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

FIFTH ANNUAL PROGRESS REPORT 1999

Prepared for

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

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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. The following progress report deals exclusively with results from the De Luz and Santa Margarita stations; summary information from the Case Springs station, which will cease operation, will be presented in a separate final report.

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. Field work was conducted by Jim Asmus, Peter Beck, Christine Collier, Barbara Kus, Bonnie Peterson, Karen Schenck, Bryan Sharp, Jennifer Turnbull, and Jeff Wells.

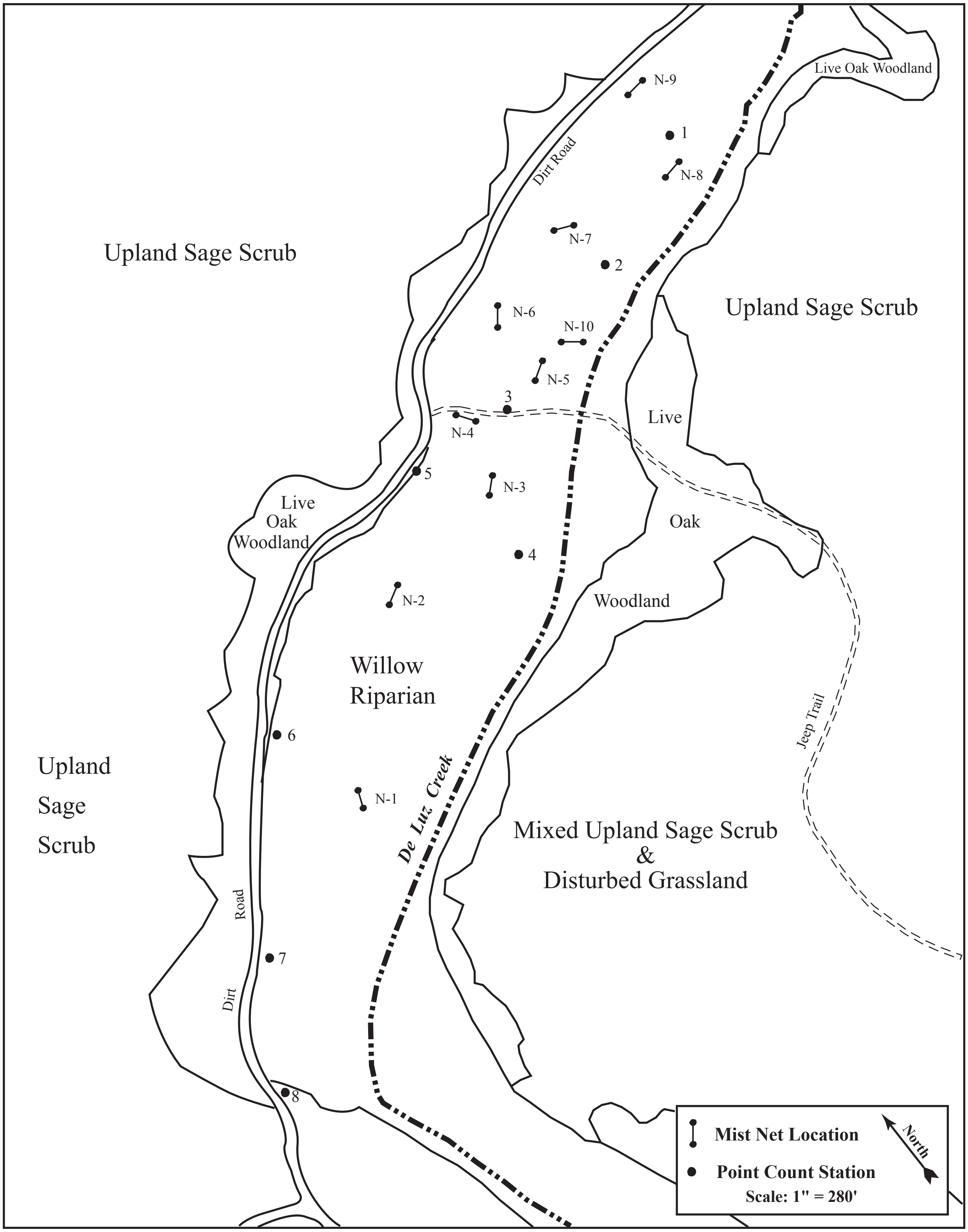


Figure 1. De Luz Creek MAPS Station, Marine Corps Base Camp Pendleton.

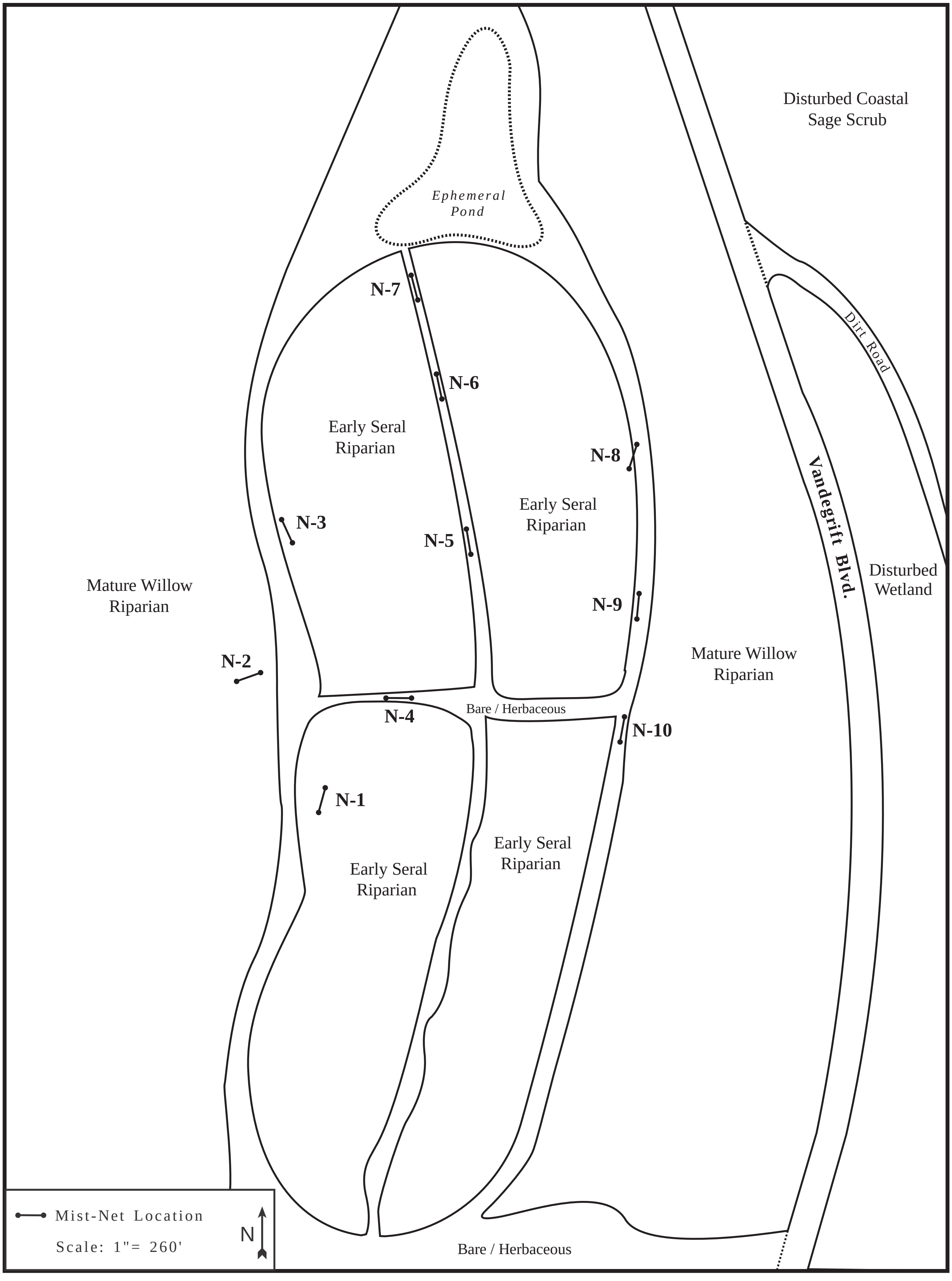


Figure 2. Santa Margarita River MAPS station, Marine Corps Base Camp Pendleton.

Results

<u>De Luz Creek</u>

Overview of 1999 Captures

Four hundred and twenty-one individuals of 43 species were caught during 766 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 1999 was comparable to the mean number (427) caught per year between 1995-98. Captures per net hour were also comparable to the 1995-98 mean (0.65), at 0.67.

As in previous years, the most abundant species at the station included common yellowthroats and song sparrows, which together made up 26 percent of the individuals captured (Figure 3). Also abundant were lesser goldfinches, yellow-breasted chats, house wrens, wrentits, bushtits, California towhees, spotted towhees, and orange-crowned warblers; together, these ten species comprised 70 percent of all individuals captured. Among locally breeding migrant species that appeared to decline at the station between 1995 and 1998, both yellow-breasted chats and Pacific-slope flycatchers rebounded with minor increases, while black-headed grosbeaks continued to decline. Several resident species showing sharp increases in 1998, including song sparrows, common yellowthroats, Bewick's wrens, and Nuttall's woodpeckers, returned to abundances similar to 1995 – 1997 (Table 2), while house wrens continued to increase in abundance. Seven species were captured for the first time at the De Luz station in 1999, bringing the total number of species captured since 1995 to 58. The new species included Cooper's hawk, common ground-dove, cliff swallow, violet-green swallow, northern rough-winged swallow, Townsend's warbler, and MacGillivray's warbler.

The sex ratio of birds of known sex (N=271) was approximately even, at 49 percent female and 51 percent male (Table 1), identical to the sex ratio in 1998 and typical of the even sex ratio that has characterized the De Luz population since 1995. Age composition, as usual, changed relative to prior years, with the proportion of juvenile birds in the population declining to 12 percent (Table 1), well below the 30 percent maximum recorded in 1998 and the 23 percent mean per year since 1995. This reverses the general trend of increased productivity between 1995 and 1998, and may be related to the relatively dry 1998-99 winter combined with colder spring temperatures.

Three hundred and fifty-three of the birds caught (84 percent), including 24 hummingbirds, one California quail, one common ground-dove, and one Cooper's hawk, were new captures. Of these, 95 percent (310/326; hummingbirds, quail, dove, and hawk excluded), were banded; the remainder escaped prior to banding (11) or were not banded for other reasons (5) (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, and one common yellowthroat was captured five times (Table 3).

Overall capture rates by net ranged from 45 to 87 captures per 100 net-hours, for an overall average capture rate of 67 per 100 net-hours (Table 4). Nets differed in their capture

Table 1. Sex and Age of Individuals Captured: De Luz Creek, 1999

		Female					Male					Unknown Sex						
		Age[a,b]				Female	Age[a,b]				Male	Age[a,b]					Unknown	Species
Species	**Code**	A	O	S	U	**Total**	A	H	O	S	**Total**	A	H	O	S	U	**Total**	**Total**
CAQU	0.0	0	0	0	0	**0**	0	0	0	0	**0**	0	0	0	0	1	**1**	**1**
COGD	320.0	1	0	0	0	**1**	0	0	0	0	**0**	0	0	0	0	0	**0**	**1**
COHA	333.0	0	0	0	0	**0**	0	0	0	0	**0**	0	0	0	1	0	**1**	**1**
NUWO	397.0	0	0	0	0	**0**	0	1	1	0	**2**	0	0	0	0	0	**0**	**2**
BCHU	429.0	1	0	0	1	**2**	7	0	0	0	**7**	0	0	0	0	0	**0**	**9**
COHU	430.0	1	0	0	0	**1**	0	0	0	0	**0**	0	0	0	0	0	**0**	**1**
ANHU	431.0	4	0	0	0	**4**	1	0	0	0	**1**	0	0	0	0	0	**0**	**5**
UNHU	440.9	1	0	0	0	**1**	0	0	0	0	**0**	1	1	0	0	6	**8**	**9**
ATFL	454.0	0	1	1	0	**2**	0	0	1	0	**1**	3	1	1	0	0	**5**	**8**
WEWP	462.0	0	0	0	0	**0**	0	0	0	0	**0**	1	0	0	0	0	**1**	**1**
PSFL	464.1	1	0	0	0	**1**	0	0	0	0	**0**	5	2	0	0	0	**7**	**8**
WIFL	466.0	0	0	0	0	**0**	0	0	0	0	**0**	1	0	0	0	0	**1**	**1**
HOOR	505.0	1	0	0	0	**1**	0	0	2	0	**2**	0	0	0	0	0	**0**	**3**
BUOR	508.0	0	1	1	0	**2**	0	0	0	1	**1**	0	0	0	0	0	**0**	**3**
HOFI	519.0	2	0	0	0	**2**	1	0	1	0	**2**	0	4	0	0	0	**4**	**8**
LEGO	530.0	7	6	9	0	**22**	2	0	5	14	**21**	0	0	0	0	0	**0**	**43**
GCSP	557.0	0	0	0	0	**0**	0	0	0	0	**0**	1	0	0	0	0	**1**	**1**
RCSP	580.0	0	0	0	0	**0**	0	0	0	0	**0**	1	2	0	0	0	**3**	**3**
SOSP	581.0	12	0	0	0	**12**	23	0	0	0	**23**	8	7	0	0	4	**19**	**54**
LISP	583.0	0	0	0	0	**0**	0	0	0	0	**0**	1	0	0	0	0	**1**	**1**
SPTO	588.0	5	2	1	0	**8**	2	0	2	1	**5**	1	4	0	0	0	**5**	**18**
CALT	591.1	1	0	0	0	**1**	2	0	0	0	**2**	8	1	0	0	4	**13**	**16**
BHGR	596.0	2	0	0	0	**2**	0	0	4	1	**5**	0	1	0	0	0	**1**	**8**
LAZB	599.0	0	0	0	0	**0**	0	0	1	1	**2**	0	0	0	0	0	**0**	**2**
CLSW	612.0	0	1	0	0	**1**	0	0	0	0	**0**	0	0	0	0	0	**0**	**1**
VGSW	615.0	0	0	0	0	**0**	1	0	0	0	**1**	0	0	0	0	0	**0**	**1**
NRWS	617.0	1	0	0	0	**1**	0	0	0	0	**0**	0	0	0	0	0	**0**	**1**
WAVI	627.0	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**	1	0	0	0	0	**1**	**1**
LBVI	633.4	4	0	0	0	**4**	1	0	0	0	**1**	2	0	0	0	0	**2**	**7**
OCWA	646.0	6	1	0	0	**7**	2	0	4	1	**7**	1	1	0	0	0	**2**	**16**
YWAR	652.0	2	1	0	0	**3**	1	0	2	1	**4**	0	0	0	0	0	**0**	**7**
TOWA	668.0	0	0	1	0	**1**	0	0	0	0	**0**	0	0	0	0	0	**0**	**1**
MGWA	680.0	1	0	0	0	**1**	0	0	0	0	**0**	0	0	0	0	0	**0**	**1**
COYE	681.0	8	6	2	1	**17**	7	1	12	7	**27**	0	10	0	0	1	**11**	**55**
YBCH	683.0	10	2	0	0	**12**	9	0	0	1	**10**	1	2	0	0	0	**3**	**25**
WIWA	685.0	1	1	0	0	**2**	0	0	2	0	**2**	1	0	0	0	0	**1**	**5**
BEWR	719.0	4	0	0	0	**4**	1	0	0	0	**1**	2	2	0	0	0	**4**	**9**
HOWR	721.0	9	0	0	0	**9**	3	0	0	0	**3**	9	3	0	0	0	**12**	**24**
OATI	733.0	2	0	0	0	**2**	0	0	0	0	**0**	1	0	0	0	0	**1**	**3**
WREN	742.0	0	0	0	0	**0**	0	0	0	0	**0**	19	1	0	0	2	**22**	**22**
BUSH	743.0	7	0	0	0	**7**	8	0	0	0	**8**	1	3	0	0	3	**7**	**22**
SWTH	758.0	0	0	0	0	**0**	0	0	0	0	**0**	2	0	2	4	0	**8**	**8**
HETH	759.0	0	0	0	0	**0**	0	0	0	0	**0**	2	0	1	0	0	**3**	**3**
Total		**94**	**22**	**15**	**2**	**133**	**71**	**2**	**37**	**28**	**138**	**75**	**45**	**4**	**5**	**21**	**150**	**421**

