NEOTROPICAL MIGRATORY BIRD MONITORING STUDY AT MARINE CORPS BASE CAMP PENDLETON, CALIFORNIA

SIXTH ANNUAL PROGRESS REPORT 2000

Prepared for

U.S. Marine Corps
Environmental and Natural Resources Office
Camp Pendleton, California

Prepared by

Barbara E. Kus, Ph.D.
and
Peter P. Beck

USGS Biological Resources Division
San Diego Field Station
Department of Biology
San Diego State University
San Diego, California 92182

February 8, 2001

Cooperative Letter Agreement N68711-94-LT-4049

Introduction

This report is the fifth annual progress update summarizing the activities of two 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. 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 due to low capture rates, so the following progress report deals exclusively with results from the De Luz and Santa Margarita stations.

Methods

Following the protocol established in past years, the De Luz and Santa Margarita banding stations were operated once during every 10-day period between April 1 and August 31, 1999, for a total of 15 days per station. Ten mistnets were erected at each site in fixed locations (Figures 1-2). 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, 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 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 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. Typically, three field personnel operated the De Luz station, and five to six the Santa Margarita station, working on consecutive days. Fieldwork was conducted by Matthew Alexander, Peter Beck, Laurie Clarke, Peter Famolaro, David Kisner, Barbara Kus, Melissa Mersy, Bonnie Peterson, Bryan Sharp, Jennifer Turnbull, Mike Wellick, and Jeff Wells.

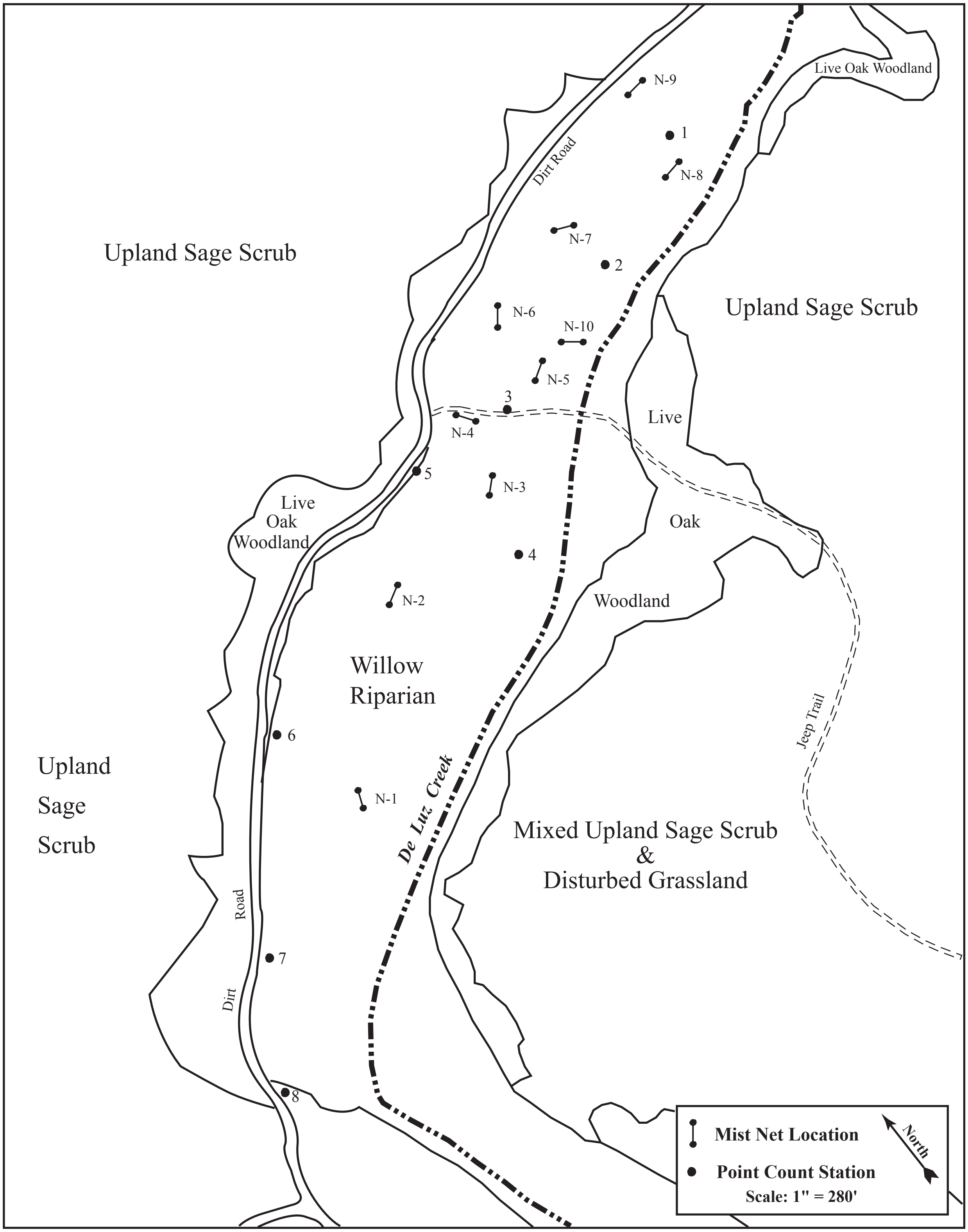


Figure 1. De Luz Creek MAPS Station, Marine Corps Base Camp Pendleton.

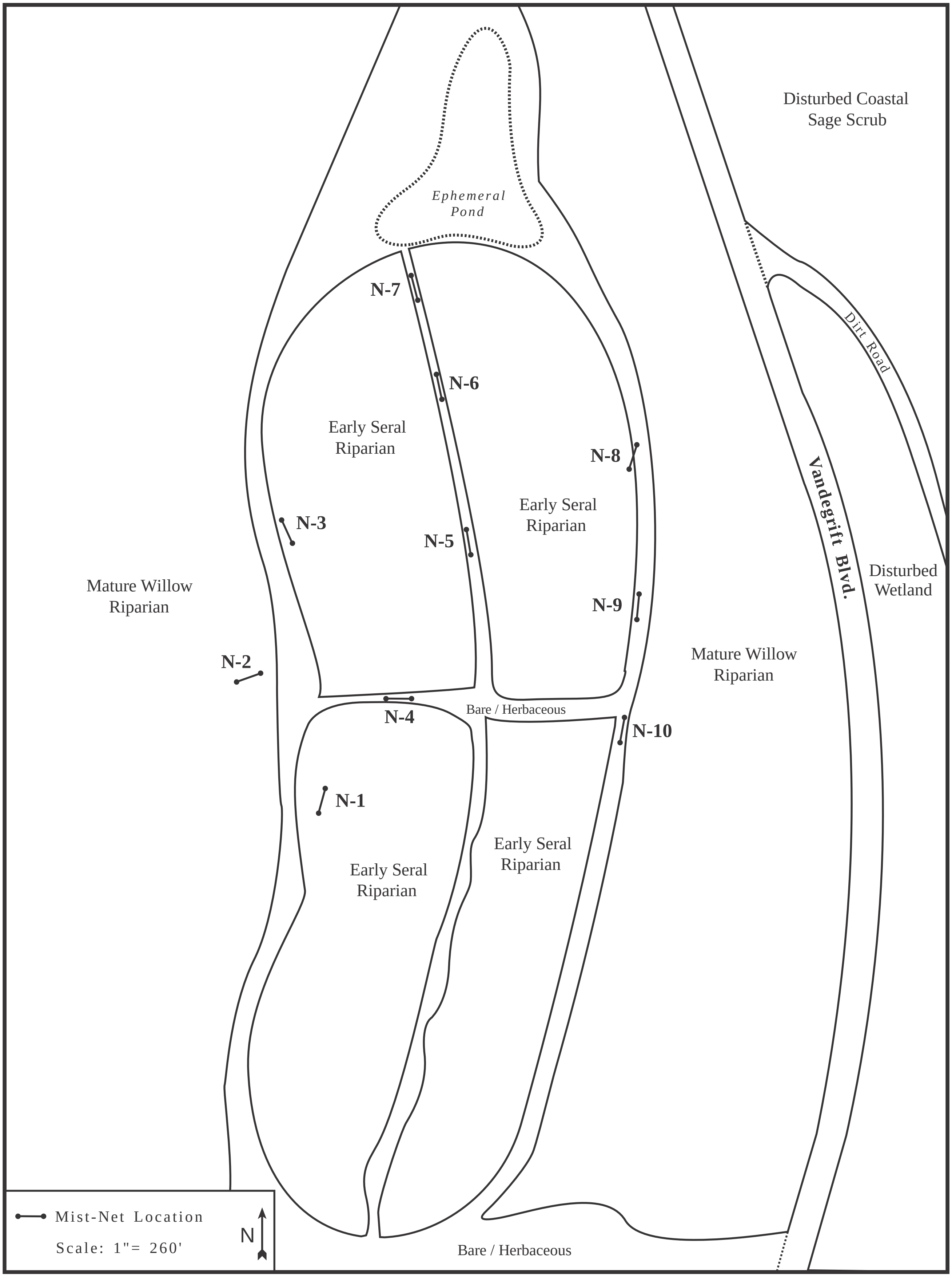


Figure 2. Santa Margarita River MAPS station, Marine Corps Base Camp Pendleton.

Results

De Luz Creek

Overview of 2000 Captures

Three hundred and seventy-one individuals of 37 species were caught during 758 net-hours (Table 1; see attached list of A.O.U. codes for common and taxonomic species names). Overall, the number of individuals caught in 2000 was well below the mean number (426) caught per year between 1995-99. Captures per net hour were also lower than the 1995-99 mean (0.65), at 0.57. Overall, 2000 had the lowest total captures, individuals captured, and capture rates for all years of the study. This is most likely attributable to two consecutive winters with below-normal local rainfall (1998-1999: 3.67 inches below normal, 1999-2000: 2.87 inches below normal). Lower precipitation negatively impacts productivity, while lower productivity is related to lower capture rates in the subsequent year (see Fifth Annual Progress Report, 1999).

As in previous years, the most abundant species at the station included common yellowthroats and song sparrows, which together made up 25 percent of the individuals captured (Figure 3). Also abundant were wrentits, bushtits, yellow-breasted chats, lesser goldfinches, spotted towhees, and black-headed grosbeaks; together, these eight species comprised 61 percent of all individuals captured. Among locally breeding migrant species that appeared to decline at the station between 1995 and 1998, Pacific-slope flycatchers continued to rebound from their low in 1998, yellow-breasted chats resumed a decline that temporarily abated in 1999, and black-headed grosbeaks rebounded strongly from their 5-year low recorded in 1999 (Table 2). Capture trends among resident species were mixed, with captures of six species (lesser goldfinch, song sparrow, California towhee, orange-crowned warbler, common yellowthroat, and house wren) lower than both the previous year and their 1995-1999 average, while those of two species (wrentit and bushtit) were higher than both the previous year and their average. Three species were captured for the first time at the De Luz station in 2000, bringing the total number of species captured since 1995 to 61. The new species included Hammond's flycatcher, western scrub-jay, and white-crowned sparrow.

The sex ratio of birds of known sex (N=248) was much more skewed towards females than in previous years, at 54 percent female and 46 percent male (Table 1). Age composition continued to fluctuate, with the proportion of juvenile birds in the population increasing to 22 percent (Table 1) from a low of 12 percent in 1999, comparable to the 21 percent annual mean since 1995.

Three hundred and ten of the birds caught (84 percent), including 34 hummingbirds and one California quail, were new captures. Of these, 96 percent (264/275; hummingbirds and quail excluded) were banded; the remainder escaped prior to banding (7) or were not banded for other reasons (3) (Table 3). The majority of birds were captured only once during the season, but some individuals of the most abundant species were captured 2-4 times (Table 3). Overall capture rates by net ranged from 39 to 84 captures per 100 net-hours, for an overall average capture rate of 57 per 100 net-hours (Table 4). Nets differed in their capture rates relative to

Table 1. Sex and Age of Individuals Captured: De Luz Creek, 2000

		Female						Male						Unknown Sex						
		Age[a]					Female	Age[a]					Male	Age[a]					Unknown	Species
Species	Code	A	H	O	S	U	Total	A	H	O	S	U	Total	A	H	O	S	U	Total	Total
CAQU	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
DOWO	394.0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
NUWO	397.0	0	0	0	0	0	0	0	1	0	1	0	2	0	0	0	0	0	0	2
BCHU	429.0	1	0	0	0	1	2	6	0	0	0	1	7	0	1	0	0	1	2	11
ANHU	431.0	6	0	0	0	2	8	0	0	0	0	0	0	0	1	0	0	0	1	9
ALHU	434.0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	2
UNHU	440.9	7	0	0	0	1	8	0	0	0	0	0	0	0	1	0	0	3	4	12
ATFL	454.0	3	0	0	0	0	3	0	0	0	0	0	0	2	1	1	0	0	4	7
PSFL	464.1	0	0	0	0	0	0	0	0	0	0	0	0	5	3	2	1	0	11	11
WIFL	466.0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
HAFL	468.0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1
WESJ	481.0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
PUFI	517.0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	2
HOFI	519.0	4	0	0	0	0	4	3	0	0	0	0	3	0	2	0	0	0	2	9
LEGO	530.0	3	0	6	2	0	11	3	0	3	2	0	8	0	0	0	0	1	1	20
WCSP	554.0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	4	4
SOSP	581.0	17	0	0	0	0	17	12	0	0	0	0	12	4	7	0	0	2	13	42
SPTO	588.0	8	0	2	1	0	11	2	0	3	0	0	5	0	2	0	0	1	3	19
CALT	591.1	1	0	0	0	0	1	2	0	0	0	0	2	1	1	0	0	3	5	8
BHGR	596.0	5	0	3	0	0	8	2	0	4	1	0	7	0	1	0	0	0	1	16
LAZB	599.0	0	0	1	0	0	1	2	0	0	1	0	3	0	0	0	0	0	0	4
VGSW	615.0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	2
WAVI	627.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
LBVI	633.4	3	0	0	0	0	3	2	0	0	0	0	2	0	2	0	0	0	2	7
OCWA	646.0	5	0	0	0	0	5	0	0	2	1	0	3	0	0	0	0	0	0	8
YWAR	652.0	3	0	1	1	0	5	2	0	1	2	0	5	0	0	0	0	0	0	10
MGWA	680.0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1
COYE	681.0	5	0	5	2	0	12	4	4	11	4	0	23	0	14	0	0	0	14	49
YBCH	683.0	10	0	0	0	0	10	8	0	0	0	0	8	0	3	0	0	0	3	21
WIWA	685.0	1	0	1	2	0	4	0	0	2	0	0	2	0	0	0	0	0	0	6
CATH	710.0	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	2
BEWR	719.0	2	0	0	0	0	2	2	0	0	0	0	2	1	4	0	0	0	5	9
HOWR	721.0	1	0	0	0	0	1	2	0	0	0	0	2	0	1	0	0	3	4	7
OATI	733.0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1
WREN	742.0	0	0	0	0	0	0	0	0	0	0	0	0	13	13	0	0	6	32	32
BUSH	743.0	7	6	0	0	0	13	6	4	0	0	2	12	0	1	0	0	1	2	27
SWTH	758.0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	4	4
HETH	759.0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1
Total		94	6	19	8	7	134	62	9	26	14	3	114	33	60	4	5	21	123	371

[a] Age Key
A = After Hatching Year
H = Hatching Year
O = Older than Second Year
S = Second Year
U = Unknown Age

Table 2. Number of Birds Captured, Banded, and Recaptured: De Luz Creek, 1995 - 2000

