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**Songbird monitoring in the Point Reyes National Seashore:
Results of the 1997 field season**

Final Report

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EXECUTIVE SUMMARY

In order to assess health of songbird populations breeding in Point Reyes National Seashore, we used multiple standardized monitoring techniques, including fixed-radius point counts, nest monitoring, spot mapping, and vegetation measurements in riparian and coastal scrub habitats during the 1997 breeding season. Species diversity was highest in riparian habitat. In riparian habitat, species richness and diversity were highest at undisturbed sites and lowest at burned sites. However, relative abundance was highest at burned riparian sites for four understory-nesting species, but lowest for one canopy-nesting species. In coastal scrub habitat, diversity was highest at ungrazed sites. Between grazed coastal scrub sites, the highest diversity was found on an elk-grazed plot, and lowest on a cattle-grazed plot. Two Neotropical migrant species associated with riparian habitat, Swainson's Thrush and Wilson's Warbler, were present regularly in shrubby drainages of Tomales Point and absent on cattle-grazed plots on Point Reyes Headlands. Abundances of 13 species breeding in the Park, including avian predator and parasite species, are reported by drainage.

We report timing of nest initiation for 4 species and preferred nest substrate for 5 species in order to help guide planning of management activities. Neotropical migrant species had a shorter breeding period than the resident Song Sparrow.

Nest success rates are reported for all nests monitored. Nest predation was the most significant nest mortality factor. Two of the most abundant species in the Park, Wilson's Warbler and Warbling Vireo, had extremely low nest survivorship, suggesting local populations of these species may be acting as sinks. Since abundance data may not reflect this reproductive failure, we recommend nest monitoring of target species in future breeding seasons in order to examine primary population parameters. In addition, point count surveys, which monitor secondary population parameters, should be continued.

INTRODUCTION

The Point Reyes Bird Observatory (PRBO) and the Point Reyes National Seashore (PORE) began a cooperative assessment of songbirds in riparian and coastal scrub habitats in the spring of 1997. The assessment of riparian areas is a continuation of and elaboration upon a Brown-headed Cowbird study initiated by the Kern River Research Center (KRRC) with PORE in 1995. This project is part of a region wide songbird monitoring program being implemented by PRBO with help from numerous federal, state, and private land holders as part of the Partners in Flight (PIF) Bird Conservation Program. All monitoring protocols follow nationally standardized guidelines to allow comparisons across space and time. Standardization of methods is essential for land management agencies to garner specific information of population health and status across different regions and habitat types (Ralph et al. 1995).

This report presents preliminary findings of data from the 1997 breeding season. Future reports will include analysis of the Kern River Research Center data from 1995 and 1996, as well as habitat correlations with nest success, nest site selection, species diversity and abundance (pending availability of funds).

The **principle objectives** (short and long term) of the PORE songbird monitoring program are summarized below:

- 1) Determine relative abundance, species richness, and species diversity by site and habitat type (short/long term).
- 2) Determine breeding productivity of as many species as possible in riparian areas, with special focus on species of concern (short/long term).
- 3) Assess specific habitat conditions for successfully breeding species in riparian habitats (long term).
- 4) Identify important source populations of species of concern (short/long term).
- 5) Identify anthropogenic, biological (e.g. cowbird parasitism) and vegetational causes of nest failure of selected species (long term).
- 6) Direct adaptive management efforts to conserve songbird populations and help determine best management practices for declining and sensitive bird populations (short/long term).
- 7) Promote national and regional conservation efforts by using standardized methodologies and contributing data to national monitoring programs (short/long term).

METHODS

Study Sites

All PRBO study sites located within PORE are presented in Table 1. Census techniques used in 1997 are indicated for each site. Techniques include fixed-radius point-count surveys, nest monitoring, mist-netting, spot mapping, and area searches (fall).

TABLE 1. Songbird census techniques used at each study site in PORE, 1997.

HABITAT	TREATMENT	STUDY SITE	CENSUS TECHNIQUES				
			point count	nest monitor	mist net	spot map	area search
Riparian	Burned 1995	Muddy Hollow	X	X	X	X	X
		Coast Trail/Lagunitas	X	X	X	X	X
		Coast Camp	X				X
	Cattle grazed/year-round	Upper Olema Creek	X				
		Abbott's/Kehoe	X				
		Palomarin Grid 5	X	X		X	X
	Ungrazed/Unburned	Bear Valley	X	X		X	X
		Lower Olema Creek	X	X		X	X
		Arroyo Hondo	X		X		
		Pine Gulch	X		X		X
Coastal Scrub	Burned 1995	Limantour Road		X		X	X
	Cattle grazed/year-round	Point Reyes	X	X			
		Headlands					
		Palomarin Grid 5	X	X		X	X
	Elk grazed	Tomaes Point	X				
	Ungrazed/Unburned	Coast Trail/Palomarin	X				
		Palomarin Grids	X	X	X	X	X

Point Count Censuses

The point count method is used to monitor population changes of breeding landbirds. This data provides information on secondary population parameters, such as abundance, species richness and diversity, as well as comparisons of bird communities across time (trends), location, and treatment. This enables us to assess yearly changes of bird populations at fixed points, seek out differences in species composition between habitats, and determine breeding status and abundance patterns of species.