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

[b] Age classes without captures for a given sex not shown

Figure 3. Number of Individuals Caught per Species: De Luz Creek, 1999

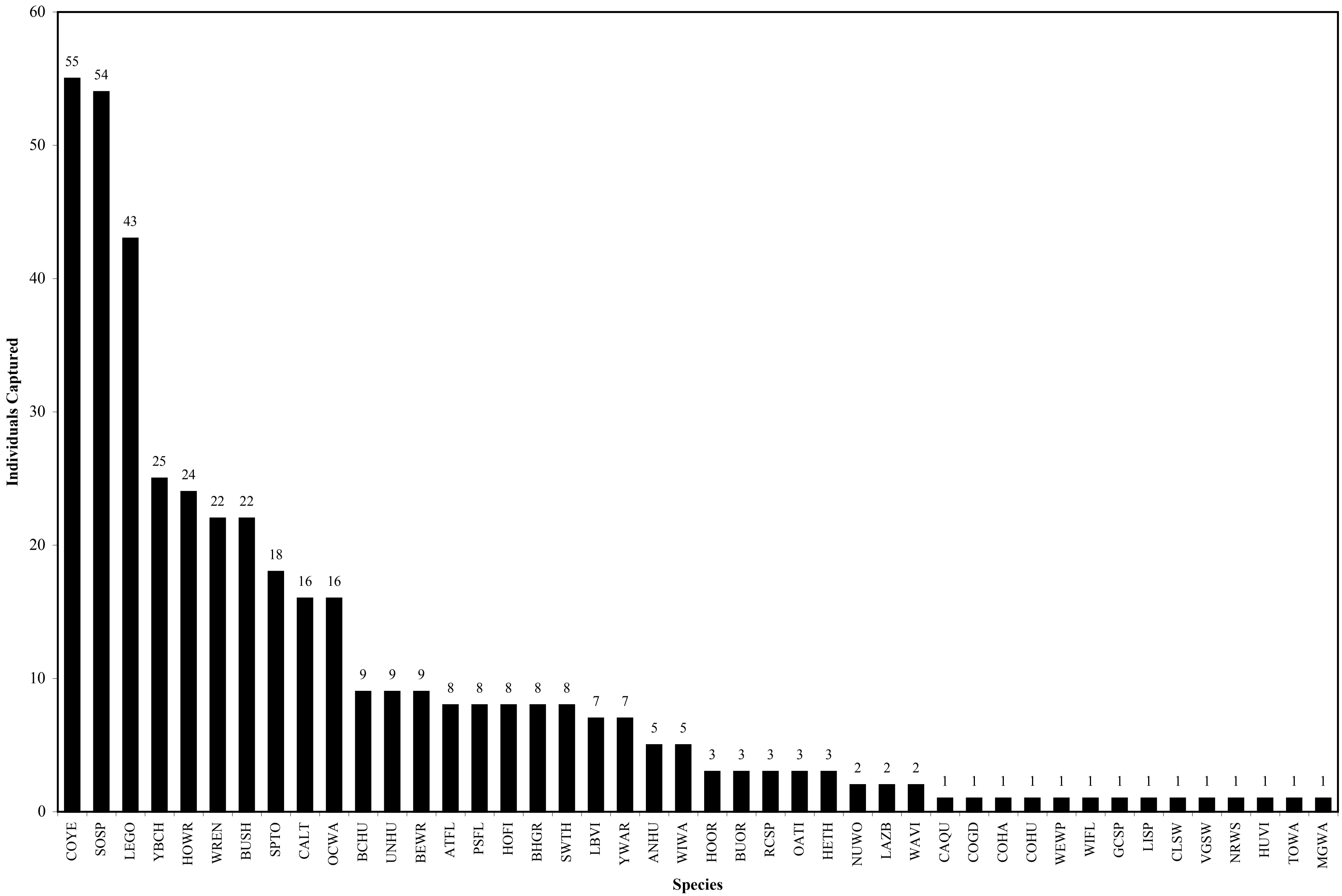


Table 2. Number of Birds Captured, Banded, and Recaptured: De Luz Creek, 1995 - 1999

		Total Captures						**New Individuals Banded**						**Recaptured 1999**				
		Year						Year						Originally Banded				
Species	**Code**	1995	1996	1997	1998	1999	**Total**	1995	1996	1997	1998	1999	**Total**	1995	1996	1997	1998	**Total**
CAQU	0.0	2	0	1	2	1	**6**	0	0	0	0	0	**0**	0	0	0	0	**0**
MODO	316.0	0	0	2	0	0	**2**	0	0	0	0	0	**0**	0	0	0	0	**0**
COGD	320.0	0	0	0	0	1	**1**	0	0	0	0	0	**0**	0	0	0	0	**0**
COHA	333.0	0	0	0	0	1	**1**	0	0	0	0	0	**0**	0	0	0	0	**0**
AMKE	360.0	0	0	1	0	0	**1**	0	0	0	0	0	**0**	0	0	0	0	**0**
DOWO	394.0	2	2	2	1	0	**7**	2	2	2	1	0	**7**	0	0	0	0	**0**
NUWO	397.0	4	4	2	12	2	**24**	4	2	1	6	1	**14**	1	0	0	0	**1**
RSFL	413.0	0	0	0	1	0	**1**	0	0	0	1	0	**1**	0	0	0	0	**0**
BCHU	429.0	3	2	5	7	9	**26**	0	0	0	0	0	**0**	0	0	0	0	**0**
COHU	430.0	2	2	1	2	1	**8**	0	0	0	0	0	**0**	0	0	0	0	**0**
ANHU	431.0	5	5	16	15	5	**46**	0	0	0	0	0	**0**	0	0	0	0	**0**
ALHU	434.0	0	0	1	1	0	**2**	0	0	0	0	0	**0**	0	0	0	0	**0**
UNHU	440.9	11	1	2	8	9	**31**	0	0	0	0	0	**0**	0	0	0	0	**0**
ATFL	454.0	13	9	11	15	8	**56**	10	7	9	9	6	**41**	1	0	0	0	**1**
WEWP	462.0	0	1	0	0	1	**2**	0	1	0	0	1	**2**	0	0	0	0	**0**
PSFL	464.1	14	9	7	2	8	**40**	14	9	6	0	8	**37**	0	0	0	0	**0**
WIFL	466.0	1	1	0	2	1	**5**	1	1	0	2	1	**5**	0	0	0	0	**0**
HOOR	505.0	2	0	0	3	3	**8**	2	0	0	3	3	**8**	0	0	0	0	**0**
BUOR	508.0	5	1	7	3	3	**19**	5	1	5	3	3	**17**	0	0	0	0	**0**
PUFI	517.0	0	1	0	0	0	**1**	0	1	0	0	0	**1**	0	0	0	0	**0**
HOFI	519.0	1	23	8	8	8	**48**	1	22	8	8	6	**45**	0	0	1	0	**1**
LEGO	530.0	15	14	14	26	45	**114**	15	13	14	25	41	**108**	0	0	0	1	**1**
LASP	552.0	1	1	0	0	0	**2**	1	1	0	0	0	**2**	0	0	0	0	**0**
GCSP	557.0	3	2	0	1	1	**7**	3	2	0	0	1	**6**	0	0	0	0	**0**
DEJU	567.7	0	1	0	0	0	**1**	0	0	0	0	0	**0**	0	0	0	0	**0**
RCSP	580.0	1	4	1	0	3	**9**	1	4	1	0	3	**9**	0	0	0	0	**0**
SOSP	581.0	70	69	74	75	79	**367**	51	43	45	52	31	**222**	2	2	6	9	**19**
LISP	583.0	1	1	0	0	1	**3**	1	1	0	0	1	**3**	0	0	0	0	**0**
SPTO	588.0	38	27	25	24	21	**135**	33	17	10	14	17	**91**	0	0	0	1	**1**
CALT	591.1	20	25	10	23	16	**94**	17	19	8	16	13	**73**	1	0	0	0	**1**
BHGR	596.0	33	40	36	21	8	**138**	26	33	23	8	5	**95**	0	0	2	1	**3**
BLGR	597.0	0	1	2	1	0	**4**	0	1	2	1	0	**4**	0	0	0	0	**0**
LAZB	599.0	12	1	0	2	2	**17**	12	1	0	1	2	**16**	0	0	0	0	**0**
WETA	607.0	1	0	1	0	0	**2**	1	0	1	0	0	**2**	0	0	0	0	**0**
CLSW	612.0	0	0	0	0	1	**1**	0	0	0	0	1	**1**	0	0	0	0	**0**
VGSW	615.0	0	0	0	0	1	**1**	0	0	0	0	1	**1**	0	0	0	0	**0**
NRWS	617.0	0	0	0	0	1	**1**	0	0	0	0	1	**1**	0	0	0	0	**0**
PHAI	620.0	2	0	0	0	0	**2**	2	0	0	0	0	**2**	0	0	0	0	**0**
WAVI	627.0	0	3	0	1	2	**6**	0	3	0	1	2	**6**	0	0	0	0	**0**
HUVI	632.0	2	0	2	0	1	**5**	2	0	1	0	1	**4**	0	0	0	0	**0**
LBVI	633.4	10	5	8	13	8	**44**	9	5	3	5	5	**27**	0	0	1	0	**1**
NAWA	645.0	1	0	0	0	0	**1**	1	0	0	0	0	**1**	0	0	0	0	**0**
OCWA	646.0	13	4	6	9	19	**51**	12	3	5	8	16	**44**	0	0	0	0	**0**
YWAR	652.0	3	7	3	6	7	**26**	3	6	3	5	7	**24**	0	0	0	0	**0**
AUWA	656.0	2	0	0	0	0	**2**	2	0	0	0	0	**2**	0	0	0	0	**0**
TOWA	668.0	0	0	0	0	1	**1**	0	0	0	0	1	**1**	0	0	0	0	**0**
MGWA	680.0	0	0	0	0	1	**1**	0	0	0	0	1	**1**	0	0	0	0	**0**
COYE	681.0	74	70	74	96	71	**385**	62	42	42	64	40	**250**	3	0	0	11	**14**
YBCH	683.0	55	51	43	28	35	**212**	39	30	27	18	17	**131**	2	0	2	4	**8**
WIWA	685.0	2	2	2	2	5	**13**	2	2	2	2	5	**13**	0	0	0	0	**0**
NOMO	703.0	0	0	1	0	0	**1**	0	0	1	0	0	**1**	0	0	0	0	**0**
CATH	710.0	2	5	7	3	0	**17**	0	4	6	3	0	**13**	0	0	0	0	**0**
BEWR	719.0	22	11	19	32	17	**101**	16	4	11	22	4	**57**	1	0	1	3	**5**
HOWR	721.0	3	8	8	18	36	**73**	2	8	5	13	20	**48**	0	0	0	2	**2**
OATI	733.0	7	5	1	3	6	**22**	6	1	1	2	2	**12**	1	0	0	0	**1**
WREN	742.0	49	45	50	22	28	**194**	33	26	21	9	17	**106**	0	1	1	1	**3**
BUSH	743.0	10	14	20	8	23	**75**	9	13	18	4	16	**60**	1	0	1	1	**3**
SWTH	758.0	22	8	6	4	8	**48**	22	8	6	4	8	**48**	0	0	0	0	**0**
HETH	759.0	1	0	2	2	3	**8**	1	0	2	2	2	**7**	0	0	0	1	**1**
Total		**540**	**485**	**481**	**502**	**511**	**2519**	**423**	**336**	**289**	**312**	**310**	**1670**	**13**	**3**	**15**	**35**	**66**

Table 3. Capture Frequency of Individuals: De Luz Creek, 1999

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	0	1	1
COGD	320.0	0	0	0	0	0	0	1	1
COHA	333.0	0	0	0	0	0	0	1	1
NUWO	397.0	2	0	0	0	0	2	0	2
BCHU	429.0	0	0	0	0	0	0	9	9
COHU	430.0	0	0	0	0	0	0	1	1
ANHU	431.0	0	0	0	0	0	0	5	5
UNHU	440.9	0	0	0	0	0	0	9	9
ATFL	454.0	7	0	0	0	0	7	1	8
WEWP	462.0	1	0	0	0	0	1	0	1
PSFL	464.1	8	0	0	0	0	8	0	8
WIFL	466.0	1	0	0	0	0	1	0	1
HOOR	505.0	3	0	0	0	0	3	0	3
BUOR	508.0	3	0	0	0	0	3	0	3
HOFI	519.0	7	0	0	0	0	7	1	8
LEGO	530.0	40	2	0	0	0	44	1	45
GCSP	557.0	1	0	0	0	0	1	0	1
RCSP	580.0	3	0	0	0	0	3	0	3
SOSP	581.0	33	14	4	1	0	77	2	79
LISP	583.0	1	0	0	0	0	1	0	1
SPTO	588.0	15	3	0	0	0	21	0	21
CALT	591.1	14	0	0	0	0	14	2	16
BHGR	596.0	8	0	0	0	0	8	0	8
LAZB	599.0	2	0	0	0	0	2	0	2
CLSW	612.0	1	0	0	0	0	1	0	1
VGSW	615.0	1	0	0	0	0	1	0	1
NRWS	617.0	1	0	0	0	0	1	0	1
WAVI	627.0	2	0	0	0	0	2	0	2
HUVI	632.0	1	0	0	0	0	1	0	1
LBVI	633.4	5	1	0	0	0	7	1	8
OCWA	646.0	13	3	0	0	0	19	0	19
YWAR	652.0	7	0	0	0	0	7	0	7
TOWA	668.0	1	0	0	0	0	1	0	1
MGWA	680.0	1	0	0	0	0	1	0	1
COYE	681.0	43	8	2	0	1	70	1	71
YBCH	683.0	20	2	1	2	0	35	0	35
WIWA	685.0	5	0	0	0	0	5	0	5
BEWR	719.0	5	1	2	1	0	17	0	17
HOWR	721.0	13	7	1	1	0	34	2	36
OATI	733.0	2	0	0	1	0	6	0	6
WREN	742.0	14	6	0	0	0	26	2	28
BUSH	743.0	18	1	0	0	0	20	3	23
SWTH	758.0	8	0	0	0	0	8	0	8
HETH	759.0	3	0	0	0	0	3	0	3
Total		**313**	**48**	**10**	**6**	**1**	**468**	**43**	**511**

