:07
to	Captures	9	1	4	11	8	4	10	6	3	7	63
June 19	Captures/100 Net Hours	34.00	4.00	15.00	41.00	30.00	15.00	37.00	22.00	11.00	27.00	24.00
June 20	Net Hours	25:25	27:20	26:45	26:25	26:50	17:35	26:40	26:55	27:15	26:20	257:30
to	Captures	3	0	6	9	8	2	8	10	2	2	50
June 29	Captures/100 Net Hours	12.00	0.00	22.00	34.00	30.00	11.00	30.00	37.00	7.00	8.00	19.00
June 30	Net Hours	27:30	27:35	27:34	27:18	27:22	26:30	27:40	27:25	27:45	28:35	275:14
to	Captures	8	1	5	7	0	11	3	5	6	7	53
July 9	Captures/100 Net Hours	29.00	4.00	18.00	26.00	0.00	42.00	11.00	18.00	22.00	24.00	19.00
July 10	Net Hours	24:51	25:40	25:25	25:20	25:25	20:40	25:33	25:43	25:32	25:25	249:34
to	Captures	5	1	8	9	2	13	5	4	3	3	53
July 19	Captures/100 Net Hours	20.00	4.00	31.00	36.00	8.00	63.00	20.00	16.00	12.00	12.00	21.00
July 20	Net Hours	23:05	19:40	24:28	24:30	24:50	18:12	24:15	23:55	23:40	21:50	228:25
to	Captures	8	0	3	13	6	5	7	6	9	2	59
July 29	Captures/100 Net Hours	35.00	0.00	12.00	53.00	24.00	27.00	29.00	25.00	38.00	9.00	26.00
July 30	Net Hours	22:55	21:30	24:20	24:20	23:55	21:25	24:02	23:45	21:45	23:58	231:55
to	Captures	8	0	3	19	2	2	18	6	0	3	61
August 8	Captures/100 Net Hours	35.00	0.00	12.00	78.00	8.00	9.00	75.00	25.00	0.00	13.00	26.00
August 9	Net Hours	24:00	22:17	23:45	23:55	24:05	19:25	23:31	23:55	23:19	23:34	231:46
to	Captures	14	4	13	17	6	3	11	5	3	4	80
August 18	Captures/100 Net Hours	58.00	18.00	55.00	71.00	25.00	15.00	47.00	21.00	13.00	17.00	35.00
August 19	Net Hours	23:10	18:57	23:45	22:45	22:58	22:28	22:46	23:13	23:18	23:12	226:32
to	Captures	18	0	10	71	0	4	7	12	2	3	127
August 28	Captures/100 Net Hours	78.00	0.00	42.00	312.00	0.00	18.00	31.00	52.00	9.00	13.00	56.00
August 29	Net Hours	4:30	0:00	4:35	3:35	3:25	3:40	3:30	3:40	0:00	4:25	31:20
to	Captures	6	0	5	5	4	1	2	2	0	0	25
August 31[b]	Captures/100 Net Hours	133.00	0.00	109.00	140.00	117.00	27.00	57.00	55.00	0.00	0.00	80.00
Net Totals	Net Hours	376:59	370:15	385:56	382:25	387:42	344:55	387:15	387:31	379:52	385:01	3787:51
	Captures	135	20	95	191	63	107	117	125	65	53	971
	Captures/100 Net Hours	36.00	5.00	25.00	50.00	16.00	31.00	30.00	32.00	17.00	14.00	26.00

[a] Not operated during this period in 1999 due to lack of access

[b] Operated during this period only in 1995

Figure 4. Mean (+ standard deviation) Captures, Net Hours, and Capture Rate per Net, Case Springs, 1995-1999