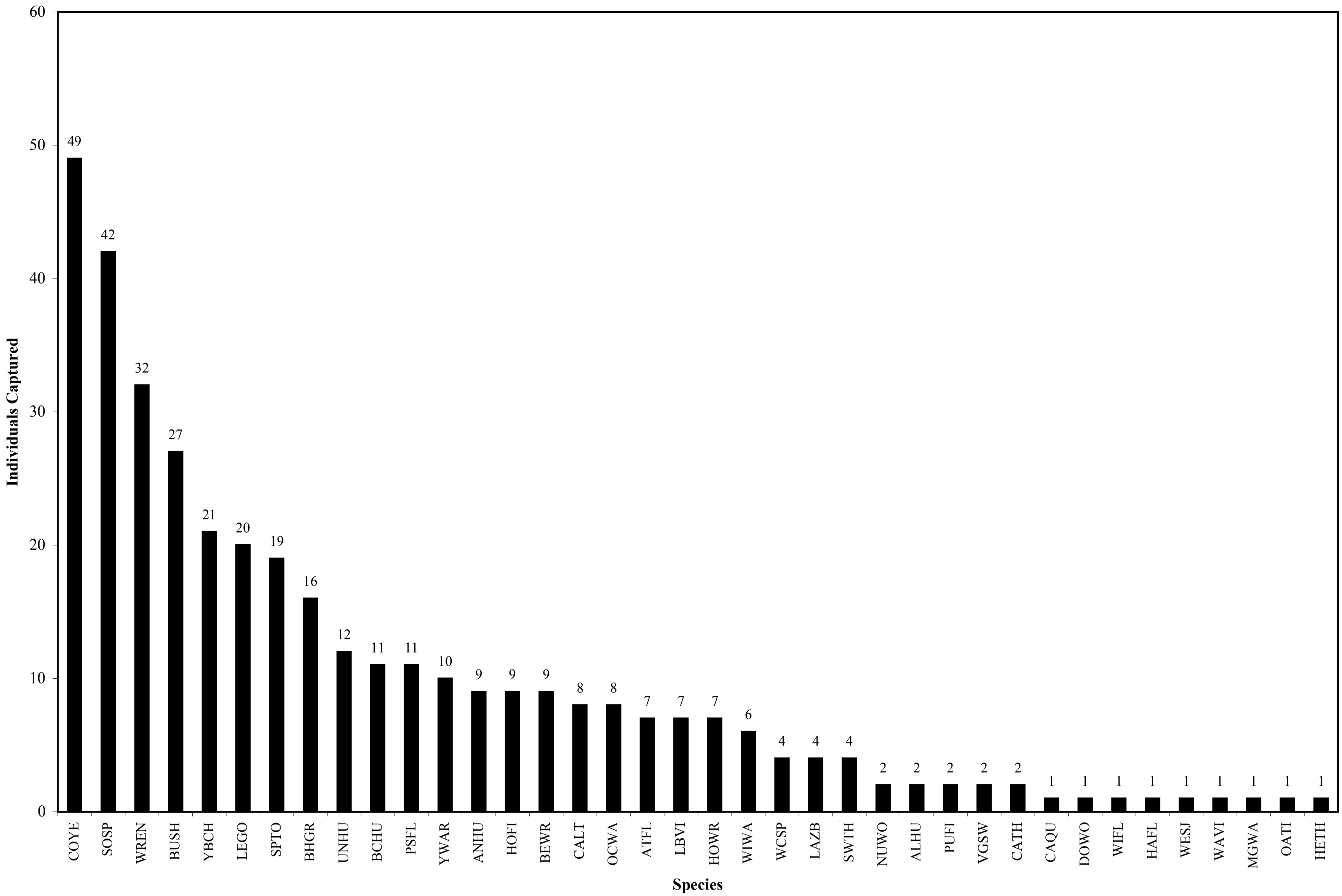
Species	Code	Total Captures[a]							New Individuals Banded							Recaptured Individuals, 2000					
		Year						Total	Year						Total	Originally Banded					Total
		1995	1996	1997	1998	1999	2000		1995	1996	1997	1998	1999	2000		1995	1996	1997	1998	1999	
CAQU	0.0	2	0	1	2	1	1	7	0	0	0	0	0	0	0	0	0	0	0	0	0
MODO	316.0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
COGD	320.0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
COHA	333.0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
AMKE	360.0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
DOWO	394.0	2	2	2	1	0	1	8	2	2	2	1	0	1	8	0	0	0	0	0	0
NUWO	397.0	4	4	2	12	2	4	28	4	2	1	6	1	2	16	0	0	0	0	0	0
RSFL	413.0	0	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0
BCHU	429.0	3	2	5	7	9	11	37	0	0	0	0	0	0	0	0	0	0	0	0	0
COHU	430.0	2	2	1	2	1	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0
ANHU	431.0	5	5	16	15	5	9	55	0	0	0	0	0	0	0	0	0	0	0	0	0
ALHU	434.0	0	0	1	1	0	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0
UNHU	440.9	11	1	2	8	9	12	43	0	0	0	0	0	0	0	0	0	0	0	0	0
ATFL	454.0	13	9	11	15	8	7	63	10	7	9	9	6	5	46	0	1	1	0	0	2
WEWP	462.0	0	1	0	0	1	0	2	0	1	0	0	1	0	2	0	0	0	0	0	0
PSFL	464.1	14	9	7	2	8	11	51	14	9	6	0	8	10	47	0	0	0	0	1	1
WIFL	466.0	1	1	0	2	1	1	6	1	1	0	2	1	1	6	0	0	0	0	0	0
HAFL	468.0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0
WESJ	481.0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0
HOOR	505.0	2	0	0	3	3	0	8	2	0	0	3	3	0	8	0	0	0	0	0	0
BUOR	508.0	5	1	7	3	3	0	19	5	1	5	3	3	0	17	0	0	0	0	0	0
PUFI	517.0	0	1	0	0	0	2	3	0	1	0	0	0	2	3	0	0	0	0	0	0
HOFI	519.0	1	23	8	8	8	9	57	1	22	8	8	6	9	54	0	0	0	0	0	0
LEGO	530.0	15	14	14	26	45	20	134	15	13	14	25	41	17	125	0	0	0	1	0	1
LASP	552.0	1	1	0	0	0	0	2	1	1	0	0	0	0	2	0	0	0	0	0	0
WCSP	554.0	0	0	0	0	0	5	5	0	0	0	0	0	4	4	0	0	0	0	0	0
GCSP	557.0	3	2	0	1	1	0	7	3	2	0	0	1	0	6	0	0	0	0	0	0
DEJU	567.7	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
RCSP	580.0	1	4	1	0	3	0	9	1	4	1	0	3	0	9	0	0	0	0	0	0
SOSP	581.0	70	69	74	75	79	54	421	51	43	45	52	31	25	247	1	0	4	3	8	16
LISP	583.0	1	1	0	0	1	0	3	1	1	0	0	1	0	3	0	0	0	0	0	0
SPTO	588.0	38	27	25	24	21	20	155	33	17	10	14	17	15	106	0	0	0	1	2	3
CALT	591.1	20	25	10	23	16	9	103	17	19	8	16	13	6	79	1	0	0	1	0	2
BHGR	596.0	33	40	36	21	8	17	155	26	33	23	8	5	13	108	2	0	0	0	1	3
BLGR	597.0	0	1	2	1	0	0	4	0	1	2	1	0	0	4	0	0	0	0	0	0
LAZB	599.0	12	1	0	2	2	4	21	12	1	0	1	2	4	20	0	0	0	0	0	0
WETA	607.0	1	0	1	0	0	0	2	1	0	1	0	0	0	2	0	0	0	0	0	0
CLSW	612.0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0
VGSW	615.0	0	0	0	0	1	2	3	0	0	0	0	1	2	3	0	0	0	0	0	0
NRWS	617.0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0
PHAI	620.0	2	0	0	0	0	0	2	2	0	0	0	0	0	2	0	0	0	0	0	0
WAVI	627.0	0	3	0	1	2	1	7	0	3	0	1	2	1	7	0	0	0	0	0	0
HUVI	632.0	2	0	2	0	1	0	5	2	0	1	0	1	0	4	0	0	0	0	0	0
LBVI	633.4	10	5	8	13	8	7	51	9	5	3	5	5	4	31	0	0	1	1	1	3
NAWA	645.0	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0
OCWA	646.0	13	4	6	9	19	8	59	12	3	5	8	16	5	49	0	0	1	1	1	3
YWAR	652.0	3	7	3	6	7	10	36	3	6	3	5	7	10	34	0	0	0	0	0	0
AUWA	656.0	2	0	0	0	0	0	2	2	0	0	0	0	0	2	0	0	0	0	0	0
TOWA	668.0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0
MGWA	680.0	0	0	0	0	1	1	2	0	0	0	0	1	1	2	0	0	0	0	0	0
COYE	681.0	74	70	74	96	71	67	452	62	42	42	64	40	37	287	0	1	2	4	5	12
YBCH	683.0	55	51	43	28	35	28	240	39	30	27	18	17	16	147	1	1	1	1	1	5
WIWA	685.0	2	2	2	2	5	6	19	2	2	2	2	5	6	19	0	0	0	0	0	0
NOMO	703.0	0	0	1	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0
CATH	710.0	2	5	7	3	0	2	19	0	4	6	3	0	1	14	0	1	0	0	0	1
BEWR	719.0	22	11	19	32	17	17	118	16	4	11	22	4	6	63	0	0	0	2	1	3
HOWR	721.0	3	8	8	18	36	9	82	2	8	5	13	20	4	52	0	0	0	0	1	1
OATI	733.0	7	5	1	3	6	1	23	6	1	1	2	2	1	13	0	0	0	0	0	0
WREN	742.0	49	45	50	22	28	39	233	33	26	21	9	17	27	133	1	0	0	0	2	3
BUSH	743.0	10	14	20	8	23	28	103	9	13	18	4	16	23	83	0	0	1	0	0	1
SWTH	758.0	22	8	6	4	8	4	52	22	8	6	4	8	4	52	0	0	0	0	0	0
HETH	759.0	1	0	2	2	3	1	9	1	0	2	2	2	1	8	0	0	0	0	0	0
Total		540	485	481	502	511	432	2951	423	336	289	312	310	265	1935	6	4	11	15	24	60

a Includes multiple captures of some individuals (i.e., these numbers do not reflect total individuals)

Table 3. Capture Frequency of Individuals: De Luz Creek, 2000

Species	Code	# Individuals / Capture Incidence (Banded Birds Only)				# Captures		
		1 Capture	2 Captures	3 Captures	4 Captures	Banded Birds	Unbanded Birds	All Birds
CAQU	0	0	0	0	0	0	1	1
DOWO	3940	1	0	0	0	1	0	1
NUWO	3970	0	2	0	0	4	0	4
BCHU	4290	0	0	0	0	0	11	11
ANHU	4310	0	0	0	0	0	9	9
ALHU	4340	0	0	0	0	0	2	2
UNHU	4409	0	0	0	0	0	12	12
ATFL	4540	7	0	0	0	7	0	7
PSFL	4641	11	0	0	0	11	0	11
WIFL	4660	1	0	0	0	1	0	1
HAFL	4680	1	0	0	0	1	0	1
WESJ	4810	1	0	0	0	1	0	1
PUFI	5170	2	0	0	0	2	0	2
HOFI	5190	9	0	0	0	9	0	9
LEGO	5300	18	0	0	0	18	2	20
WCSP	5540	3	1	0	0	5	0	5
SOSP	5810	32	7	1	1	53	1	54
SPTO	5880	17	1	0	0	19	1	20
CALT	5911	7	1	0	0	9	0	9
BHGR	5960	15	1	0	0	17	0	17
LAZB	5990	4	0	0	0	4	0	4
VGSW	6150	2	0	0	0	2	0	2
WAVI	6270	1	0	0	0	1	0	1
LBVI	6334	7	0	0	0	7	0	7
OCWA	6460	8	0	0	0	8	0	8
YWAR	6520	10	0	0	0	10	0	10
MGWA	6800	1	0	0	0	1	0	1
COYE	6810	39	3	6	1	67	0	67
YBCH	6830	15	5	1	0	28	0	28
WIWA	6850	6	0	0	0	6	0	6
CATH	7100	2	0	0	0	2	0	2
BEWR	7190	5	1	2	1	17	0	17
HOWR	7210	4	0	1	0	7	2	9
OATI	7330	1	0	0	0	1	0	1
WREN	7420	25	3	2	0	37	2	39
BUSH	7430	23	1	0	0	25	3	28
SWTH	7580	4	0	0	0	4	0	4
HETH	7590	1	0	0	0	1	0	1
Total		**283**	**26**	**13**	**3**	**386**	**46**	**432**

Figure 3. Number of Individuals Caught per Species: De Luz Creek, 2000



previous years; compared to their 1995-1999 mean capture rates, captures at nets 3 and 4 were higher, at nets 5 and 7 were equal to, and at all other nets were lower (Figure 4). Changes in vegetative cover in the vicinity of the nets, in response to yearly fluctuations in precipitation and severity of winter flooding, are probably responsible for the shifts in capture rates.

Capture rates peaked at 93 captures per 100-net hours in early May (Table 4), coinciding with peak movement of migrants through the site (Table 5). Captures in 2000 were much more erratic on a period-to-period basis than in previous years, but as in previous years were generally higher from April to June than in July and August.

Population Trends, Productivity, Survivorship, and Recruitment: 1995 - 2000

Sixty of the birds caught in 2000 (16 percent) were recaptured individuals originally banded in previous years (Table 2), providing five years of survival data for the 1995 banded cohort, four years for the 1996 cohort, three years for the 1997 cohort, two years for the 1998 cohort, and one year for the 1999 cohort. As discussed in previous reports, 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 (Fourth Annual Progress Report, 1998, Table 6). This derives from the failure of birds to return to the banding site, and/or be recaptured, during every year that they are alive.

The factors responsible for the irregular recapture histories of some birds are unknown and need to be investigated. Possible explanations are that birds do not return to the De Luz Creek region every year to breed, that they return to the general vicinity but to a territory outside of the netting station, or that they return to the station but are simply not recaptured. Documentation of either of the first two phenomena would have important implications for collecting and interpreting monitoring data for species of conservation and management concern.

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 survival, productivity, and recruitment rates are all affected by capture rates: as captures per species decline, the likelihood that capture ratios accurately represent population parameters declines. Therefore, estimates of population parameters are likely to be most accurate for species with consistently high numbers of captures and recaptures. Although estimates of population parameters for abundant species may not be representative of all species, these estimates are likely to indicate general trends within subgroups with which they share ecological conditions.

<u>Population Size</u>

The majority of species (65 percent) captured at De Luz Creek average fewer than six individuals per year, and many are not caught at all in some years; such low average capture rates make these species poor indicators of long term population trends within the community.

Table 4. Capture Rate by Net and Date: De Luz Creek, 2000

MAPS Period	Date		Net										Date Total
			1	2	3	4	5	6	7	8	9	10	
		Net Hours	4:35	4:20	4:10	4:05	4:15	4:25	4:10	4:25	4:25	4:30	**43:20**
		Captures	2	2	3	0	4	5	8	4	4	3	**35**
-3	4/3	Captures/Net Hour	0.44	0.46	0.72	0.00	0.94	1.13	1.92	0.91	0.91	0.67	**0.81**
		Net Hours	4:30	4:30	4:30	4:35	4:35	4:40	4:20	4:30	4:35	4:30	**45:15**
		Captures	0	1	3	1	2	3	4	3	2	6	**25**
-2	4/11	Captures/Net Hour	0.00	0.22	0.67	0.22	0.44	0.64	0.92	0.67	0.44	1.33	**0.55**
		Net Hours	4:57	4:50	4:43	4:47	4:40	4:37	4:35	4:50	4:50	4:28	**47:17**
		Captures	3	4	4	4	7	2	5	3	1	4	**37**
-1	4/24	Captures/Net Hour	0.61	0.83	0.85	0.84	1.50	0.43	1.09	0.62	0.21	0.90	**0.78**
		Net Hours	5:26	5:24	5:31	5:03	5:23	5:16	5:30	5:30	5:30	5:21	**53:54**
		Captures	7	7	4	3	8	2	3	3	3	10	**50**
1	5/3	Captures/Net Hour	1.29	1.30	0.73	0.59	1.49	0.38	0.55	0.55	0.55	1.87	**0.93**
		Net Hours	5:05	5:05	4:50	4:45	5:05	5:05	5:10	5:10	5:10	5:05	**50:30**
		Captures	4	3	1	3	2	4	4	6	9	5	**41**
2	5/15	Captures/Net Hour	0.79	0.59	0.21	0.63	0.39	0.79	0.77	1.16	1.74	0.98	**0.81**
		Net Hours	4:50	4:49	4:52	5:00	5:02	4:57	5:14	5:00	4:59	5:08	**49:51**
		Captures	0	1	4	3	3	1	4	5	7	1	**29**
3	5/24	Captures/Net Hour	0.00	0.21	0.82	0.60	0.60	0.20	0.76	1.00	1.40	0.19	**0.58**
		Net Hours	5:36	5:29	5:20	5:30	5:20	5:25	5:45	5:45	5:40	5:37	**55:27**
		Captures	1	3	5	2	1	1	2	2	2	5	**24**
4	6/5	Captures/Net Hour	0.18	0.55	0.94	0.36	0.19	0.18	0.35	0.35	0.35	0.89	**0.43**
		Net Hours	5:45	5:35	5:35	5:20	5:30	5:30	5:30	5:35	5:25	5:25	**55:10**
		Captures	8	3	11	6	5	1	4	0	4	2	**44**
5	6/14	Captures/Net Hour	1.39	0.54	1.97	1.13	0.91	0.18	0.73	0.00	0.74	0.37	**0.80**
		Net Hours	5:00	5:15	5:25	5:01	5:02	5:00	5:10	5:05	5:05	5:00	**51:03**
		Captures	1	3	4	6	2	4	4	2	1	2	**29**
6	6/23	Captures/Net Hour	0.20	0.57	0.74	1.20	0.40	0.80	0.77	0.39	0.20	0.40	**0.57**
		Net Hours	5:25	5:15	5:00	4:55	5:20	5:20	5:20	5:20	5:20	5:10	**52:25**
		Captures	4	4	1	4	2	1	2	0	4	2	**24**
7	7/5	Captures/Net Hour	0.74	0.76	0.20	0.81	0.38	0.19	0.38	0.00	0.75	0.39	**0.46**
		Net Hours	5:10	5:08	5:20	5:15	5:13	5:10	5:15	5:15	5:15	5:16	**52:17**
		Captures	0	1	0	2	0	4	2	1	0	3	**13**
8	7/13	Captures/Net Hour	0.00	0.19	0.00	0.38	0.00	0.77	0.38	0.19	0.00	0.57	**0.25**
		Net Hours	5:05	5:20	5:30	5:10	5:20	5:20	5:20	5:25	5:25	5:15	**53:10**
		Captures	1	3	4	2	2	1	0	0	5	0	**18**
9	7/21	Captures/Net Hour	0.20	0.56	0.73	0.39	0.38	0.19	0.00	0.00	0.92	0.00	**0.34**
		Net Hours	4:56	4:57	5:00	5:15	4:50	4:55	4:55	5:15	5:05	5:00	**50:08**
		Captures	1	2	3	0	3	2	0	1	1	4	**17**
10	8/2	Captures/Net Hour	0.20	0.40	0.60	0.00	0.62	0.41	0.00	0.19	0.20	0.80	**0.34**
		Net Hours	5:15	5:15	5:15	5:20	5:15	5:10	5:05	4:40	5:00	5:05	**51:20**
		Captures	2	3	6	4	3	0	8	0	2	3	**31**
11	8/10	Captures/Net Hour	0.38	0.57	1.14	0.75	0.57	0.00	1.57	0.00	0.40	0.59	**0.60**
		Net Hours	4:35	4:50	5:00	4:25	4:43	4:40	4:45	4:50	4:50	4:40	**47:18**
		Captures	0	1	11	0	1	0	1	0	1	0	**15**
12	8/22	Captures/Net Hour	0.00	0.21	2.20	0.00	0.21	0.00	0.21	0.00	0.21	0.00	**0.32**
		Net Hours	**76:10**	**76:02**	**76:01**	**74:26**	**75:33**	**75:30**	**76:04**	**76:35**	**76:34**	**75:30**	**758:25**
		Captures	**34**	**41**	**64**	**40**	**45**	**31**	**51**	**30**	**46**	**50**	**432**
Net Total		**Captures/Net Hour**	**0.45**	**0.54**	**0.84**	**0.54**	**0.60**	**0.41**	**0.67**	**0.39**	**0.60**	**0.66**	**0.57**