Table 4. Capture Rate by Net and Date: De Luz Creek, 1999

MAPS Period	Date		Net 1	2	3	4	5	6	7	8	9	10	Date Total
		Net Hours	4:55	4:55	4:55	5:20	4:55	4:40	4:50	5:05	5:05	4:45	**49:25**
		Captures	5	0	1	1	2	4	2	2	3	4	**24**
-3	4/5	Captures/Net Hour	1.02	0.00	0.20	0.19	0.41	0.86	0.41	0.39	0.59	0.84	**0.49**
		Net Hours	5:05	5:10	5:10	5:05	4:55	5:15	5:15	5:15	5:15	5:15	**51:40**
		Captures	2	1	5	1	2	3	7	5	2	2	**30**
-2	4/15	Captures/Net Hour	0.39	0.19	0.97	0.20	0.41	0.57	1.33	0.95	0.38	0.38	**0.58**
		Net Hours	5:05	5:05	5:00	5:05	5:10	5:10	4:50	5:20	5:10	5:10	**51:05**
		Captures	4	6	1	1	1	4	1	6	6	11	**41**
-1	4/22	Captures/Net Hour	0.79	1.18	0.20	0.20	0.19	0.77	0.21	1.13	1.16	2.13	**0.80**
		Net Hours	5:20	5:20	5:20	5:10	4:55	5:00	5:05	5:25	5:15	5:00	**51:50**
		Captures	10	9	5	3	12	5	6	1	9	6	**66**
1	5/1	Captures/Net Hour	1.88	1.69	0.94	0.58	2.44	1.00	1.18	0.18	1.71	1.20	**1.27**
		Net Hours	5:25	5:15	5:05	5:15	5:25	5:10	5:05	5:25	5:10	5:15	**52:30**
		Captures	3	2	6	2	6	4	8	4	6	8	**49**
2	5/13	Captures/Net Hour	0.55	0.38	1.18	0.38	1.11	0.77	1.57	0.74	1.16	1.52	**0.93**
		Net Hours	5:30	5:30	5:30	5:35	5:35	5:40	5:30	5:30	5:30	5:30	**55:20**
		Captures	9	6	6	3	12	2	9	12	7	7	**73**
3	5/22	Captures/Net Hour	1.64	1.09	1.09	0.54	2.15	0.35	1.64	2.18	1.27	1.27	**1.32**
		Net Hours	5:25	5:25	5:10	5:35	5:35	5:35	5:30	5:45	5:45	5:35	**55:20**
		Captures	4	4	6	2	6	2	2	3	7	5	**41**
4	6/5	Captures/Net Hour	0.74	0.74	1.16	0.36	1.07	0.36	0.36	0.52	1.22	0.90	**0.74**
		Net Hours	5:35	5:45	5:55	5:55	5:50	5:55	5:30	5:50	5:40	5:55	**57:50**
		Captures	6	3	2	5	2	4	0	1	2	5	**30**
5	6/11	Captures/Net Hour	1.07	0.52	0.34	0.85	0.34	0.68	0.00	0.17	0.35	0.85	**0.52**
		Net Hours	5:15	5:15	5:15	5:30	5:25	5:30	5:15	5:05	5:35	5:30	**53:35**
		Captures	4	2	11	6	2	3	2	2	7	1	**40**
6	6/21	Captures/Net Hour	0.76	0.38	2.10	1.09	0.37	0.55	0.38	0.39	1.25	0.18	**0.75**
		Net Hours	4:50	4:45	4:35	4:50	4:50	4:50	4:45	4:45	4:45	4:50	**47:45**
		Captures	3	1	5	2	1	0	5	4	4	3	**28**
7	6/30	Captures/Net Hour	0.62	0.21	1.09	0.41	0.21	0.00	1.05	0.84	0.84	0.62	**0.59**
		Net Hours	4:55	4:45	4:55	4:30	4:40	4:55	4:50	4:50	4:50	4:45	**47:55**
		Captures	2	3	2	1	0	5	3	0	2	4	**22**
8	7/12	Captures/Net Hour	0.41	0.63	0.41	0.22	0.00	1.02	0.62	0.00	0.41	0.84	**0.46**
		Net Hours	4:40	4:40	4:40	3:30	3:35	5:15	5:05	5:05	5:20	5:05	**46:55**
		Captures	0	2	3	0	0	3	1	1	2	2	**14**
9	7/22	Captures/Net Hour	0.00	0.43	0.64	0.00	0.00	0.57	0.20	0.20	0.38	0.39	**0.30**
		Net Hours	5:10	5:05	5:05	5:10	4:50	5:10	5:00	5:20	5:10	5:10	**51:10**
		Captures	0	0	0	3	3	0	2	0	2	2	**12**
10	8/2	Captures/Net Hour	0.00	0.00	0.00	0.58	0.62	0.00	0.40	0.00	0.39	0.39	**0.23**
		Net Hours	5:10	5:00	4:50	4:35	4:40	4:50	5:10	5:10	5:10	4:40	**49:15**
		Captures	2	1	2	1	1	6	4	1	4	3	**25**
11	8/12	Captures/Net Hour	0.39	0.20	0.41	0.22	0.21	1.24	0.77	0.19	0.77	0.64	**0.51**
		Net Hours	4:20	4:30	4:40	4:30	4:05	4:25	4:30	4:30	4:30	4:35	**44:35**
		Captures	0	3	1	3	2	1	2	0	0	4	**16**
12	8/23	Captures/Net Hour	0.00	0.67	0.21	0.67	0.49	0.23	0.44	0.00	0.00	0.87	**0.36**
		Net Hours	**76:40**	**76:25**	**76:05**	**75:35**	**74:25**	**77:20**	**76:10**	**78:20**	**78:10**	**77:00**	**766:10**
		Captures	**54**	**43**	**56**	**34**	**52**	**46**	**54**	**42**	**63**	**67**	**511**
Net Total		**Captures/Net Hour**	**0.70**	**0.56**	**0.74**	**0.45**	**0.70**	**0.59**	**0.71**	**0.54**	**0.81**	**0.87**	**0.67**

rates relative to previous years; captures at net 2 declined, while captures at nets 4, 8 and 9 increased (Figure 4). Responses of vegetative cover in the vicinity of the nets to yearly fluctuations in winter flooding severity is probably responsible for the shifts in capture rates.

Capture rates peaked at 132 captures per 100-net hours in late May (Table 4), coinciding with peak migrant/transient movement through the site (Table 5). Captures per 100-net hours generally increased from the onset of the season to the peak, then gradually declined for the remainder of the season.

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

Sixty-six of the birds caught in 1999 (16 percent) were recaptured individuals originally banded in previous years (Table 2), providing four years of survival data for the 1995 banded cohort, three years for the 1996 cohort, two years for the 1997 cohort, and one year for the 1998 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 (1998 Progress Report, 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.

All of the birds "skipping" years in their recapture histories were banded as adults; no birds banded as juveniles have been observed exhibiting this behavior. Consequently, survival rates for adults are those most affected by adjustments. 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 the community as a whole. Similarity in trends among these common species, or within subgroups such as resident and migrant species, will indicate whether component species within the community respond similarly under prevailing 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 have no captures in some years; such low average capture rates

Figure 4. Captures, Net Hours, and Capture Rate by Net: De Luz Creek, 1999

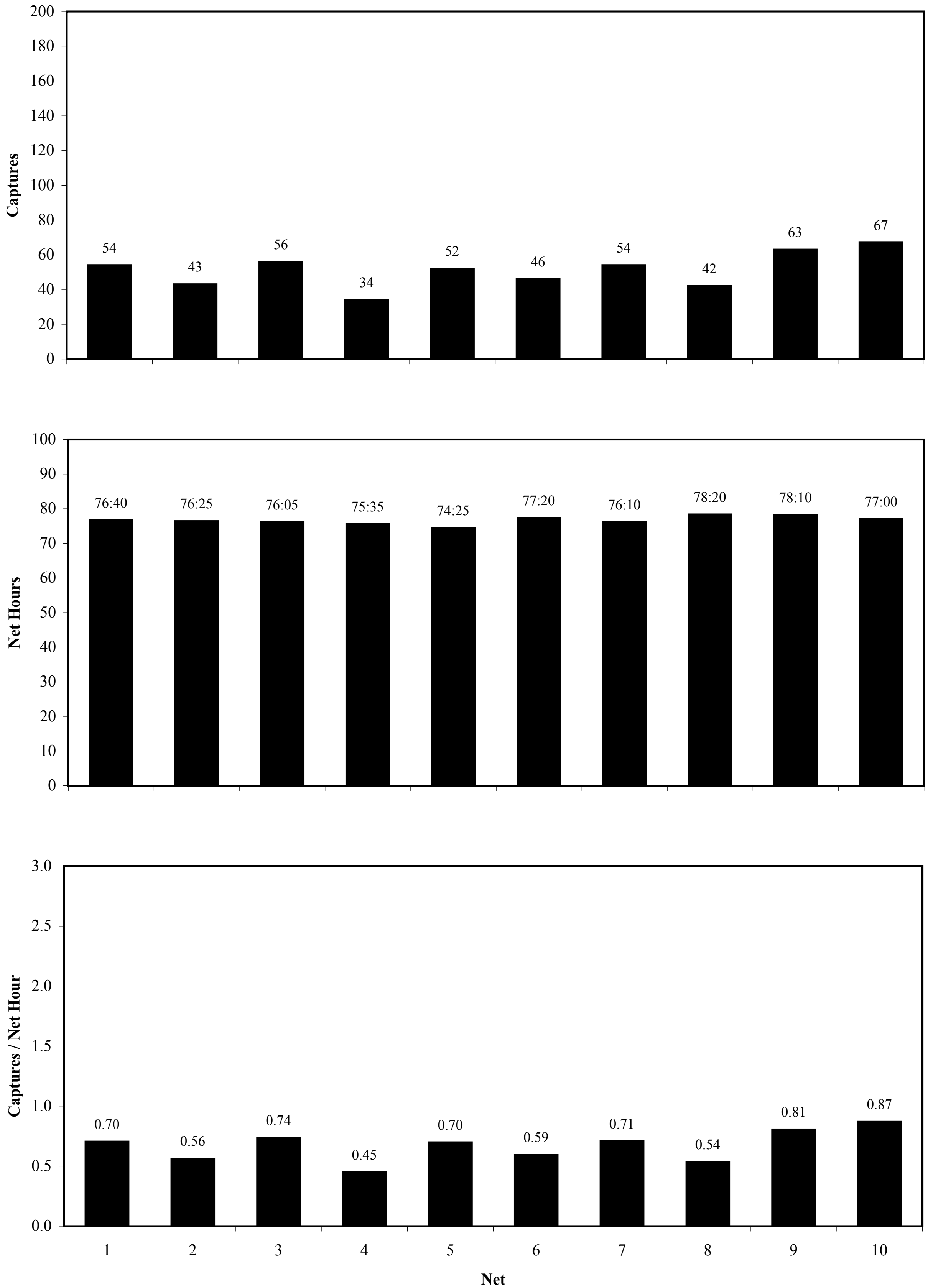


Table 5. Number of Captures by Date: De Luz Creek, 1999

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	4/15	4/22	5/1	5/13	5/22	6/5	6/11	6/21	6/30	7/12	7/22	8/2	8/12	8/23		
CAQU	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**1**	**0.13**
COGD	320.0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**1**	**0.13**
COHA	333.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
NUWO	397.0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	**2**	**0.26**
BCHU	429.0	0	0	1	1	1	1	1	3	0	0	0	0	1	0	0	**9**	**1.17**
COHU	430.0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
ANHU	431.0	0	2	1	0	0	0	1	0	1	0	0	0	0	0	0	**5**	**0.65**
UNHU[b]	440.9	0	0	0	2	0	0	0	0	2	0	0	1	0	3	1	**9**	**1.17**
ATFL	454.0	0	0	0	1	0	0	2	0	0	2	1	0	1	1	0	**8**	**1.04**
WEWP	462.0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	**1**	**0.13**
PSFL	464.1	0	0	1	0	2	3	0	0	0	0	0	1	1	0	0	**8**	**1.04**
WIFL	466.0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	**1**	**0.13**
HOOR	505.0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	**3**	**0.39**
BUOR	508.0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	**3**	**0.39**
HOFI	519.0	0	0	0	0	1	0	0	0	4	1	1	1	0	0	0	**8**	**1.04**
LEGO	530.0	0	4	5	9	3	19	1	3	1	0	0	0	0	0	0	**45**	**5.87**
GCSP	557.0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
RCSP	580.0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	**3**	**0.39**
SOSP	581.0	9	5	1	12	10	6	7	4	7	3	2	4	2	5	2	**79**	**10.31**
LISP	583.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
SPTO	588.0	2	3	0	2	2	0	3	1	0	2	2	0	2	2	0	**21**	**2.74**
CALT	591.1	2	1	0	0	0	0	1	1	0	0	1	0	0	6	4	**16**	**2.09**
BHGR	596.0	0	0	0	1	0	2	0	1	2	1	1	0	0	0	0	**8**	**1.04**
LAZB	599.0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	**2**	**0.26**
CLSW	612.0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**1**	**0.13**
VGSW	615.0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**1**	**0.13**
NRWS	617.0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**1**	**0.13**
WAVI	627.0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	**2**	**0.26**
HUVI	632.0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	**1**	**0.13**
LBVI	633.4	0	0	0	1	1	0	2	1	1	1	1	0	0	0	0	**8**	**1.04**
OCWA	646.0	0	1	3	5	4	4	0	2	0	0	0	0	0	0	0	**19**	**2.48**
YWAR	652.0	0	0	2	0	2	3	0	0	0	0	0	0	0	0	0	**7**	**0.91**
TOWA	668.0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
MGWA	680.0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
COYE	681.0	5	7	11	8	5	3	9	3	5	6	3	2	2	1	1	**71**	**9.27**
YBCH	683.0	0	0	4	2	2	4	0	6	7	3	4	1	1	0	1	**35**	**4.57**
WIWA	685.0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	1	**5**	**0.65**
BEWR	719.0	3	0	1	2	1	2	1	1	1	2	0	0	1	0	2	**17**	**2.22**
HOWR	721.0	0	2	3	5	5	5	3	3	4	2	1	2	0	0	1	**36**	**4.70**
OATI	733.0	0	0	0	1	0	1	1	1	0	0	1	0	1	0	0	**6**	**0.78**
WREN	742.0	1	0	1	3	2	2	5	0	0	3	3	2	0	5	1	**28**	**3.65**
BUSH	743.0	1	2	3	3	3	4	4	0	1	2	0	0	0	0	0	**23**	**3.00**
SWTH	758.0	0	0	0	1	3	4	0	0	0	0	0	0	0	0	0	**8**	**1.04**
HETH	759.0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	**3**	**0.39**
Total		**24**	**30**	**41**	**66**	**49**	**73**	**41**	**30**	**40**	**28**	**22**	**14**	**12**	**25**	**16**	**511**	**66.70**
Species		**8**	**12**	**16**	**22**	**18**	**22**	**14**	**13**	**15**	**12**	**13**	**7**	**9**	**8**	**10**	**43**	**5.61**

[a] 766:10 total net-hours

[b] Not included in species total

make these species poor indicators of long term population trends within the community. 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 may experience very different conditions affecting survival and productivity. Six resident (Figure 5a) and five migrant species (Figure 5b) 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 on a yearly basis for common yellowthroats and song sparrows, except for 1996 when captures of these two species moved in opposite directions. Black-headed grosbeak and yellow-breasted chat captures appeared to track one another each year, although chat captures were consistently higher, and these two migrant species followed different capture trends than the resident species. 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

Adults

Among all four species, most captures of adults each year were new captures (Figures 6a-d). Recaptures were lower but generally less variable between years. Although ideally, survivorship should be broken down by species and cohort (year of initial banding), 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 0.40 (Figure 7a). Mean survivorship across years was highest for song sparrows (0.37) and lowest for yellow-breasted chats (0.27), but there was no significant difference in survivorship between species (Two-way ANOVA, data arcsine transformed: $F = 1.91$, $p = 0.20$) or years ($F = 0.53$, $p = 0.67$). Cumulative survivorship declined for all four species (Figure 7b) from a mean across species of 0.26 after one year to 0.05 after four years. Survival significantly declined across years since time of first capture (Two-way ANOVA, data arcsine transformed: $F = 11.76$, $p = 0.002$) but did not significantly vary among species ($F = 0.85$, $p = 0.50$). Common yellowthroats, song sparrows, and yellow-breasted chats all showed positive relationships between adult survivorship and changes in population size (Figure 8a-b), although none of these relationships were significant (COYE: $R^2 = 0.18$, $p > 0.50$; SOSP: $R^2 = 0.61$, $p > 0.20$; YBCH: $R^2 = 0.62$, $p > 0.20$). It is possible that this non-significance is an artifact of low sample size ($N = 4$ years), and data from subsequent years may strengthen these relationships.