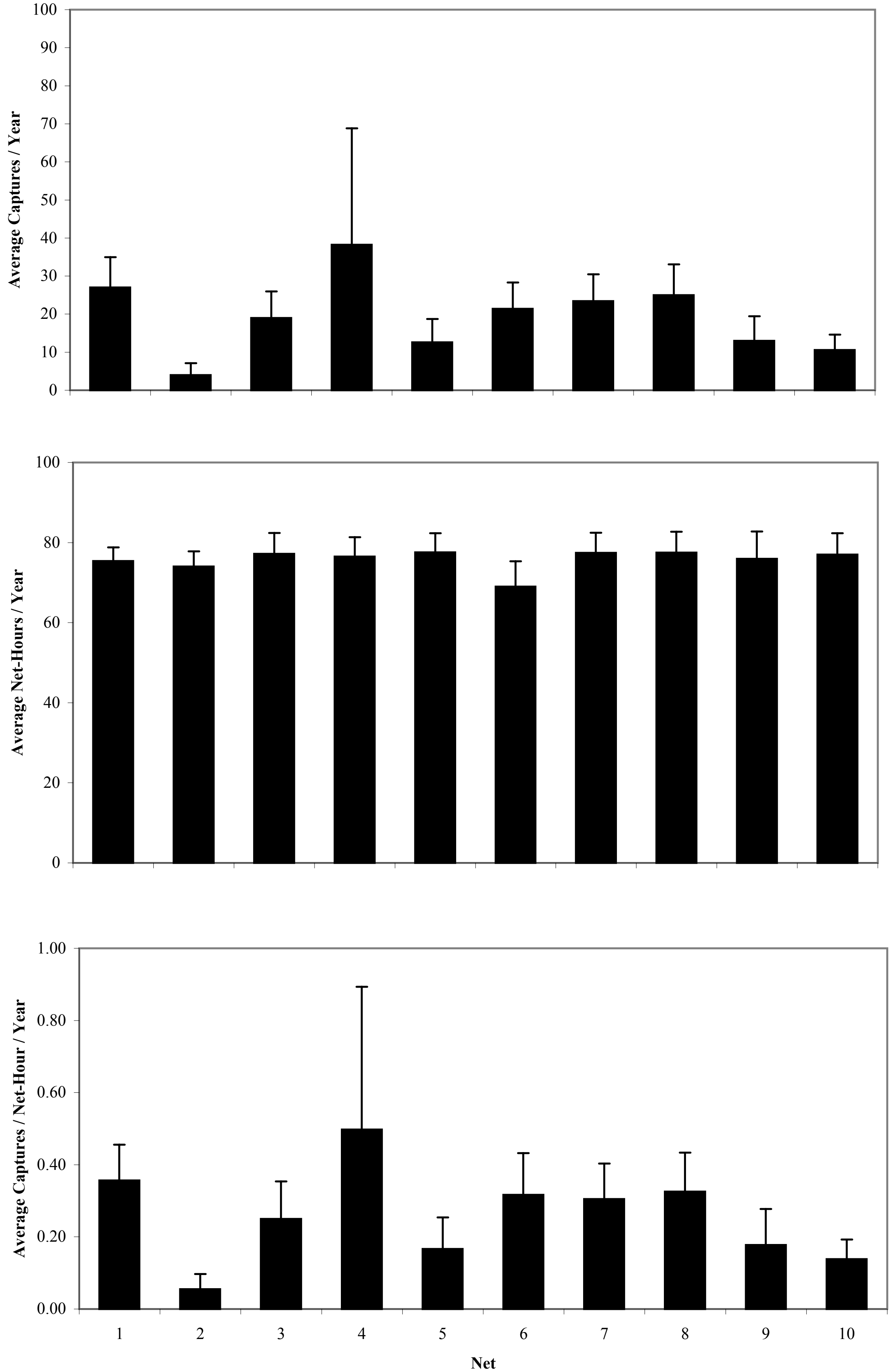


Table 5. Distribution of Captures per Month, Case Springs, 1995-1999

Species	Captures / Month					
	April	May	June	July	August	Total
ACWO	13	8	2	11	10	44
ALHU	0	0	0	4	3	7
ANHU	9	19	27	15	7	77
ATFL	0	9	10	6	0	25
AUWA	1	0	0	0	0	1
BCHU	0	0	2	3	0	5
BCSP	0	0	0	0	1	1
BEWR	1	1	3	2	2	9
BHGR	4	16	14	11	1	46
BTYW	1	0	0	0	2	3
BUSH	0	3	6	5	8	22
CALT	13	15	11	17	19	75
CATH	0	1	0	0	0	1
CAVI	1	0	0	0	0	1
CHSP	1	1	0	6	12	20
COHU	0	1	4	4	3	12
COYE	0	1	1	0	0	2
DEJU	21	2	0	0	0	23
EUST	1	0	0	0	0	1
GCSP	5	1	0	0	0	6
HAFL	0	2	0	0	0	2
HETH	3	0	0	0	0	3
HEWA	0	3	0	0	1	4
HOFI	0	1	0	0	0	1
HOWR	8	23	17	11	3	62
HUVI	1	1	1	0	0	3
LASP	4	2	5	0	0	11
LAZB	0	1	3	5	3	12
LEGO	2	6	17	31	90	146
MODO	0	0	0	0	1	1
NUWO	1	1	1	2	1	6
OATI	8	12	14	21	20	75
OCWA	2	1	1	1	3	8
PHAI	0	0	2	1	2	5
PSFL	0	12	3	15	25	55
RCSP	2	0	0	0	2	4
RSFL	5	3	3	0	2	13
RSHA	0	0	1	0	0	1
SOSP	0	0	1	0	0	1
SPTO	3	6	13	5	8	35
SWTH	0	18	0	0	0	18
TOWA	4	3	0	0	0	7
UNHU	2	1	5	3	3	14
VGSW	0	1	0	0	0	1
WAVI	0	1	0	0	1	2
WBNU	6	7	15	4	8	40
WCSP	4	0	0	0	0	4
WEBL	0	3	1	10	5	19
WESJ	1	0	2	0	4	7
WETA	0	1	0	1	6	8
WEWP	0	1	2	0	1	4
WIFL	0	1	0	0	0	1
WIWA	0	6	0	0	1	7
WREN	1	0	0	2	3	6
YWAR	0	3	0	0	1	4
Total Captures	**128**	**198**	**187**	**196**	**262**	**971**
Total Species	**28**	**38**	**28**	**24**	**33**	**54**

Lists of species detected at the site during operating days and point counts conducted at the site in 1996 and 1997 were combined to produce a comparative "non-capture" list of species at the site to test the effectiveness of using mist-net captures to adequately sample the local bird community (Table 6). Of the nineteen species considered to be regular breeders at the site, sixteen were captured in all five years, two were captured in four years, and one was captured in three of the five years the station operated. All nineteen of these species were detected on the bird list in all four years this list was compiled, and in both of the years point counts were conducted. Birds that were considered to usually or occasionally breed at the site (ten species) were captured less consistently than regular breeders, and not necessarily in the years in which they were considered to have bred at the site. Two species considered usual local breeders based on regular detection on bird lists (California quail and common raven (*Corvus corax*)) were never captured in the nets.

Twenty-six neotropical migrant species were detected at the site, including five species (ash-throated flycatcher (*Myiarchus cinerascens*), black-chinned sparrow (*Spizella atrogularis*), black-headed grosbeak, lazuli bunting (*Passerina amoena*), and Pacific-slope flycatcher) that were considered to be regular or occasional breeders at the site (Table 6). All five breeding neotropical migrant species were captured in at least one year, while fifteen out of twenty-one non-breeding neotropical migrant species were captured at least once.

Between 1996 and 1999, a cumulative total of eighty-two species were detected at the site by combining capture and non-capture detections (Table 7). Sixty-six percent (54/82) of all species detected were captured in at least one year, while ninety-four percent (77/82) of all species were either detected on bird lists or point counts. Twenty-eight species (34 percent) were detected and listed on bird lists or point counts but not captured by the mist-nets, while five species (six percent) were caught in mist-nets but never detected otherwise during operation of the station. This indicates that neither capture nor non-capture methods were completely adequate to describe the total bird community using the site during the breeding season, although regular breeders were likely to be captured on an annual basis. Most species (31/33, 94 percent) that were detected by either, but not both, capture and non-capture methods were non-breeders, and were temporally limited at the site.

Population Trends, Productivity, Survivorship, and Recruitment: 1995 - 1999

Population trends and demographics for species are inferred from captured individuals. Various factors affect capture rates for each species, such as habitat preference, nesting and foraging height preferences, territorial behavior, natal and breeding site fidelity, and other behavioral factors intrinsic to each species. Apparent population size, productivity, survival, and recruitment rates are all affected by capture rates: as captures per species decline, the likelihood that captures accurately represent species' population parameters declines. Capture and recapture numbers at the Case Springs MAPS site were consistently low for most species, limiting the ability to determine population parameters for any given species. With low sample sizes for individual species, we grouped all species to show trends within the total bird community at the site, grouping species according to breeding status where appropriate.

Table 6. Annual Breeding Status of Species Detected and Method of Detection, Case Springs, 1995-1999

Species	Breeding Status at Site[a]						Method of Detection[b]					
	1995	1996	1997	1998	1999	Cumulative[c]	1995[d]	1996	1997	1998	1999	Cumulative
ACWO	B	B	B	B	B	B	C	C+N	C+N	C+N	C+N	C+N
ALHU[e]	M	-	T	M	-	M	C	-	C	C	-	C
AMGO	-	T	-	-	T	T	-	N	-	-	N	N
AMKE	-	T	T	-	-	T	-	N	N	-	-	N
ANHU	B	B	B	B	B	B	C	C+N	C+N	C+N	C+N	C+N
ATFL[e]	B	B	B	B	B	B	C	C+N	C+N	C+N	C+N	C+N
AUWA	-	M	M	M	-	M	-	N	N	C+N	-	C+N
BCHU[e]	-	T	T	T	T	T	-	C	N	N	C	C+N
BCSP[e]	-	L	T	-	L	O	-	N	C	-	N	C+N
BEWR	B	B	B	B	B	B	C	C+N	C+N	N	C+N	C+N
BGGN	-	T	T	-	M	T	-	N	N	-	N	N
BHCO	-	T	-	-	-	T	-	N	-	-	-	N
BHGR[e]	B	B	B	B	B	B	C	C+N	C+N	C+N	C+N	C+N
BLGR[e]	-	T	T	-	T	T	-	N	N	-	N	N
BTPI	-	T	T	T	T	T	-	N	N	N	N	N
BTYW[e]	M	M	M	M	M	M	C	N	N	C+N	C	C+N
BUOR[e]	-	T	-	T	T	T	-	N	-	N	N	N
BUSH	B	B	B	B	B	B	C	C+N	C+N	C+N	C+N	C+N
CALT	B	B	B	B	B	B	C	C+N	C+N	C+N	C+N	C+N
CAQU	-	L	L	L	L	U	-	N	N	N	N	N
CATH	-	L	L	B	L	U	-	N	N	C+N	N	C+N
CAVI[e]	-	-	-	M	M	T	-	-	-	C+N	N	C+N
CEDW	-	-	-	M	-	M	-	-	-	N	-	N
CHSP	T	T	T	T	T	T	C	C+N	C	C	C	C+N
CLSW[e]	-	T	T	T	T	T	-	N	N	N	N	N
COHA	-	T	T	T	-	T	-	N	N	N	-	N
COHU	B	B	L	L	L	B	C	C+N	N	C+N	C+N	C+N
CORA	-	L	L	L	L	U	-	N	N	N	N	N
COYE	-	-	T	-	T	T	-	-	C+N	-	C	C+N
DEJU	M	M	M	M	M	M	C	N	C+N	C+N	C+N	C+N
DOWO	-	-	-	T	-	T	-	-	-	N	-	N
EUST	-	T	T	T	T	T	-	C	N	N	N	C+N
GCSP	-	M	M	M	-	M	-	C+N	C+N	C	-	C+N
GOEA	-	T	T	-	-	T	-	N	N	-	-	N
HAFL[e]	M	-	-	-	-	M	C	-	-	-	-	C
HETH	M	-	-	M	-	M	C	-	-	C+N	-	C+N
HEWA[e]	M	M	-	M	M	M	C	C+N	-	N	C+N	C+N
HOFI	-	L	T	T	B	O	-	N	N	C+N	N	C+N
HOLA	-	-	T	-	-	T	-	-	N	-	-	N
HOWR	B	B	B	B	B	B	C	C+N	C+N	C+N	C+N	C+N
HUVI	-	B	B	B	B	U	-	N	C+N	C+N	N	C+N
LAGO	-	T	-	-	-	T	-	N	-	-	-	N
LASP	L	B	B	B	B	B	C	C+N	C+N	C+N	C+N	C+N
LAZB[e]	L	L	T	T	T	O	C	C+N	C	N	N	C+N
LEGO	B	B	B	B	B	B	C	C+N	C+N	C+N	C+N	C+N
MODO	-	B	L	B	B	U	-	N	N	C+N	N	C+N
MOQU	-	-	T	-	T	T	-	-	N	-	N	N
NAWA[e]	-	M	-	-	-	M	-	N	-	-	-	N
NUWO	B	B	B	B	B	B	C	C+N	C+N	C+N	C+N	C+N
OATI	B	B	B	B	B	B	C	C+N	C+N	C+N	C+N	C+N
OCWA	T	T	T	T	T	T	C	C+N	C+N	C+N	C+N	C+N
PHAI	-	L	L	L	T	U	-	C+N	C+N	N	N	C+N
PSFL[e]	B	L	L	L	B	B	C	C+N	C+N	C+N	C+N	C+N
PUFI	-	-	-	T	-	T	-	-	-	N	-	N
RCKI	-	-	M	M	M	M	-	-	N	N	N	N
RCSP	T	T	T	-	-	T	C	C+N	N	-	-	C+N
RSFL	B	L	L	B	B	B	C	C+N	C+N	C+N	C+N	C+N
RSHA	-	T	T	T	T	T	-	C	N	N	N	C+N