Point count methodology followed guidelines described in Ralph et al. (1993 and 1995). In summary, we tallied individuals within a fifty-meter radius over a five-minute period for each visit to a station. All stations were censused 3 times, with the exception of M Ranch, which was established late in the season, and censused twice (see Appendix 2 for dates of all point count censuses). Counts were conducted from local sunrise until approximately 3 hours after sunrise. All birds detected were recorded; those detected within a radius of 50 meters surrounding the census station being recorded separately from those at greater than 50 meters. The type of detection (song, visual, or call) was also

noted. Counts were not conducted in excessively rainy, foggy, or windy conditions. PRBO field biologists, trained in the songs and calls of the birds in the area, conducted all censuses.

In 1997, a total of 208 point count stations were censused, in both riparian and coastal scrub habitat. The 90 KRRC riparian points were established in 1995 at 200 meter intervals, as were 8 riparian points established in 1996 by PRBO at Coast Camp and 8 riparian points established by PRBO in 1997 on M Ranch. The M Ranch transect was established to serve as a replicate for the Abbott's/Kehoe site because its grazed, shrubby willow riparian habitat resembles that of Abbott's/Kehoe. Eleven additional riparian points, surveyed in previous years by PRBO in the Arroyo Hondo and Pine Gulch, are also included in our analysis.

In 1997, a total of 74 permanent point count stations were established at 250 meter intervals in coastal scrub habitat. Two transects of 15 points each were established on Tomales Point in elk grazed grassland/scrub, and two transects of 15 points each were established on the Point Reyes Headlands, in cattle grazed grassland/scrub. In 1997, PRBO also established 14 points in late successional coastal scrub habitat along the Coast Trail between the Palomarin Trailhead and Bass Lake. Finally, we included 17 stations located on Palomarin coastal scrub study sites, which have been surveyed by PRBO since 1990. The number of point count census stations at each site, in each habitat type, are presented in Tables 2 and 3.

New transects were selected at random and stratified by land use and habitat as part of county wide songbird monitoring program following protocols described by Hutto (1995). Ultimately, PRBO (with assistance from the staff of The National Park Service and others, including Marin Municipal Water District, Marin Natural Resource Conservation Service, California State Parks), will use GIS quad maps to grid the entire Marin County and the Peninsula (San Francisco and San Mateo County) region. Each gridded square will be assigned a random number and start points for transects will be placed at the nearest road or accessible trail.

Nest Monitoring

Nest monitoring enables us to assess reproductive success in specific habitats, and measurement of vegetation associated with nests may identify habitat influences on breeding productivity. Examination of nests also allows collection of life history data (e.g. clutch size, number of broods, number of nesting attempts), which provide important insight into vulnerability of species to decimation, perturbations, and parasitism (Martin and Geupel 1993).

All nests of migrant and resident species, including both open-cup and cavity nests, were sought, beginning at the onset of breeding season. Field personnel concentrated on species that are 1) known to be local Brown-headed Cowbird hosts, 2) listed as Species of Concern in Marin and Sonoma County (Geupel and King, unpublished), and/or 3) number the most abundant on our study sites. Priority species were Wilson's Warbler, Warbling Vireo, Song Sparrow, Swainson's Thrush, Common Yellowthroat, Pacific Slope Flycatcher, Allen's Hummingbird, and Nuttall's White-crowned Sparrow. Other species of interest for which nests were located include Yellow Warbler, Olive-sided Flycatcher, Anna's Hummingbird, Bewick's Wren, Hutton's Vireo, Wrentit, Brown Towhee, and Spotted Towhee.

Nest finding and monitoring followed specific guidelines in Martin and Geupel (1993). Nest monitoring occurred at 6 sites, 4 riparian and 2 coastal scrub. Area of nest plots was 12 to 16 hectares. Nest searching began in late March and lasted until breeding activity declined in late July. Plots were

searched at least once every 4 days, and individual nests were checked every 1-4 days until outcome was determined. Outcome could usually be determined by conditions at the nest or by observing fledglings near the nest.