Figure 5a. De Luz Creek Population Trends, 1995-1999: Adult Captures, Resident Species

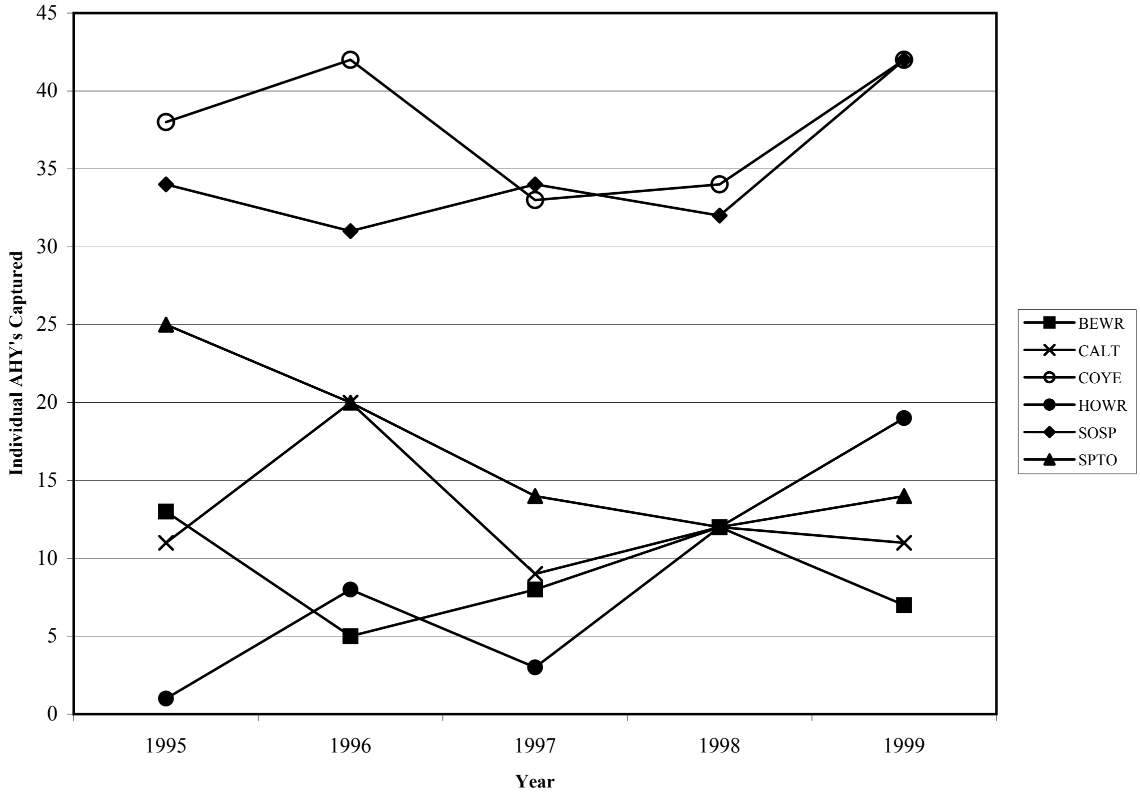


Figure 5b. De Luz Creek Population Trends, 1995-1999: Adult Captures, Migrant Species

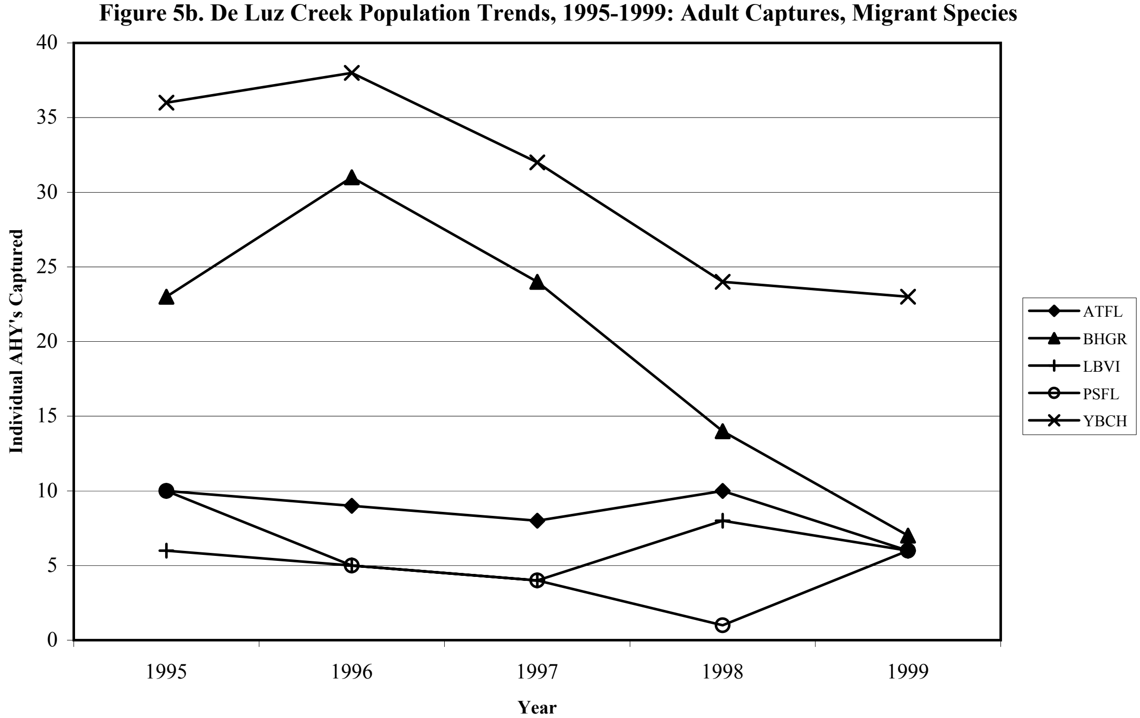


Figure 6a. Composition of Adult Common Yellowthroat Captures at De Luz Creek, 1995 - 1999

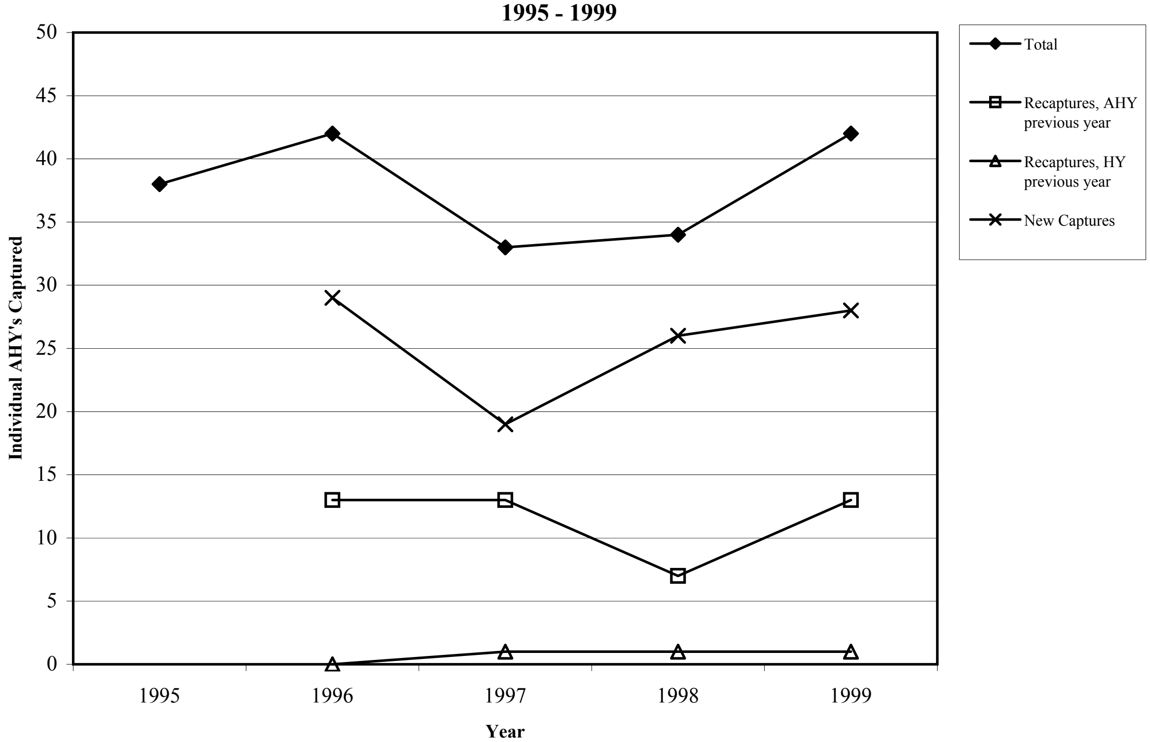


Figure 6b. Composition of Adult Song Sparrow Captures at De Luz Creek, 1995 - 1999

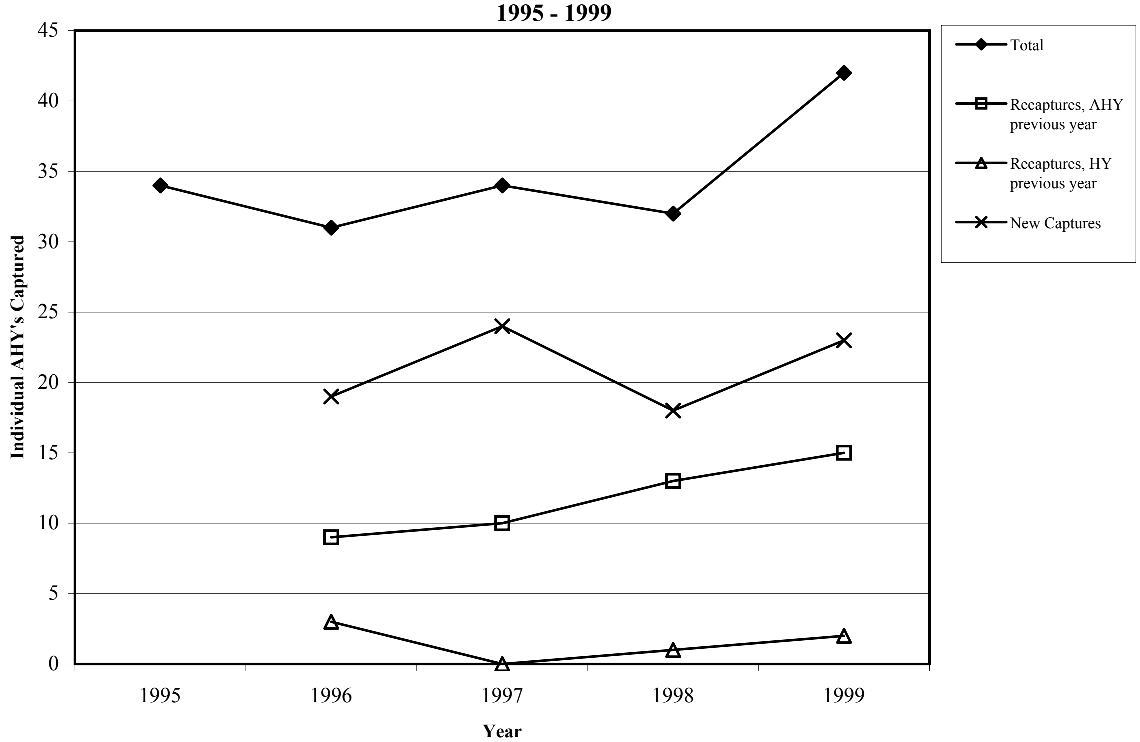


Figure 6c. Composition of Adult Black-Headed Grosbeak Captures at De Luz Creek, 1995 - 1999

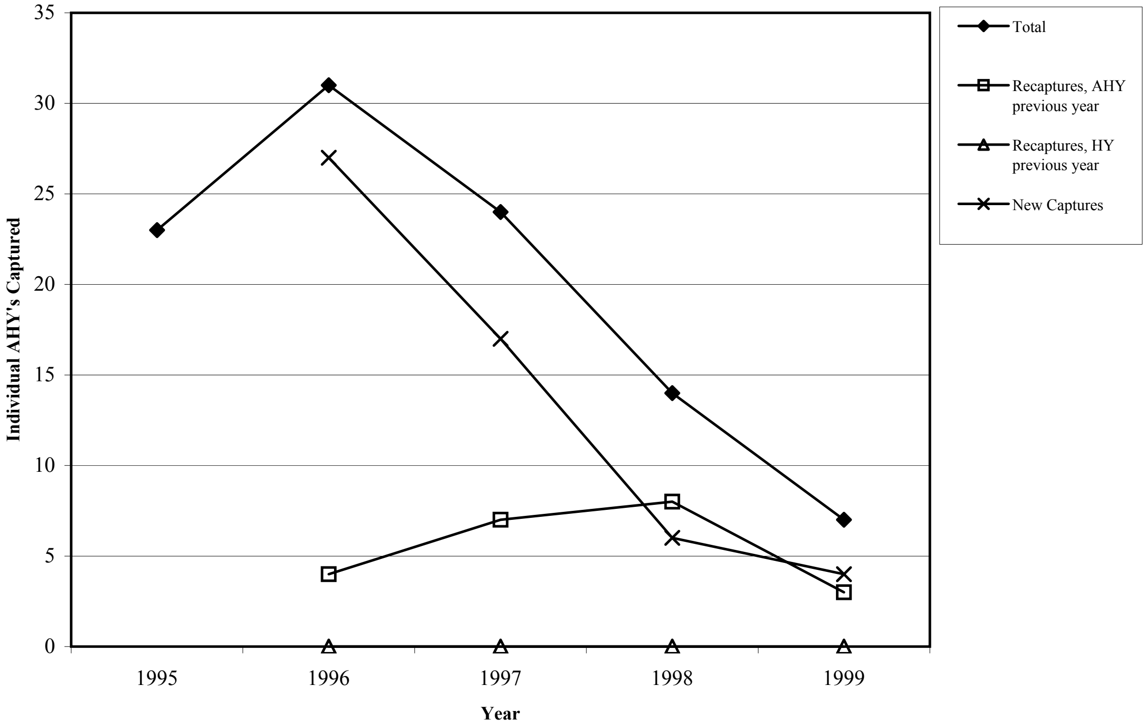


Figure 6d. Composition of Adult Yellow-Breasted Chat Captures at De Luz Creek, 1995 - 1999

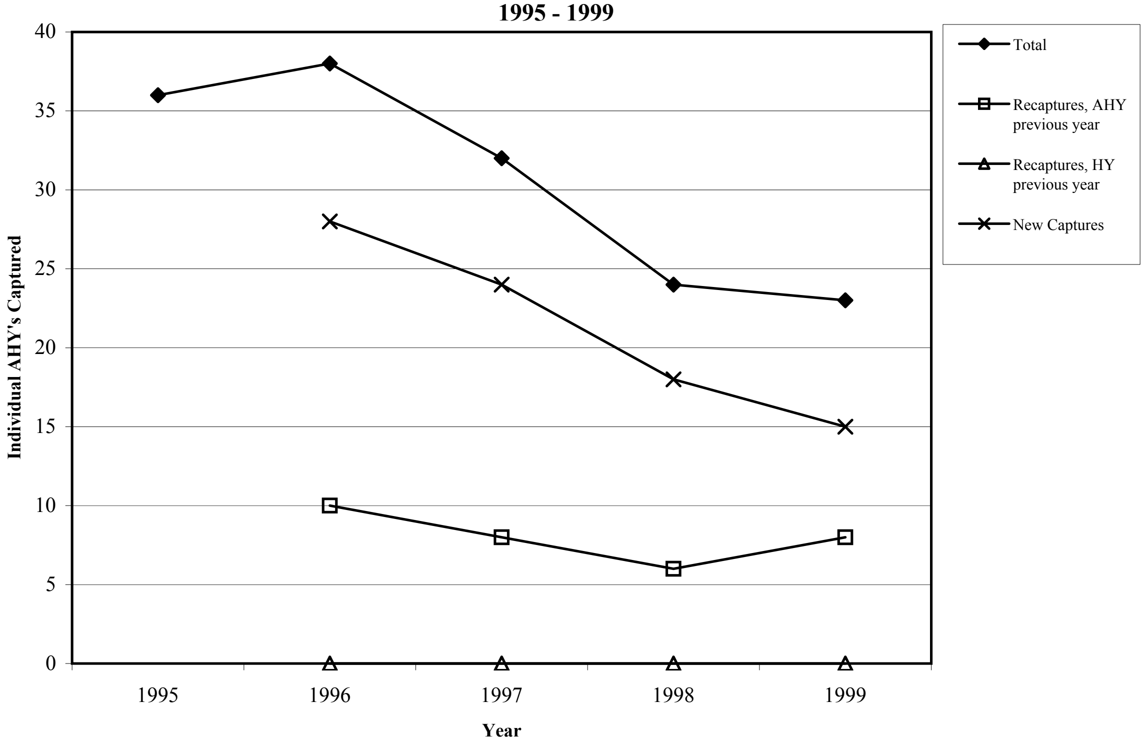


Figure 7a. Adult Survivorship between Years at De Luz Creek, 1995 -1999
(All Cohorts Combined)