Table 6 (continued). Annual Breeding Status of Species Detected and Method of Detection, Case Springs, 1995-1999

	Breeding Status at Site[a]						Method of Detection[b]					
Species	1995	1996	1997	1998	1999	Cumulative[c]	1995[d]	1996	1997	1998	1999	Cumulative
RTHA	-	T	T	T	T	T	-	N	N	N	N	N
RUHU[e]	-	-	-	M	-	M	-	-	-	N	-	N
RWBL	-	T	-	-	-	T	-	N	-	-	-	N
SOSP	-	T	-	-	-	T	-	C+N	-	-	-	C+N
SPOW	-	-	T	-	-	T	-	-	N	-	-	N
SPTO	B	B	B	B	B	B	C	C+N	C+N	C+N	C+N	C+N
SWTH[e]	T	-	-	T	T	T	C	-	-	C	C	C
TOWA[e]	M	M	-	M	M	M	C	N	-	C+N	C+N	C+N
TUVU	-	T	-	T	T	T	-	N	-	N	N	N
VGSW[e]	-	-	T	-	T	T	-	-	C+N	-	N	C+N
WAVI[e]	T	T	M	M	-	T	C	C+N	N	N	-	C+N
WBNU	B	B	B	B	B	B	C	C+N	C+N	C+N	C+N	C+N
WCSP	-	-	M	M	M	M	-	-	C+N	N	C	C+N
WEBL	B	B	L	B	B	B	C	C+N	C+N	C+N	C+N	C+N
WEKI[e]	-	-	-	-	T	T	-	-	-	-	N	N
WESJ	B	B	B	B	B	B	C	C+N	N	C+N	N	C+N
WETA[e]	T	T	T	T	-	T	C	C+N	C+N	C+N	-	C+N
WEWP[e]	T	T	T	T	T	T	C	N	C+N	N	C+N	C+N
WIFL[e]	-	-	-	-	T	T	-	-	-	-	C	C
WIWA[e]	T	T	T	T	T	T	C	N	C+N	C+N	C+N	C+N
WREN	-	B	B	B	B	U	-	C+N	C+N	C+N	C+N	C+N
WTKI	-	-	-	-	T	T	-	-	-	-	N	N
WTSW	-	T	-	T	T	T	-	N	-	N	N	N
YWAR[e]	T	-		T	-	T	C	-		C	-	C

[a] M = Migrant; T = Transient (breeds locally, but not at site); L = Likely Breeder; B = Definite Breeder

[b] C = Captured only; N = Not captured, detected on Bird List and/or Point Count only; C+N = Both captured and detected on Bird list and/or Point Count

[c] M = Migrant; T = Transient (breeds locally, but not at site); O = Occasional Breeder (breeder ≤ two years); U = Usual Breeder (breeder > two years); B = Regular Breeder

[d] No Bird List or Point Count conducted this year

[e] Neotropical Migrant

Table 7. Summary of Species Detected by Breeding Status and Method of Detection, Case Springs, 1995-1999

Breeding Status	Detection Method[a]	Number of Species					
		1995[b]	1996	1997	1998	1999	Cumulative[c]
Regular Breeder	C	19	0	0	0	0	0
	N	NA	1	1	1	2	0
	C+N	NA	18	18	18	17	19
	Total	19	19	19	19	19	19
Usual Breeder	C	0	0	0	0	0	0
	N	NA	5	4	3	6	2
	C+N	NA	2	3	4	1	5
	Total	0	7	7	7	7	7
Occasional Breeder	C	1	0	2	0	0	0
	N	NA	2	1	1	3	0
	C+N	NA	1	0	1	0	3
	Total	1	3	3	2	3	3
Transient	C	9	3	1	3	5	3
	N	NA	17	16	14	16	22
	C+N	NA	6	6	4	3	14
	Total	9	26	23	21	24	39
Migrant	C	7	0	1	2	2	2
	N	NA	5	3	5	1	4
	C+N	NA	2	3	5	3	8
	Total	7	7	7	12	6	14
Total	C	36	3	4	5	7	5
	N	NA	30	25	24	28	28
	C+N	NA	29	30	32	24	49
Total Captured Species[d]		**36**	**32**	**34**	**37**	**31**	**54**
Total Non-Captured Species[e]		**NA**	**59**	**55**	**56**	**52**	**77**
Total Detected Species		**36**	**62**	**59**	**61**	**59**	**82**

[a] C = Captured only; N = Not captured, detected on Bird List and/or Point Count only;
C+N = Both captured and detected on Bird List and/or Point Count

[b] No Bird List or Point Count conducted this year

[c] Not additive across years

[d] All species captured, regardless of detection using non-capture methods (= "C" + "C+N")

[e] All species detected using non-capture methods, regardless of capture (= "N" + "C+N")

Total Population Size

The number of individuals captured each year, an index of population size, fluctuated annually at the site, peaking in 1995 and 1998 (Figure 5a), and generally reflected the number of total captures. Newly banded individuals, recaptured individuals, and unbanded captures all appeared to follow trends similar to that of total individuals, although average recaptures were relatively low (8 percent of total). Juveniles and adult captures appeared to follow similar trends, except in 1998 when juveniles made up a relatively large proportion of all individuals captured (Figure 5b). As mentioned earlier, this peak in 1998 was the result of a large number of juvenile lesser goldfinch captured late in the season.

The nineteen regular breeding species (see Table 6) at the site accounted for 74 percent of all individual adults captured on an average annual basis, and generally reflected the overall capture trends (Figure 6a). Migrants and other transients (27 species captured) followed similar adult capture trends, and accounted for 23 percent of all individual adults captured. Irregular breeders (usual plus occasional breeding species, 8 species captured) remained consistently low, and accounted for only three percent of all individuals captured.