Nests were located at all stages (construction, egg-laying, incubation, and nestling). Upon finding a nest, various data were recorded directly onto a "nest card." Data included date and time of check, number of eggs or young, evidence of cowbird parasitism, nest attempt, cue used to find nest (adult behavior, random search, begging young), and parental elusiveness. Basic measurements of the nest and nest substrate were also recorded on a "nest record sheet" after outcome was determined. Examples of data collected include: nest height, plant height, plant species, and number of support branches. For a complete list of data variables see Martin et al. (1997). More detailed measurements of vegetation associated with the nest site were recorded separately (see below).

Special care was taken to minimize human impact around the nest. When possible, nest contents and activity were checked from a distance with binoculars. Otherwise, nest checks were very brief, and we avoided making paths directly to the nest and used sticks to part vegetation, in order to reduce human smell at the nest site. Nest checks were temporarily postponed if an avian predator, such as a jay, was present.

All data from nest monitoring was recorded and entered in a format compatible with the "Breeding Biology Research and Monitoring Database (BBIRD)" program run out of the Fish and Wildlife Service Cooperative Unit at the University of Montana (Martin et al. 1997) and will be submitted to the program.

Spot Mapping

The spot mapping method determines the number of territories in a given area. By marking on a detailed map throughout the breeding season the locations of observed territorial behavior, such as singing, courtship, or nesting activities, it is possible to count the number of territories in an area and estimate density of birds. Spot mapping was conducted at the 4 nest plots and followed International Bird Census Committee recommendations (IBCC 1970). Each plot was visited by the same observer at least 8 times during the breeding season (April-July), and territorial individuals were mapped. Number of territories detected for four species on three sites -- Muddy Hollow, Olema Creek, and Coast Trail--are presented in Appendix 3.

Vegetation assessment

Point count vegetation assessment

Point count vegetation assessment relates differences in bird composition and abundance to differences in vegetation. These vegetation changes can either be over time or differences between habitats or study sites.

Vegetation at each point count station was assessed using the relevé method, a plot of 50 meter radius centered on the census point, following the procedures outlined in Ralph et al. (1993, pp. 37-39: "Methods of Habitat Assessment: Estimation of stand characteristics"). In summary, general habitat characteristics of the site were recorded (maximum tree dbh, canopy cover, aspect). The cover, abundance, and height of each vegetation stratum (tree, shrub, herb, and bare ground) were estimated. Within each vegetation stratum the species composition was determined and each species' relative

cover estimated, as a percent of the total cover for that stratum.

Nest vegetation assessment

As soon as a nesting attempt terminated (successful or unsuccessful), we measured the vegetation associated with the nest (nest substrate and surrounding patch). We used a slightly modified version of the BBIRD (Martin and Conway 1995) method for vegetation measurements. The modification made to the BBIRD protocol was the addition of a section for forb cover and average forb height by species. In summary, the basic units for vegetation sampling were a 5-meter radius plot (for shrubs and forbs) and an 11.3 meter radius plot (for trees) centered on the nest. The plot was divided into 4 quadrants to facilitate our measurements and estimations. Stems of all shrubs were counted by species within each 5-meter radius plot at 10 cm above the ground. The number of stems of each shrub species was counted for each of two size classes (<2.5 cm diameter or >2.5 cm diameter). For each of the four quadrants in the plot we made visual estimates of % vegetation, bare ground, water, logs or stumps, and litter.

Vegetation was also sampled at the plot level utilizing the point count locations as plot vegetation points. Four subpoints were established at each plot vegetation sampling point (point count location). A "nest" vegetation assessment was done at each point count location (as described above) and the point-centered quarter method (Mueller-Dombois and Ellenberg 1974) was done at each subpoint. The point-centered quarter method is used to estimate densities of woody plants.

Personnel

Field work was conducted by interns Jim DeStaebler and Katie Fehring, under the supervision of staff biologist Stacy Small. Data analysis was conducted by Stacy Small. All phases of the project were carried out with the guidance of Terrestrial Program Director Geoffrey Geupel.

Statistical Analysis

Point count census data yielded information on relative abundance, species richness (defined as the number of species detected within 50 m) and species diversity. Species diversity measures ecological diversity based on the number of species detected within 50 meters weighted by the number of individuals of each species. A high score indicates high ecological (species) diversity. Species diversity was measured using a modification of the Shannon-Wiener index (also called Shannon-Weaver index or just Shannon index; Krebs 1989). We used a transformation of the usual Shannon-Wiener index (symbolized H'). This transformed index, which was introduced by MacArthur (1965) is N_1 where $N_1 = 2^{H'}$. The advantage of N_1 over H' (the original Shannon-Wiener metric) is that N_1 is measured in terms of species whereas H' is measured in terms of bits of information, and thus the former is more easily interpretable. Also, species diversity (measured as N_1) and richness can be compared.