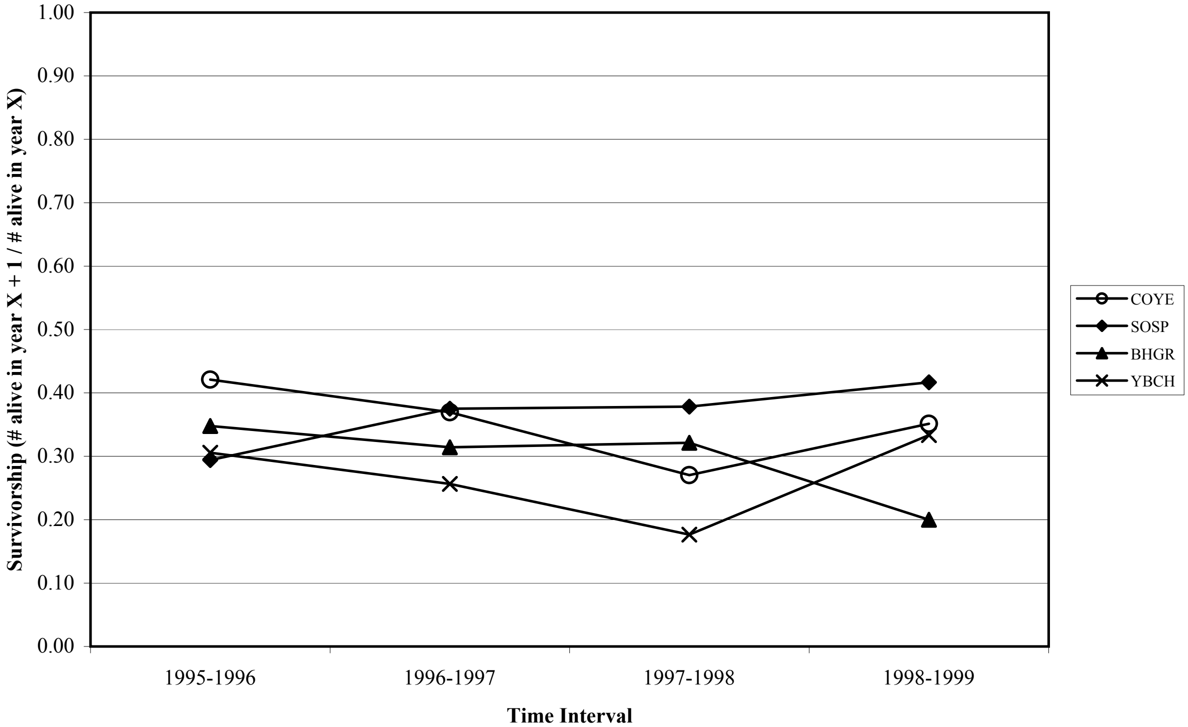


Figure 7b. Adult Survivorship from Time of First Capture at De Luz Creek, 1995-1999
(All Cohorts Combined)

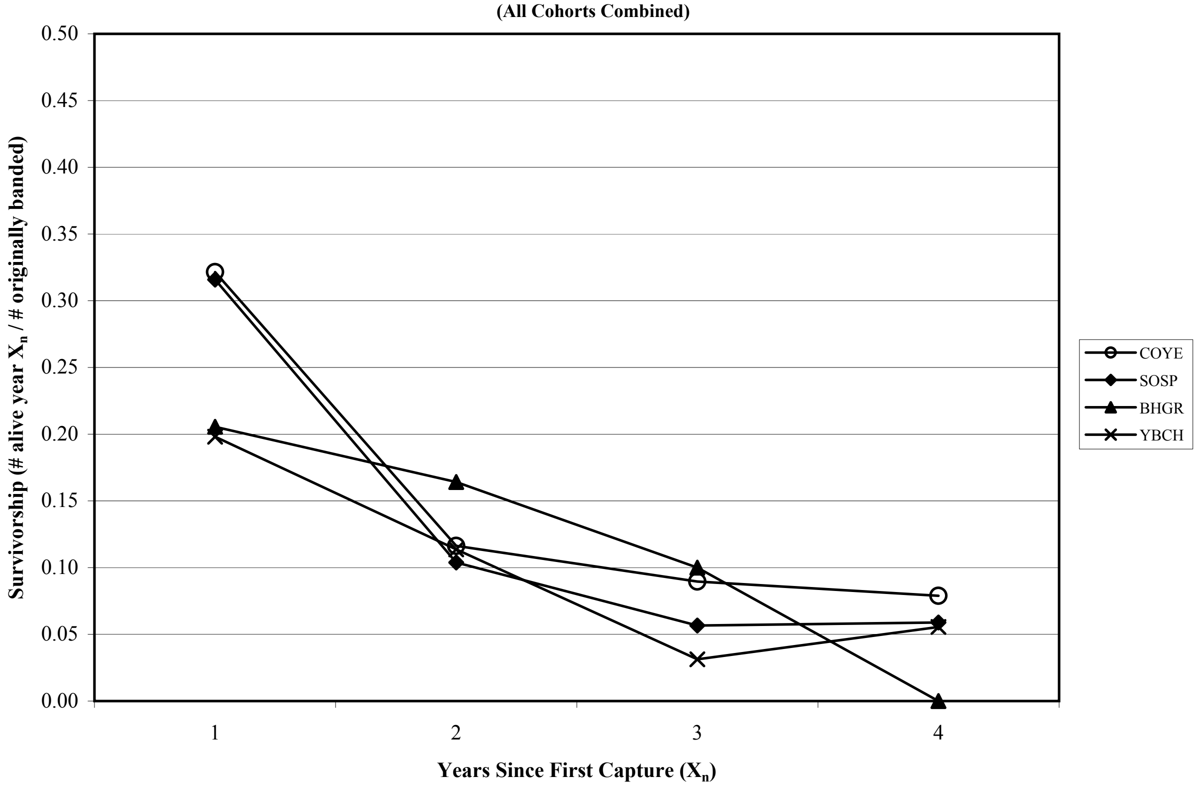


Figure 8a. Relationship between Survivorship and Changes in Adult Population Size, Resident Species

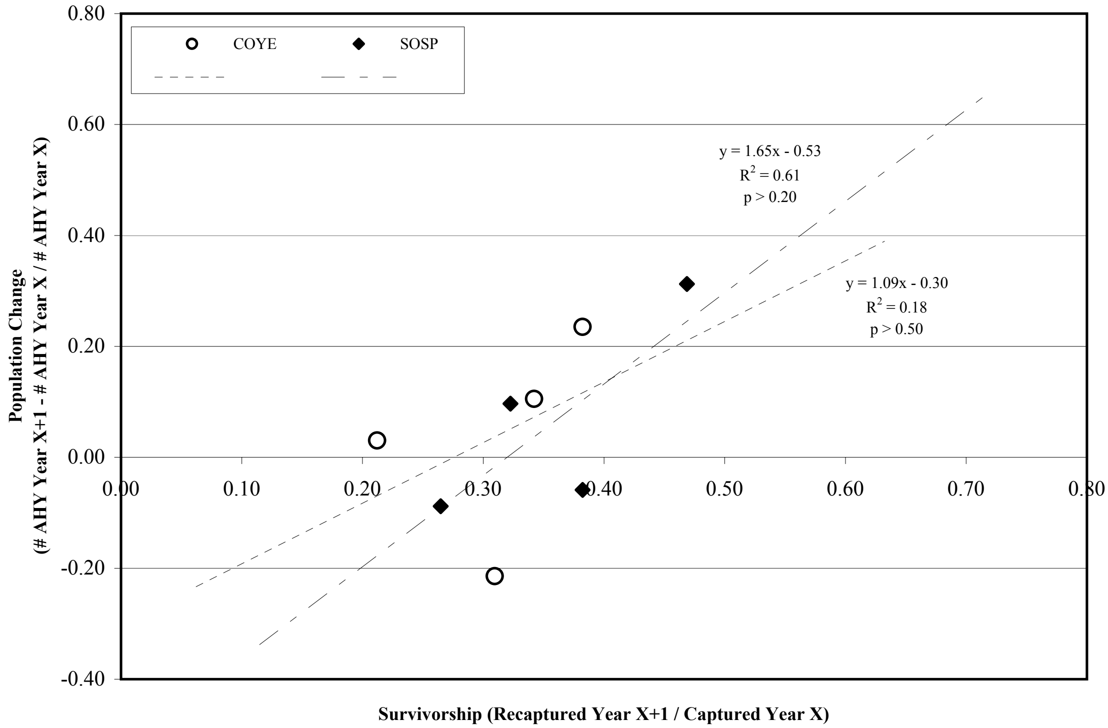
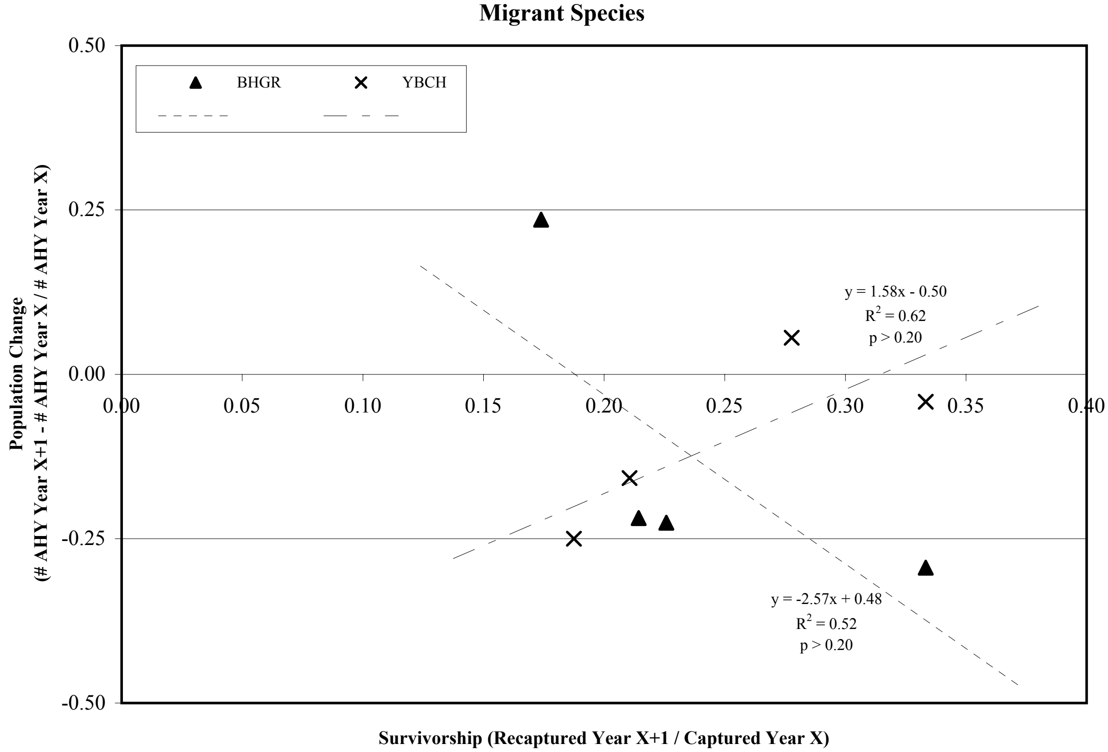


Figure 8b. Relationship between Survivorship and Changes in Adult Population Size, Migrant Species



Juveniles

The number of juvenile (hatching-year, HY) individuals captured is most appropriately indexed to adults at the site (number HY captures / number AHY captures) to control for fluctuations in adult population size. Indexed productivity for common yellowthroats and song sparrows ranged between 0.17 (SOSP, 1999) and 0.97 (COYE, 1998) hatch-years 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), although the trends for these migrant species were generally lower than and dissimilar to trends for the two resident species. Apparent productivity for grosbeaks (0.07 – 0.25) was generally more than twice as high as that for chats (0.00 – 0.09), 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 hatch-year chats may not be adequately sampled, and the extremely low average captures of hatch-year chats (1.8 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 hatch-years) was extremely low 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 were not significant. However, productivity was significantly and strongly positively correlated with population change in the subsequent year for both common yellowthroats and song sparrows (Figure 11a; COYE: $y = 0.63x - 0.35$, $R^2 = 0.93$, $p < 0.05$; SOSP: $y = 0.99x - 0.58$, $R^2 = 0.98$, $p < 0.01$). 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 can be confirmed by re-sighting or recapture of banded birds outside, but adjacent to, the banding station.

In summary, adult populations for 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. Although annual adult survivorship appeared variable, it did not significantly differ between species or given years, but survivorship for all four species did decline as a function of time since banding, indicating probable normal mortality rates for these species. Productivity was also highly variable between years, with residents and migrants again following different trends. Recruitment, although not from within the site, appears to be the strongest determinant of breeding population size among residents.

Figure 9a. Annual Productivity (HY/AHY), 1995-1999: De Luz Creek, Resident Species

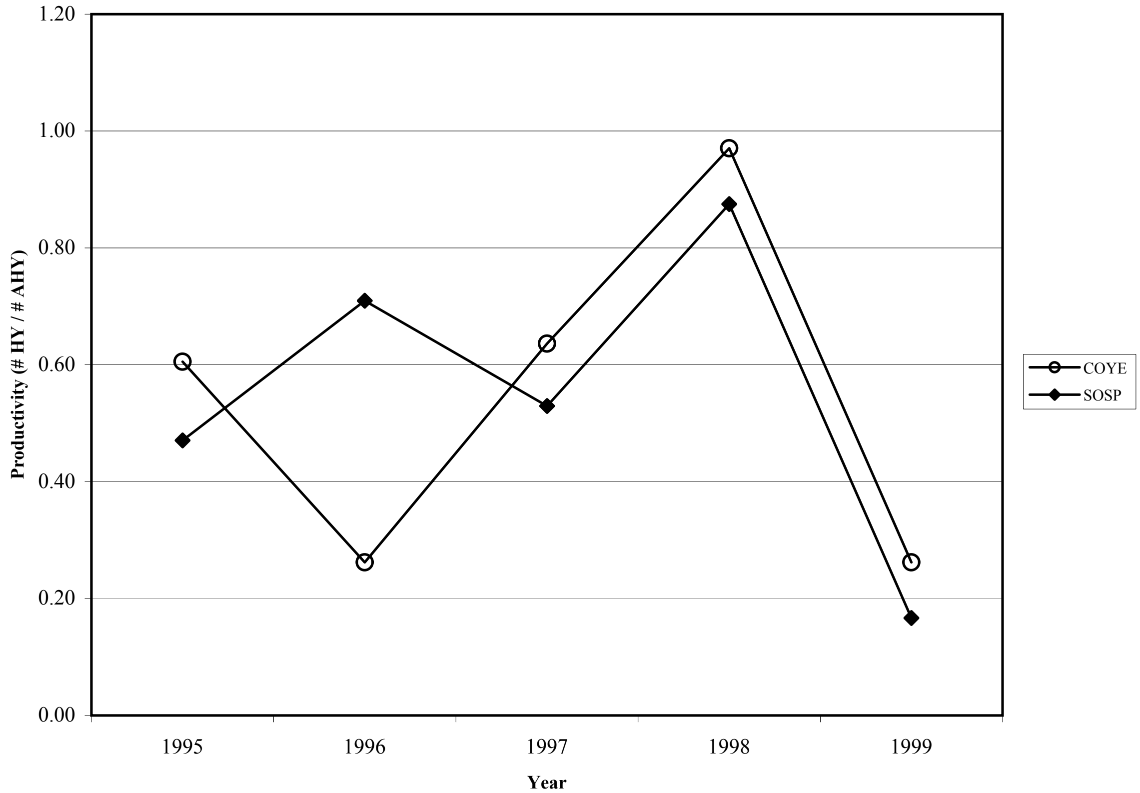


Figure 9b. Annual Productivity (HY/AHY), 1995-1999: De Luz Creek, Migrant Species