Adult Population Size

Appropriate assessment of population trends requires focusing on the species most likely to reflect local conditions at the site. To do this we excluded migrants, transients, and other unpredictable species (such as lesser goldfinch) from our analysis and separated adults from juveniles to distinguish between the breeding population and breeding productivity. Adult lesser goldfinch captures did not reflect the general trend among other breeders (Figure 6b), and their exclusion from the group of breeding species did not affect the apparent trend existing in this group. The trend among adult breeders, excluding lesser goldfinch, showed a capture peak in 1995 followed by a relatively large decline in 1996, and a gradual increase in individuals captured from 1997 to 1999.

Juvenile Population Size

In contrast to adults, captures of individual lesser goldfinch juveniles strongly influenced overall juvenile capture rates, but only in 1998 when they accounted for 63 percent of all juveniles captured at the site (Figure 7a). Excluding 1998, lesser goldfinch accounted for only nine percent of all juveniles captured on an annual basis. With lesser goldfinch excluded, both juvenile captures and apparent productivity (juveniles/adults) at the site fluctuated less overall (Figure 7b), but productivity declined in both 1998 and 1999. The decline in productivity in 1998 is in sharp contrast to the De Luz Creek and Santa Margarita River MAPS stations, where productivity peaked in 1998 (Kus and Beck 1998). Although unknown, it is possible that the sharp peak of lesser goldfinch juveniles captured in 1998 was the result of locally high productivity of this species, but not necessarily at the Case Springs station; other factors (such as the presence of water) may have caused a strong post-breeding influx into the site.

Figure 5. Total Captures, Case Springs, 1995-1999
(All Species Combined)

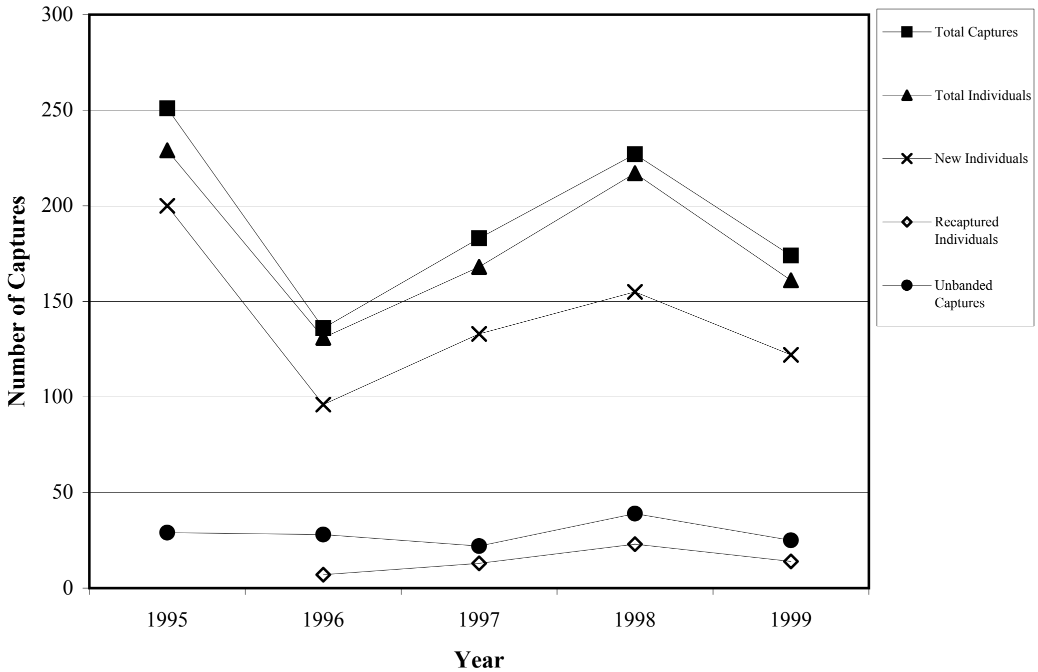


Figure 6. Total Individuals Captured by Age, Case Springs, 1995-1999
(All Species Combined)

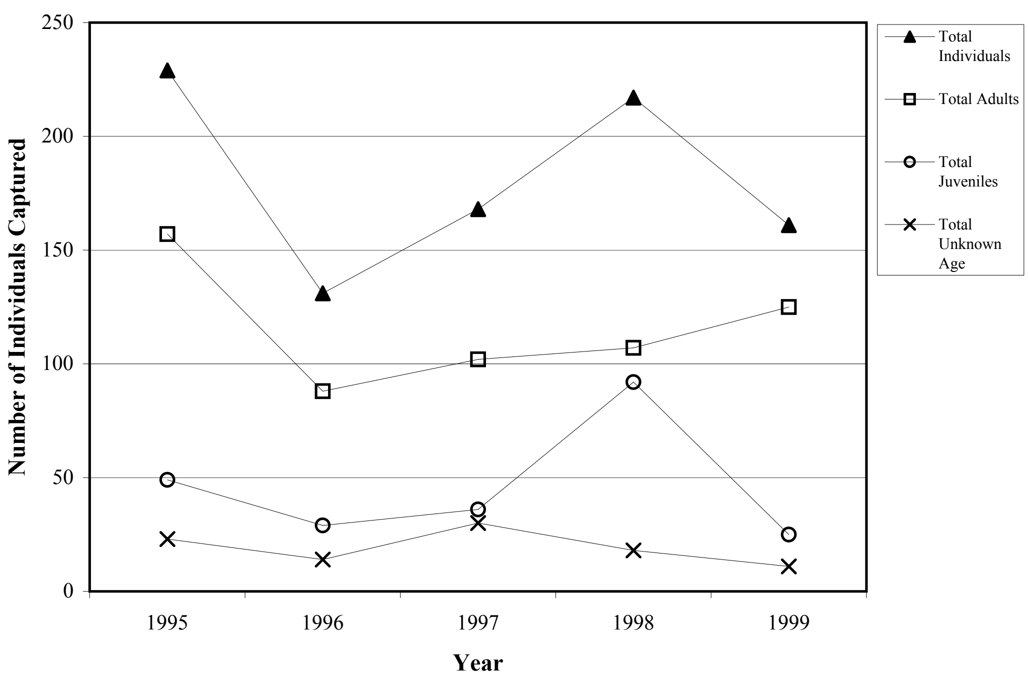


Figure 7. Adult Captures by Breeding Status, Case Springs, 1995-1999 (All Species Combined)

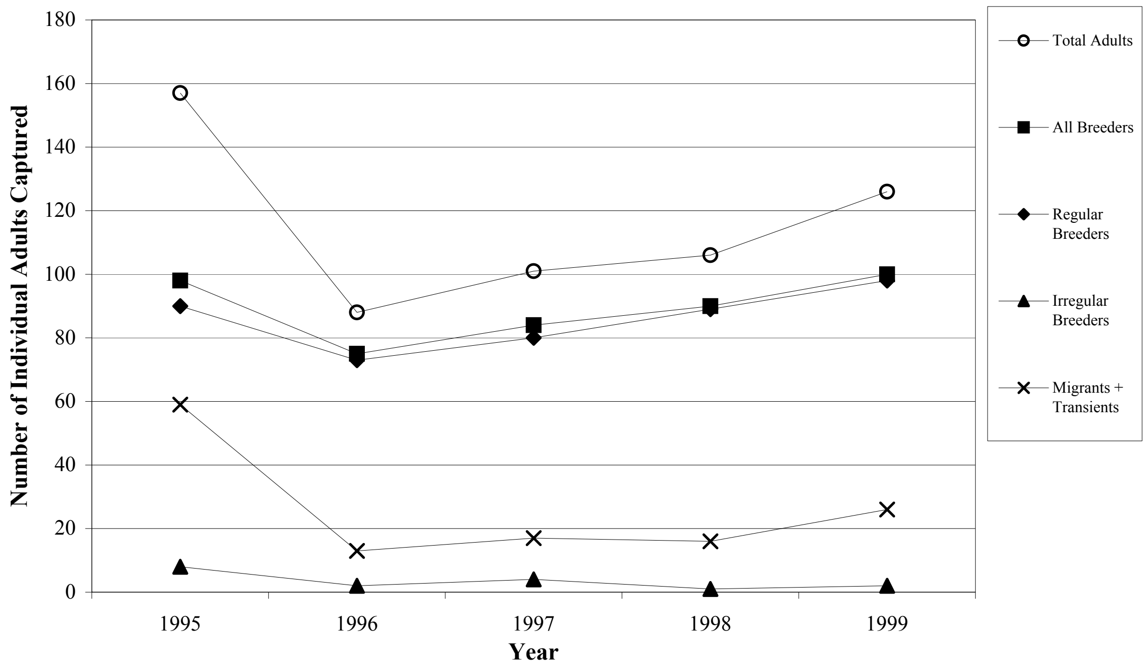


Figure 8. Adult Captures of Breeding Species, Case Springs, 1995-1999 (All Regular and Irregular Breeding Species Combined)