Figure 4. Captures, Net Hours, and Capture Rate by Net: De Luz Creek, 2000

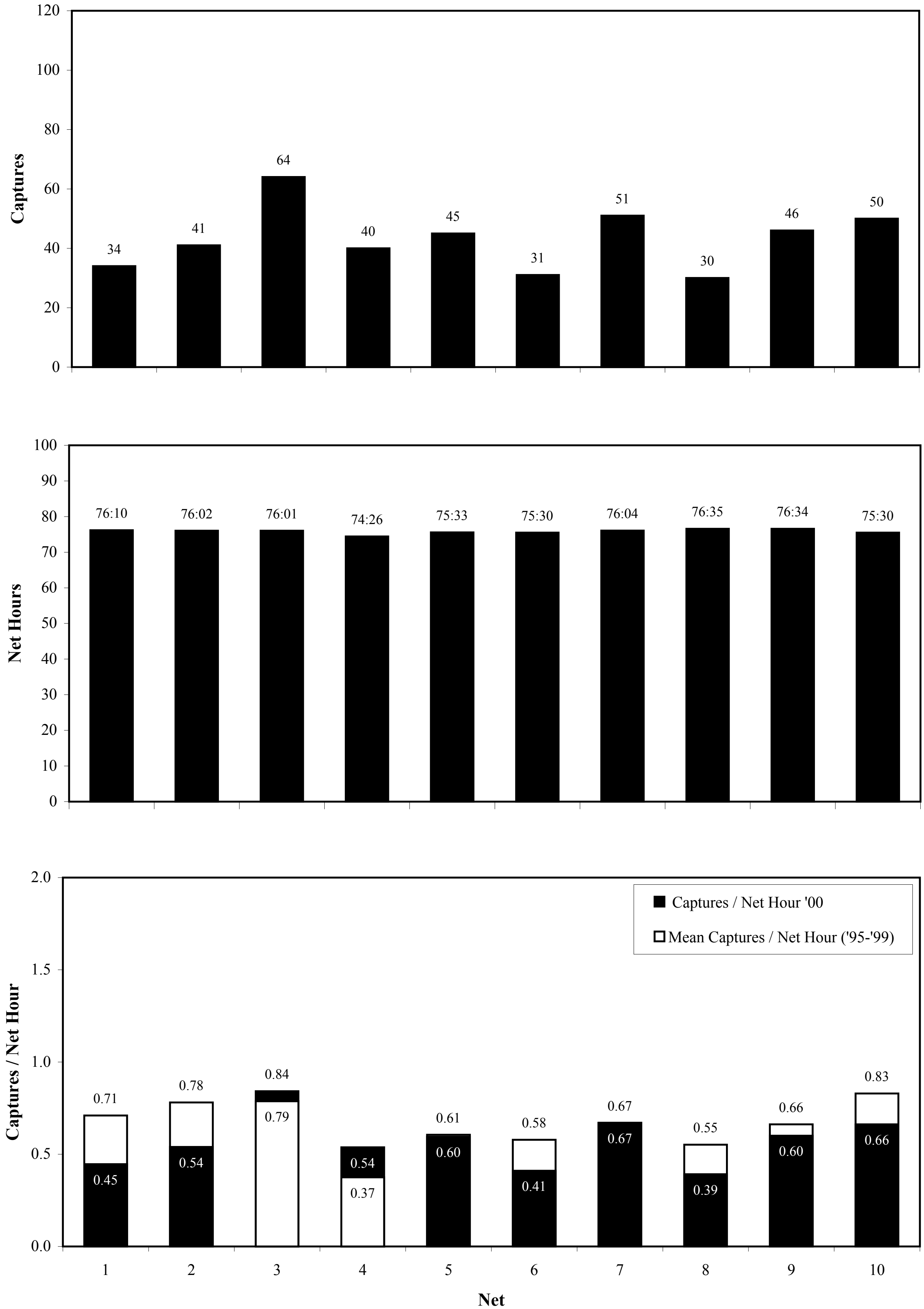


Table 5. Number of Captures by Date: De Luz Creek, 2000

Species	Code	MAPS Period															Total	Captures per 100 Net Hours[a]
		-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12		
		Date																
		4/3	4/11	4/24	5/3	5/15	5/24	6/5	6/14	6/23	7/5	7/13	7/21	8/2	8/10	8/22		
CAQU	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**1**	**0.13**
DOWO	394.0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**1**	**0.13**
NUWO	397.0	0	0	0	0	0	1	0	2	0	0	0	1	0	0	0	**4**	**0.53**
BCHU	429.0	0	0	0	4	0	1	0	2	0	3	0	0	0	1	0	**11**	**1.45**
ANHU	431.0	0	1	3	1	0	1	0	2	0	0	0	0	1	0	0	**9**	**1.19**
ALHU	434.0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	**2**	**0.26**
UNHU[b]	440.9	0	0	3	3	1	1	0	0	1	0	1	1	1	0	0	**12**	**1.58**
ATFL	454.0	0	0	0	0	0	0	1	0	3	2	1	0	0	0	0	**7**	**0.92**
PSFL	464.1	0	0	1	0	5	1	0	1	0	1	0	0	1	0	1	**11**	**1.45**
WIFL	466.0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**1**	**0.13**
HAFL	468.0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
WESJ	481.0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**1**	**0.13**
PUFI	517.0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	**2**	**0.26**
HOFI	519.0	5	2	0	0	0	0	0	0	0	0	0	0	0	2	0	**9**	**1.19**
LEGO	530.0	4	2	4	3	1	1	3	1	0	1	0	0	0	0	0	**20**	**2.64**
WCSP	554.0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**5**	**0.66**
SOSP	581.0	2	2	6	5	6	4	4	6	5	4	0	1	2	5	2	**54**	**7.12**
SPTO	588.0	5	2	1	2	2	2	2	1	0	0	2	0	1	0	0	**20**	**2.64**
CALT	591.1	1	0	2	0	1	1	1	0	0	0	0	0	0	3	0	**9**	**1.19**
BHGR	596.0	0	1	1	0	1	0	1	3	2	0	3	3	0	2	0	**17**	**2.24**
LAZB	599.0	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	**4**	**0.53**
VGSW	615.0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	**2**	**0.26**
WAVI	627.0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
LBVI	633.4	0	0	0	1	2	0	2	0	0	0	0	1	0	1	0	**7**	**0.92**
OCWA	646.0	0	0	1	4	1	1	0	0	0	0	0	0	0	0	1	**8**	**1.05**
YWAR	652.0	0	0	0	3	3	2	0	2	0	0	0	0	0	0	0	**10**	**1.32**
MGWA	680.0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
COYE	681.0	8	4	4	5	5	5	4	6	7	3	2	3	5	5	1	**67**	**8.83**
YBCH	683.0	0	0	2	5	3	3	2	3	1	3	1	3	2	0	0	**28**	**3.69**
WIWA	685.0	0	1	0	3	2	0	0	0	0	0	0	0	0	0	0	**6**	**0.79**
CATH	710.0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**2**	**0.26**
BEWR	719.0	2	2	3	2	0	0	2	3	1	1	0	0	0	1	0	**17**	**2.24**
HOWR	721.0	0	0	2	1	1	0	0	1	1	1	1	1	0	0	0	**9**	**1.19**
OATI	733.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**1**	**0.13**
WREN	742.0	2	4	1	1	4	0	2	4	7	5	2	4	1	2	0	**39**	**5.14**
BUSH	743.0	1	0	0	0	1	3	0	7	0	0	0	0	0	8	8	**28**	**3.69**
SWTH	758.0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	**4**	**0.53**
HETH	759.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
Total		**35**	**25**	**37**	**50**	**41**	**29**	**24**	**44**	**29**	**24**	**13**	**18**	**17**	**31**	**15**	**432**	**56.96**
Species		**11**	**13**	**16**	**19**	**16**	**14**	**11**	**15**	**9**	**10**	**7**	**8**	**10**	**11**	**7**	**37**	**4.88**

[a] 758:25 total net-hours

[b] Not included in species total

Although seventeen species average greater than six captures per year, six of these species are disproportionately represented by transient individuals, or have age classes that are difficult to distinguish, making them poor indicators of breeding population size, productivity, and survivorship. We therefore confined our examination of population trends to the remaining 11 species with adequate numbers of known-age individuals. We considered residents and migrants separately, since these two groups experience different conditions affecting survival and productivity. Six resident (Figure 5a) and five migrant (Figure 5b) species were initially selected for preliminary analysis of population trends.

The two most abundant resident species breeding at the site are common yellowthroats and song sparrows (COYE and SOSP, Figure 5a), while the two most abundant breeding migrant species are black-headed grosbeaks and yellow-breasted chats (BHGR and YBCH, Figure 5b). The number of adult (AHY) captures, an index of local population size, was similar across years for common yellowthroats and song sparrows, except for 1996 when captures of these two species moved in opposite directions. From 1995 to 1999, black-headed grosbeak and yellow-breasted chat captures appeared to track one another, although chat captures were consistently higher. In 2000, while chats continued to decline from their 1996 peak, grosbeaks rebounded from their 1999 low, but the overall trends for these two species remained similar. Because of their higher capture rates and apparent similarity in population trends (within resident and migrant subgroups) these four species were selected for further detailed analysis.

Survival and Population Size

Among all four species, most captures of adults each year were new captures (Figures 6a-d). Recaptures were lower and generally less variable between years. Ideally, survivorship should be broken down by species and cohort (year of initial banding), but limited recaptures for the most common species require that all cohorts be pooled for analysis. Between-year survivorship estimates are useful in examining whether species respond differently to variable annual environmental conditions, while cumulative survivorship estimates (survivorship since time of initial banding) are used to compare species' longevity and mortality rates. Indexed survivorship of adults between years (individuals recaptured in year X+1 / individuals captured in year X) generally ranged between 0.20 and 0.50 (Figure 7a). Mean survivorship across years was highest for song sparrows (0.38) and lowest for yellow-breasted chats (0.28). Differences in mean survivorship between species (Two-way ANOVA, data arcsine transformed: $F = 3.00$, $p = 0.07$) and years ($F = 2.77$, $p = 0.08$) were both significant at the $\alpha = 0.10$ level, although this was due to fluctuations in chat survivorship; when chats were dropped from the analysis, survivorship did not differ between species ($F = 1.04$, $p = 0.40$) or years ($F = 1.24$, $p = 0.37$). Cumulative survivorship declined for all four species (Figure 7b) from a mean across species of 0.26 after one year to 0.03 after five years. Survival significantly declined across years since time of first capture (Two-way ANOVA, data arcsine transformed: $F = 13.74$, $p = 0.0002$) but did not vary significantly among species ($F = 0.35$, $p = 0.79$). All four focal species showed positive relationships between adult survivorship and changes in population size (Figure 8a-b), although none of these relationships were significant (COYE: $R^2 = 0.19$, $p >0.40$; SOSP: $R^2 = 0.30$, $p >0.20$; BHGR: $R^2 = 0.30$, $p > 0.30$; YBCH: $R^2 = 0.64$, $p > 0.10$).

Figure 5a. De Luz Creek Population Trends, 1995-2000: Adult Captures, Resident Species

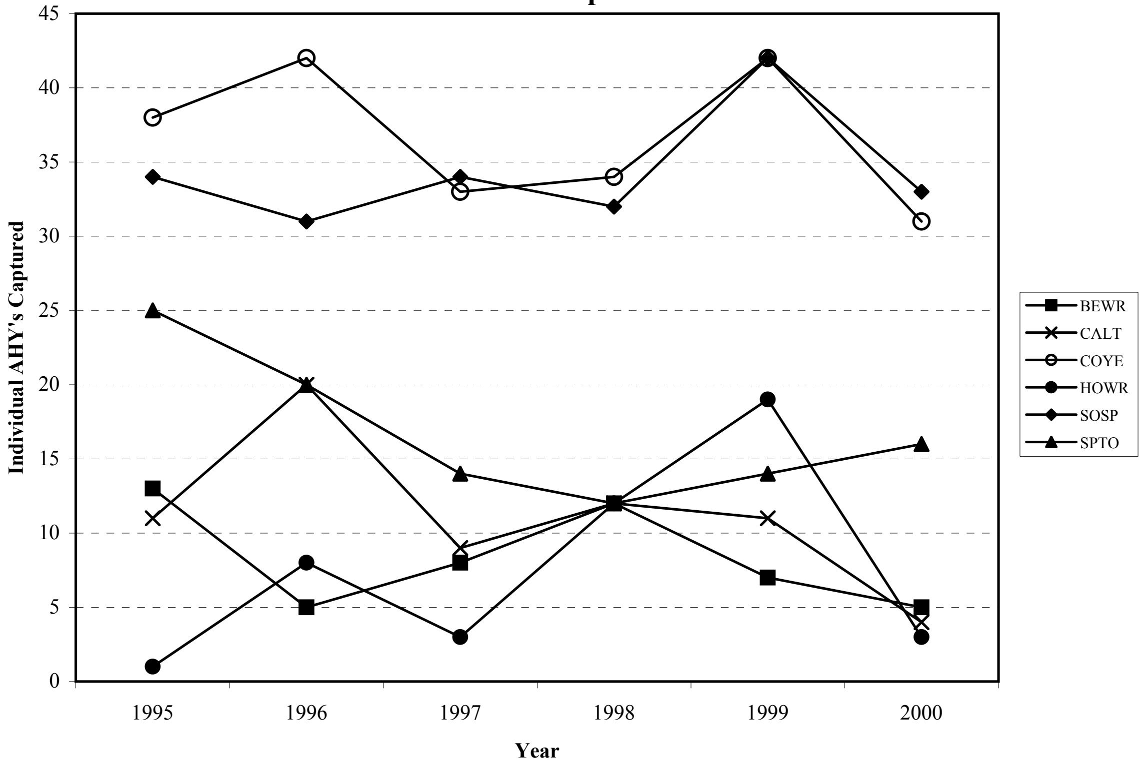


Figure 5b. De Luz Creek Population Trends, 1995-2000: Adult Captures, Migrant Species

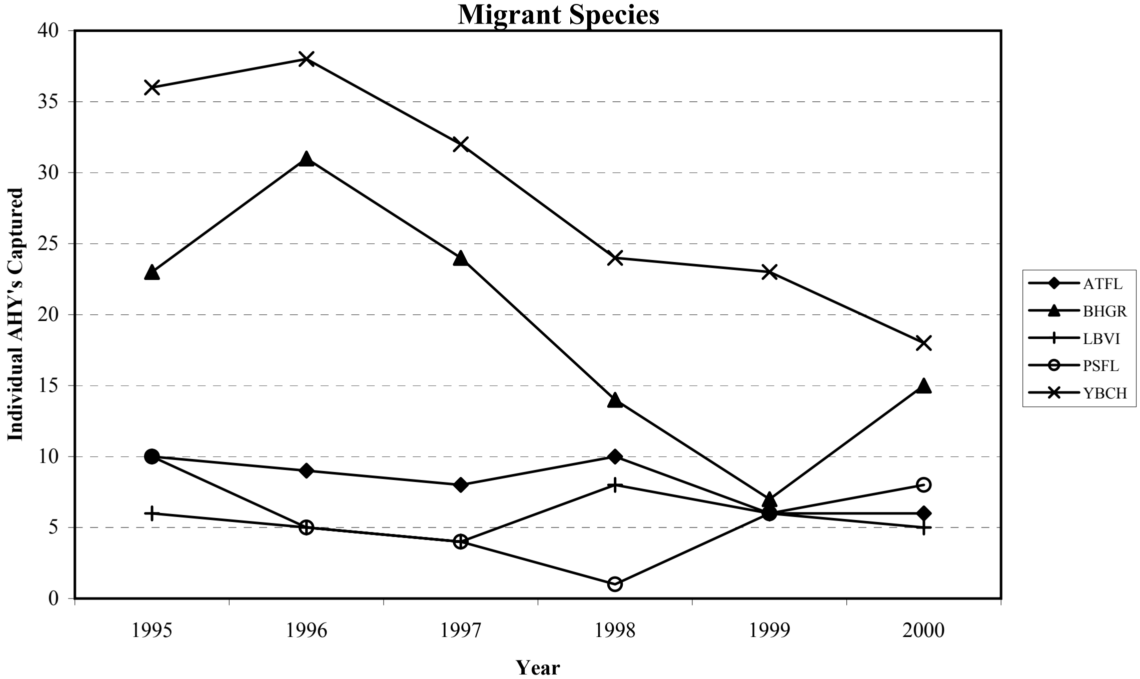


Figure 6a. Composition of Adult Common Yellowthroat Captures at De Luz Creek, 1995 - 2000

