2003
ANALYSIS OF AVIAN GUILD SPECIES DIVERSITY IN THE CARMEL RIVER RIPARIAN CORRIDOR

Twelfth Annual Report

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ANALYSIS OF AVIAN GUILD SPECIES DIVERSITY - 2003

ABSTRACT

The Monterey Peninsula Water Management District (MPWMD) restores vegetation along the Carmel River to provide habitat for wildlife indicator species, to stabilize river banks for preventing erosion, and to improve water quality. To evaluate long-term restoration efforts and determine bird/habitat relationships over time, in 1999 we resumed the Avian Guild Species Diversity project (begun in 1992) to elucidate annual trends pertaining to species diversity, abundance, and richness of breeding birds. We conducted surveys along 10 transects on selected reaches of the Carmel River riparian corridor during spring and summer. Data collected from the seasonally dry reaches continued to show a trend toward higher species diversity compared to the perennially watered reaches. This finding may be indicative of ongoing habitat restoration occurring at the Carmel River Mouth and at the Highway 1 Bridge. Spanning from 1992 to present, species diversity at the Schulte restoration site increased significantly. These findings reinforce the importance of ongoing habitat restoration to increase vegetative structural integrity for supporting diverse birds and other wildlife.

BACKGROUND

This report presents results of avian monitoring along the lower Carmel River during spring and late summer, 2003. The monitoring is a continuation of a project first initiated in 1992 by David Mullen of EIP Associates, Berkeley, CA, and repeated most years through 1998; the 1999-2002 projects and reports were prepared by Chris Tenney of the Ventana Wilderness Society. This 2003 report, prepared by Chris Tenney and Sarah Stock, is intended for inclusion as Appendix P to the 1993 report, to facilitate year-to-year data comparisons.

Since 1992 the Monterey Peninsula Water Management District (MPWMD) has monitored wildlife values in selected habitats around the Los Padres Reservoir and along the Lower Carmel River Riparian Corridor. These studies are intended to provide baseline information on the wildlife values available in habitats which will be impacted during the construction and operation of the proposed New Los Padres Dam and Reservoir. The data are intended to facilitate informed public discussion on the merits of this water storage facility and aid in the development of agency approved strategies to ensure adequate mitigation for any habitat values which might be reduced or lost during development of this project.

METHODS

The method used in this report to measure the value of wildlife habitat is defined by the Species Diversity Index (SDI) which has historically been applied to avian guilds in potentially effected project areas (Shannon and Weaver 1949, Odum 1971). SDI measurements provide accurate, repeatable, and reliable evaluation of the resources available to wildlife in various habitats through time (Mullen 1992). Use of this technique is encouraged by the U. S. Fish and Wildlife Service (1993). Beginning in 1997, a second type of data analysis, the Resident Species Analysis (RSA), was presented to provide additional information on annual changes in bird numbers. The methods and rationale for this analysis are provided in the 1997 Report (pp. J-2, J-3).

Specific methods by which SDI field data are collected, statistically analyzed, and interpreted for this study were provided in the 1993 Report (EIP Associates 1993). Site 5A (see Appendix M-1) at the Rancho Canada golf course was sampled only during the year 2000. Aerial photos and detailed descriptions of all sites are provided at the end of the 1999 report (Appendix L-2).

RESULTS

Los Padres Reservoir

The reservoir was last monitored in 1997. There are no current plans to resume monitoring at that location.

Lower Carmel River Riparian Corridor

Spring. Table P-1 presents SDI results from 20 hours of observations obtained during surveys in late May. This year (2003), 62 species were recorded from nine transect sites (data from transect L not included), five fewer than from the same time period in 2002. Numbers of species recorded at each site during a two-hour period ranged from a low of 28 at Garland Park (transect 2B), to a high of 40 at the Highway One bridge (transect 4C). No new species were detected this year, although two species, Brown Creeper and Western Tanager (a late migrant), were detected for only the second time during spring surveys. White-tailed Kites, first observed two years ago near the Highway One Bridge in fields newly-restored to native vegetation, were again present this year. Survey data from the lagoon transect are not included in any annual totals or SDI analyses. They are presented in Table P-1 only as baseline information for future analyses.