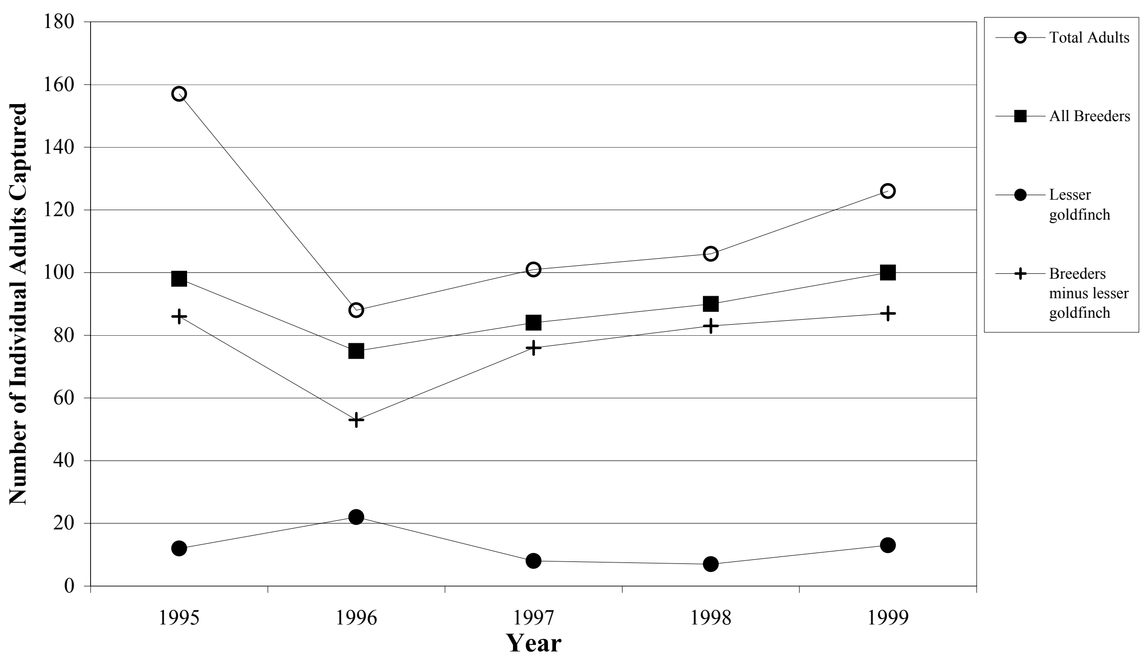


Figure 9. Juvenile Captures of Breeding Species, Case Springs, 1995-1999
(All Regular and Irregular Breeding Species Combined)

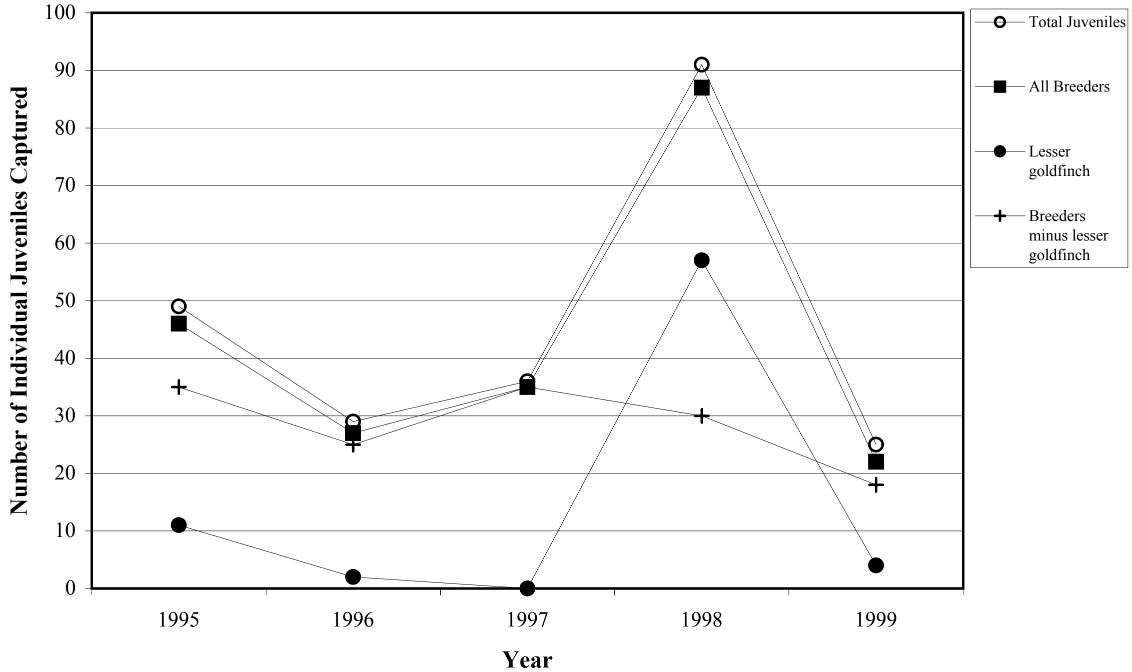
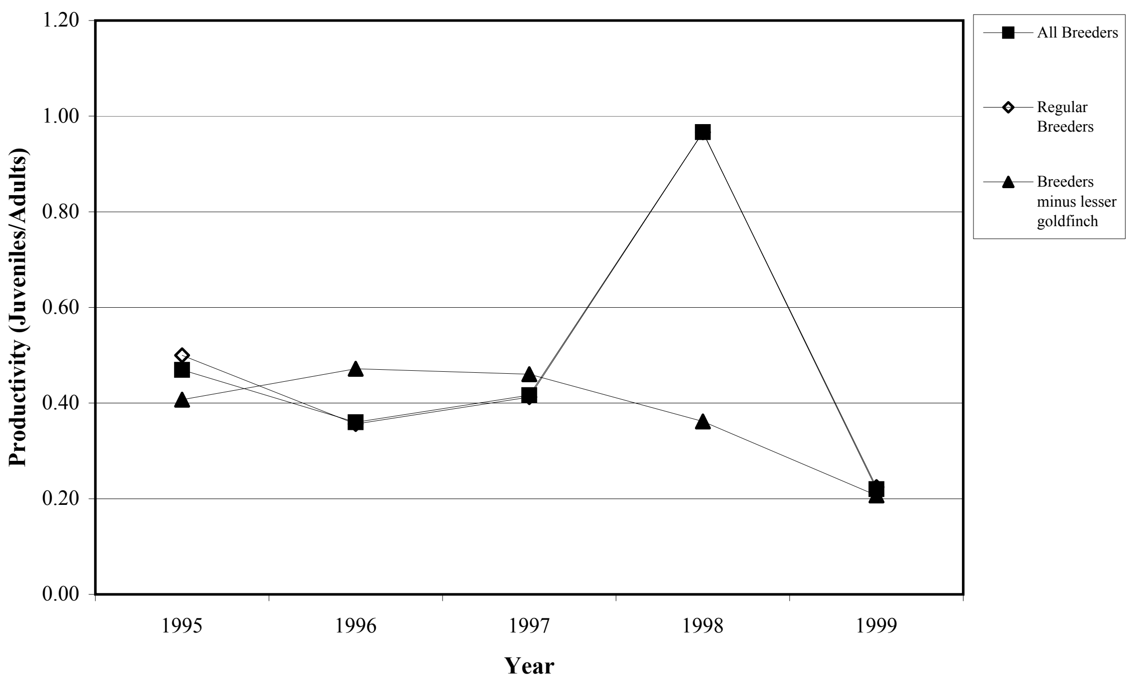