Nest success was calculated using Mayfield (1975), as recommended by Johnson (1979). This method takes into account sample size and number of observation days and offers the advantage of correcting for the fact that nests in any sample are likely to be found at various stages in the nest cycle. Nests found early in the nest cycle have a higher probability of failure, and since a sample may contain quite a few nests found in the late stages of the nest cycle, limiting analysis to proportion successful can lead to biased results which overestimate nest success (Martin 1993).

RESULTS AND DISCUSSION

Point Count Census Data

Data from standardized fixed-radius point count census allows comparisons between sites and habitats, both within and across years. A summary of species richness, species diversity, total number of individuals, and mean number of individuals per station by site and treatment type is presented for riparian habitat in Table 2. Bear Valley had the highest diversity index (25.87) of all sites, followed by Upper Olema (25.32) and Lower Olema Creek (22.94). Muddy Hollow was the median (19.25), just slightly lower than Coast Trail/Laguna (20.11). Coast Camp (11.21) and Pine Gulch (11.76) had the lowest diversity indices.

TABLE 2. Species richness, diversity, total individuals, mean number of individuals, and number of stations for all riparian sites in PORE, based on 1997 point count data, all detections within 50 meters.

Treatment	Site	Species Richness	Diversity N_1	Total ind. (<50m)	Mean # ind./station	# of Visits	# of Stations
Not grazed/not burned	Bear Valley	49	25.87	682	14.21	3	16
	Lower Olema Creek	50	22.94	514	11.42	3	15
	Arroyo Hondo	21	13.63	109	6.06	3	6
	Pine Gulch	17	11.76	125	8.33	3	5
Cattle Grazed (year-round)	Upper Olema Creek	42	25.32	263	6.74	3	13
	Abbott's/Kehoe	37	17.78	659	13.73	3	16
Cattle Grazed	M Ranch	31	16.10	227	14.19	2	8
Burned - moderate	Muddy Hollow	48	19.25	614	12.04	3	17
	Coast Trail/Laguna	41	20.11	343	8.79	3	13
	Coast Camp	18	11.21	186	7.75	3	8

Point count data for coastal scrub habitat of three treatment types is presented in Table 3. Our data shows the highest diversity index in mature coastal scrub along the Coast Trail at Palomarin (14.37), and the lowest on cattle grazed Point Reyes North (4.66).

TABLE 3. Species richness, diversity, total individuals, mean number of individuals, and number of stations for all coastal scrub sites in PORE, based on 1997 point count data, all detections within 50 meters.

Treatment	Site	Species Richness	Diversity, N_1	Total ind. (<50m)	Mean # ind./station	# of Visits	# of Stations
Elk Grazed (year-round)	Tomales Point North	17	7.03	214	4.76	3	15
	Tomales Point South	22	12.90	308	6.84	3	15
Cattle Grazed (year-round)	Point Reyes North	10	4.66	216	4.80	3	15
	Point Reyes South	21	7.11	363	8.07	3	15
	Palomarin G5	13	9.05	51	4.25	3	4
Not grazed	Palomarin	24	11.74	226	5.79	3	13
	Coast Trail/Palo	27	14.37	343	8.17	3	14

Richness and diversity by habitat

In order to compare species richness and diversity between habitats, we first combined all sites by habitat, regardless of treatment type. This data is presented in Table 4. We found the diversity index to be remarkably higher for riparian habitat (29.42) than for grassland/scrub (16.06). Data from corresponding habitats in the Golden Gate National Recreation Area (GGNRA) is presented for comparison.

TABLE 4. Species richness, diversity, mean number of individuals detected, and number of stations for all sites in **PORE** by habitat, as compared to **GGNRA**, based on 1997 fixed-radius point count data, all detections within 50 meters.

Location	Habitat	Species Richness	Diversity, N_1	Mean # ind./station	# of Stations
PORE	Riparian	82	29.42	31.90	117
	Grassland/scrub	52	16.06	18.12	91
GGNRA	Riparian	53	24.32	20.56	66
	Grassland/scrub	32	15.27	11.75	45

Richness and diversity by habitat and treatment

Riparian habitat

Species richness and diversity by habitat combined with treatment type is presented in Table 5. In riparian habitat, richness and diversity were highest at the "undisturbed" (neither burned nor grazed) sites, and lowest at the burned sites.

Scrub habitat

In scrub habitat, diversity was highest at ungrazed sites, and lowest at cattle-grazed sites. The elk grazed sites showed a higher diversity than cattle grazed sites, but a slightly lower species richness. Higher species richness on cattle-grazed sites may be attributed to the presence of a number of species detected on these transects that are attracted by human dwellings and activities, such as the House Sparrow, European Starling, House Finch, Cliff and Barn Swallows. Except for the European Starling, which occurred in low numbers near the Historic Pierce Ranch, none of these species occurred within a 50 meter radius of the elk grazed Tomales Point stations.