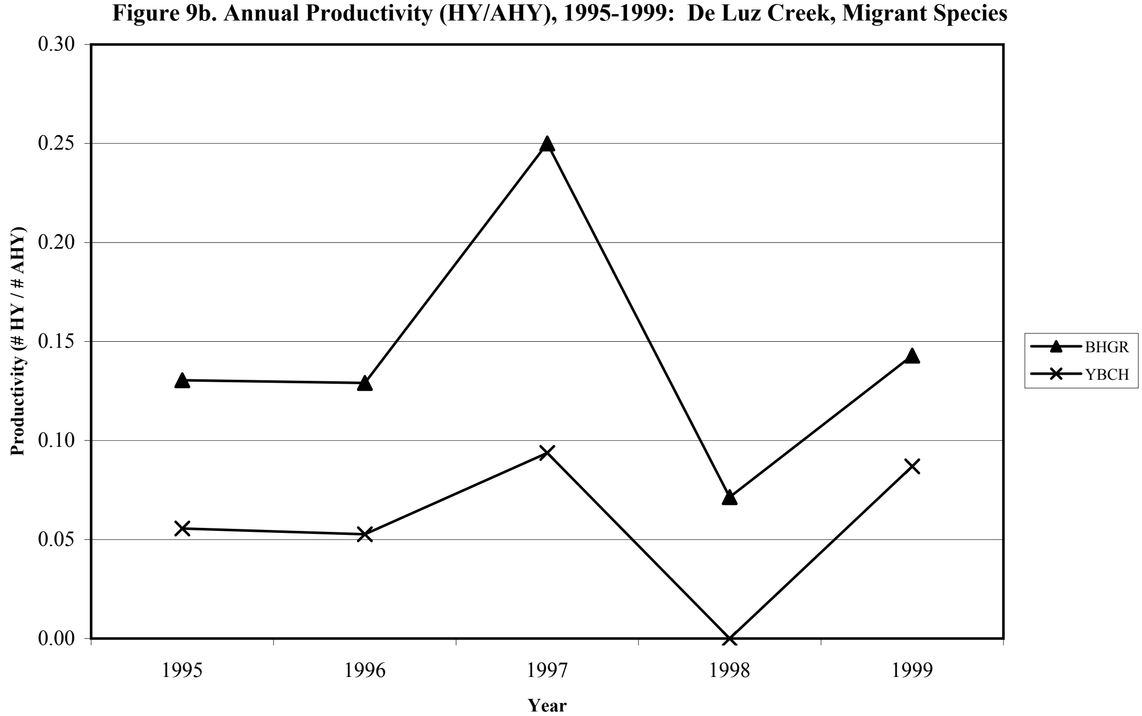
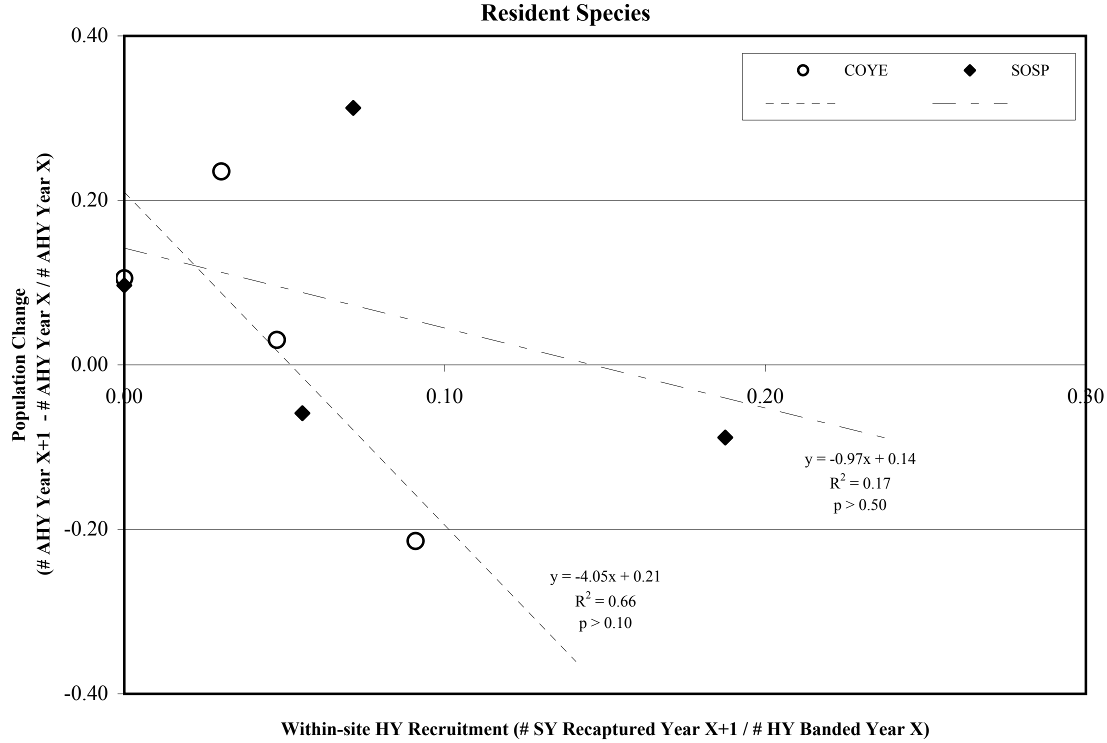


Figure 10. Relationship between Recruitment and Changes in Population Size, Resident Species



Figue 11a. Relationship between Productivity and Changes in Adult Population Size, Resident Species

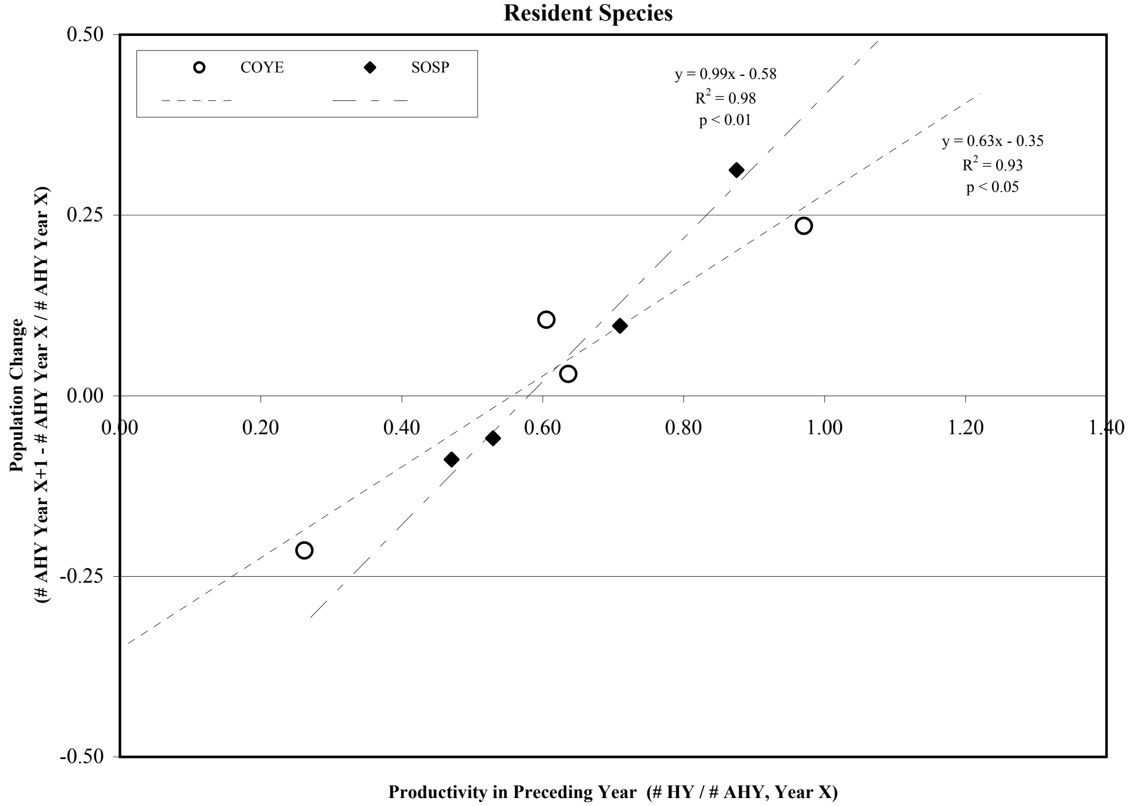
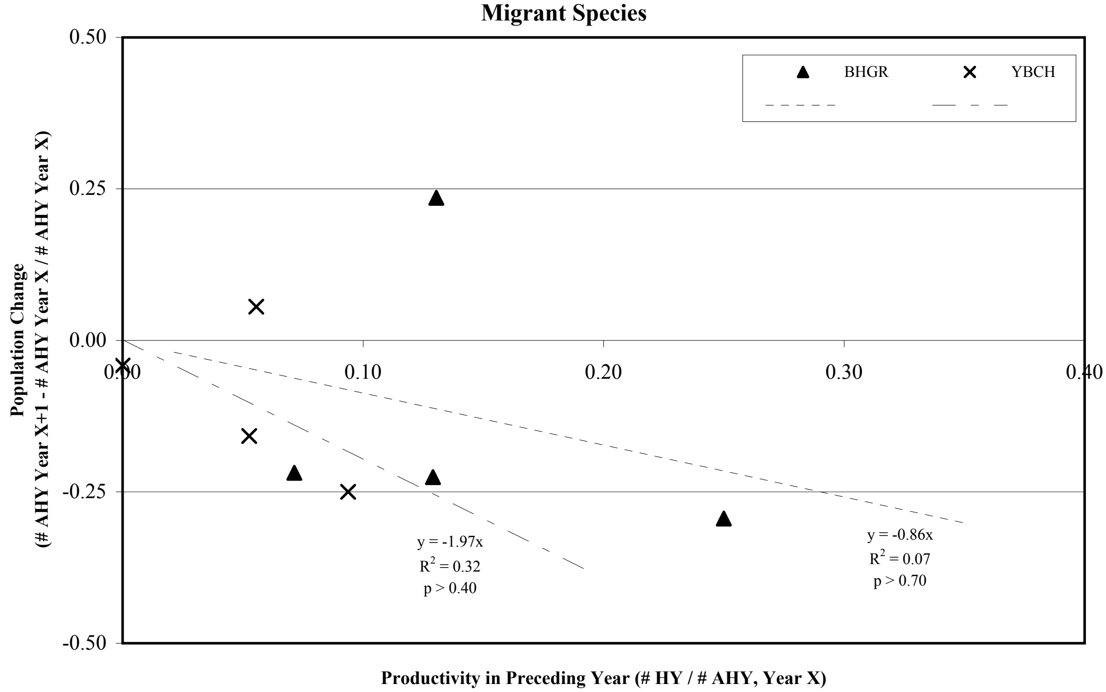


Figure 11b. Relationship between Productivity and Changes in Adult Population Size, Migrant Species



The high variability in population size, and its relationship to productivity, is interesting because hypotheses can be developed to test what factors are responsible for this variability. The most obvious initial hypothesis is that population fluctuations are linked to prevailing environmental conditions. As an initial assessment of environmental impacts 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.

Environmental Impacts on Population Trends

All variables measuring population size, changes in population size, survivorship, productivity, and recruitment were compared to 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 ecosystem productivity and subsequent benefits such as habitat and food availability). As predicted, both species did have higher productivity following wet years (Table 6). Also, common yellowthroats showed a decrease in survivorship following wet winters, but song sparrows did 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). Although productivity of song sparrows increased with warmer winter temperatures, it did not do so in common yellowthroats (Table 6). A counter-intuitive result was that song sparrows showed decreased survivorship during warmer winters. 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 there is no relationship 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 currently prevailing conditions.

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 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

Table 6. Summary of Significant Relationships between Environmental Variables and MAPS Survivorship and Productivity Measures ($\alpha = 0.10$), De Luz Creek 1995-1999

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 + 0.33	0.997	4	0.001	Negative	Wetter Winter, lower survivorship
	Total Winter/Spring Precipitation	Survivorship	y = -0.01x + 0.32	0.95	4	0.02	Negative	Wetter Winter/Spring, lower survivorship
	Total Winter Precipitaion	Productivity	y = 0.08x + 0.47	0.90	5	0.01	Positive	Wetter Winter, higher productivity
	Total Winter/Spring Precipitation	Productivity	y = 0.05x + 0.49	0.86	5	0.02	Positive	Wetter Winter/Spring, higher productivity
SOSP	Average Winter Temperature	Population Size	y = -3.16x + 33.48	0.97	5	0.002	Negative	Colder Winter, higher population size
	Average Winter/Spring Temperature	Population Size	y = -2.12x + 33.17	0.79	5	0.04	Negative	Colder Winter/Spring, higher population size
	Average Spring Temperature	Survivorship	y = -0.04x + 0.33	0.88	4	0.06	Negative	Colder Spring, higher survivorship
	Average Winter/Spring Temperature	Survivorship	y = -0.05x + 0.34	0.89	4	0.06	Negative	Colder Winter/Spring, higher survivorship
	Average Winter Temperature	Productivity	y = 0.23x + 0.60	0.86	5	0.02	Positive	Warmer Winter, higher productivity
	Total Winter Precipitation	Productivity	y = 0.06x + 0.49	0.66	5	0.097	Positive	Wetter Winter, higher productivity
	Average Winter Temperature	Population Change	y = -0.14x + 0.03	0.92	4	0.04	Negative	Colder Winter, higher population size
BHGR	Average Spring Temperature	Population Size	y = 4.22x + 22.92	0.82	5	0.03	Positive	Warmer Spring, higher population size
	Total Spring Precipitation	Survivorship	y = 0.03x + 0.25	0.85	4	0.08	Positive	Wetter Spring, higher survivorship
	Total Winter/Spring Precipitation	Survivorship	y = 0.01x + 0.23	0.90	4	0.05	Positive	Wetter Winter/Spring, higher survivorship
YBCH	Total Winter Precipitation	Survivorship	y = -0.02 + 0.26	0.85	4	0.08	Negative	Wetter Winter, lower survivorship
	Average Spring Temperature	New AHY Captures	y = 2.31x + 22.89	0.84	4	0.08	Positive	Warmer Spring, higher population size
	Total Winter/Spring Precipitation	Productivity	y = -0.006 + 0.06	0.69	5	0.08	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

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. Black-headed grosbeaks did show a positive relationship between winter precipitation and survivorship, indicating that wet winters are associated with increased survivorship for this species. Conversely, chats exhibited a negative relationship between winter precipitation and survivorship, indicating that this species has higher mortality during locally wet winters (Table 6). Also contrary to predictions, there was a weak negative relationship between precipitation and productivity for chats, indicating that chats have lower productivity after locally wet winters. Black-headed grosbeaks did not exhibit any relationship between these two factors.

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 and chat population size (which is a weak function of survivorship) increased with warmer spring weather (Table 6). Black-headed grosbeaks also showed increased productivity for breeding seasons following warmer winters (but not necessarily warmer springs).

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. Knowledge of the mechanisms regulating population dynamics will be useful for management of all species, including species of special concern.

<u>Santa Margarita River</u>

Overview of 1999 Captures

Nine hundred and forty-seven individuals of 40 species were caught during 766 net-hours (Table 7), more than twice as many birds as were caught at the De Luz station. Overall captures totaled 1154, for an average capture rate of 1.51 capture per net-hour, comparable to the 1998 capture rate (1.56) and almost 2.5 times higher than the capture rate at De Luz. In contrast to 1998, species richness was comparable to that at De Luz, influenced by either the longer sampling period for this site in 1999 (sampling in 1998 commenced in early May) or successional changes in the bird community.

Once again, the most abundant species at the Santa Margarita station were song sparrows and common yellowthroats, although they comprised a lower percentage of individuals captured in 1999 (45 percent) than in 1998 (67 percent) (Figure 12). These two species were followed in abundance by orange-crowned warblers, bushtits, yellow warblers, American goldfinches, Wilson’s warblers, Swainson thrushes, lesser goldfinches, least Bell's vireos, and yellow breasted chats. These nine species comprised 82 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, Swainson’s thrush) confirmed that this site supports breeding populations of several species of intense conservation concern. Fourteen new species were captured at the site in 1999 (Table 8) including California quail, sharp-shinned hawk, Nuttall’s woodpecker, black-chinned hummingbird, ash-throated flycatcher, white-crowned sparrow, blue grosbeak, tree swallow, Nashville warbler, yellow-rumped (Audubon’s) warbler, black-throated gray warbler, hooded warbler, ruby-crowned kinglet, and hermit thrush. The female hooded warbler, which was captured twice in late May – early June and appeared to be developing a brood patch, is particularly notable because this is a vagrant Eastern North America species not known to breed in San Diego County.