Figure 10. Productivity of Breeding Species, Case Springs, 1995-1999
(All Regular and Irregular Breeding Species Combined)



Survivorship

As discussed in previous reports (Kus and Beck 1997, 1998), estimated survival rates are a function of the number of years of recapture data from which they are calculated, and require adjustment as additional years of data are collected. This derives from the failure of birds to return to the banding site, and/or be recaptured, during every year that they are alive. Individual survival between years is therefore either determined from actual recapture within the year of interest, or inferred from recaptures in subsequent years. For example, a bird originally banded in 1995 and not recaptured until 1997 must have "survived" in1996. Adjustments to survival rates are highest in the second year after the year of initial capture, and decline after that. These adjustments to survival mean that survival estimates for earlier cohorts are less biased than estimates for more recent cohorts.

All individuals initially banded in the same year are considered to be in the same "banding cohort". An analysis of recapture rates by banding cohort shows that for only nine of the forty-seven species (19 percent) captured from 1995 to 1998 were any individuals recaptured in subsequent years (Table 8). The species with the highest number of individuals recaptured were California towhee (eight individuals) and oak titmouse (six individuals), while the species with the highest proportion of individuals recaptured were red-shafted flicker (*Colaptes auratus;* 33 percent) and ash-throated flycatcher (29 percent). The species with the most individuals captured, lesser goldfinch (120), had no individuals captured in subsequent years, indicative of the highly irruptive behavior of this species. Ninety-three percent (544/584) of all individuals captured and banded between 1995 and 1998 were not recaptured in subsequent years. Notable exceptions included one ash-throated flycatcher, one red-shafted flicker, and one spotted towhee that survived over the entire five-year span of the study, and one oak titmouse that was caught on nine separate occasions spanning four years of the study.

When all cohorts were combined, an average of only sixteen adults survived per year (Table 9). Survival across sequential years was documented for only nine species, and in only five of these species was there survival in all four inter-year periods (acorn woodpecker, ash-throated flycatcher, California towhee, oak titmouse, and spotted towhee). Four species (black-headed grosbeak, house wren, red-shafted flicker, and white-breasted nuthatch) had individuals surviving in three of the four years. The maximum number of adult survivors in one year for a species was five, in 1997 and 1998, for California towhee.

Local recruitment (recapture of birds initially banded as juveniles) was also extremely low at the site, with only six out of 162 birds banded as juveniles recaptured as adults (Table 10), similar to the low recruitment rate at the De Luz Creek site (Kus and Beck 2000). Species with at least one juvenile recruited into the adult population included California towhee (2), oak titmouse (2), ash-throated flycatcher (1), and white-breasted nuthatch (1). Because measurement of recruitment in this study is limited to the boundaries of the station (as defined by the perimeter described by the outermost mist-nets), it is likely that dispersal of juveniles even at a small scale limits the ability to detect recruitment, and it is probable that subsequent survival of banded juveniles is higher than measured.

Table 8. Cumulative Survivorship by Banding Cohort, Case Springs, 1995-1999

Species[a]	Year of Initial Capture[b]: 1995 Number Initially Banded	1995 Number Surviving[c] to: 1996	1995 Number Surviving[c] to: 1997	1995 Number Surviving[c] to: 1998	1995 Number Surviving[c] to: 1999	1996 Number Initially Banded	1996 Number Surviving[c] to: 1997	1996 Number Surviving[c] to: 1998	1996 Number Surviving[c] to: 1999	1997 Number Initially Banded	1997 Number Surviving[c] to: 1998	1997 Number Surviving[c] to: 1999	1998 Number Initially Banded	1998 Number Surviving[c] to: 1999	Total Individuals Recaptured
ACWO	11	1	0	0	0	4	2	2	1	9	1	0	4	0	**4**
ATFL	4	2	2	1	1	1	0	0	0	6	1	0	3	1	**4**
AUWA	0	0	0	0	0	0	0	0	0	0	0	0	1	0	**0**
BCSP	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0**
BEWR	1	0	0	0	0	1	0	0	0	2	0	0	0	0	**0**
BHGR	11	0	0	0	0	3	1	0	0	10	1	0	11	1	**3**
BTYW	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
BUSH	2	0	0	0	0	2	0	0	0	5	0	0	1	0	**0**
CALT	16	3	3	1	0	7	4	3	2	8	1	0	9	0	**8**
CATH	0	0	0	0	0	0	0	0	0	0	0	0	1	0	**0**
CAVI	0	0	0	0	0	0	0	0	0	0	0	0	1	0	**0**
CHSP	14	0	0	0	0	2	0	0	0	1	0	0	2	0	**0**
COYE	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0**
DEJU	6	0	0	0	0	0	0	0	0	2	0	0	5	0	**0**
EUST	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**0**
GCSP	0	0	0	0	0	2	0	0	0	2	0	0	1	0	**0**
HAFL	2	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
HETH	1	0	0	0	0	0	0	0	0	0	0	0	2	0	**0**
HEWA	2	0	0	0	0	1	0	0	0	0	0	0	0	0	**0**
HOFI	0	0	0	0	0	0	0	0	0	0	0	0	1	0	**0**
HOWR	8	2	1	1	0	7	0	0	0	7	1	0	7	0	**3**
HUVI	0	0	0	0	0	0	0	0	0	1	0	0	2	0	**0**
LASP	6	0	0	0	0	1	0	0	0	2	0	0	1	0	**0**
LAZB	9	0	0	0	0	2	0	0	0	1	0	0	0	0	**0**
LEGO	24	0	0	0	0	24	0	0	0	8	0	0	64	0	**0**
NUWO	1	0	0	0	0	1	0	0	0	1	0	0	2	0	**0**
OATI	16	2	1	1	0	7	2	2	1	16	1	1	1	1	**6**
OCWA	3	0	0	0	0	1	0	0	0	2	0	0	1	0	**0**
PHAI	0	0	0	0	0	1	0	0	0	4	0	0	0	0	**0**
PSFL	9	0	0	0	0	7	0	0	0	12	0	0	13	0	**0**
RCSP	3	0	0	0	0	1	0	0	0	0	0	0	0	0	**0**
RSFL	1	1	1	1	1	1	0	0	0	1	0	0	3	1	**2**
SOSP	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**0**
SPTO	4	1	1	1	1	3	0	0	0	7	3	1	8	1	**5**
SWTH	16	0	0	0	0	0	0	0	0	0	0	0	1	0	**0**
TOWA	3	0	0	0	0	0	0	0	0	0	0	0	1	0	**0**
VGSW	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0**
WAVI	1	0	0	0	0	1	0	0	0	0	0	0	0	0	**0**
WBNU	9	1	1	1	0	3	0	0	0	8	4	0	2	0	**5**
WCSP	0	0	0	0	0	0	0	0	0	2	0	0	0	0	**0**
WEBL	4	0	0	0	0	4	0	0	0	7	0	0	2	0	**0**
WESJ	3	0	0	0	0	3	0	0	0	0	0	0	1	0	**0**
WETA	1	0	0	0	0	3	0	0	0	3	0	0	1	0	**0**
WEWP	2	0	0	0	0	0	0	0	0	1	0	0	0	0	**0**
WIWA	3	0	0	0	0	0	0	0	0	1	0	0	1	0	**0**
WREN	0	0	0	0	0	1	0	0	0	1	0	0	2	0	**0**
YWAR	3	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total	**200**	**13**	**10**	**7**	**3**	**96**	**9**	**7**	**4**	**133**	**13**	**2**	**155**	**5**	**40**