Between grazed scrub sites, the highest diversity occurred at elk-grazed Tomales Point South (12.90) and lowest at cattle-grazed Point Reyes North (4.66). Two riparian-associate Neotropical migrant species, Swainson's Thrush and Wilson's Warbler, were present throughout breeding season on the Tomales Point transects, occurring in densely vegetated shrubby drainages. These species were not present with any regularity in drainages along the cattle-grazed Point Reyes Headlands transects.

TABLE 5. Species diversity and richness for all sites in PORE, by habitat and treatment type, based on 1997 fixed-radius point count data, all detections within 50 meters.

Habitat	Treatment	Species Richness	Diversity N_1	Number of Stations
Riparian	Undisturbed	65	27.55	42
	Cattle Grazed	63	25.50	37
	Burned	51	20.02	38
Scrub	Ungrazed	36	14.89	27
	Elk Grazed	24	11.42	30
	Cattle Grazed	28	8.65	34

Relative abundance

We then calculated relative abundance the most abundant species on each riparian site by averaging all detections of that species within 50 meters of a point count station over 3 visits and all stations at the site. Results varied tremendously by species and site. Relative abundance values of eight species are presented in Table 6. Target species for nest monitoring are presented in bold type.

Relative abundance was highest for Allen's Hummingbird at Lower Olema (3.40) and lowest in Arroyo Hondo (0.33). Song Sparrow was most abundant at Abbott's/Kehoe (7.81), and least abundant at Arroyo Hondo (2.33). Swainson's Thrush was most abundant at Muddy Hollow (4.59) and least at Coast Camp (1.50). Warbling Vireo was most abundant at Bear Valley (2.56) and absent from Coast Camp.

TABLE 6. Relative abundance of target species in PORE, based on mean number of individuals per point by species and site, averaged over 3 visits. Based on 1997 fixed-radius point count data, all detections within 50 meters.

Species	TREATMENT AND SITE								
	Ungrazed/Unburned				Cattle Grazed		Burned		
	BV	LO	AH	PI	UO	AK	MH	CT	CC
Allen's Hummingbird	1.81	3.40	0.33	0.40	0.38	0.38	2.47	1.69	3.25
Common Yellowthroat	3.00	0.60	---	0.60	0.08	1.81	0.88	2.62	---
Nuttall's White-crowned Sparrow	---	---	---	---	---	1.19	---	0.08	---
Pacific Slope Flycatcher	0.69	1.13	---	0.40	0.38	---	1.35	0.62	0.25
Song Sparrow	5.56	4.53	2.33	4.80	3.08	7.81	7.53	3.92	5.50
Swainson's Thrush	3.06	3.00	3.00	3.20	2.62	2.06	4.59	4.00	1.50
Warbling Vireo	2.56	0.86	0.50	0.60	1.08	---	1.00	0.23	---
Wilson's Warbler	2.94	3.13	2.83	4.00	1.38	1.06	5.06	2.69	3.00

Relative abundance in each treatment type was averaged for the five most abundant species (Table 7). Relative abundances of the four species which are primarily understory nesters, Song Sparrow, Swainson's Thrush, Wilson's Warbler, and Allen's Hummingbird, were highest at the burned sites, and relative abundance of the canopy-nesting Warbling Vireo was lowest at the burned sites.

TABLE 7. Relative abundance of five most abundant target species in PORE, averaged by treatment type. Based on 1997 fixed-radius point count data, all detections within 50 meters.

Species	TREATMENT		
	Ungrazed/ Unburned	Cattle Grazed	Burned
Allen's Hummingbird	1.48	0.38	2.47
Song Sparrow	4.30	5.45	5.65
Swainson's Thrush	3.06	2.34	3.36
Wilson's Warbler	3.22	1.22	3.58
Warbling Vireo	1.13	0.54	0.41

Relative abundance of Predator and Parasite Species

We also calculated relative abundance of nest parasite and predator species detected within 50 meters of point count stations. Results are presented in Table 8.

The nest parasite species, Brown-headed Cowbird, was most abundant at Abbott's/Kehoe (2.83), followed by Bear Valley (1.19). Brown-headed Cowbird abundance was lowest in the Arroyo Hondo (0.50).

Known avian predators in PORE include four species of corvids - Scrub Jay, Stellar's Jay, American Crow, and Common Raven. Where detected, Scrub Jays were most abundant at Lower Olema (0.73) and Upper Olema (0.62) and least abundant at Coast Trail/Laguna (0.15). Scrub Jays were not detected in the Arroyo Hondo or Pine Gulch. Where detected, Stellar's Jays were most abundant at Coast Camp (0.63) and Arroyo Hondo (0.50), and were least abundant at Upper Olema (0.15) and Bear Valley (0.19). Stellar's Jays were not detected at Abbott's/Kehoe or Pine Gulch.