The sex ratio of birds of known sex (N=518) was approximately even (Table 7), with 49 percent female and 51 percent male, similar to the previous year and identical to the ratio at De Luz. The proportion of hatch year birds in the population in 1999 (27 percent) declined dramatically relative to 1998 (51 percent), but remained much higher than at De Luz (12 percent), indicating that an overall level of productivity 2-3 times higher than that at De Luz is typical in most years. As in 1998, this high productivity was mainly attributable to high captures of hatch-year song sparrows (106 individuals) and common yellowthroats (61 individuals), although orange-crowned warblers (24 individuals) and bushtits (23 individuals) contributed substantially to the total. These four species together accounted for 87 percent of all hatch-year individuals captured. Single-species comparisons between the Santa Margarita and De Luz populations indicate that song sparrow productivity was 5.9 times higher at the former site (0.94 young/adult versus 0.16 young/adult, respectively), while common yellowthroat productivity was 1.8 times higher (0.48 young/adult versus 0.26 young/adult). Further analyses of species-specific survival and productivity should shed light on the differences between sites in species composition and abundance.

Table 7. Sex and Age of Individuals Captured: Santa Margarita River, 1999

		Female					Male						Unknown Sex						
		Age[a,b]				Female	Age[a,b]					Male	Age[a,b]					Unknown	Species
Species	**Code**	A	H	O	S	**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**	1	0	0	0	0	**1**	**1**
SSHA	332.0	0	0	0	0	**0**	0	0	0	0	0	**0**	0	0	1	0	0	**1**	**1**
DOWO	394.0	0	0	0	0	**0**	1	0	1	0	0	**2**	1	0	0	0	0	**1**	**3**
NUWO	397.0	0	0	0	0	**0**	0	0	1	0	0	**1**	0	0	0	0	0	**0**	**1**
BCHU	429.0	0	0	0	0	**0**	1	0	0	0	0	**1**	0	0	0	0	0	**0**	**1**
ANHU	431.0	2	0	0	0	**2**	1	0	0	0	0	**1**	0	0	0	0	1	**1**	**4**
ALHU	434.0	0	0	0	0	**0**	1	1	0	0	1	**3**	0	0	0	0	0	**0**	**3**
UNHU	440.9	0	0	0	0	**0**	0	0	0	0	0	**0**	0	1	0	0	4	**5**	**5**
ATFL	454.0	0	0	0	0	**0**	0	0	0	0	0	**0**	5	0	0	0	0	**5**	**5**
BLPH	458.0	0	0	0	0	**0**	0	0	0	0	0	**0**	1	0	0	0	0	**1**	**1**
PSFL	464.1	0	0	0	0	**0**	0	0	0	0	0	**0**	15	0	0	0	0	**15**	**15**
WIFL	466.0	2	0	0	0	**2**	0	0	0	0	0	**0**	7	0	0	0	0	**7**	**9**
HOFI	519.0	2	0	0	0	**2**	4	1	0	0	0	**5**	0	3	0	0	0	**3**	**10**
AMGO	529.0	4	0	5	0	**9**	1	0	8	6	0	**15**	0	5	0	0	0	**5**	**29**
LEGO	530.0	4	0	3	7	**14**	1	0	3	5	0	**9**	0	1	0	0	0	**1**	**24**
WCSP	554.0	0	0	0	0	**0**	0	0	0	0	0	**0**	3	0	0	1	0	**4**	**4**
SOSP	581.0	37	0	0	0	**37**	44	0	0	0	0	**44**	32	106	0	0	19	**157**	**238**
SPTO	588.0	2	0	2	3	**7**	3	0	2	0	0	**5**	0	1	0	0	0	**1**	**13**
BHGR	596.0	1	0	0	0	**1**	0	0	3	2	0	**5**	0	0	0	0	0	**0**	**6**
BLGR	597.0	0	0	0	0	**0**	0	0	1	0	0	**1**	0	0	0	0	0	**0**	**1**
TRES	614.0	1	0	0	0	**1**	0	0	0	0	0	**0**	0	0	0	0	0	**0**	**1**
WAVI	627.0	0	0	0	0	**0**	0	0	0	0	0	**0**	19	0	0	0	0	**19**	**19**
HUVI	632.0	0	0	0	0	**0**	0	0	0	0	0	**0**	1	0	0	0	0	**1**	**1**
LBVI	633.4	9	0	0	0	**9**	1	0	0	0	0	**1**	8	3	0	0	0	**11**	**21**
NAWA	645.0	0	0	0	1	**1**	0	0	3	0	0	**3**	0	0	0	0	0	**0**	**4**
OCWA	646.0	24	0	3	6	**33**	22	0	6	3	0	**31**	14	24	0	0	0	**38**	**102**
YWAR	652.0	11	0	4	2	**17**	5	0	11	3	1	**20**	2	6	0	0	0	**8**	**45**
AUWA	656.0	1	0	0	0	**1**	0	0	0	0	0	**0**	0	0	0	0	0	**0**	**1**
BTYW	665.0	0	0	0	0	**0**	0	0	1	0	0	**1**	0	0	0	0	0	**0**	**1**
TOWA	668.0	0	0	1	2	**3**	0	0	1	0	0	**1**	0	0	0	0	0	**0**	**4**
COYE	681.0	27	0	22	11	**60**	33	8	24	10	1	**76**	0	53	0	0	2	**55**	**191**
YBCH	683.0	9	0	0	0	**9**	9	0	0	0	0	**9**	1	2	0	0	0	**3**	**21**
HOWA	684.0	0	0	0	1	**1**	0	0	0	0	0	**0**	0	0	0	0	0	**0**	**1**
WIWA	685.0	1	0	0	5	**6**	3	0	11	2	0	**16**	4	0	0	0	0	**4**	**26**
BEWR	719.0	6	0	0	0	**6**	0	0	0	0	0	**0**	7	4	0	0	1	**12**	**18**
HOWR	721.0	5	0	0	0	**5**	1	0	0	0	0	**1**	4	3	0	0	1	**8**	**14**
WREN	742.0	0	0	0	0	**0**	0	0	0	0	0	**0**	14	2	0	0	1	**17**	**17**
BUSH	743.0	17	8	0	0	**25**	14	0	0	0	0	**14**	0	15	0	0	4	**19**	**58**
RCKI	749.0	2	0	0	0	**2**	0	0	0	0	0	**0**	0	0	0	0	0	**0**	**2**
SWTH	758.0	0	0	0	0	**0**	0	0	0	0	0	**0**	20	0	2	3	0	**25**	**25**
HETH	759.0	0	0	0	0	**0**	0	0	0	0	0	**0**	1	0	0	0	0	**1**	**1**
Total		**167**	**8**	**40**	**38**	**253**	**145**	**10**	**76**	**31**	**3**	**265**	**160**	**229**	**3**	**4**	**33**	**429**	**947**

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

[b] Age classes without captures for a given sex not shown

Figure 12. Number of Individuals Caught per Species: Santa Margarita River, 1999

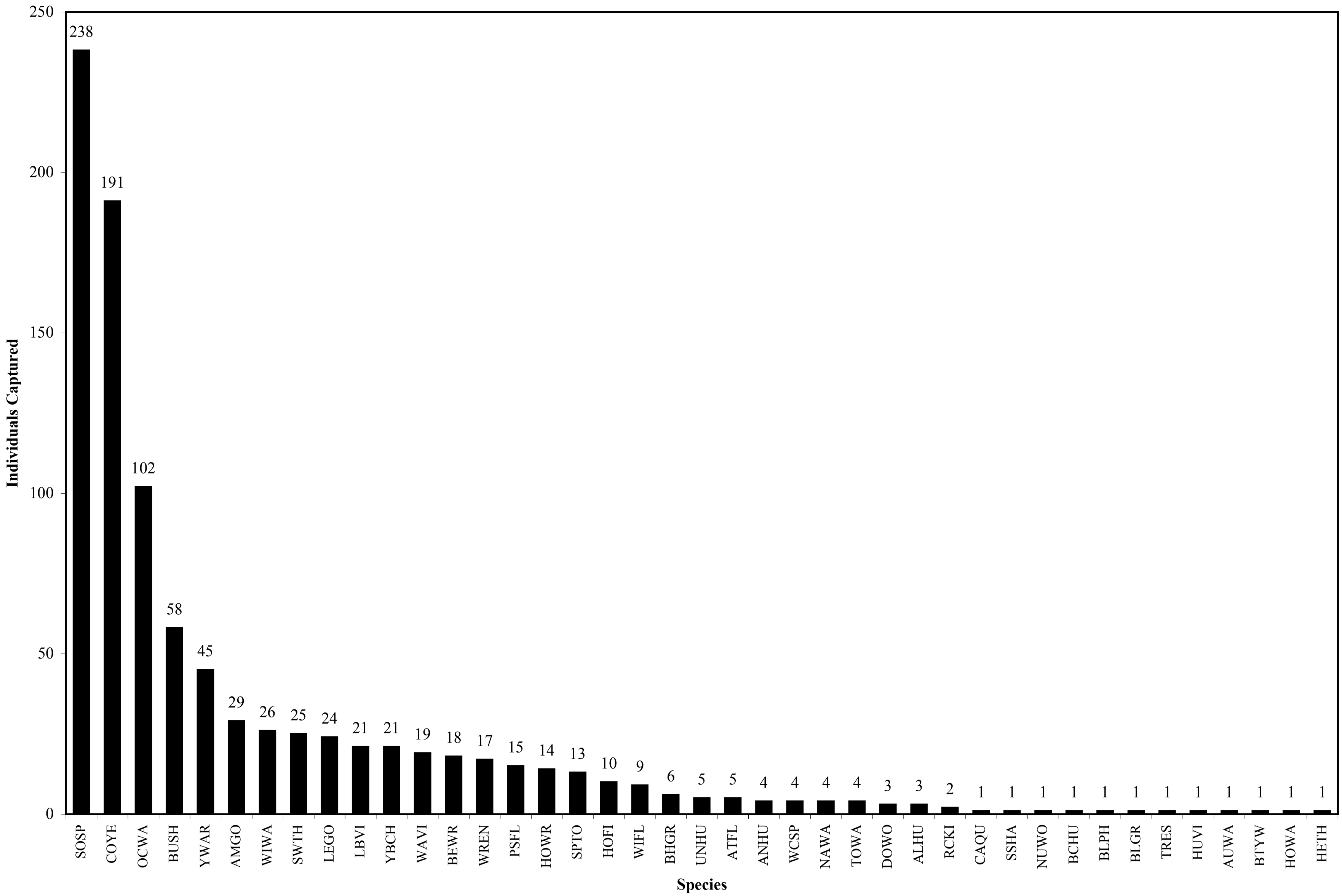


Table 8. Number of Birds Captured, Banded, and Recaptured: Santa Margarita River, 1998 - 1999

Species	Code	Total Captures			New Individuals Banded			Banded 1998, Recaptured 1999
		Year			Year			
		1998	1999	Total	1998	1999	Total	
CAQU	0.0	0	1	**1**	0	0	**0**	**0**
MODO	316.0	1	0	**1**	0	0	**0**	**0**
SSHA	332.0	0	1	**1**	0	0	**0**	**0**
DOWO	394.0	3	4	**7**	2	2	**4**	**0**
NUWO	397.0	0	1	**1**	0	1	**1**	**0**
BCHU	429.0	0	1	**1**	0	0	**0**	**0**
ANHU	431.0	3	4	**7**	0	0	**0**	**0**
ALHU	434.0	0	3	**3**	0	0	**0**	**0**
UNHU	440.9	1	5	**6**	0	0	**0**	**0**
ATFL	454.0	0	5	**5**	0	4	**4**	**0**
BLPH	458.0	2	1	**3**	2	1	**3**	**0**
PSFL	464.1	3	15	**18**	2	15	**17**	**0**
WIFL	466.0	11	11	**22**	6	7	**13**	**2**
HOOR	505.0	1	0	**1**	1	0	**1**	**0**
HOFI	519.0	2	10	**12**	2	10	**12**	**0**
AMGO	529.0	19	31	**50**	17	28	**45**	**1**
LEGO	530.0	11	26	**37**	10	23	**33**	**1**
WCSP	554.0	0	5	**5**	0	4	**4**	**0**
SOSP	581.0	400	314	**714**	316	177	**493**	**58**
SPTO	588.0	18	13	**31**	13	11	**24**	**2**
BHGR	596.0	4	6	**10**	2	6	**8**	**0**
BLGR	597.0	0	1	**1**	0	1	**1**	**0**
TRES	614.0	0	1	**1**	0	1	**1**	**0**
WAVI	627.0	3	19	**22**	3	19	**22**	**0**
HUVI	632.0	5	1	**6**	4	0	**4**	**0**
LBVI	633.4	43	33	**76**	33	14	**47**	**7**
NAWA	645.0	0	4	**4**	0	4	**4**	**0**
OCWA	646.0	29	115	**144**	26	98	**124**	**3**
YWAR	652.0	35	55	**90**	30	37	**67**	**7**
AUWA	656.0	0	1	**1**	0	1	**1**	**0**
BTYW	665.0	0	1	**1**	0	1	**1**	**0**
TOWA	668.0	1	4	**5**	1	4	**5**	**0**
COYE	681.0	230	260	**490**	196	160	**356**	**30**
YBCH	683.0	24	27	**51**	16	19	**35**	**0**
HOWA	684.0	0	2	**2**	0	1	**1**	**0**
WIWA	685.0	9	26	**35**	8	26	**34**	**0**
BEWR	719.0	24	20	**44**	14	14	**28**	**4**
HOWR	721.0	9	19	**28**	7	13	**20**	**1**
WREN	742.0	11	18	**29**	8	16	**24**	**1**
BUSH	743.0	22	62	**84**	19	54	**73**	**3**
RCKI	749.0	0	2	**2**	0	2	**2**	**0**
SWTH	758.0	12	25	**37**	12	25	**37**	**0**
HETH	759.0	0	1	**1**	0	1	**1**	**0**
Total		**936**	**1154**	**2090**	**750**	**800**	**1550**	**120**

Nine hundred and twenty-one of the birds caught (97 percent) were banded. Birds not banded included thirteen hummingbirds, one California quail, one sharp-shinned hawk, and 11 additional birds, all of which escaped prior to or during processing. 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, one least Bell's vireo was captured six times, and two song sparrows were captured five and seven times, respectively (Table 9).

Overall capture rates by net ranged from 89 to 246 captures per 100 net-hours, for an overall average capture rate of 151 per 100 net-hours (Table 10). The equitability of capture rates across all nets decreased relative to 1998: while capture rates at nets 2, 8, 9, and 10 all increased, capture rates at nets 1, 4, 5, and 7 decreased (Figure 13). Capture rates peaked at 239 captures per 100-net hours in mid-June (Table 10), and steadily declined for the rest of the season after that peak. Although peak capture rates did not coincide with the peak in migrant/transient movement through the site, species richness peaked (24 species) in mid-May due to movement of these species through the site (Table 11).