SDI values ranged from a low of 3.01 at De Dampierre Park (site 2A) to a high of 3.31 at Valley Greens Drive Bridge (site 3C). The mean SDI value this year (2003) decreased from 3.22 to 3.16 in 2002. This year's SDI mean value is somewhat higher than the 10-year mean of 3.11.

Summer. Table P-2 presents SDI results from 20 hours of observations obtained during surveys in late August. This year (2003) 54 species were recorded from nine transect sites (data from transect L not included), six fewer than were recorded in 2002. Numbers of species recorded at each site during a two-hour period ranged from a low of 20 at Robinson Canyon Road (transect 3A) to a high of 27 at both Schulte Road bridge (transect 3B) and Riverwood (transect 4B). No species were new to summer surveys. Survey data from the lagoon transect are not included in any annual totals or SDI analyses. They are presented in Table P-2 only as baseline information for future analyses.

SDI values ranged from a low of 2.61 at San Carlos Ranch Road Bridge (site 4A) to a high of 3.02 at Schulte Road Bridge (site 3B). The mean SDI value increased from 2.73 in 2002 (Table O-2) to 2.81 in 2003; this year's value (2.81) is 0.15 higher than the 12-year mean of 2.66.

Annual Trends. Species diversity along transect 3B increased significantly in spring ($n = 11$, $r^2 = 0.62$, $P = <0.05$) and in summer ($n = 12$, $r^2 = 0.47$, $P = <0.05$) (Table P-4, Figures P-1 and P-2). Species diversity also increased along transect 3C in spring, but the positive trend was only marginally significant ($n = 11$, $r^2 = 0.36$, $P = 0.05$) (Table P-4, Figure P-1). Species diversity along all other transects showed no significant trend for either season (Table P-4).

TABLE P-1
BIRD SPECIES ENCOUNTERED[3] DURING TIME CONSTRAINED SURVEYS[4]
ON FIXED TRANSECTS ALONG SELECTED REACHES[5] OF THE CARMEL RIVER
RIPARIAN CORRIDOR DURING SPRING, 24 MAY-1 JUNE, 2003.

SPECIES	TRANSECTS									
	2A	2B	2C	3A	3B	3C	4A	4B	4C	L
Brown Pelican										6
Great Blue Heron										1
Green-backed Heron		3	1	1						
Canada Goose	2				8		1	5	2	30
Mallard	8	3		3	4					8
Common Merganser	2									
Turkey Vulture	2	5	7	4	1	1	10		5	
Red-tailed Hawk	1	2					1		6	2
Red-shouldered Hawk	1	2		1	1		1		3	
White-tailed Kite									1	1
American Kestrel		2	3							
California Quail	6	6	1	11	8	4	4	9	3	
Western Gull									5	20
Mourning Dove	2		3	7	6	4	6	11	8	2
Band-tailed Pigeon			1	10	14	2			6	
Rock Dove								3	8	12
Killdeer			4				1			1
White-throated Swift			8							
Anna's Hummingbird			1	2	1		3	2		1
Allen's Hummingbird					1					
Northern Flicker		1		3	2			2	4	
Acorn Woodpecker	8		9	3		7	3	1	4	
Nuttall's Woodpecker	1	5	4		2	5		4	2	
Hairy Woodpecker								1		
Downy Woodpecker	2	3	1		1			1	1	
Western Wood-Pewee						4				
Ash-throated Flycatcher				1						
Pacific-slope Flycatcher		2	2		4	5		1	3	
Black Phoebe	3		6	5	3	3		6	1	1
Barn Swallow			3	2		6	1		3	2
Cliff Swallow	1	3	33	3	7		5	42	62	12
Violet-green Swallow		2	5	7					5	
Tree Swallow						7	8	2	2	
N. Rough-winged Swallow		1		1	2	6			5	
American Crow	13	12	7		9	3	8	7	5	

TABLE P-1 (continued)

SPECIES	TRANSECTS

[3] Total of all visual and auditory identifications.
[4] Four 15-minute transect stations per 2,000-foot census line X two repetitions of each transect = 120 minutes of census time per habitat type.
[5] See Appendix L-A for maps, locations, and descriptions of transect sites.