[a] Species with at least one recapture in any year after initial banding shaded

[b] 1999 cohort excluded because station not operated in 2000: no potential to assess survivorship from that cohort

[c] Based on actual capture in stated year, or inference of presence based on capture in subsequent year

Table 9. Annual Adult Survivorship, Case Springs, 1995-1999

Species[a]	1996 Present Prior Year[b]	1996 Surviving[c]	1996 Percent Survivorship	1997 Present Prior Year[b]	1997 Surviving[c]	1997 Percent Survivorship	1998 Present Prior Year[b]	1998 Surviving[c]	1998 Percent Survivorship	1999 Present Prior Year[b]	1999 Surviving[c]	1999 Percent Survivorship	Years Recaptures Present
ACWO	7	1	14.3	5	2	40.0	5	2	40.0	7	1	14.3	4
ATFL	4	2	50.0	3	2	66.7	6	1	16.7	5	2	40.0	4
AUWA	0	0	0.0	0	0	0.0	0	0	0.0	1	0	0.0	0
BEWR	1	0	0.0	1	0	0.0	1	0	0.0	0	0	0.0	0
BHGR	10	0	0.0	3	1	33.3	11	1	9.1	12	1	8.3	3
BTYW	1	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
BUSH	1	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0	0
CALT	9	3	33.3	6	5	83.3	11	5	45.5	11	2	18.2	4
CAVI	0	0	0.0	0	0	0.0	0	0	0.0	1	0	0.0	0
CHSP	12	0	0.0	1	0	0.0	1	0	0.0	1	0	0.0	0
COYE	0	0	0.0	0	0	0.0	1	0	0.0	0	0	0.0	0
DEJU	6	0	0.0	0	0	0.0	2	0	0.0	5	0	0.0	0
EUST	0	0	0.0	1	0	0.0	0	0	0.0	0	0	0.0	0
GCSP	0	0	0.0	2	0	0.0	2	0	0.0	1	0	0.0	0
HAFL	2	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
HETH	1	0	0.0	0	0	0.0	0	0	0.0	2	0	0.0	0
HEWA	2	0	0.0	1	0	0.0	0	0	0.0	0	0	0.0	0
HOFI	0	0	0.0	0	0	0.0	0	0	0.0	1	0	0.0	0
HOWR	8	2	25.0	6	1	16.7	7	2	28.6	7	0	0.0	3
HUVI	0	0	0.0	0	0	0.0	1	0	0.0	2	0	0.0	0
LASP	6	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0	0
LAZB	8	0	0.0	1	0	0.0	0	0	0.0	0	0	0.0	0
LEGO	12	0	0.0	22	0	0.0	8	0	0.0	7	0	0.0	0
NUWO	0	0	0.0	0	0	0.0	1	0	0.0	2	0	0.0	0
OATI	7	2	28.6	5	2	40.0	6	4	66.7	4	2	50.0	4
OCWA	3	0	0.0	1	0	0.0	2	0	0.0	1	0	0.0	0
PHAI	0	0	0.0	1	0	0.0	4	0	0.0	0	0	0.0	0
PSFL	6	0	0.0	5	0	0.0	7	0	0.0	4	0	0.0	0
RCSP	3	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
RSFL	0	0	0.0	2	1	50.0	2	1	50.0	4	2	50.0	3
SOSP	0	0	0.0	1	0	0.0	0	0	0.0	0	0	0.0	0
SPTO	4	1	25.0	2	1	50.0	5	4	80.0	11	3	27.3	4
SWTH	16	0	0.0	0	0	0.0	0	0	0.0	1	0	0.0	0
TOWA	3	0	0.0	0	0	0.0	0	0	0.0	1	0	0.0	0
VGSW	0	0	0.0	0	0	0.0	1	0	0.0	0	0	0.0	0
WAVI	0	0	0.0	1	0	0.0	0	0	0.0	0	0	0.0	0
WBNU	6	1	16.7	3	1	33.3	5	4	80.0	5	0	0.0	3
WCSP	0	0	0.0	0	0	0.0	2	0	0.0	0	0	0.0	0
WEBL	1	0	0.0	2	0	0.0	1	0	0.0	1	0	0.0	0
WESJ	2	0	0.0	3	0	0.0	0	0	0.0	1	0	0.0	0
WETA	1	0	0.0	3	0	0.0	2	0	0.0	1	0	0.0	0
WEWP	2	0	0.0	0	0	0.0	1	0	0.0	0	0	0.0	0
WIWA	3	0	0.0	0	0	0.0	1	0	0.0	1	0	0.0	0
YWAR	3	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0
Total	**150**	**12**	**8.0**	**83**	**16**	**19.3**	**99**	**24**	**24.2**	**102**	**13**	**12.7**	**4**

[a] Species with at least one year-to-year survivor shaded

[b] Based on actual capture in prior year, or inference of presence based on prior and subsequent captures

[c] Based on actual capture in stated year, or inference of presence based on subsequent capture

Table 10. Juveniles Banded and Recaptured, and Total Recruitment, Case Springs, 1995-1999

Species[a]	1995		1996		1997		1998		Total[b]	
	Banded	Recaptured	Banded	Recaptured	Banded	Recaptured	Banded	Recaptured	Banded	Recaptured
ACWO	1	0	0	0	0	0	0	0	1	0
ATFL	0	0	0	0	2	1	0	0	2	1
BCSP	0	0	0	0	1	0	0	0	1	0
BHGR	1	0	0	0	0	0	0	0	1	0
BUSH	0	0	0	0	3	0	0	0	3	0
CALT	7	0	4	2	3	0	3	0	17	2
CATH	0	0	0	0	0	0	1	0	1	0
CHSP	2	0	1	0	0	0	1	0	4	0
HOWR	0	0	2	0	0	0	2	0	4	0
LAZB	1	0	1	0	1	0	0	0	3	0
LEGO	11	0	2	0	0	0	55	0	68	0
OATI	4	0	4	1	6	0	1	1	15	2
PSFL	3	0	2	0	5	0	9	0	19	0
RCSP	0	0	1	0	0	0	0	0	1	0
SPTO	0	0	2	0	3	0	1	0	6	0
WBNU	2	0	1	0	3	1	2	0	8	1
WEBL	3	0	2	0	6	0	1	0	12	0
WESJ	1	0	0	0	0	0	0	0	1	0
WETA	0	0	0	0	1	0	0	0	1	0
Total	**36**	**0**	**22**	**3**	**34**	**2**	**76**	**1**	**168**	**6**

[a] Includes only species where juveniles banded; species with at least one juvenile recapture shaded

[b] Juveniles banded in 1999 excluded because station not operated in 2000: no potential to assess recruitment from that cohort

The mark-and-recapture design of this study requires multiple captures of individuals across years to determine within-species survival and recruitment, but the low number of individuals banded and recaptured at this site limited analysis (Table 8). Initial sample sizes of banded individuals rarely exceeded ten individuals per species per year, with few subsequent recaptures (≤ five individuals/year). With small sample sizes, capture trends are more likely to reflect stochastic events and obscure actual population parameters. California towhees, with the highest combination of banded and recaptured individuals, is the species whose capture rates most likely reflect population trends, but results for even this species are questionable.

Conclusions and Recommendations

This five-year study provided documented use of the Case Springs site by eighty-two species, fifty-four of which were captured. Nineteen species were determined to be regular breeders at the site, seven were usual breeders, and an additional three species were occasional breeders, for a total of twenty-nine potential breeding species at the site. Five neotropical migrant species were identified as potential breeders at the site, and another twenty-one neotropical migrant species visited the site on a temporary basis.