Recapture of Banded Birds

One hundred and twenty (13 percent) of all individuals caught were recaptures of birds originally banded in 1998 (Table 8). Song sparrows and common yellowthroats comprised seventy-three percent of all recaptures, and as a proportion of individuals banded in 1998, had recapture rates of eighteen percent and fifteen percent, respectively. Other species with fewer recaptures, but higher recapture rates, include southwestern willow flycatchers (33 percent), Bewick's wrens (29 percent), yellow warblers (23 percent), and least Bell's vireos (21 percent). As shown at the De Luz site (1998 Progress Report, Table 6), recaptures in future years should increase these initial estimates of survival. 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, 1999

Species	Code	# Individuals / Capture Incidence (Banded Birds Only) 1 Capture	2 Captures	3 Captures	4 Captures	5 Captures	6 Captures	7 Captures	# Captures Banded Birds	Unbanded Birds	All Birds
CAQU	0.0	0	0	0	0	0	0	0	0	1	1
SSHA	332.0	0	0	0	0	0	0	0	0	1	1
DOWO	394.0	1	1	0	0	0	0	0	3	1	4
NUWO	397.0	1	0	0	0	0	0	0	1	0	1
BCHU	429.0	0	0	0	0	0	0	0	0	1	1
ANHU	431.0	0	0	0	0	0	0	0	0	4	4
ALHU	434.0	0	0	0	0	0	0	0	0	3	3
UNHU	440.9	0	0	0	0	0	0	0	0	5	5
ATFL	454.0	4	0	0	0	0	0	0	4	1	5
BLPH	458.0	1	0	0	0	0	0	0	1	0	1
PSFL	464.1	15	0	0	0	0	0	0	15	0	15
WIFL	466.0	7	2	0	0	0	0	0	11	0	11
HOFI	519.0	10	0	0	0	0	0	0	10	0	10
AMGO	529.0	27	2	0	0	0	0	0	31	0	31
LEGO	530.0	22	2	0	0	0	0	0	26	0	26
WCSP	554.0	3	1	0	0	0	0	0	5	0	5
SOSP	581.0	181	41	8	3	1	0	1	311	3	314
SPTO	588.0	13	0	0	0	0	0	0	13	0	13
BHGR	596.0	6	0	0	0	0	0	0	6	0	6
BLGR	597.0	1	0	0	0	0	0	0	1	0	1
TRES	614.0	1	0	0	0	0	0	0	1	0	1
WAVI	627.0	19	0	0	0	0	0	0	19	0	19
HUVI	632.0	0	0	0	0	0	0	0	0	1	1
LBVI	633.4	14	5	1	0	0	1	0	33	0	33
NAWA	645.0	4	0	0	0	0	0	0	4	0	4
OCWA	646.0	92	8	1	1	0	0	0	115	0	115
YWAR	652.0	36	6	2	0	0	0	0	54	1	55
AUWA	656.0	1	0	0	0	0	0	0	1	0	1
BTYW	665.0	1	0	0	0	0	0	0	1	0	1
TOWA	668.0	4	0	0	0	0	0	0	4	0	4
COYE	681.0	145	28	10	7	0	0	0	259	1	260
YBCH	683.0	14	4	1	0	0	0	0	25	2	27
HOWA	684.0	0	1	0	0	0	0	0	2	0	2
WIWA	685.0	26	0	0	0	0	0	0	26	0	26
BEWR	719.0	16	2	0	0	0	0	0	20	0	20
HOWR	721.0	12	0	1	1	0	0	0	19	0	19
WREN	742.0	16	1	0	0	0	0	0	18	0	18
BUSH	743.0	53	4	0	0	0	0	0	61	1	62
RCKI	749.0	2	0	0	0	0	0	0	2	0	2
SWTH	758.0	25	0	0	0	0	0	0	25	0	25
HETH	759.0	1	0	0	0	0	0	0	1	0	1
Total		**774**	**108**	**24**	**12**	**1**	**1**	**1**	**1128**	**26**	**1154**

Table 10. Capture Rate by Net and Date: Santa Margarita River, 1999

MAPS Period	Date		Net										Date Total
			1	2	3	4	5	6	7	8	9	10	
		Net Hours	4:40	4:40	4:40	4:25	4:30	4:35	4:35	4:30	4:30	4:30	**45:35**
		Captures	2	6	3	1	1	1	5	7	2	6	**34**
-3	4/6	Captures/Net Hour	0.43	1.29	0.64	0.23	0.22	0.22	1.09	1.56	0.44	1.33	**0.75**
		Net Hours	4:50	4:40	4:45	4:45	4:45	4:35	4:50	4:50	4:45	4:40	**47:25**
		Captures	4	10	3	7	1	2	6	7	10	11	**61**
-2	4/16	Captures/Net Hour	0.83	2.14	0.63	1.47	0.21	0.44	1.24	1.45	2.11	2.36	**1.29**
		Net Hours	5:20	5:10	5:00	5:05	5:05	5:05	5:00	5:05	5:05	5:20	**51:15**
		Captures	0	9	3	4	4	9	3	7	7	11	**57**
-1	4/23	Captures/Net Hour	0.00	1.74	0.60	0.79	0.79	1.77	0.60	1.38	1.38	2.06	**1.11**
		Net Hours	5:50	5:55	5:55	5:45	6:05	4:40	4:35	5:50	5:35	5:25	**55:35**
		Captures	7	17	14	9	11	10	15	12	10	13	**118**
1	5/3	Captures/Net Hour	1.20	2.87	2.37	1.57	1.81	2.14	3.27	2.06	1.79	2.40	**2.12**
		Net Hours	5:15	5:05	5:15	4:50	5:10	5:15	5:15	5:05	5:05	5:05	**51:20**
		Captures	12	13	12	4	7	12	12	8	7	10	**97**
2	5/14	Captures/Net Hour	2.29	2.56	2.29	0.83	1.35	2.29	2.29	1.57	1.38	1.97	**1.89**
		Net Hours	5:25	5:15	5:15	5:30	5:40	5:40	5:40	5:45	5:30	5:40	**55:20**
		Captures	13	18	9	7	7	8	5	10	13	13	**103**
3	5/24	Captures/Net Hour	2.40	3.43	1.71	1.27	1.24	1.41	0.88	1.74	2.36	2.29	**1.86**
		Net Hours	5:00	5:05	5:05	4:50	5:10	5:00	4:50	5:10	4:55	5:00	**50:05**
		Captures	9	18	9	3	5	9	3	11	12	10	**89**
4	6/4	Captures/Net Hour	1.80	3.54	1.77	0.62	0.97	1.80	0.62	2.13	2.44	2.00	**1.78**
		Net Hours	5:35	5:35	5:40	5:30	5:15	5:20	5:15	5:00	5:00	5:20	**53:30**
		Captures	8	30	17	7	11	7	9	13	14	12	**128**
5	6/14	Captures/Net Hour	1.43	5.37	3.00	1.27	2.10	1.31	1.71	2.60	2.80	2.25	**2.39**
		Net Hours	5:15	5:10	5:10	5:15	5:30	5:20	5:25	5:20	5:20	5:20	**53:05**
		Captures	9	7	3	5	6	8	3	30	20	18	**109**
6	6/22	Captures/Net Hour	1.71	1.35	0.58	0.95	1.09	1.50	0.55	5.63	3.75	3.38	**2.05**
		Net Hours	5:05	5:10	5:10	5:20	5:00	5:00	5:00	5:40	5:45	5:45	**52:55**
		Captures	3	15	6	2	6	7	13	30	22	13	**117**
7	7/1	Captures/Net Hour	0.59	2.90	1.16	0.38	1.20	1.40	2.60	5.29	3.83	2.26	**2.21**
		Net Hours	5:00	5:05	5:00	4:55	5:05	5:05	5:15	4:30	4:15	5:05	**49:15**
		Captures	4	19	10	8	3	9	15	9	4	5	**86**
8	7/13	Captures/Net Hour	0.80	3.74	2.00	1.63	0.59	1.77	2.86	2.00	0.94	0.98	**1.75**
		Net Hours	5:15	5:20	5:10	5:10	5:10	5:10	5:20	5:10	5:05	5:20	**52:10**
		Captures	13	8	8	6	6	2	4	7	5	2	**61**
9	7/23	Captures/Net Hour	2.48	1.50	1.55	1.16	1.16	0.39	0.75	1.35	0.98	0.38	**1.17**
		Net Hours	5:05	5:15	5:05	5:05	4:55	4:55	4:55	4:55	4:50	4:55	**49:55**
		Captures	2	9	10	1	1	2	1	4	2	6	**38**
10	8/3	Captures/Net Hour	0.39	1.71	1.97	0.20	0.20	0.41	0.20	0.81	0.41	1.22	**0.76**
		Net Hours	4:50	4:50	4:55	4:55	4:55	4:55	4:55	4:55	4:50	4:55	**48:55**
		Captures	5	9	3	2	3	1	2	2	1	1	**29**
11	8/13	Captures/Net Hour	1.03	1.86	0.61	0.41	0.61	0.20	0.41	0.41	0.21	0.20	**0.59**
		Net Hours	4:55	4:55	4:55	4:55	5:00	5:00	5:00	5:00	4:55	5:00	**49:35**
		Captures	1	2	9	2	1	2	2	2	1	5	**27**
12	8/24	Captures/Net Hour	0.20	0.41	1.83	0.41	0.20	0.40	0.40	0.40	0.20	1.00	**0.54**
		Net Hours	**77:20**	**77:10**	**77:00**	**76:15**	**77:15**	**75:35**	**75:50**	**76:45**	**75:25**	**77:20**	**765:55**
		Captures	**92**	**190**	**119**	**68**	**73**	**89**	**98**	**159**	**130**	**136**	**1154**
Net Total		**Captures/Net Hour**	**1.19**	**2.46**	**1.55**	**0.89**	**0.94**	**1.18**	**1.29**	**2.07**	**1.72**	**1.76**	**1.51**

Figure 13. Captures, Net Hours, and Capture Rate by Net: Santa Margarita River, 1999

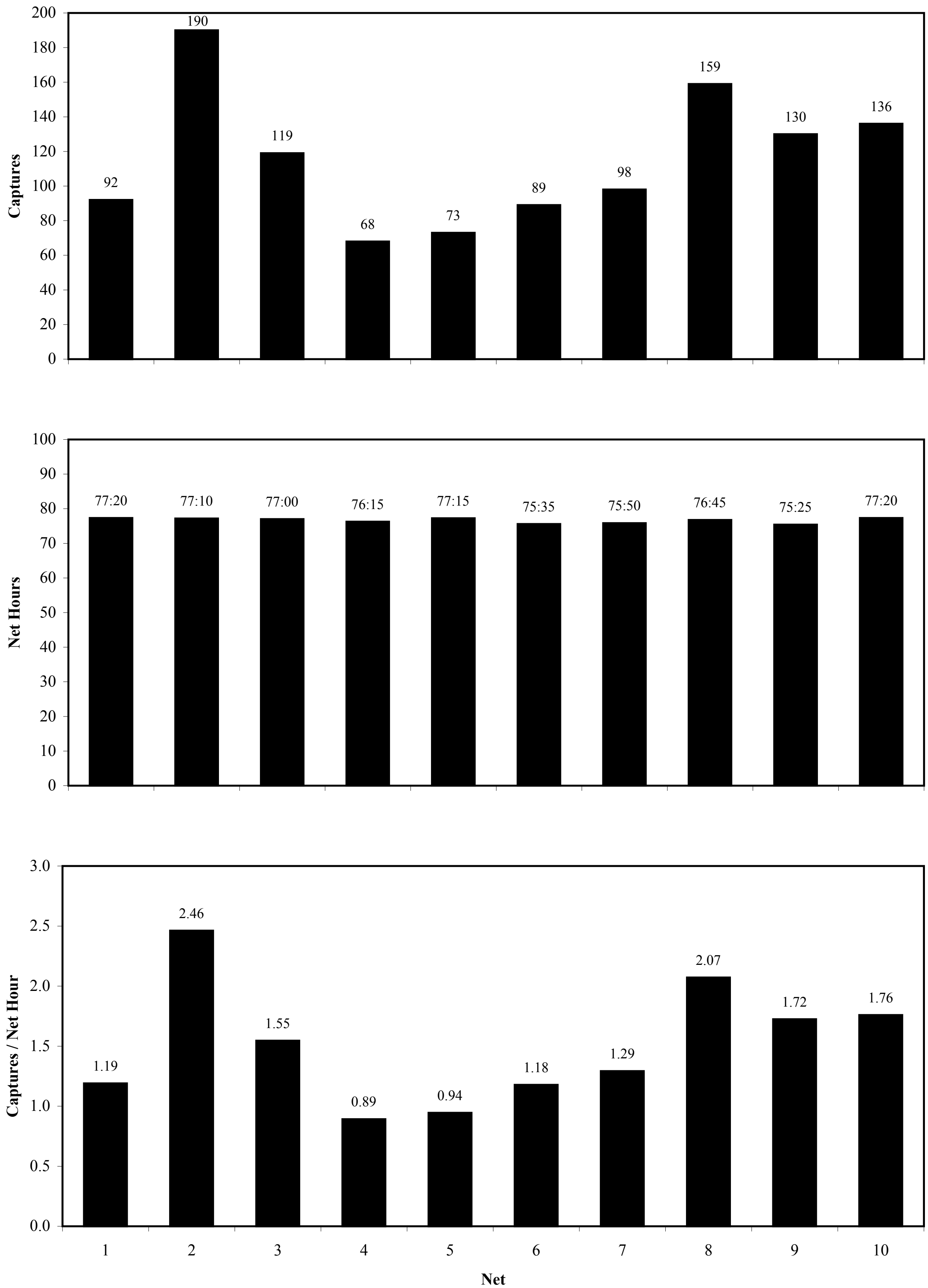


Table 11. Number of Captures by Date: Santa Margarita River, 1999

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																
		4/6	4/16	4/23	5/3	5/14	5/24	6/4	6/14	6/22	7/1	7/13	7/23	8/3	8/13	8/24		
CAQU	0.0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
SSHA	332.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
DOWO	394.0	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	**4**	**0.52**
NUWO	397.0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
BCHU	429.0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	**1**	**0.13**
ANHU	431.0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	1	**4**	**0.52**
ALHU	434.0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	**3**	**0.39**
UNHU[b]	440.9	0	0	0	0	0	0	0	3	0	0	0	1	1	0	0	**5**	**0.65**
ATFL	454.0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	**5**	**0.65**
BLPH	458.0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
PSFL	464.1	1	0	0	2	5	1	2	4	0	0	0	0	0	0	0	**15**	**1.96**
WIFL	466.0	0	0	0	0	0	4	4	2	1	0	0	0	0	0	0	**11**	**1.44**
HOFI	519.0	0	0	0	0	1	0	0	5	0	1	1	0	2	0	0	**10**	**1.31**
AMGO	529.0	0	0	0	6	0	3	0	5	4	11	1	1	0	0	0	**31**	**4.05**
LEGO	530.0	0	1	2	0	2	4	3	6	3	2	1	1	1	0	0	**26**	**3.39**
WCSP	554.0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	**5**	**0.65**
SOSP	581.0	5	17	20	16	11	23	21	31	37	31	20	30	16	20	16	**314**	**41.00**
SPTO	588.0	0	1	2	0	2	2	0	1	2	1	2	0	0	0	0	**13**	**1.70**
BHGR	596.0	0	0	0	0	1	3	0	1	0	0	1	0	0	0	0	**6**	**0.78**
BLGR	597.0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**1**	**0.13**
TRES	614.0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
WAVI	627.0	0	0	0	7	9	3	0	0	0	0	0	0	0	0	0	**19**	**2.48**
HUVI	632.0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
LBVI	633.4	0	0	3	1	2	3	7	3	4	4	1	0	4	1	0	**33**	**4.31**
NAWA	645.0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	**4**	**0.52**
OCWA	646.0	9	12	11	21	6	13	16	17	9	1	0	0	0	0	0	**115**	**15.01**
YWAR	652.0	0	2	1	4	10	12	4	3	6	2	6	3	1	1	0	**55**	**7.18**
AUWA	656.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
BTYW	665.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
TOWA	668.0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	**4**	**0.52**
COYE	681.0	13	11	11	14	13	18	15	24	23	48	31	15	9	7	8	**260**	**33.95**
YBCH	683.0	0	0	1	3	3	1	4	1	3	6	2	2	1	0	0	**27**	**3.53**
HOWA	684.0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	**2**	**0.26**
WIWA	685.0	0	1	0	17	5	3	0	0	0	0	0	0	0	0	0	**26**	**3.39**
BEWR	719.0	0	2	0	0	2	3	3	2	1	1	2	1	1	0	2	**20**	**2.61**
HOWR	721.0	0	1	0	1	1	3	0	3	1	3	4	2	0	0	0	**19**	**2.48**
WREN	742.0	0	0	0	2	2	0	2	0	2	4	3	3	0	0	0	**18**	**2.35**
BUSH	743.0	4	0	5	2	2	1	7	17	13	0	10	0	1	0	0	**62**	**8.09**
RCKI	749.0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**	**0.26**
SWTH	758.0	0	0	0	12	10	2	0	0	0	0	1	0	0	0	0	**25**	**3.26**
HETH	759.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.13**
Total		**34**	**61**	**57**	**118**	**97**	**103**	**89**	**128**	**109**	**117**	**86**	**61**	**38**	**29**	**27**	**1154**	**150.67**
Species		**7**	**18**	**10**	**20**	**24**	**19**	**13**	**16**	**14**	**15**	**15**	**11**	**10**	**4**	**4**	**40**	**5.22**

[a] 765:55 total net-hours

[b] Not included in species total

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
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
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
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
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
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
CLSW	Cliff swallow	*Petrochelidon pyrrhonota*	612.0
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
WAVI	Warbling vireo	*Vireo gilvus*	627.0
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

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

Code	Common Name	Scientific Name	AOU #
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
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
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