	2A	2B	2C	3A	3B	3C	4A	4B	4C	L
Western Scrub-Jay	6	1	7	5	11	13	8	8	7	4
Steller's Jay	9	3	1	3	5	6				
Chestnut-backed Chick.	7	6	8		8	11	9	6	6	
Bushtit	2	1	4	1	7	3	6	3	5	
Oak Titmouse	6				3	2				
Pygmy Nuthatch							1	6		
Brown Creeper				1						
Wrentit	1		4	2	5	4	2	2	1	
European Starling	15		5		16	12	1	10	9	10
Warbling Vireo		3	3	10	2	5	1		4	
Bewick's Wren		4	4	3	8	5	1	6	5	
House Wren		1					1			
Cedar Waxwing									6	
American Robin			3	1	4	12		1		
Swainson's Thrush						2	2	6	6	
Yellow Warbler						2		1		
Wilson's Warbler	1	1	2			4		2	5	
Red-winged Blackbird			9	5	3			3	8	15
Brewer's Blackbird	1		6	1	1			10	4	4
Bullock’s Oriole	1									
Western Tanager			1							
Black-headed Grosbeak	6	7	1	3	1	1		2	5	
Lesser Goldfinch			9	7		3	3	1	4	
Spotted Towhee	5	4		2		5	1			
California Towhee	1	7	5	1	7	2	2	7	4	
Purple Finch	2	3	5	3	4	3	1		2	
House Finch			9	4	7	1	3	6	4	6
Dark-eyed Junco						2				
Song Sparrow	10	11	12	10	10	12	8	7	13	8
total species	29	28	37	32	35	34	29	33	40	20
total individuals	125	104	197	125	177	167	102	184	242	146
diversity index	3.01	3.09	3.26	3.21	3.28	3.31	3.04	3.02	3.19	2.55

mean diversity index **3.16** (site L not included)

total species all surveys **62** (site L not included)

2A = DE DAMPIERRE PARK, west from eastern park boundary, 1750’ along north bank
2B = GARLAND PARK, west from Carmel River bridge 1750’ along south bank
2C = CARMEL VALLEY RANCH GOLF CLUB, west from eastern property limit 3300’ along south bank
3A = ROBINSON CANYON ROAD, east from barns area for 2000’ along south bank
3B = SCHULTE ROAD BRIDGE, west for 1375’ along south bank
3C = VALLEY GREENS DRIVE BRIDGE, east for 2200’ along south bank
4A = SAN CARLOS RANCH ROAD BRIDGE, west for 1250’ along south bank
4B = RIVERWOOD, west for 2500’ from eastern property boundary along north bank
4C = HIGHWAY ONE BRIDGE, west for 2250’ along south bank
L = CARMEL LAGOON, from northwestern marsh behind elementary school to river’s edge

TABLE P-2

BIRD SPECIES ENCOUNTERED[6] DURING TIME CONSTRAINED SURVEYS[7] ON FIXED TRANSECTS ALONG SELECTED REACHES[8] OF THE CARMEL RIVER RIPARIAN CORRIDOR DURING THE SUMMER, 19 AUG - 28 AUG, 2003.

SPECIES	TRANSECTS									
	2A	**2B**	**2C**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**L**
Black-cr. N.-Heron							2			
Great Blue Heron		1	1		1	1	1			
Green-backed Heron	1	4								
Great Egret										1
Canada Goose			2			2	5	2	2	12
Mallard	5	10	1				1			6
Common Merganser		9								
Turkey Vulture	6	6	7	3	2				8	
White-tailed Kite									2	1
Red-tailed Hawk						1		3	2	
Red-shouldered Hawk	4		1	2	1		2		3	
California Quail	5	6			6		27		4	
Western Gull										20
Mourning Dove	3	4	2	5	7	4	9	14	2	
Band-tailed Pigeon		1	1	2		6		1		
Rock Dove			2				2	3	1	
Killdeer			1							
Greater Yellowlegs										1
Least Sandpiper										4
Anna's Hummingbird					1	1	1	5	1	1
Belted Kingfisher	2	6	1	2	2		2			
Northern Flicker							1		1	
Acorn Woodpecker	7	2	9	1		6				
Nuttall's Woodpecker			2	1			2	1	1	
Downy Woodpecker				1		1				
Black Phoebe	3	2	7		9		1	6	3	1
Barn Swallow			2		11			3	16	4
Cliff Swallow								5	4	5
American Crow	15	4	9		10	5	1	3	2	
Western Scrub-Jay	18	10	10	8	8	8	13	9	8	7
Steller's Jay	12	5	7	4	4		3			
Ch.-backed Chickadee	1	11	8	3	7	8	2	7	5	
Bushtit	3	2	1	10	9	1	13			
Oak Titmouse	2									
Pygmy Nuthatch					9			15		