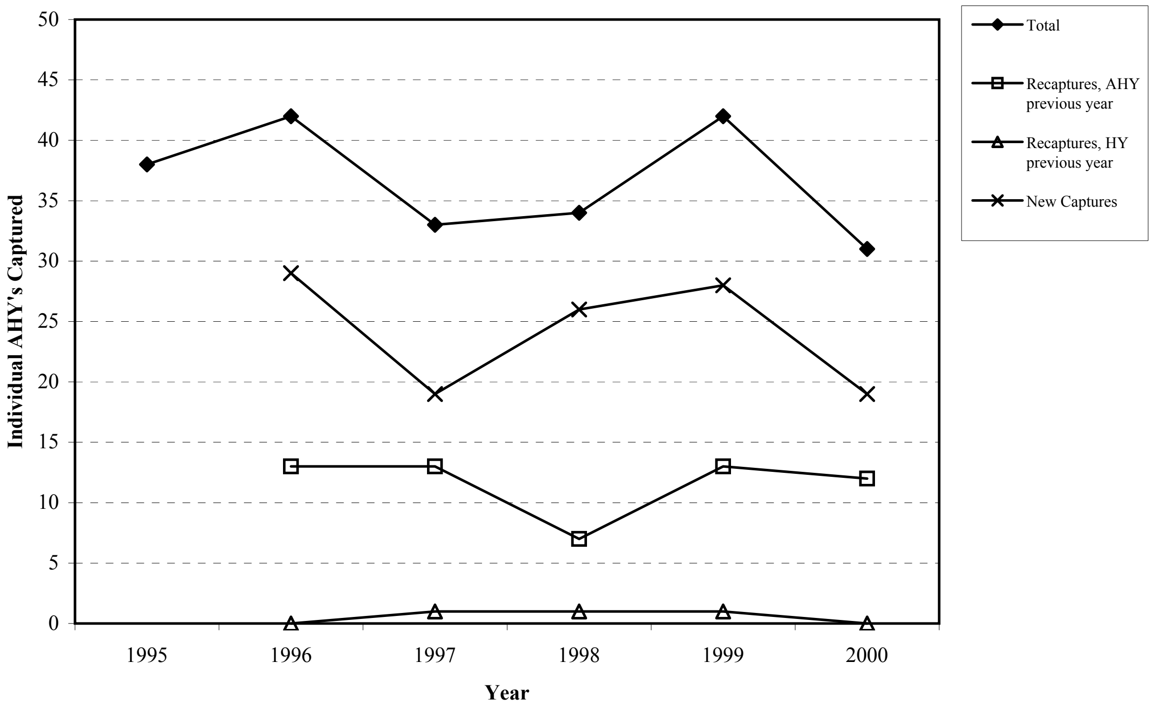


Figure 6b. Composition of Adult Song Sparrow Captures at De Luz Creek, 1995 - 2000

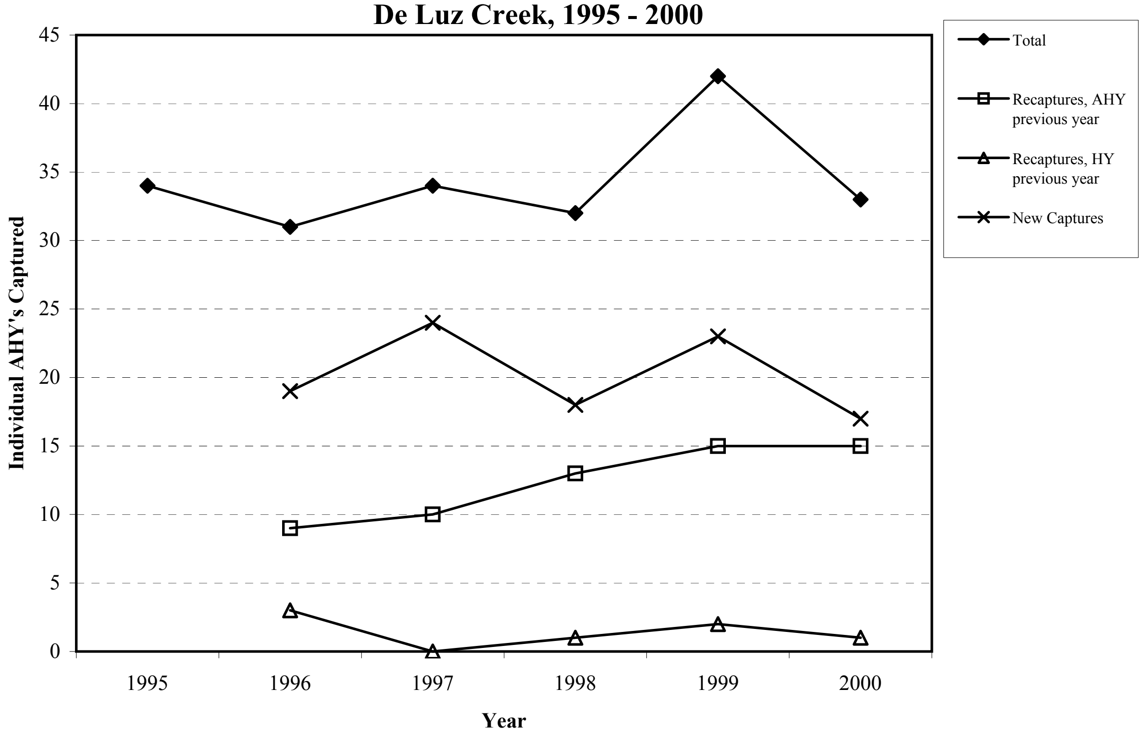


Figure 6c. Composition of Adult Black-Headed Grosbeak Captures at De Luz Creek, 1995 - 2000

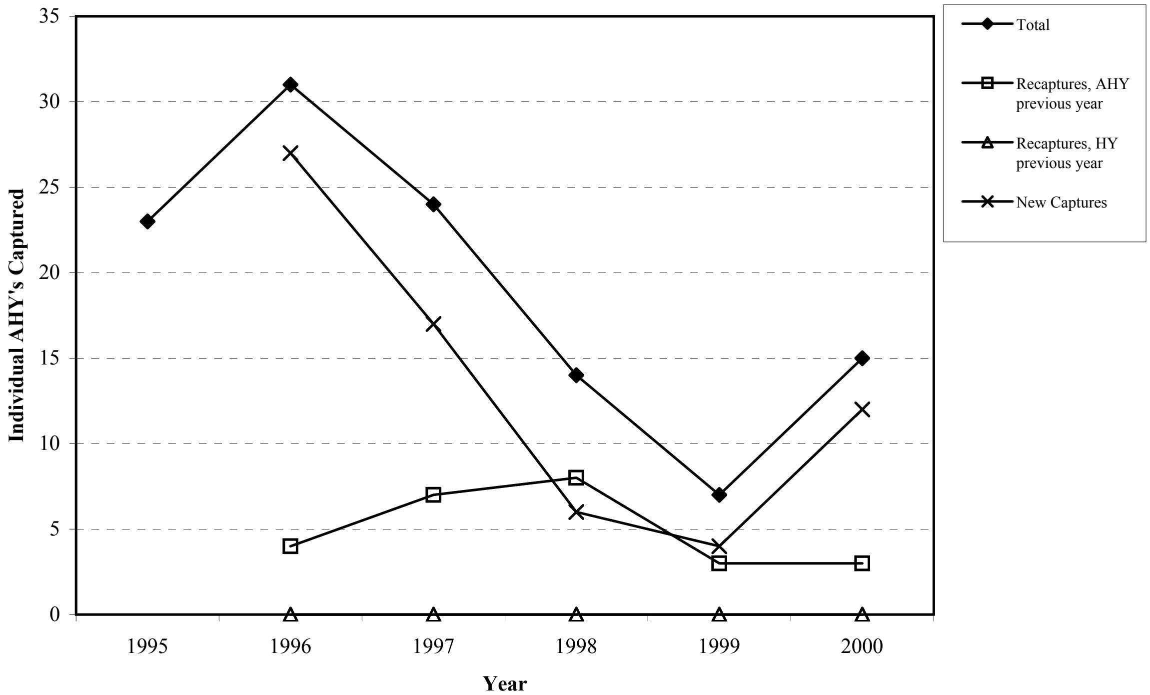


Figure 6d. Composition of Adult Yellow-Breasted Chat Captures at De Luz Creek, 1995 - 2000

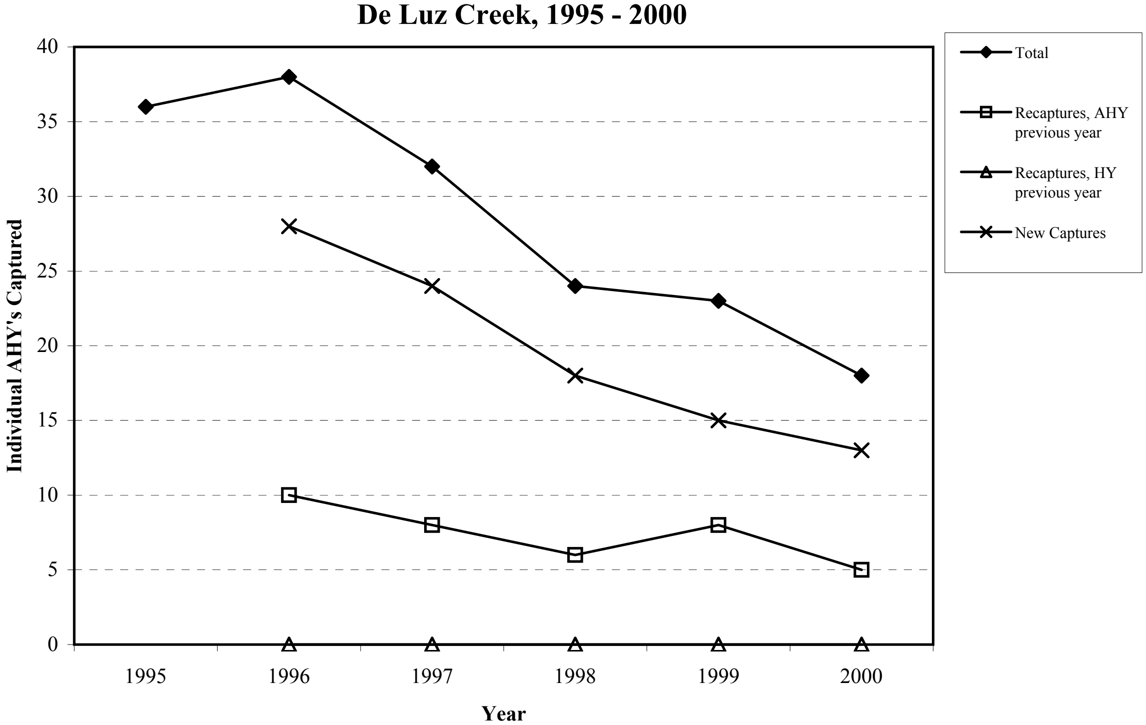


Figure 7a. Adult Survivorship between Years at De Luz Creek, 1995 -2000 (All Cohorts Combined)

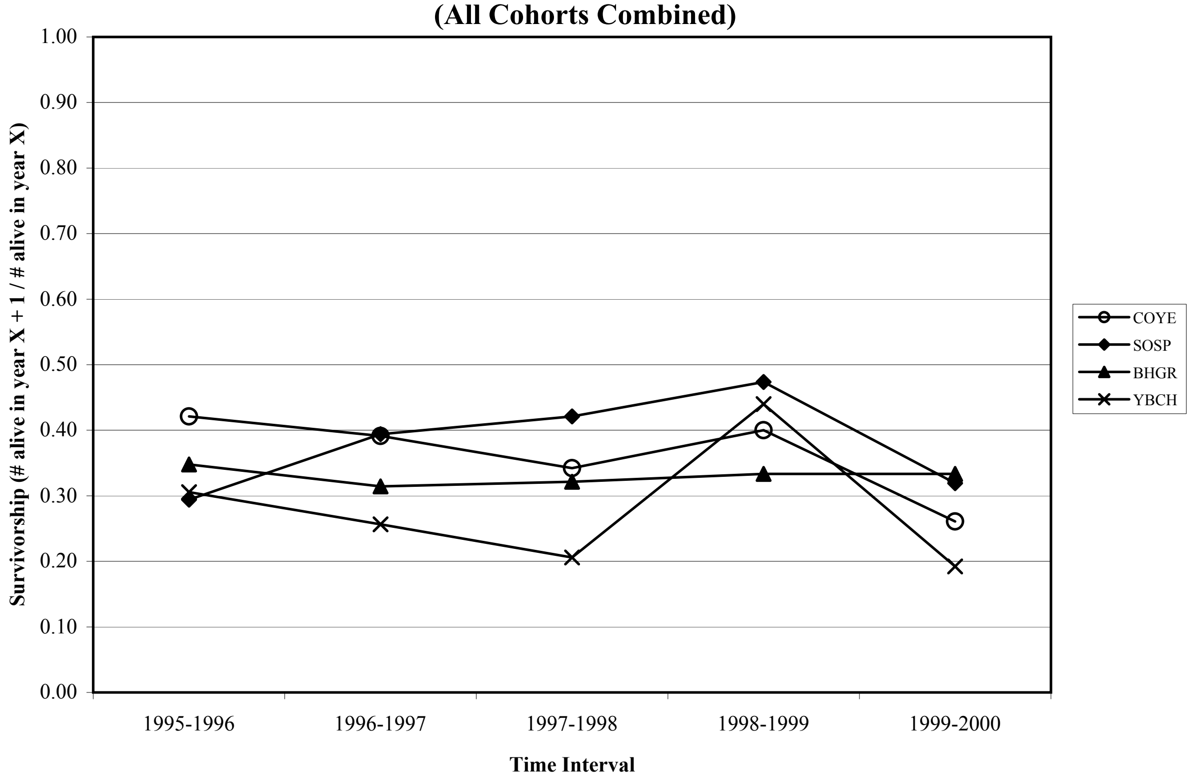


Figure 7b. Adult Survivorship from Time of First Capture at De Luz Creek, 1995-2000 (All Cohorts Combined)

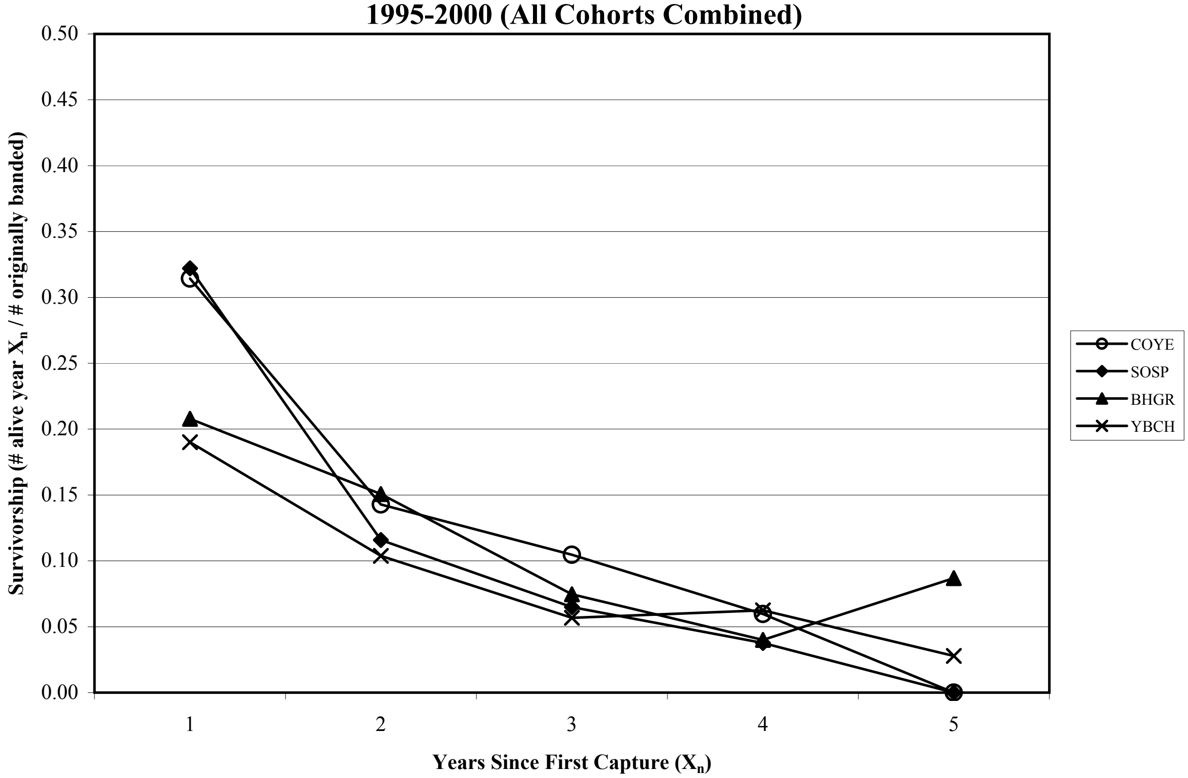


Figure 8a. Relationship between Survivorship and Changes in Adult Population Size, Resident Species, De Luz Creek 1995 -2000