Although this study captured many species, overall captures per species were very low. Excluding non-banded birds, only six species averaged more than five adults captured per year, and for only two species were at least five adults captured in all years. Only four species averaged more than three juveniles captured per year, and in no species were at least three juveniles captured in all years. Low captures and recaptures prevented single-species analysis of population trends, productivity, or survival for any one species. Extremely low capture of returning juveniles prevented analysis of recruitment of juveniles into the local adult population, although this low recruitment may not reflect actual survival of juveniles produced from this site.

The breeding community at the site was well represented by net captures, but bird lists and point counts documented twenty-eight species, mostly non-breeders, not sampled by nets. Non-capture methods (such as point counts) may be a more cost-effective way to assess and monitor certain bird community attributes and trends, but cannot assess population productivity and survival. Focused nest-searches and territory monitoring would give more precise information about trends and productivity for specific species (indicator species or species of special concern), but they cannot be used to assess trends within the entire bird community. Implementation of a Rapid Ornithological Inventory (http://www.rsl.psw.fs.fed.us/pif/roiprot.htm), which combines mist-netting and point counts over a short duration, offers an alternative and more cost-effective method for assessing oak woodland communities in general on Base. Considering the high proportion of neotropical migrants using the site, the Case Springs site might also be suited for a migration monitoring station.

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Appendix 1. Alpha Codes, Common Names, and Scientific Names of Species Detected at Case Springs MAPS Station, Marine Corps Base Camp Pendleton

Code	Common Name	Scientific Name	A.O.U. #
BTPI	Band-tailed pigeon	*Columba fasciata*	312.0
MODO	Mourning dove	*Zenaida macroura*	316.0
TUVU	Turkey vulture	*Cathartes aura*	325.0
WTKI	White-tailed kite	*Elanus leucurus*	328.0
COHA	Cooper's hawk	*Accipiter cooperii*	333.0
RTHA	Red-tailed hawk	*Buteo jamaicensis*	337.0
RSHA	Red-shouldered hawk	*Buteo lineatus*	339.0
GOEA	Golden eagle	*Aquila chrysaetos*	349.0
AMKE	American kestrel	*Falco sparverius*	360.0
SPOW	Spotted owl	*Stix occidentalis*	369.0
CAQU	California quail	*Callipepla californica*	--
MOQU	Mountain quail	*Oreortyx pictus*	--
DOWO	Downy woodpecker	*Picoides pubescens*	394.0
NUWO	Nuttall's woodpecker	*Picoides nuttallii*	397.0
ACWO	Acorn woodpecker	*Melanerpes formicivorus*	407.0
RSFL	Red-shafted flicker	*Colaptes auratus cafer*	413.0
WTSW	White-throated swift	*Aeronautes saxatalis*	425.0
BCHU	Black-chinned hummingbird	*Archilochus alexandri*	429.0
COHU	Costa's hummingbird	*Calypte costae*	430.0
ANHU	Anna's hummingbird	*Calypte anna*	431.0
RUHU	Rufous hummingbird	*Selasphorus rufus*	433.0
ALHU	Allen's hummingbird	*Selasphorus sasin*	434.0
WEKI	Western kingbird	*Tyrannus verticalis*	447.0
ATFL	Ash-throated flycatcher	*Myiarchus cinerascens*	454.0
WEWP	Western wood-pewee	*Contopus sordidulus*	462.0
PSFL	Pacific-slope flycatcher	*Empidonax difficilis*	464.1
WIFL	Willow flycatcher	*Empidonax traillii*	466.0
HAFL	Hammond's flycatcher	*Empidonax hammondii*	468.0
HOLA	Horned lark	*Eremophila alpestris*	474.0
WESJ	Western scrub-jay	*Aphelocoma californica*	481.0
CORA	Common raven	*Corvus corax*	486.0
EUST	European starling	*Sturnus vulgaris*	493.0
BHCO	Brown-headed cowbird	*Molothrus ater*	495.0
RWBL	Red-winged blackbird	*Agelaius phoeniceus*	498.0
BUOR	Bullock's oriole	*Icterus bullockii*	508.0
PUFI	Purple finch	*Carpodacus purpureus*	517.0
HOFI	House finch	*Carpodacus mexicanus*	519.0
AMGO	American goldfinch	*Carduelis tristis*	529.0
LEGO	Lesser goldfinch	*Carduelis psaltria*	530.0
LAGO	Lawrence's goldfinch	*Carduelis lawrencei*	531.0
LASP	Lark sparrow	*Chondestes grammacus*	552.0
WCSP	White-crowned sparrow	*Zonotrichia leucophrys*	554.0
GCSP	Golden-crowned sparrow	*Zonotrichia atricapilla*	557.0
CHSP	Chipping sparrow	*Spizella passerina*	560.0
BCSP	Black-chinned sparrow	*Spizella atrogularis*	565.0
DEJU	Dark-eyed junco	*Junco hyemalis*	567.7
RCSP	Rufous-crowned sparrow	*Aimophila ruficeps*	580.0
SOSP	Song sparrow	*Melospiza melodia*	581.0

Appendix 1 (*continued*). Alpha Codes, Common Names, and Scientific Names of Species Detected at Case Springs MAPS Station, Marine Corps Base Camp Pendleton

Code	Common Name	Scientific Name	AOU #
SPTO	Spotted towhee	*Pipilo maculatus*	588.0
CALT	California towhee	*Pipilo crissalis*	591.1
BHGR	Black-headed grosbeak	*Pheucticus melanocephalus*	596.0
BLGR	Blue grosbeak	*Guiraca caerulea*	597.0
LAZB	Lazuli bunting	*Passerina amoena*	599.0
WETA	Western tanager	*Piranga ludoviciana*	607.0
CLSW	Cliff swallow	*Petrochelidon pyrrhonota*	612.0
VGSW	Violet-green swallow	*Tachycineta thalassina*	615.0
CEDW	Cedar waxwing	*Bombycilla cedrorum*	619.0
PHAI	Phainopepla	*Phainopepla nitens*	620.0
WAVI	Warbling vireo	*Vireo gilvus*	627.0
CAVI	Cassin's vireo	*Vireo cassinii*	629.1
HUVI	Hutton's vireo	*Vireo huttoni*	632.0
NAWA	Nashville warbler	*Vermivora ruficapilla*	645.0
OCWA	Orange-crowned warbler	*Vermivora celata*	646.0
YWAR	Yellow warbler	*Dendroica petechia*	652.0
AUWA	Audubon's warbler	*Dendroica coronata auduboni*	656.0
BTYW	Black-throated gray warbler	*Dendroica nigrescens*	665.0
TOWA	Townsend's warbler	*Dendroica townsendi*	668.0
HEWA	Hermit warbler	*Dendroica occidentalis*	669.0
COYE	Common yellowthroat	*Geothlypis trichas*	681.0
WIWA	Wilson's warbler	*Wilsonia pusilla*	685.0
CATH	California thrasher	*Toxostoma redivivum*	710.0
BEWR	Bewick's wren	*Thyromanes bewickii*	719.0
HOWR	House wren	*Troglodytes aedon*	721.0
WBNU	White-breasted nuthatch	*Sitta carolinensis*	727.0
OATI	Oak titmouse	*Baeolophus inornatus*	733.0
WREN	Wrentit	*Chamaea fasciata*	742.0
BUSH	Bushtit	*Psaltriparus minimus*	743.0
RCKI	Ruby-crowned kinglet	*Regulus calendula*	749.0
BGGN	Blue-gray gnatcatcher	*Polioptila caerulea*	751.0
SWTH	Swainson's thrush	*Catharus ustulata*	758.0
HETH	Hermit thrush	*Catharus guttatus*	759.0
WEBL	Western bluebird	*Sialia mexicana*	767.0