TABLE P-2 (continued)

SPECIES	TRANSECTS									
	2A	**2B**	**2C**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**L**

[6] Total of all visual and auditory identifications.
[7] Four 15-minute transect stations per 2,000 census line X two repetitions of each transect = 120 minutes of census time per habitat type.
[8] See Appendix L-A for maps, locations, and descriptions of transect sites.

Wrentit	2	4	1	2	1	2	3	1		
European Starling	1		28		10			3		10
Warbling Vireo			1							
Hutton's Vireo			1	1	2	2		1		
Bewick's Wren		1	3	3	5	2	4	8	1	
Northern Mockingbird								1		
California Thrasher									1	
American Robin				3	5	5				
Townsend's Warbler		1								
Orange-crowned Warbler					1	1		1		
Yellow Warbler		2	4	1	2	2		1		1
Wilson's Warbler	1					1		2		
Red-winged Blackbird			4							
Brewer's Blackbird			30		2		1	4		4
Western Tanager			1							
American Goldfinch		1							1	2
Lesser Goldfinch		3						3		
Spotted Towhee	2								1	
California Towhee	3	2		3		4	3	2	1	
House Finch		1	1	4	5	6	1	4		8
Dark-eyed Junco	8				11					
Savannah Sparrow			1							
Song Sparrow	2	5	5	1	3	3	6	7	3	3
total species	22	25	31	20	27	22	24	27	23	18
total individuals	106	103	154	60	134	72	106	115	73	91
diversity index	2.73	2.96	2.8	2.68	3.02	2.79	2.61	2.97	2.74	2.45

mean diversity index **2.81** (site L not included)
total species all surveys **54** (site L not included)

2A = DE DAMPIERRE PARK, west from eastern park boundary, 1750’ along north bank
2B = GARLAND PARK, west from Carmel River bridge 1750’ along south bank
2C = CARMEL VALLEY RANCH GOLF CLUB, west from eastern property limit 3300’ along south bank
3A = ROBINSON CANYON ROAD, east from barns area for 2000’ along south bank
3B = SCHULTE ROAD BRIDGE, west for 1375’ along south bank
3C = VALLEY GREENS DRIVE BRIDGE, east for 2200’ along south bank
4A = SAN CARLOS RANCH ROAD BRIDGE, west for 1250’ along south bank
4B = RIVERWOOD, west for 2500’ from eastern property boundary along north bank
4C = HIGHWAY ONE BRIDGE, west for 2250’ along south bank
L = CARMEL LAGOON, from northwestern marsh behind elementary school to river’s edge

TABLE P-3
SPECIES DIVERSITY OF BIRDS
UTILIZING LOWER CARMEL RIVER RIPARIAN CORRIDOR HABITATS

SPRING	Perennially Watered Reaches Transects 2A-3A	Seasonally Dry Reaches Transects 3B-4C*	Percent Difference
1992	3.15	3.21	1.9
1994	2.96	2.91	-1.7
1995	3.13	3.14	0.3
1996	3.19	2.91	-8.7
1997	3.15	3.20	1.6
1998	3.22	2.78	-13.6
1999	3.19	3.29	3.1
2000	3.08	2.98	-3.2
2001	3.06	3.19	4.2
2002	3.17	3.27	3.2
2003	3.14	3.17	1.0
Mean (11 years)	**3.13**	**3.10**	**-1.0**
SUMMER			
1992	2.81	2.62	-6.8
1993	2.90	2.59	-10.7
1994	2.76	2.60	-5.6
1995	2.48	2.69	8.4
1996	2.83	2.47	-12.7
1997	2.85	2.66	-6.7
1998	2.62	2.51	-4.2
1999	2.70	2.69	-0.4
2000	2.52	2.65	5.2
2001	2.68	2.92	9.0
2002	2.73	2.73	0.0
2003	2.79	2.83	1.0
Mean (12 years)	**2.73**	**2.66**	**-2.6**