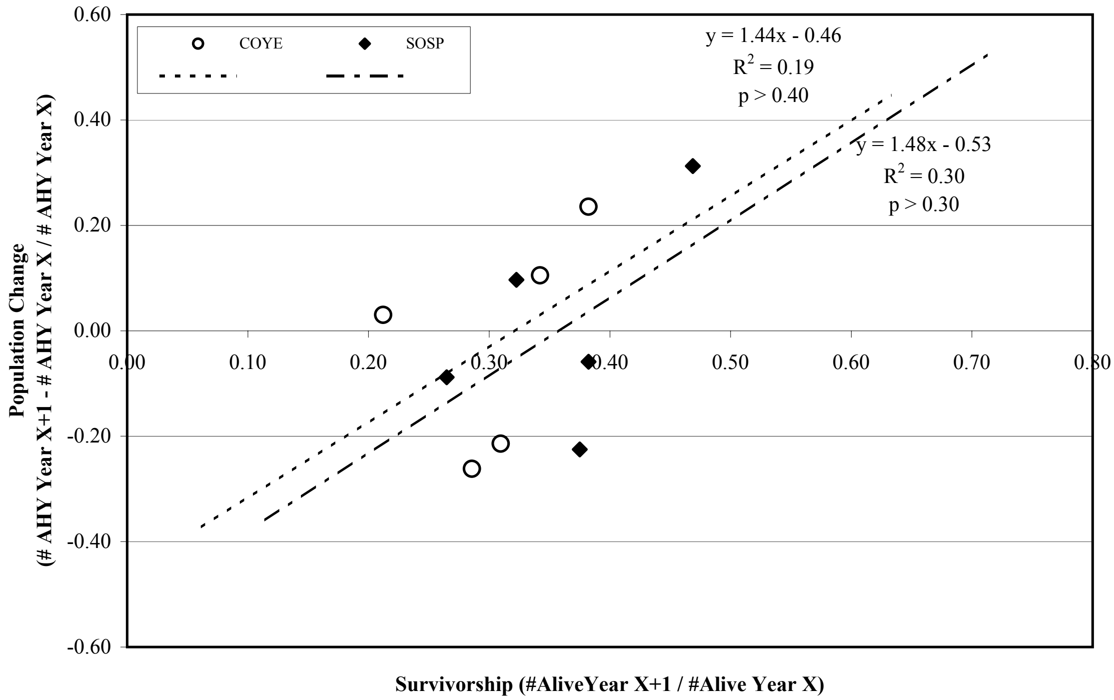
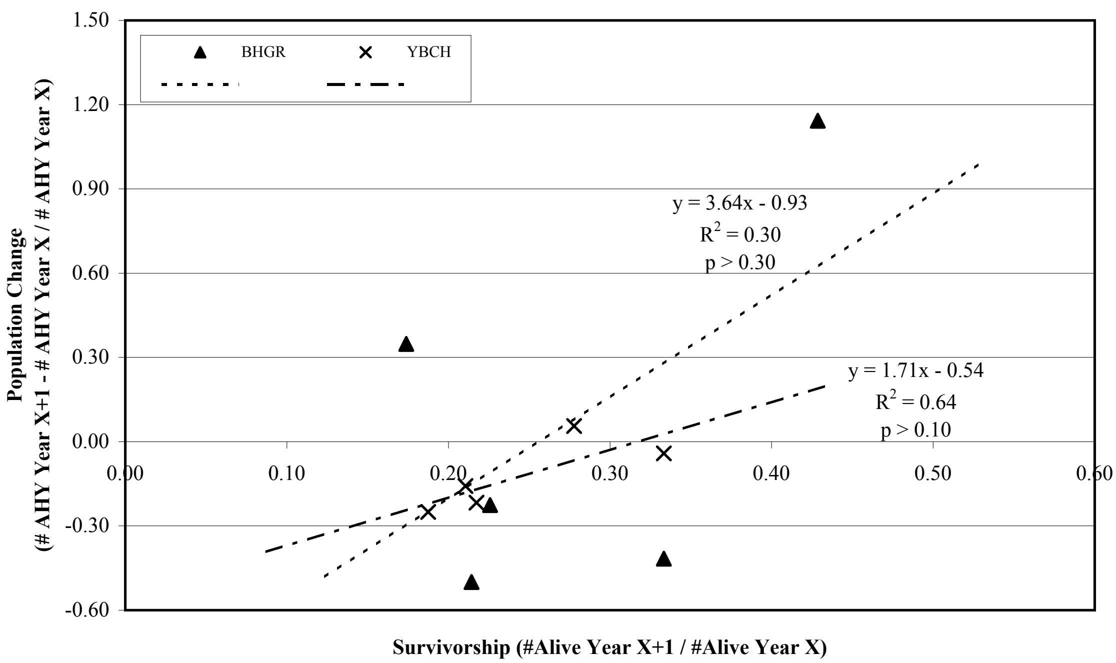


Figure 8b. Relationship between Survivorship and Changes in Adult Population Size, Migrant Species, De Luz Creek 1995 -2000



Productivity, Recruitment, and Population Size

The number of juvenile (hatching-year, HY) individuals captured was indexed to adults at the site (number HY captures / number AHY captures) to control for fluctuations in adult population size when calculating annual productivity. Indexed productivity for common yellowthroats and song sparrows ranged between 0.17 (SOSP, 1999) and 0.97 (COYE, 1998) HY's per adult (Figure 9a), and appeared to follow similar trends, except in 1996 when sparrow productivity (0.71) was nearly three times as high as that for yellowthroats (0.26). Indexed productivity for black-headed grosbeaks and yellow-breasted chats followed similar yearly trends (Figure 9b), except in 2000 when chat productivity increased while grosbeak productivity declined. Productivity of these migrant species was generally lower than, and trends dissimilar to those of the two resident species. Apparent productivity of grosbeaks (0.07 – 0.25) has generally been higher than that for chats (0.00 – 0.17), but this measure of chat productivity may be an underestimate. Although chat captures have declined over the course of this study, they still remain relatively high, and chats are the most commonly captured migrant species at this site. It is possible that hatching-year chats may not be adequately sampled, and the extremely low average captures of hatching-year chats (2.0 per year) may be a poor indicator of actual chat productivity at the site. Alternatively, chats may actually be experiencing low productivity, a possibility that warrants further investigation through comparison with other populations in the region.

Local recruitment (recapture of birds initially banded as hatching-years) has been extremely low since 1995 for common yellowthroats and song sparrows (Figure 6a-b) and non-existent for black-headed grosbeaks and yellow-breasted chats (Figure 6c-d). Although there appear to be weak negative relationships between local recruitment and population change (Figure 10) for both common yellowthroats and song sparrows, these relationships are not significant. However, productivity is significantly and strongly positively correlated with population change in the subsequent year for both common yellowthroats and song sparrows (Figure 11a; COYE: $y = 0.69x – 0.40$, $R^2 = 0.94$, $p < 0.01$; SOSP: $y = 0.74x – 0.40$, $R^2 = 0.93$, $p < 0.01$). In contrast, black-headed grosbeaks and yellow-breasted chats did not exhibit this significant positive relationship between productivity and population change (Figure 11b). These results indicate (at least among resident species) that although population fluctuations are a function of yearly productivity and subsequent recruitment of juvenile birds, most locally banded juveniles move away from their natal site and out of our sampling area. This local reciprocal recruitment of juveniles could be confirmed by re-sighting or recapture of banded birds outside, but adjacent to, the banding station.

In summary, adult populations of the four most common species (two migrant, two resident species) fluctuated on a yearly basis, with residents and migrants following different trends. Adult survivorship does not appear to be driving population fluctuations to a great extent. Mean annual adult survivorship differed significantly between species and years, and survivorship of all four species declined as a function of time since banding, a typical pattern of mortality for these passerine species. Productivity was also highly variable between years, with residents and migrants again exhibiting different trends. Recruitment, although not from within the banding site, appears to be the strongest determinant of breeding population size among residents.

Figure 9a. Annual Productivity, 1995-2000: De Luz Creek, Resident Species

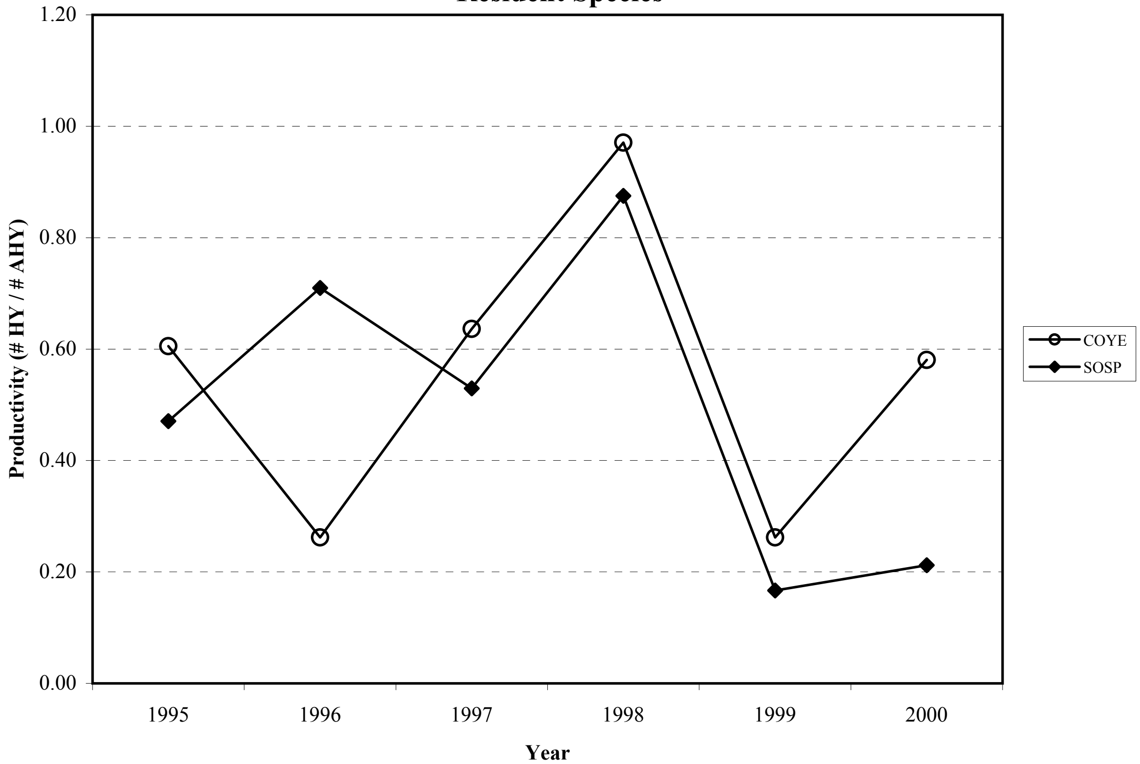


Figure 9b. Annual Productivity, 1995-2000: De Luz Creek, Migrant Species

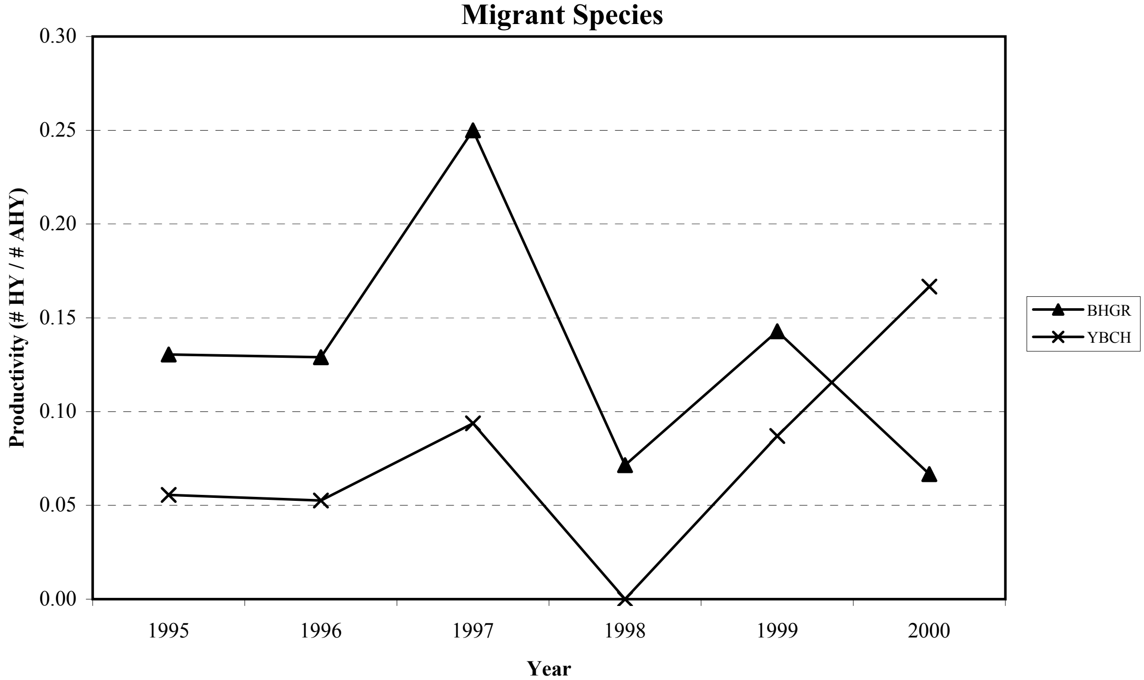


Figure 10. Relationship between Recruitment and Changes in Population Size, Resident Species, De Luz Creek 1995 -2000

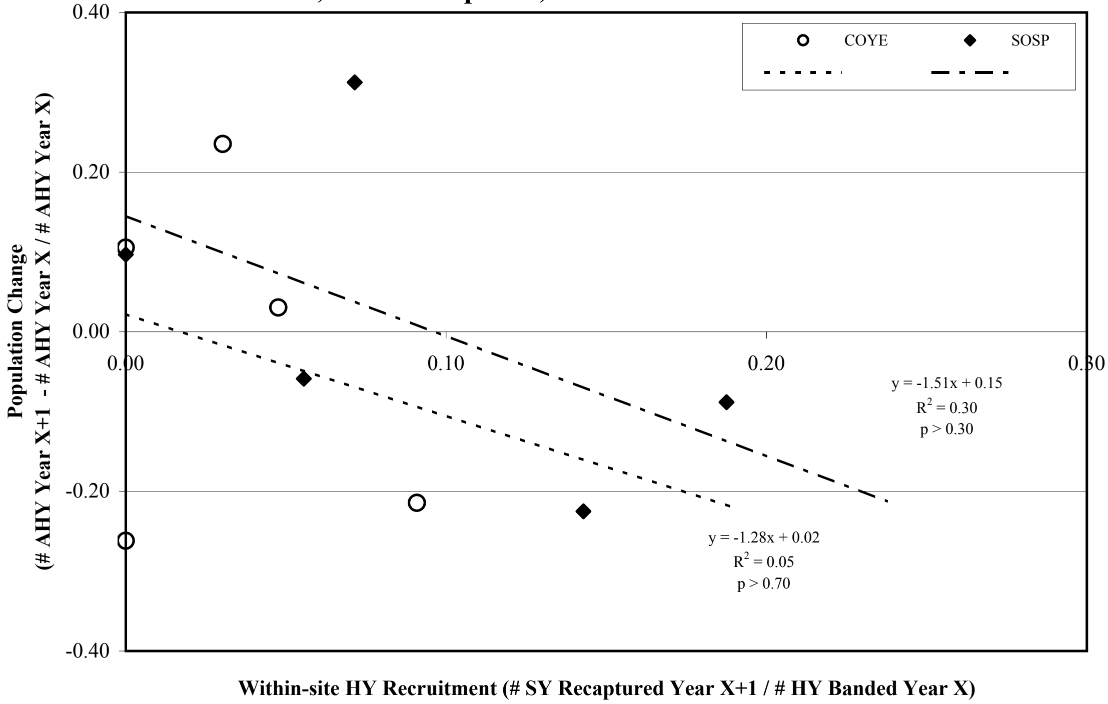


Figure 11a. Relationship between Productivity and Changes in Adult Population Size, Resident Species, De Luz Creek 1995 -2000