American Crows were detected at 5 sites, and were by far the most abundant at Abbott's/Kehoe (3.19). American Crow abundance was lowest at Muddy Hollow (0.06) and Coast Trail/Laguna (0.08). This species was not detected at Lower Olema, Arroyo Hondo, Pine Gulch, or Coast Camp. Common Raven was also detected at 5 sites, with the highest abundance again at Abbott's/Kehoe (2.38). Of the other four sites where this species was detected, abundance was lowest at Lower Olema (0.07). This species was not detected at Arroyo Hondo, Pine Gulch, Coast Camp, or Muddy Hollow.

TABLE 8. Relative abundance of nest parasite and predator species, by species and site, averaged over three visits. Based on 1997 fixed-radius point count data, all detections within 50 meters.

Species	TREATMENT AND SITE								
	Ungrazed/Unburned				Grazed		Burned		
	BV	LO	AH	PI	UO	AK	MH	CT	CC
Brown-headed Cowbird	1.19	.53	.50	1.00	.54	2.83	1.12	.54	1.00
Scrub Jay	.50	.73	---	---	.62	.50	.53	.15	.25
Stellar's Jay	.19	.40	.50	---	.85	---	.24	.23	.63
American Crow	.25	---	---	---	.23	3.19	.06	.08	---
Common Raven	.19	.07	---	---	.15	2.38	---	.15	---

Nest Monitoring Data

Nests were located and monitored for outcome according to guidelines presented in Martin and Geupel (1993). 346 nests were located for 33 species on 4 riparian plots (Muddy Hollow, Coast Trail/Laguna, Olema Creek, and Bear Valley) and two coastal scrub plots (Limantour Road and E Ranch). Nests were located primarily by observation of adult behaviors, which include nest material carries, food carries, female foraging trips, and defensive behavior.

We calculated nest success in two ways, as shown in Martin (1993): 1) "proportion successful", a percentage of successful nests out of all nests located for that species, and 2) "estimated nest success" using the Mayfield method, which calculates the probability of nest success based on the daily survival rate of the given sample of nests.

We made every effort to find nests early in the nest cycle, in order to get the most accurate estimate of nest success for a given species on each plot. Ninety-seven (28%) of the nests were located during the building stage, and 140 (40%) were found with eggs - totaling 237 of 345 nests (68%) that were found before the nestling period.

Proportion Successful Nests

A list of all nests located in the PORE in 1997 and proportion successful is presented in Table 9. 309 open-cup and 33 cavity nests were monitored, as well as 4 pendulum nests. 72% of cavity nests fledged at least one host young, compared to 38% of open-cup nests.

TABLE 9. Number of nests located and proportion successful in PORE, 1997. Target species are in bold.

Species	Nest Type	Number of Nests	Proportion of Successful Nests
Allen's Hummingbird	cup	23	.35
American Goldfinch	cup	13	.15
American Robin	cup	15	.20
Anna's Hummingbird	cup	7	.28
Ash-throated Flycatcher	cav	1	1.00
Bewick's Wren	cav	2	.00
Black-headed Grosbeak	cup	8	.62
Black Phoebe	cup	1	1.00
Brown Towhee	cup	3	.33
California Quail	cup	1	.00
Chestnut-backed Chickadee	cav	8	.87
Common Bushtit	pend	4	.00
Common Yellowthroat	cup	11	.36
Downy Woodpecker	cav	7	.86
Hairy Woodpecker	cav	1	1.00
Hutton's Vireo	cup	4	.00
Mourning Dove	cup	1	.00
Nuttall's Woodpecker	cav	3	1.00
Nuttall's White-crowned Sparrow	cup	15	.53
Orange-crowned Warbler	cup	3	.33
Olive-sided Flycatcher	cup	1	.00
Pacific-slope Flycatcher	cup	12	.25
Song Sparrow	cup	73	.46
Spotted Towhee	cup	2	1.00
Steller's Jay	cup	1	.00
Swainson's Thrush	cup	48	.42
Tree Swallow	cav	7	.43
Warbling Vireo	cup	21	.14
Western Bluebird	cav	4	.75
Western Wood-Pewee	cup	10	.70
Wilson's Warbler	cup	34	.32
Wrentit	cup	1	1.00
Yellow Warbler	cup	1	.00
TOTAL OPEN-CUP NESTS		309	.38
TOTAL CAVITY NESTS		33	.72
TOTAL PENDULUM NESTS		4	.00
TOTAL NESTS LOCATED		346	

Riparian Nest Plots

Mayfield Estimates of Nest Survivorship

We calculated Mayfield estimates of nest survivorship for five of our target species, combining data from **all riparian nest plots** (Table 10). The results of these five species are highlighted for several reasons. Overall, we have the largest sample of nests for these five species. Based on 1997 point count data, these 5 species are of the top 8 most abundant species in the riparian areas of PORE and GGNRA. Song Sparrow, Swainson's Thrush and Wilson's Warbler are the three most abundant species breeding on our riparian nest plots. The canopy nesting Warbling Vireo is one of the most abundant species on our study plots, and by including it in our analysis, we can compare the response of understory nesters to that of a canopy nesting species to habitat perturbations. Furthermore, proportional abundance of these four species, when compared among 15 drainages monitored in Marin County (Gardali 1997), was highly similar, with a mean percent similarity of 84% and a range of 68% - 80% (Krebs 1989).