*Does not include Carmel Lagoon (transect L) results

TABLE P-4
RESULTS FROM LINEAR REGRESSION EXAMINING SPECIES DIVERSITY INDICES
FROM 1992 TO 2003 IN THE CARMEL RIVER RIPARIAN CORRIDOR

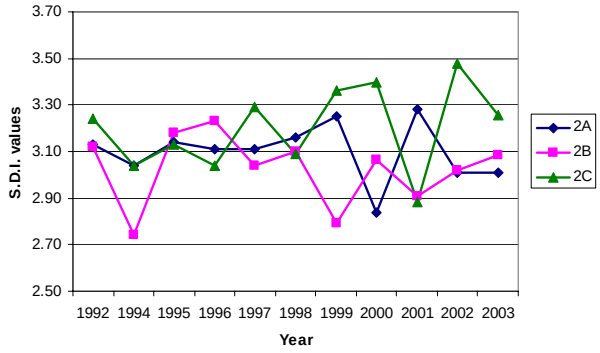
SPRING 1992 - 2003					**SUMMER 1992 - 2003**				
Transect	**Mean ± SE**	***n***	r^2	***P*-value**	**Transect**	**Mean ± SE**	***n***	r^2	***P*-value**
2A	3.10 ± 0.04	11	0.03	0.61	2A	2.71 ± 0.06	12	0.01	0.77
2B	3.03 ± 0.05	11	0.01	0.77	2B	2.67 ± 0.07	12	0.01	0.87
2C	3.20 ± 0.05	11	0.09	0.34	2C	2.76 ± 0.07	12	0.05	0.50
3A	3.18 ± 0.04	11	0.04	0.56	3A	2.76 ± 0.06	12	0.14	0.24
3B	3.09 ± 0.07	**11**	**0.62**	**0.01**[9]	**3B**	**2.66 ± 0.06**	**12**	**0.47**	**0.01**[7]
3C	3.17 ± 0.07	11	0.36	0.05	3C	2.85 ± 0.05	12	0.12	0.27
4A	3.19 ± 0.05	11	0.12	0.23	4A	2.76 ± 0.05	12	0.21	0.13
4B	2.97 ± 0.14	11	0.01	0.89	4B	2.66 ± 0.08	12	0.02	0.65
4C	3.06 ± 0.09	11	0.03	0.62	4C	2.38 ± 0.13	12	0.24	0.10

FIGURE P-1

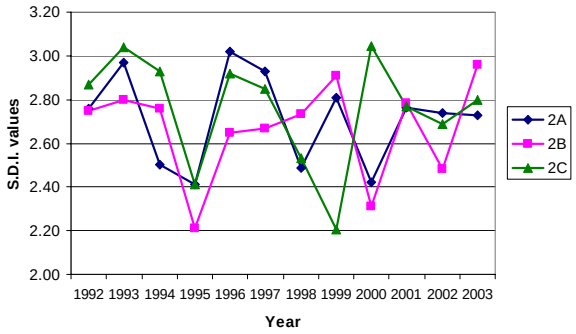
[9] Significant positive trend in species diversity from 1992 to 2003.