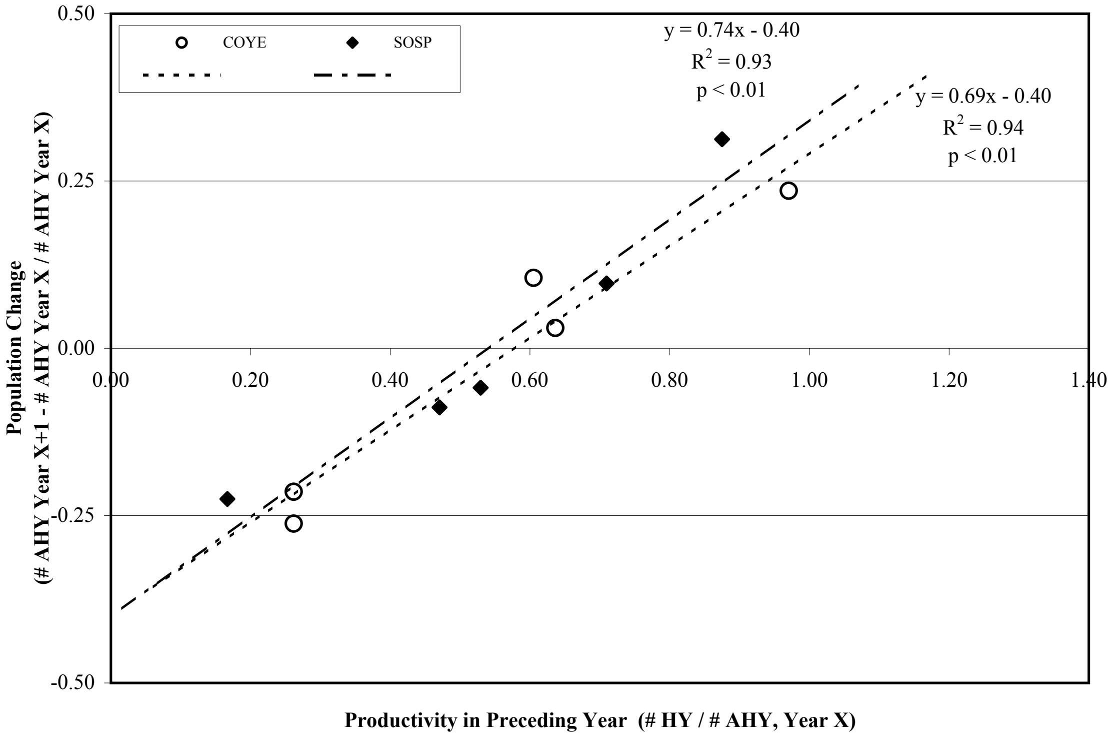
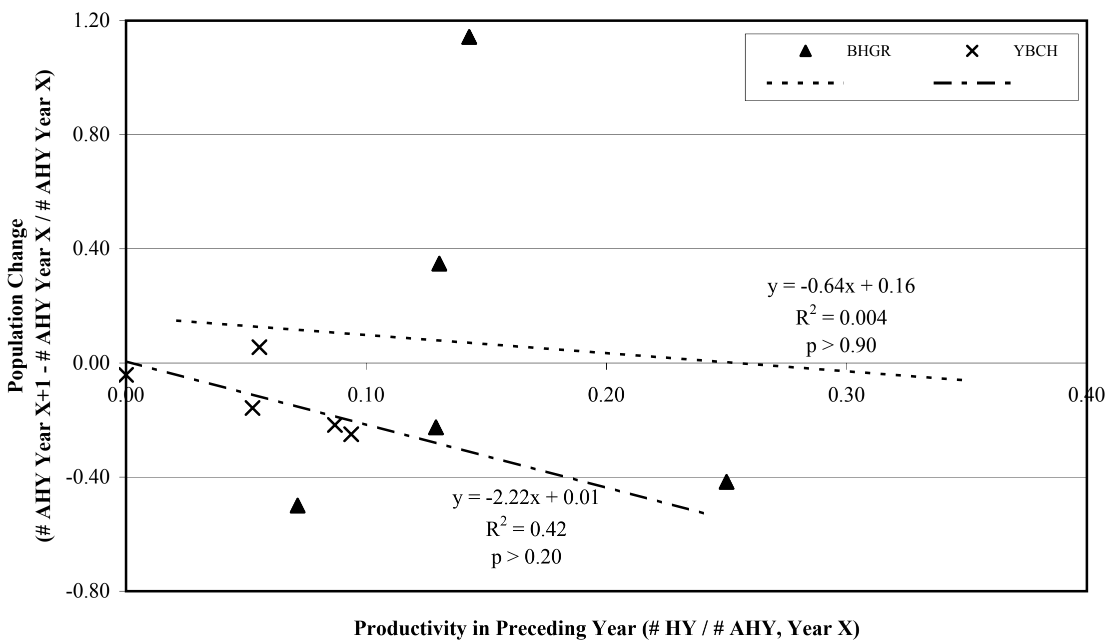


Figure 11b. Relationship between Productivity and Changes in Adult Population Size, Migrant Species, De Luz Creek 1995 -2000



Factors Influencing Population Trends

The high variability in population size, and its relationship to productivity, provides an opportunity to develop and test hypotheses identifying the factors responsible for this variability. An obvious initial hypothesis is that population fluctuations are linked to prevailing environmental conditions, which also vary across years. In a continuing assessment of environmental influences on bird populations, mean monthly temperature and precipitation data collected at the Oceanside Marina weather station were downloaded from the National Climatic Data Center (NCDC) and compared to capture data collected over the course of this study.

Changes in population size, survivorship, productivity, and recruitment were compared to trends in standardized local temperature and precipitation measures to determine how environmental factors influence population dynamics (Table 6, relationships significant at $\alpha = 0.10$ shown).

Residents

Our initial hypothesis was that wet winters should limit survivorship of residents (by increasing energy requirements for homeostasis) but benefit subsequent productivity (by increasing habitat and food availability). As predicted, both species did have higher productivity following wet years (Table 6). Common yellowthroats also show a decrease in survivorship following wet winters, but song sparrows do not exhibit the same relationship.

We also predicted that colder winter temperatures should depress resident survivorship (due to higher energy requirements), while warmer winter temperatures should benefit productivity (due to better physical condition of breeding birds following milder winters). The inclusion of year 2000 data weakened support for this hypothesis. Common yellowthroats showed no relationships between winter temperatures and either survivorship or productivity. In contrast to results reported in 1999, song sparrows no longer exhibited increased productivity with warmer winter temperatures, but continued to show decreased survivorship during warmer winters, contrary to our predictions. Warmer winter temperatures may be associated with negative environmental or competitive factors that are the actual factor limiting survivorship, but this is currently unknown. Although no relationship exists between total winter precipitation and mean temperature within a given year, time-delayed effects from previous years may influence survival, and outweigh the affects of prevailing conditions (Figure 12). For the period 1991-2000, warmer springs were followed by wetter winters ($y = 1.47x + 1.23$; $R^2 = 0.55$, $t_{slope} = 2.69$, $p = 0.04$), while wetter winter/springs were followed by colder winters ($y = -0.13x + 0.06$; $R^2 = 0.45$, $t_{slope} = -2.23$, $p = 0.06$). Wet years are likely to generate higher food availability and improve the condition of individual birds, and this may outweigh the higher energetic costs of subsequent cold winters.

Although more data will be required to confirm the relationships exhibited, this preliminary analysis indicates that environmental factors influence residents' survivorship and population size (which is a weak function of survivorship) in a manner opposite to their effects on productivity. Relationships exhibited by using data gathered at this station illustrate the value of gathering long-term survivorship and productivity data on multiple species over a period

Figure 12a. Annual Departure From Normal Mean Temperature, Oceanside Marina, 1990-2000

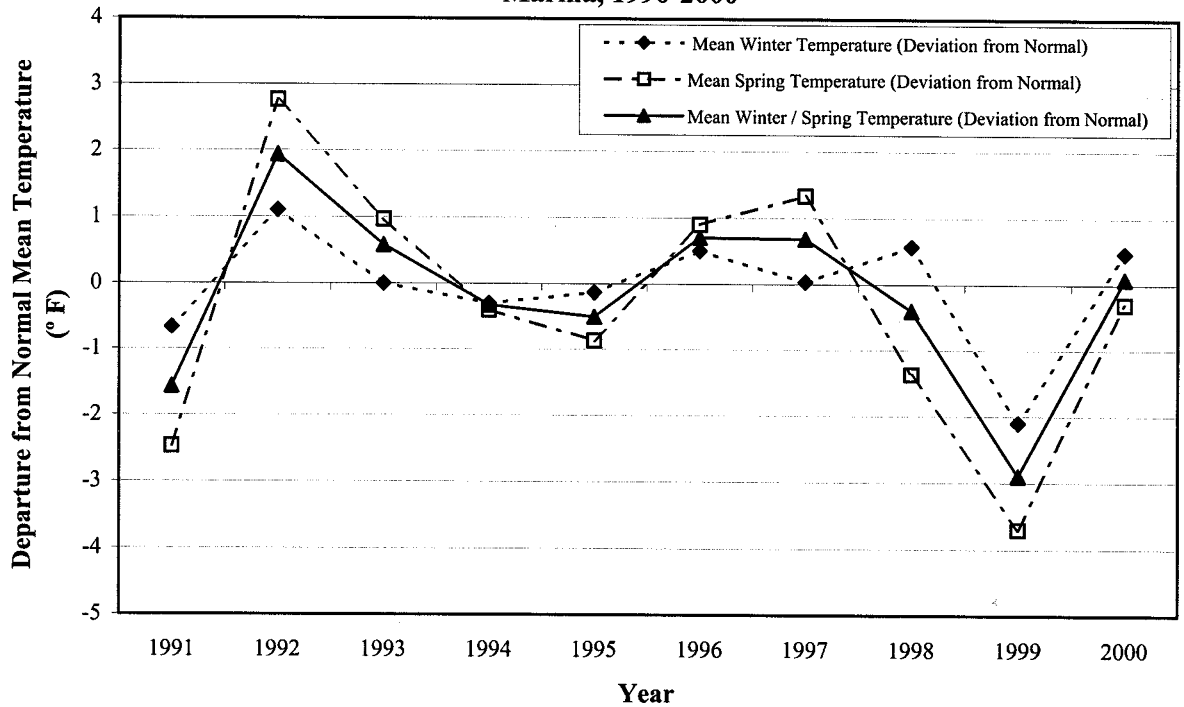
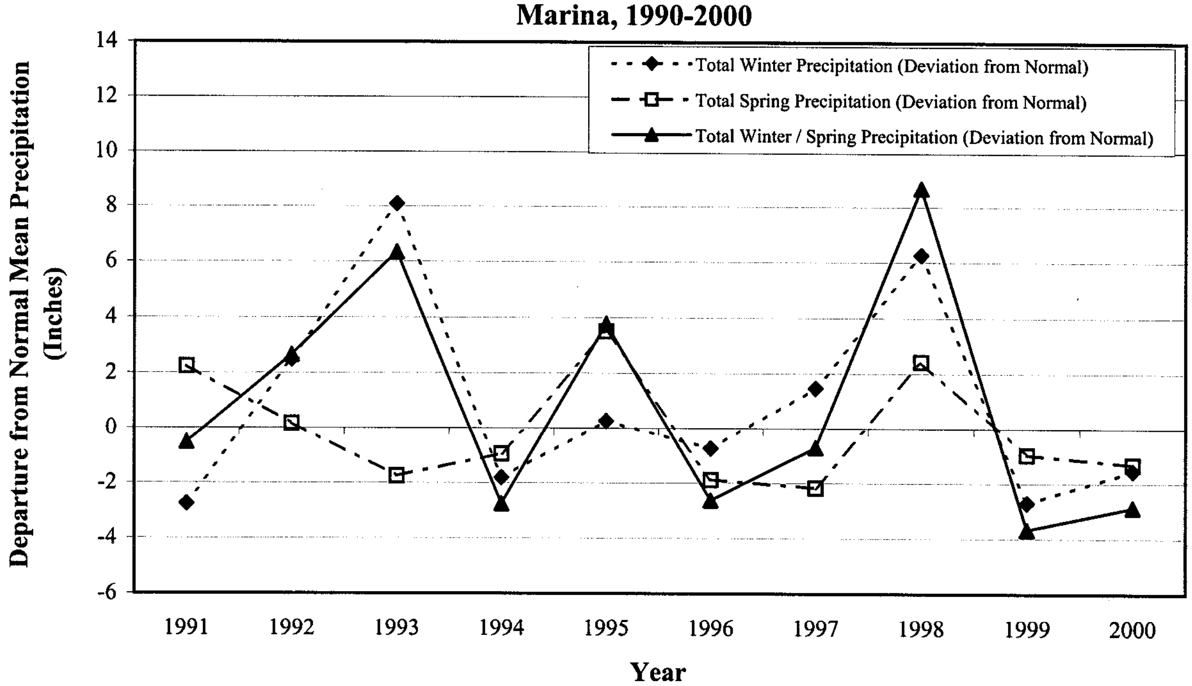


Figure 12b. Annual Departure From Normal Mean Precipitation, Oceanside Marina, 1990-2000



encompassing variable conditions to understand environmentally determined trends within this community. Understanding natural fluctuations, versus other impacts on bird populations, will be useful for management of all bird species, including species of special concern. As a word of caution, it is important to note that while relationships between variables are suggestive of causal relationships, they are not sufficient to determine causality or the mechanisms by which one factor influences the other. Relationships that are substantiated by future data can be used to develop rigorous tests of hypotheses concerning causal mechanisms.

Migrants

Both yellow-breasted chats and black-headed grosbeaks are Neotropical migrants, and therefore local winter weather conditions do not act on these species directly. Despite this, it is possible that local conditions are proximal cues related to environmental conditions experienced by these species on their wintering grounds or during migration. Although they experience some overlap, these two species differ in wintering range, with black-headed grosbeaks being restricted mainly to inland Central Mexico, and yellow-breasted chats wintering in coastal Central Mexico and Central America (1995, Howell, S., and S. Webb. A guide to the birds of Mexico and Northern Central America.). Thus, we do not expect that the two species will necessarily be similar with regard to the influence of local winter conditions.

We predicted that migrants' productivity should increase following wet winters (for the same reasons as residents), but survivorship should not necessarily be adversely affected by wet winters (because migrants are not present during locally harsh conditions). In fact, wet winters may benefit ecosystem productivity along migration routes, and therefore benefit survivorship. In contrast to the relationships reported in 1999, neither black-headed grosbeaks nor yellow-breasted chats showed any relationship between winter precipitation and survivorship (Table 6). Yellow-breasted chats continued to exhibit a weak negative relationship between precipitation and productivity, indicating that chats have lower productivity after locally wet winters, but the magnitude (i.e. the slope of the line describing the relationship = -0.008) of this relationship is extremely small and may not be biologically important.

Although local winter temperatures are unlikely to affect migrants, warmer spring (March – May) temperatures should benefit survivorship (lower energy costs during migration and territory establishment) and productivity (more energy resources available for reproduction versus homeostasis). Although survivorship did not increase with warmer spring temperatures, grosbeak population size (which is a weak function of survivorship) increased with warmer spring weather (Table 6).

Because the relationships between local environmental conditions and the conditions experienced by migrants on their wintering grounds and during migration are uncertain, explanations of mechanisms underlying existing relationships are not currently possible. It is important to note that environmental factors that benefit resident species may not be beneficial to migrants, and migrant species themselves may each respond in a different manner to prevailing conditions. As stated previously for residents, relationships exhibited by migrants that are substantiated by future data can be used to develop rigorous tests of hypotheses concerning causal mechanisms.

<u>Santa Margarita River</u>

Overview of 2000 Captures

Five hundred and sixty-one individuals of 31 species were caught during 760 net-hours (Table 7). Overall captures totaled 705, for an average capture rate of 0.93 captures per net-hour, much lower than the 1998-1999 average capture rate (1.54) but almost two times higher than the capture rate at De Luz in 2000. Species richness was comparable to 1998 (27 species), but much lower than 1999 (40 species). As at the De Luz site, the Santa Margarita station in 2000 had the lowest total captures, individuals captured, and capture rates for all years of the study.

Once again, the two most abundant species at the Santa Margarita station were common yellowthroats and song sparrows, although in 2000 yellowthroats outnumbered song sparrows for the first time in the three years of this study (Figure 13). Together these two species comprised 51 percent of all individuals captured, comparable to the 1998-1999 average (56 percent). While captures of individual common yellowthroats have shown a slight decline from the 1998 high (1998 = 200, 1999 = 191, 2000 = 178), the number of song sparrow individuals has decreased to a third of their 1998 high (1998 = 328, 1999 = 238, 2000 = 109). As at the De Luz station, these steady declines are most likely attributable to relatively dry winters in 1998-1999 and 1999-2000. Common yellowthroats and song sparrows were followed in abundance by orange-crowned warblers, least Bell's vireos, bushtits, yellow warblers, yellow-breasted chats, Wilson's warblers, spotted towhees, wrentits, and American goldfinches. These nine species comprised 89 percent of all individuals captured. Once again, relatively high captures of sensitive species (southwestern willow flycatcher, least Bell's vireo, yellow warbler, yellow-breasted chat) confirmed that this site supports breeding populations of several species of conservation concern. Three new species were captured at the site in 2000 (Table 8) including common ground-dove, rufous hummingbird, and lazuli bunting.

The sex ratio of birds of known sex (N=340), as opposed to De Luz, was slightly more skewed towards males than in previous years (♀:♂ ratio in 1998 and 1999 ≈ 1:1), at 46 percent female and 54 percent male (Table 7). The proportion of hatching-year birds in the population in 2000 (34 percent) was comparable to the 1998-1999 average (39 percent), and remained much higher than at De Luz (22 percent), indicating that this site has consistently higher productivity. As in 1998-1999, this high productivity was mainly attributable to high captures of hatching-year common yellowthroats (91 individuals) and song sparrows (33 individuals), although orange-crowned warblers (21 individuals), bushtits (nine individuals), least Bell's vireos (nine individuals), and wrentits (eight individuals) contributed substantially to the total. These six species together accounted for 93 percent of all hatching-year individuals captured. Single-species comparisons between the Santa Margarita and De Luz populations indicate that song sparrow productivity was 2.2 times higher at the former site (0.46 young/adult versus 0.21 young/adult, respectively), while common yellowthroat productivity was 1.9 times higher (1.10 young/adult versus 0.58 young/adult). Further analyses of species-specific survival and productivity should shed light on the differences between sites in species composition and abundance.