Allen's Hummingbird is of particular interest, because, while it shares the riparian zone with the other species for breeding, it has a nest cycle and life history, which differs in many ways from the other four species.

Estimates of nest success for Wilson's Warbler and Warbling Vireo were extremely low for the Park overall, at 0.15 and 0.18, respectively. Given such poor reproductive success, these populations may be sinks, and we believe that such results warrant close monitoring of reproductive success in future seasons. Allen's Hummingbird and Song Sparrow had respective estimated nest successes of 0.26 and 0.28. Swainson's Thrush had the highest estimated nest survivorship, at 0.34.

TABLE 10. Mayfield estimates of total and daily (with standard error) nest survivorship for five species in **PORE**, 1997 (all riparian nest plots combined).

Species	Number of Nests	Total Surv.	Daily Surv. (SE)
Song Sparrow	63	0.28	0.95 (.008)
Swainson's Thrush	37	0.34	0.96 (.009)
Wilson's Warbler	27	0.15	0.93 (.017)
Warbling Vireo	15	0.18	0.95 (.014)
Allen's Hummingbird	23	0.26	0.97 (.007)

Mayfield estimates of nest survivorship by site

Tables 11 through 14 present estimated nest survivorship for five target species, **by site**. We show here estimates of survivorship only for those species for which we had a large enough sample to do Mayfield calculations.

At Muddy Hollow (Table 11), Warbling Vireos did poorly, with an estimated total nest survivorship of 0.08. Neither did Wilson's Warblers fare well, with an estimated total survivorship of 0.18. However, Song Sparrows had a reasonably successful season here, with an estimated nest survivorship of 0.46.

TABLE 11. Mayfield estimates of total and daily (with standard error) nest survivorship for five species at **Muddy Hollow**, 1997.

Species	Number of Nests	Total Surv.	Daily Surv. (SE)
Song Sparrow	24	0.46	0.97 (.011)
Swainson's Thrush	20	0.25	0.95 (.014)
Wilson's Warbler	11	0.18	0.93 (.024)
Warbling Vireo	5	0.08	0.93 (.035)
Allen's Hummingbird	18	0.24	0.97 (.009)

Results were dismal for two species at Coast Trail/Laguna (Table 12), with Song Sparrows at their lowest survivorship in the park this year, at 0.08, and Wilson's Warblers at an extreme low of 0.04.

TABLE 12. Mayfield estimates of total and daily (with standard error) nest survivorship for three species at **Coast Trail**, 1997.

Species	Number of Nests	Total Surv.	Daily Surv. (SE)
Song Sparrow	13	0.08	0.92 (.029)
Swainson's Thrush	4	0.21	0.95 (.030)
Wilson's Warbler	7	0.04	0.88 (.048)

At Olema Creek (Table 13), Song Sparrows did poorly (0.12), while other species did relatively well. Swainson's Thrushes had the highest nest survivorship,(0.53) at this site, followed by Wilson's Warbler's (0.36) and Warbling Vireos (0.27).

TABLE 13. Mayfield estimates of total and daily (with standard error) nest survivorship for four species at **Olema Creek**, 1997.

Species	Number of Nests	Total Surv.	Daily Surv. (SE)
Song Sparrow	15	0.12	0.92 (.022)
Swainson's Thrush	9	0.53	0.98 (.012)
Wilson's Warbler	5	0.36	0.96 (.039)
Warbling Vireo	5	0.27	0.96 (.019)

Although Mayfield estimates of nest survivorship for Bear Valley are presented below (Table 14), sample sizes overall were rather small at this site. More intensive coverage of this reference site, along with the sites above, is recommended.

Song Sparrows had the highest estimated nest survivorship at Bear Valley (0.53), while Wilson's Warblers had a very low nest survivorship (0.18).

TABLE 14. Mayfield estimates of total and daily (with standard error) nest survivorship for four species at **Bear Valley**, 1997.