SPECIES DIVERSITY INDICES DURING SPRING 1992 - 2003
IN THE CARMEL RIVER RIPARIAN CORRIDOR

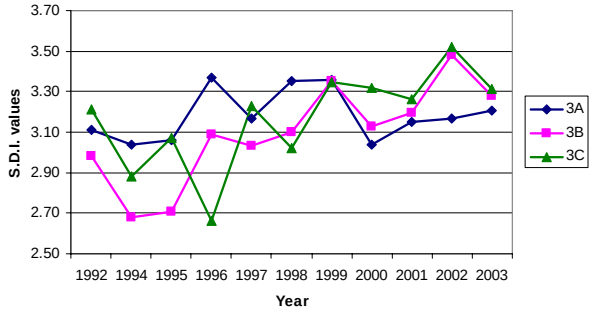
Spring 1992 – 2003



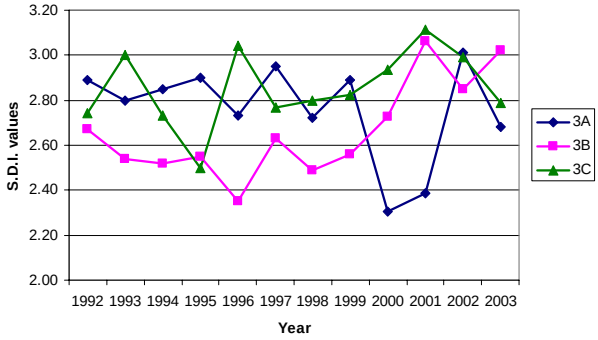
Summer 1992 - 2003

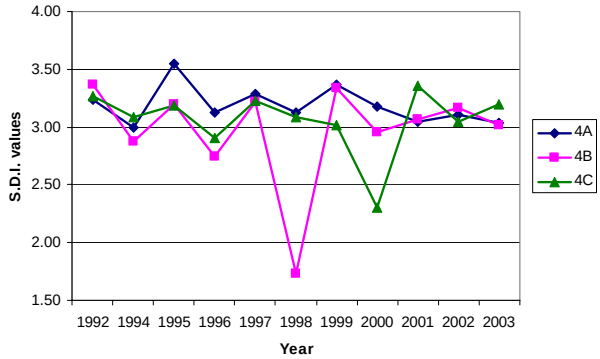


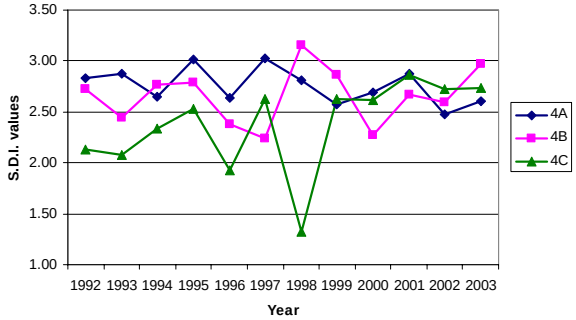
3B: $n = 11$, $r^2 = 0.62$, $P < 0.05$



3B: $n = 12$, $r^2 = 0.47$, $P < 0.05$







DISCUSSION

Year 2003 data show a continuation in the recent trend toward higher SDI values in the seasonally dry reaches than in the perennially watered reaches (Table P-3). Mean SDI values (1992-2003) are now only slightly higher in the watered reaches, 1.0% higher in spring and 2.6% higher in late summer. Ongoing habitat restoration at some sites (e.g., Carmel River Mouth, site 4C) may be an important factor influencing this trend. To date, the most dramatic differences between watered and dry spring SDI values occurred in 1996 (-8.7%) and 1998 (-13.6%); these differences may have been responses to natural events – intense winter rains and floods along the Carmel River in 1995 and 1998.

Spring and summer species diversity along transect 3B increased significantly from 1992 to 2003 (barring spring 1993). Because this increase is not specific to season (statistical significance occurred in both spring and summer), on-going habitat restoration efforts west of Schulte Bridge have likely improved habitat features for all birds in the area. Since the restoration project began in 1987, sycamore, box elder, and cottonwood have reached maturity and two floods have allowed for recruitment of understory species. This vegetative structural integrity is important for supporting diverse birds and other wildlife. This assertion is further supported by 3B being one of three transects having the highest abundance, species richness, and species diversity in both spring and summer, compared to the other transects.

As more baseline information is obtained from this long-term monitoring program, it should be possible to determine, with some precision, the reaction of bird populations to habitat manipulations. This will permit the planning and development of mitigation measures, the success of which can be monitored using similar field techniques.