Table 6. Summary of Significant Relationships between Environmental Variables and MAPS Survivorship and Productivity Measures ($\alpha = 0.10$), De Luz Creek 1995-2000

Species	Independent Variable[a,b]	Dependent Variable[c]	Equation	R^2	N	P	Slope of Relationship	General Relationship
COYE	Total Winter Precipitation	Survivorship	y = -0.02x + 0.32	0.75	5	0.06	Negative	Wetter Winter, lower survivorship
	Total Winter/Spring Precipitation	Survivorship	y = -0.01x + 0.30	0.75	5	0.06	Negative	Wetter Winter/Spring, lower survivorship
	Total Winter Precipitaion	Productivity	y = 0.07x + 0.52	0.77	6	0.02	Positive	Wetter Winter, higher productivity
	Total Winter/Spring Precipitation	Productivity	y = 0.05x + 0.53	0.73	6	0.02	Positive	Wetter Winter/Spring, higher productivity
SOSP	Average Winter Temperature	Population Size	y = -3.05x + 33.66	0.96	6	0.0007	Negative	Colder Winter, higher population size
	Average Spring Temperature	Population Size	y = -1.34x + 33.11	0.57	6	0.08	Negative	Colder Spring, higher population size
	Average Winter/Spring Temperature	Population Size	y = -2.12x + 33.18	0.80	6	0.02	Negative	Colder Winter/Spring, higher population size
	Average Spring Temperature	Survivorship	y = -0.04x + 0.34	0.85	5	0.03	Negative	Colder Spring, higher survivorship
	Average Winter/Spring Temperature	Survivorship	y = -0.05x + 0.35	0.83	5	0.03	Negative	Colder Winter/Spring, higher survivorship
	Total Winter Precipitation	Productivity	y = 0.07x + 0.46	0.68	6	0.04	Positive	Wetter Winter, higher productivity
	Average Winter Temperature	Population Change	y = -0.16x - 0.01	0.80	5	0.04	Negative	Colder Winter, higher population size
BHGR	Average Spring Temperature	Population Size	y = 4.07x + 21.71	0.73	6	0.03	Positive	Warmer Spring, higher population size
	Average Winter/Spring Temperature	Population Size	y = 5.21x + 21.03	0.65	6	0.05	Positive	Warmer Winter/Spring, higher population size
	Average Spring Temperature	New AHY Captures	y = 3.79x + 15.58	0.68	5	0.08	Positive	Warmer Spring, higher population size
YBCH	Total Winter/Spring Precipitation	Productivity	y = -0.008 + 0.08	0.54	6	0.096	Negative	Wetter Winter/Spring, lower productivity

[a] Temperature and Precipitation values are deviations from normal monthly means measured at Oceanside Marina (data from National Climatic Data Center)
[b] Winter = December - February; Spring = March - May; Winter/Spring = December - May
[c] Population Size = Total AHY captures in year X
New AHY Captures = Total unbanded (new) AHY captures in year X
Survivorship = Total recaptures in year X+1 / Total captures in year X
Productivity = Total HY captures in year X / Total AHY captures in year X
Population Change = (Total captures in year X+1 - Total captures in year X) / Total captures in year X

Table 7. Sex and Age of Individuals Captured: Santa Margarita River, 2000

Species	Code	Female					Female Total	Male					Male Total	Unknown Sex					Unknown Total	Species Total
		Age[a]						Age[a]						Age[a]						
		A	H	O	S	U		A	H	O	S	U		A	H	O	S	U		
CAQU	0.0	1	0	0	0	0	**1**	1	0	0	0	0	**1**	0	0	0	0	0	**0**	**2**
COGD	320.0	1	0	0	0	0	**1**	0	0	0	0	0	**0**	0	0	0	0	0	**0**	**1**
DOWO	394.0	2	0	0	0	0	**2**	0	0	1	0	0	**1**	0	0	0	0	0	**0**	**3**
NUWO	397.0	0	0	0	0	0	**0**	0	0	1	0	0	**1**	0	0	0	0	0	**0**	**1**
ANHU	431.0	0	0	0	0	0	**0**	0	0	0	0	0	**0**	0	1	0	0	0	**1**	**1**
RUHU	433.0	0	0	0	0	0	**0**	1	0	0	0	0	**1**	0	0	0	0	0	**0**	**1**
ATFL	454.0	0	0	0	0	0	**0**	0	0	0	0	0	**0**	0	0	1	1	0	**2**	**2**
PSFL	464.1	0	0	0	0	0	**0**	0	0	0	0	0	**0**	2	0	0	0	0	**2**	**2**
WIFL	466.0	2	0	0	0	0	**2**	0	0	0	0	0	**0**	2	0	0	0	0	**2**	**4**
HOFI	519.0	4	0	0	0	0	**4**	3	0	0	0	0	**3**	0	0	0	0	1	**1**	**8**
AMGO	529.0	2	0	5	1	0	**8**	2	0	3	0	0	**5**	0	0	0	0	0	**0**	**13**
LEGO	530.0	1	2	2	0	0	**5**	0	0	2	1	0	**3**	0	0	0	0	0	**0**	**8**
SOSP	581.0	28	0	0	0	0	**28**	34	0	0	0	0	**34**	10	33	0	0	4	**47**	**109**
SPTO	588.0	3	0	3	1	0	**7**	3	0	2	1	0	**6**	0	4	0	0	0	**4**	**17**
BHGR	596.0	0	0	1	0	0	**1**	1	0	0	0	0	**1**	0	0	0	0	0	**0**	**2**
LAZB	599.0	0	0	0	0	0	**0**	0	0	2	1	0	**3**	0	0	0	0	0	**0**	**3**
WAVI	627.0	0	0	0	0	0	**0**	0	0	0	0	0	**0**	2	0	0	0	0	**2**	**2**
HUVI	632.0	0	0	0	0	0	**0**	0	0	0	0	0	**0**	0	1	0	0	0	**1**	**1**
LBVI	633.4	10	0	0	0	0	**10**	1	0	0	0	0	**1**	4	9	0	0	3	**16**	**27**
OCWA	646.0	8	0	3	0	0	**11**	16	2	4	1	0	**23**	3	19	0	0	2	**24**	**58**
YWAR	652.0	8	0	2	1	0	**11**	2	0	6	2	0	**10**	1	1	0	0	0	**2**	**23**
BTYW	665.0	1	0	0	0	0	**1**	0	0	0	0	0	**0**	0	0	0	0	0	**0**	**1**
TOWA	668.0	0	0	0	0	0	**0**	0	0	1	0	0	**1**	0	0	0	0	0	**0**	**1**
COYE	681.0	18	0	18	3	1	**40**	17	12	24	3	3	**59**	0	79	0	0	0	**79**	**178**
YBCH	683.0	9	0	0	0	1	**10**	9	0	0	0	0	**9**	0	0	0	0	0	**0**	**19**
WIWA	685.0	1	0	3	0	0	**4**	3	0	5	1	1	**10**	4	0	0	0	0	**4**	**18**
BEWR	719.0	3	0	0	0	0	**3**	0	0	0	0	0	**0**	5	2	0	0	0	**7**	**10**
HOWR	721.0	1	0	0	0	0	**1**	0	0	0	0	0	**0**	0	1	0	0	0	**1**	**2**
WREN	742.0	0	0	0	0	0	**0**	0	0	0	0	0	**0**	7	8	0	0	1	**16**	**16**
BUSH	743.0	3	5	0	0	0	**8**	7	2	0	0	1	**10**	1	2	0	0	3	**6**	**24**
SWTH	758.0	0	0	0	0	0	**0**	0	0	0	0	0	**0**	4	0	0	0	0	**4**	**4**
Total		**106**	**7**	**37**	**6**	**2**	**158**	**100**	**16**	**51**	**10**	**5**	**182**	**45**	**160**	**1**	**1**	**14**	**221**	**561**

[a] Age Key
A = After Hatching Year
H = Hatching Year
O = Older than Second Year
S = Second Year
U = Unknown Age

Figure 13. Number of Individuals Caught per Species: Santa Margarita River, 2000

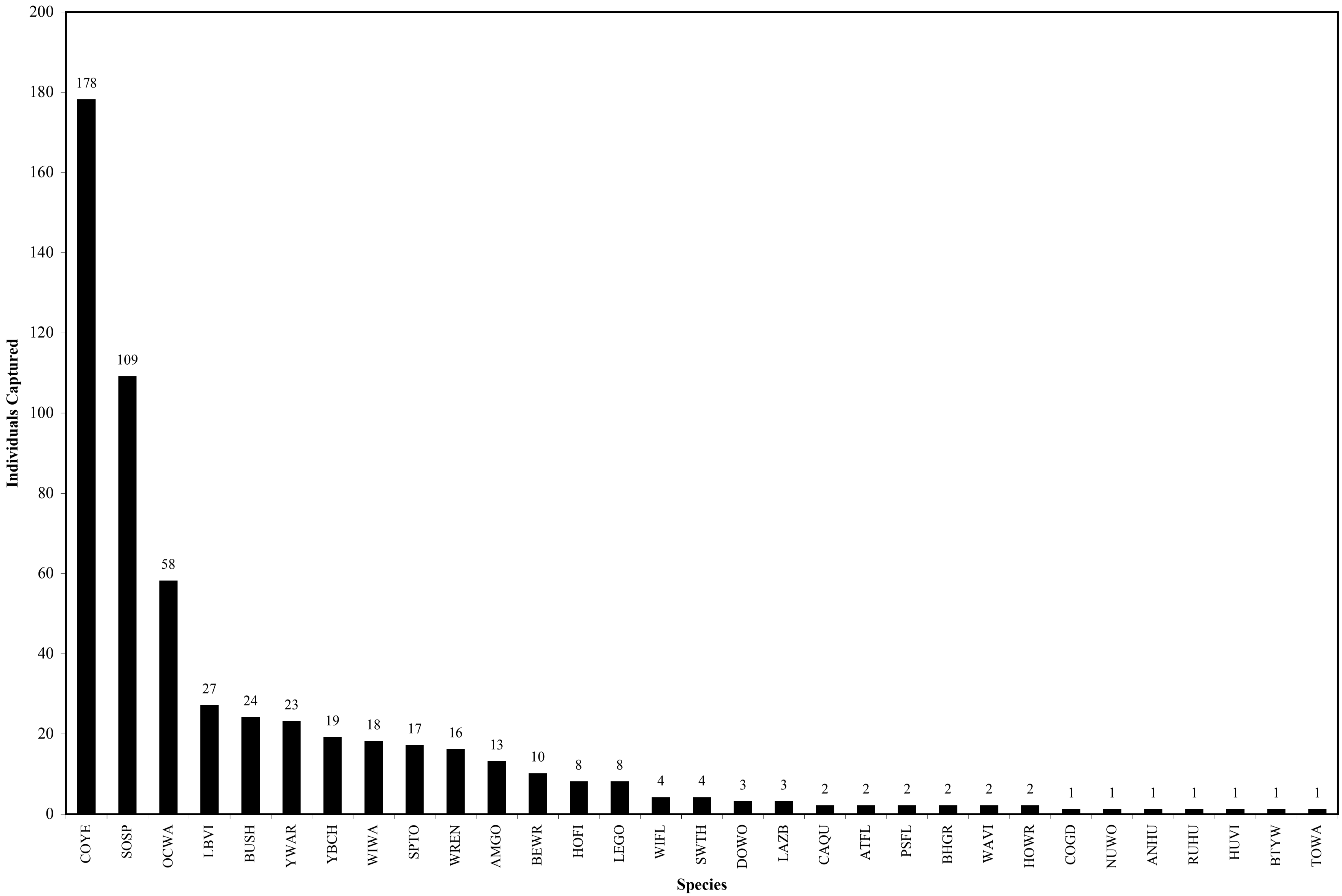


Table 8. Number of Birds Captured, Banded, and Recaptured: Santa Margarita River, 1998 - 2000

Species	Code	Total Captures[a]				New Individuals Banded				Recaptured Individuals, 2000		
		Year				Year				Originally Banded		
		1998	1999	2000	Total	1998	1999	2000	Total	1998	1999	Total
CAQU	0.0	0	1	2	3	0	0	0	0	0	0	0
MODO	316.0	1	0	0	1	0	0	0	0	0	0	0
COGD	320.0	0	0	1	1	0	0	0	0	0	0	0
SSHA	332.0	0	1	0	1	0	0	0	0	0	0	0
DOWO	394.0	3	4	3	10	2	2	2	6	0	1	1
NUWO	397.0	0	1	1	2	0	1	1	2	0	0	0
BCHU	429.0	0	1	0	1	0	0	0	0	0	0	0
ANHU	431.0	3	4	1	8	0	0	0	0	0	0	0
RUHU	433.0	0	0	1	1	0	0	0	0	0	0	0
ALHU	434.0	0	3	0	3	0	0	0	0	0	0	0
UNHU	440.9	1	5	0	6	0	0	0	0	0	0	0
ATFL	454.0	0	5	2	7	0	4	2	6	0	0	0
BLPH	458.0	2	1	0	3	2	1	0	3	0	0	0
PSFL	464.1	3	15	2	20	2	15	2	19	0	0	0
WIFL	466.0	11	11	4	26	6	7	3	16	0	1	1
HOOR	505.0	1	0	0	1	1	0	0	1	0	0	0
HOFI	519.0	2	10	8	20	2	10	8	20	0	0	0
AMGO	529.0	19	31	14	64	17	28	12	57	0	1	1
LEGO	530.0	11	26	8	45	10	23	8	41	0	0	0
WCSP	554.0	0	5	0	5	0	4	0	4	0	0	0
SOSP	581.0	400	314	149	863	316	177	69	562	27	11	38
SPTO	588.0	18	13	19	50	13	11	12	36	2	2	4
BHGR	596.0	4	6	2	12	2	6	2	10	0	0	0
BLGR	597.0	0	1	0	1	0	1	0	1	0	0	0
LAZB	599.0	0	0	3	3	0	0	3	3	0	0	0
TRES	614.0	0	1	0	1	0	1	0	1	0	0	0
WAVI	627.0	3	19	2	24	3	19	2	24	0	0	0
HUVI	632.0	5	1	1	7	4	0	1	5	0	0	0
LBVI	633.4	43	33	33	109	33	14	19	66	5	3	8
NAWA	645.0	0	4	0	4	0	4	0	4	0	0	0
OCWA	646.0	29	115	68	212	26	98	46	170	1	9	10
YWAR	652.0	35	55	28	118	30	37	13	80	4	6	10
AUWA	656.0	0	1	0	1	0	1	0	1	0	0	0
BTYW	665.0	0	1	1	2	0	1	1	2	0	0	0
TOWA	668.0	1	4	1	6	1	4	1	6	0	0	0
COYE	681.0	230	260	240	730	196	160	140	496	15	18	33
YBCH	683.0	24	27	25	76	16	19	15	50	1	3	4
HOWA	684.0	0	2	0	2	0	1	0	1	0	0	0
WIWA	685.0	9	26	18	53	8	26	17	51	0	0	0
BEWR	719.0	24	20	14	58	14	14	4	32	2	4	6
HOWR	721.0	9	19	2	30	7	13	2	22	0	0	0
WREN	742.0	11	18	18	47	8	16	15	39	1	0	1
BUSH	743.0	22	62	30	114	19	54	20	93	0	2	2
RCKI	749.0	0	2	0	2	0	2	0	2	0	0	0
SWTH	758.0	12	25	4	41	12	25	4	41	0	0	0
HETH	759.0	0	1	0	1	0	1	0	1	0	0	0
Total		936	1154	705	2795	750	800	424	1974	58	61	119

a Includes multiple captures of some individuals (i.e., these numbers do not reflect total individuals)

Five hundred and forty-three of the birds caught (97 percent) were banded. Birds not banded included two hummingbirds, two California quail, one common ground-dove, and 13 additional birds that escaped prior to banding (11) or were not banded for other reasons (two) (Table 9). The majority of birds (81 percent) were captured only once during the season, but some individuals of the most abundant species were captured 2-4 times, and one common yellowthroat was captured five times (Table 9).

Overall capture rates by net ranged from 59 to 145 captures per 100 net-hours, for an overall average capture rate of 93 per 100 net-hours (Table 10). Capture rates at all nets were lower than, but proportional to, the 1998-1999 averages (Figure 14). Capture rates peaked at 154 captures per 100-net hours in early May (Table 10), and declined steadily for the rest of the season after that peak. Peak capture rates coincided with the peak movement of migrants through the site, as did species richness (Table 11). Declines in Spring migrants (warbling vireo, Nashville warbler, black-throated gray warbler, Townsend's warbler, hooded warbler, Wilson's warbler, and Swainson's thrush) contributed to overall declines at the site, decreasing from 80 individuals captured in 1999 to 25 individuals captured in 2000.

Recapture of Banded Birds

One hundred and nineteen (22 percent) of all individuals caught were recaptures of birds originally banded in 1998 or 1999 (Table 8), representing a substantial increase over 1999 (13 percent). Song sparrows, common yellowthroats, orange-crowned warblers, yellow warblers, and least Bell's vireos comprised eighty-three percent of all recaptures. Species with the highest survivorship rates in 2000 include least Bell's vireos (35 percent), Bewick's wrens (32 percent), spotted towhees (29 percent), yellow warblers (22 percent), yellow-breasted chats (20 percent), common yellowthroats (17 percent), and song sparrows (15 percent). Seven species showed recruitment of hatching-year individuals from previous years: song sparrow (20 individuals), common yellowthroat (11 individuals), Bewick's wren (two individuals), yellow warbler (two individuals), bushtit (two individuals), orange-crowned warbler (two individuals), and least Bell's vireo (one individual). As shown at the De Luz site (1998 Progress Report, Table 6), recaptures in future years should increase these initial estimates of survival and recruitment. These high capture numbers, particularly for several sensitive species, will be useful for understanding determinants of population demographics for these species, and when compared to the De Luz site may indicate how habitat characteristics at each site affect demographics.

Table 9. Capture Frequency of Individuals: Santa Margarita River, 2000

Species	Code	# Individuals / Capture Incidence (Banded Birds Only)					# Captures		
		1 Capture	2 Captures	3 Captures	4 Captures	5 Captures	Banded Birds	Unbanded Birds	All Birds
CAQU	0	0	0	0	0	0	0	2	2
COGD	3200	0	0	0	0	0	0	1	1
DOWO	3940	3	0	0	0	0	3	0	3
NUWO	3970	1	0	0	0	0	1	0	1
ANHU	4310	0	0	0	0	0	0	1	1
RUHU	4330	0	0	0	0	0	0	1	1
ATFL	4540	2	0	0	0	0	2	0	2
PSFL	4641	2	0	0	0	0	2	0	2
WIFL	4660	4	0	0	0	0	4	0	4
HOFI	5190	8	0	0	0	0	8	0	8
AMGO	5290	12	1	0	0	0	14	0	14
LEGO	5300	8	0	0	0	0	8	0	8
SOSP	5810	78	20	7	2	0	147	2	149
SPTO	5880	14	2	0	0	0	18	1	19
BHGR	5960	2	0	0	0	0	2	0	2
LAZB	5990	3	0	0	0	0	3	0	3
WAVI	6270	2	0	0	0	0	2	0	2
HUVI	6320	1	0	0	0	0	1	0	1
LBVI	6334	23	2	2	0	0	33	0	33
OCWA	6460	49	4	3	0	0	66	2	68
YWAR	6520	18	5	0	0	0	28	0	28
BTYW	6650	1	0	0	0	0	1	0	1
TOWA	6680	1	0	0	0	0	1	0	1
COYE	6810	133	25	9	5	1	235	5	240
YBCH	6830	15	2	2	0	0	25	0	25
WIWA	6850	17	0	0	0	0	17	1	18
BEWR	7190	6	4	0	0	0	14	0	14
HOWR	7210	2	0	0	0	0	2	0	2
WREN	7420	15	0	1	0	0	18	0	18
BUSH	7430	16	6	0	0	0	28	2	30
SWTH	7580	4	0	0	0	0	4	0	4
Total		**440**	**71**	**24**	**7**	**1**	**687**	**18**	**705**

Table 10. Capture Rate by Net and Date: Santa Margarita River, 2000

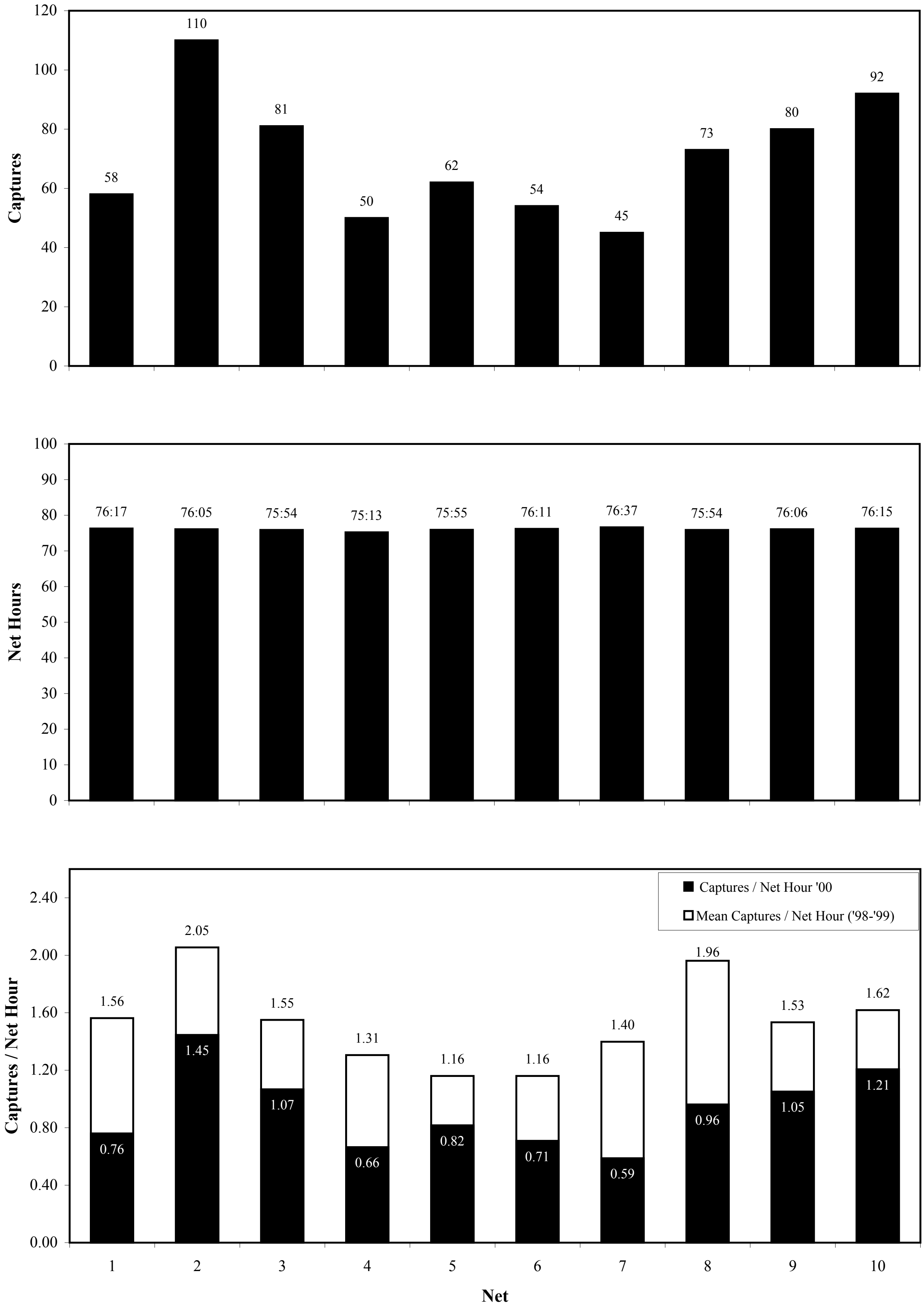
MAPS Period	Date		Net 1	2	3	4	5	6	7	8	9	10	Date Total
		Net Hours	4:40	4:50	4:45	4:35	4:40	4:45	4:38	4:45	4:45	4:45	**47:08**
		Captures	1	2	7	4	0	2	6	3	1	7	**33**
-3	4/5	Captures/Net Hour	0.21	0.41	1.47	0.87	0.00	0.42	1.29	0.63	0.21	1.47	**0.70**
		Net Hours	4:40	4:30	4:30	4:40	4:29	4:35	4:31	4:30	4:30	4:40	**45:35**
		Captures	0	8	4	3	5	2	7	4	3	7	**43**
-2	4/12	Captures/Net Hour	0.00	1.78	0.89	0.64	1.12	0.44	1.55	0.89	0.67	1.50	**0.94**
		Net Hours	4:50	4:55	4:50	4:55	5:00	4:50	4:50	5:00	4:50	5:00	**49:00**
		Captures	7	9	8	7	2	3	8	5	7	12	**68**
-1	4/26	Captures/Net Hour	1.45	1.83	1.66	1.42	0.40	0.62	1.66	1.00	1.45	2.40	**1.39**
		Net Hours	5:00	4:55	4:55	4:45	4:55	5:05	5:15	5:10	5:00	4:55	**49:55**
		Captures	13	10	11	6	7	5	1	8	6	10	**77**
1	5/5	Captures/Net Hour	2.60	2.03	2.24	1.26	1.42	0.98	0.19	1.55	1.20	2.03	**1.54**
		Net Hours	5:15	5:18	5:13	5:05	5:00	5:10	5:05	5:18	5:20	5:15	**51:59**
		Captures	8	5	9	6	6	5	5	6	12	7	**69**
2	5/17	Captures/Net Hour	1.52	0.94	1.73	1.18	1.20	0.97	0.98	1.13	2.25	1.33	**1.33**
		Net Hours	4:45	4:55	5:10	4:55	4:55	4:55	4:55	4:55	4:55	4:55	**49:15**
		Captures	4	9	5	6	11	8	3	3	7	13	**69**
3	5/26	Captures/Net Hour	0.84	1.83	0.97	1.22	2.24	1.63	0.61	0.61	1.42	2.64	**1.40**
		Net Hours	5:20	5:15	5:05	5:15	5:18	5:13	5:15	5:05	5:20	5:15	**52:21**
		Captures	6	8	2	1	2	6	2	3	9	7	**46**
4	6/7	Captures/Net Hour	1.13	1.52	0.39	0.19	0.38	1.15	0.38	0.59	1.69	1.33	**0.88**
		Net Hours	5:30	5:27	5:30	5:20	5:28	5:25	5:23	5:35	5:28	5:20	**54:26**
		Captures	3	12	3	1	4	3	1	8	12	5	**52**
5	6/15	Captures/Net Hour	0.55	2.20	0.55	0.19	0.73	0.55	0.19	1.43	2.20	0.94	**0.96**
		Net Hours	5:07	5:15	5:13	5:10	5:10	5:10	5:15	5:01	5:05	5:10	**51:36**
		Captures	3	9	3	1	6	4	0	4	4	8	**42**
6	6/26	Captures/Net Hour	0.59	1.71	0.58	0.19	1.16	0.77	0.00	0.80	0.79	1.55	**0.81**
		Net Hours	5:10	5:10	5:10	5:10	5:15	5:15	5:13	5:08	5:10	5:10	**51:51**
		Captures	1	4	2	7	3	7	1	4	7	6	**42**
7	7/6	Captures/Net Hour	0.19	0.77	0.39	1.35	0.57	1.33	0.19	0.78	1.35	1.16	**0.81**
		Net Hours	5:35	5:25	5:13	5:10	5:20	5:20	5:30	5:25	5:25	5:25	**53:48**
		Captures	2	15	6	2	2	4	0	6	4	3	**44**
8	7/14	Captures/Net Hour	0.36	2.77	1.15	0.39	0.38	0.75	0.00	1.11	0.74	0.55	**0.82**
		Net Hours	5:15	5:10	5:25	5:21	5:38	5:37	5:37	5:10	5:08	5:10	**53:31**
		Captures	2	7	4	1	7	1	2	9	1	3	**37**
9	7/24	Captures/Net Hour	0.38	1.35	0.74	0.19	1.24	0.18	0.36	1.74	0.19	0.58	**0.69**
		Net Hours	5:25	5:20	5:10	5:07	5:02	5:11	5:20	5:22	5:20	5:15	**52:32**
		Captures	5	5	7	1	5	1	0	6	3	1	**34**
10	8/3	Captures/Net Hour	0.92	0.94	1.35	0.20	0.99	0.19	0.00	1.12	0.56	0.19	**0.65**
		Net Hours	5:00	4:55	5:00	5:05	5:05	5:05	5:05	4:55	5:05	5:00	**50:15**
		Captures	1	3	4	2	2	0	3	1	4	0	**20**
11	8/11	Captures/Net Hour	0.20	0.61	0.80	0.39	0.39	0.00	0.59	0.20	0.79	0.00	**0.40**
		Net Hours	4:45	4:45	4:45	4:40	4:40	4:35	4:45	4:35	4:45	5:00	**47:15**
		Captures	2	4	6	2	0	3	6	3	0	3	**29**
12	8/23	Captures/Net Hour	0.42	0.84	1.26	0.43	0.00	0.65	1.26	0.65	0.00	0.60	**0.61**
		Net Hours	**76:17**	**76:05**	**75:54**	**75:13**	**75:55**	**76:11**	**76:37**	**75:54**	**76:06**	**76:15**	**760:27**
		Captures	**58**	**110**	**81**	**50**	**62**	**54**	**45**	**73**	**80**	**92**	**705**
Net Total		**Captures/Net Hour**	**0.76**	**1.45**	**1.07**	**0.66**	**0.82**	**0.71**	**0.59**	**0.96**	**1.05**	**1.21**	**0.93**

Table 11. Number of Captures by Date: Santa Margarita River, 2000

Species	Code	MAPS Period															Total	Captures per 100 Net Hours[a]
		-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12		
		Date																
		4/5	4/12	4/26	5/5	5/17	5/26	6/7	6/15	6/26	7/6	7/14	7/24	8/3	8/11	8/23		
CAQU	0.0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**2**	**0.26**
COGD	320.0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
DOWO	394.0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	**3**	**0.39**
NUWO	397.0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**1**	**0.13**
ANHU	431.0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**1**	**0.13**
RUHU	433.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
ATFL	454.0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	**2**	**0.26**
PSFL	464.1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	**2**	**0.26**
WIFL	466.0	0	0	0	0	0	1	1	0	0	2	0	0	0	0	0	**4**	**0.53**
HOFI	519.0	0	3	1	0	1	1	0	0	1	0	0	0	0	1	0	**8**	**1.05**
AMGO	529.0	0	2	4	3	3	1	0	0	0	1	0	0	0	0	0	**14**	**1.84**
LEGO	530.0	0	1	2	1	1	0	1	0	2	0	0	0	0	0	0	**8**	**1.05**
SOSP	581.0	13	7	17	11	18	15	3	6	9	12	11	6	9	5	7	**149**	**19.59**
SPTO	588.0	0	3	3	2	3	2	1	2	1	1	0	0	1	0	0	**19**	**2.50**
BHGR	596.0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	**2**	**0.26**
LAZB	599.0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	**3**	**0.39**
WAVI	627.0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	**2**	**0.26**
HUVI	632.0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**1**	**0.13**
LBVI	633.4	1	0	0	2	5	3	3	4	0	6	0	7	1	0	1	**33**	**4.34**
OCWA	646.0	4	9	7	8	21	8	2	4	1	0	0	1	2	1	0	**68**	**8.94**
YWAR	652.0	0	3	3	5	1	5	5	1	0	2	1	1	0	1	0	**28**	**3.68**
BTYW	665.0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
TOWA	668.0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
COYE	681.0	10	13	17	20	6	21	28	24	20	8	21	15	11	9	17	**240**	**31.56**
YBCH	683.0	0	0	2	4	3	2	0	2	4	3	3	0	0	0	2	**25**	**3.29**
WIWA	685.0	0	1	3	14	0	0	0	0	0	0	0	0	0	0	0	**18**	**2.37**
BEWR	719.0	1	0	1	1	2	1	1	2	0	1	1	1	0	2	0	**14**	**1.84**
HOWR	721.0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	**2**	**0.26**
WREN	742.0	0	0	1	0	0	0	0	6	0	0	4	1	4	0	2	**18**	**2.37**
BUSH	743.0	3	0	0	2	1	5	1	0	2	5	0	5	5	1	0	**30**	**3.95**
SWTH	758.0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	**4**	**0.53**
Total		**33**	**43**	**68**	**77**	**69**	**69**	**46**	**52**	**42**	**42**	**44**	**37**	**34**	**20**	**29**	**705**	**92.71**
Species		**7**	**10**	**16**	**14**	**16**	**15**	**10**	**10**	**10**	**11**	**8**	**8**	**8**	**7**	**5**	**31**	**4.08**

[a] 760:27 total net-hours

Figure 14. Captures, Net Hours, and Capture Rate by Net: Santa Margarita River, 2000



Alpha Codes, Common Names, and Scientific Names
of Species Caught at MAPS Stations, Camp Pendleton

Code	Common Name	Scientific Name	AOU #
MODO	Mourning dove	*Zenaida macroura*	316.0
COGD	Common ground-dove	*Columbina passerina*	320.0
SSHA	Sharp-shinned hawk	*Accipiter striatus*	332.0
COHA	Cooper's hawk	*Accipiter cooperii*	333.0
RSHA	Red-shouldered hawk	*Buteo lineatus*	339.0
AMKE	American kestrel	*Falco sparverius*	360.0
CAQU	California quail	*Callipepla californica*	0.0
DOWO	Downy woodpecker	*Dendrocopos pubescens*	394.0
NUWO	Nuttall's woodpecker	*Dendrocopos nuttallii*	397.0
ACWO	Acorn woodpecker	*Melanerpes formicivorus*	407.0
RSFL	Red-shafted Flicker	*Colaptes auratus cafer*	413.0
BCHU	Black-chinned hummingbird	*Archilochus alexandri*	429.0
COHU	Costa's hummingbird	*Archilochus costae*	430.0
ANHU	Anna's hummingbird	*Archilochus anna*	431.0
RUHU	Rufous hummingbird	*Selasphorus rufus*	433.0
ALHU	Allen's hummingbird	*Selasphorus sasin*	434.0
UNHU	Unidentified hummingbird species	*Trochilidae spp.*	440.9
ATFL	Ash-throated flycatcher	*Myiarchus cinerascens*	454.0
BLPH	Black phoebe	*Sayornis nigricans*	458.0
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
WESJ	Western scrub-jay	*Aphelocoma californica*	481.0
EUST	European starling	*Sturnus vulgaris*	493.0
HOOR	Hooded oriole	*Icterus cucullatus*	505.0
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
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*	567.1
RCSP	Rufous-crowned sparrow	*Aimophila ruficeps*	580.0
SOSP	Song sparrow	*Melospiza melodia*	581.0
LISP	Lincoln's sparrow	*Melospiza lincolnii*	583.0
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
TRES	Tree swallow	*Tachycineta bicolor*	614.0
VGSW	Violet-green swallow	*Tachycineta thalassina*	615.0
NRWS	Northern rough-winged swallow	*Stelgidopteryx serripennis*	617.0
PHAI	Phainopepla	*Phainopepla nitens*	620.0

Alpha Codes, Common Names, and Scientific Names
of Species Caught at MAPS Stations, Camp Pendleton
(continued)

Code	Common Name	Scientific Name	AOU #
WAVI	Warbling vireo	*Vireo gilvus*	627.0
CAVI	Cassin's vireo	*Vireo cassinii*	629.1
HUVI	Hutton's vireo	*Vireo huttoni*	632.0
LBVI	Least Bell's vireo	*Vireo bellii pusillus*	633.4
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*	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
MGWA	MacGillivray's warbler	*Oporornis tolmiei*	680.0
COYE	Common yellowthroat	*Geothlypis trichas*	681.0
YBCH	Yellow-breasted chat	*Icteria virens*	683.0
HOWA	Hooded warbler	*Wilsonia citrina*	684.0
WIWA	Wilson's warbler	*Wilsonia pusilla*	685.0
NOMO	Northern mockingbird	*Mimus polyglottos*	703.0
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
SWTH	Swainson's thrush	*Catharus ustulata*	758.0
HETH	Hermit thrush	*Catharus guttatus*	759.0
WEBL	Western bluebird	*Sialia mexicana*	767.0