Species	Number of Nests	Total Surv.	Daily Surv. (SE)
Song Sparrow	6	0.53	0.97 (.014)
Swainson's Thrush	4	0.24	0.95 (.028)
Wilson's Warbler	4	0.18	0.93 (.036)
Warbling Vireo	3	0.16	0.94 (.031)

Mayfield estimates of nest survivorship by species

Tables 15 through 19 present the same nest survivorship results as above, **by species**, for ease of comparison across sites.

Song Sparrows (Table 15) had a high nest survivorship of 0.54 at Bear Valley and an extremely low survivorship of 0.08 at Coast Trail/Laguna.

TABLE 15. Mayfield estimates of total and daily (with standard error) nest survivorship for **Song Sparrows** at four riparian sites in **PORE**, 1997.

Treatment	Site	Number of Nests	Total Surv.	Daily Surv. (SE)
Burned	Muddy Hollow	24	0.46	0.97 (.011)
	Coast Trail/Laguna	13	0.08	0.91 (.029)
Grazed, year-round	Olema Creek	15	0.12	0.92 (.022)
Unburned/ungrazed	Bear Valley	6	0.54	0.97 (.014)

Swainson's Thrushes (Table 16) had a high nest survivorship of 0.53 at Olema Creek and a low survivorship of 0.21 at Coast Trail/Laguna.

TABLE 16. Mayfield estimates of total and daily (with standard error) nest survivorship for **Swainson's Thrushes** at four riparian sites in **PORE**, 1997.

Treatment	Site	Number of Nests	Total Surv.	Daily Surv. (SE)
Burned	Muddy Hollow	20	0.25	0.95 (.014)
	Coast Trail - Laguna	4	0.21	0.95 (.030)
Grazed, year-round	Olema Creek	9	0.53	0.98 (.012)
Unburned/ungrazed	Bear Valley	4	0.24	0.95 (.028)

Wilson's Warblers (Table 17) had a high nest survivorship of 0.36 at Olema Creek and a low survivorship of 0.04 at Coast Trail/Laguna.

TABLE 17. Mayfield estimates of total and daily (with standard error) nest survivorship for **Wilson's Warblers** at four riparian sites in **PORE**, 1997.

Treatment	Site	Number of Nests	Total Surv.	Daily Surv. (SE)
Burned	Muddy Hollow	11	0.18	0.93 (.024)

	Coast Trail /Laguna	7	0.04	0.88 (.048)
Grazed, year-round	Olema Creek	5	0.36	0.96 (.039)
Unburned/ungrazed	Bear Valley	4	0.18	0.93 (.036)

Warbling Vireos (Table 18) had a high nest survivorship of 0.27 at Olema Creek and a low survivorship of 0.08 at Muddy Hollow. Six Warbling Vireo nests located in the Park were not included in our Mayfield calculations, because they failed (either abandoned or depredated) before the second nest check.

TABLE 18. Mayfield estimates of total and daily (with standard error) nest survivorship for **Warbling Vireos** at three riparian sites in **PORE**, 1997.

Treatment	Site	Number of Nests	Total Surv.	Daily Surv. (SE)
Burned	Muddy Hollow	5	0.08	0.93(.035)
Grazed, year-round	Olema Creek	5	0.27	0.96(.019)
Unburned/ungrazed	Bear Valley	3	0.16	0.94(.031)

Allen's Hummingbirds (Table 19) had an estimated nest survivorship of 0.24 at Muddy Hollow. This is the only site with a sample large enough to do Mayfield calculations for this species.

TABLE 19. Mayfield estimates of total and daily (with standard error) nest survivorship for **Allen's' Hummingbirds** at Muddy Hollow, **PORE**, 1997.

Treatment	Site	Number of Nests	Total Surv.	Daily Surv. (SE)
Burned	Muddy Hollow	18	0.24	0.97(.009)

Coastal Scrub Nest Plots

Proportion Successful Nests

Nest monitoring was conducted on two coastal scrub plots. One scrub plot, burned in the 1995 Vision Fire, was monitored throughout the breeding season. The boundaries of this plot correspond with those of area search plots established immediately after the fire. Nest searching was conducted on a second coastal scrub plot in the second half of the breeding season. This plot was established to overlap with the cattle grazed Point Reyes North point count transect. Nests located and proportion successful on grassland/scrub plots are presented in Tables 20 and 21.

TABLE 20. Number of nests located and proportion successful for cattle grazed **Point Reyes Headlands**, 1997.

Species	Number of Nests	Proportion of Successful Nests
American Goldfinch	1	1.00
Nuttall's White-crowned Sparrow	11	0.45
Song Sparrow	2	1.00

TABLE 21. Number of nests located and proportion successful for **Burned Coastal Scrub Plots**, 1997.

Species	Number of Nests	Proportion of Successful Nests
Nuttall's White-crowned Sparrow	4	0.75
Song Sparrow	4	0.75
Spotted Towhee	1	1.00

Breeding Chronology

We calculated mean and range of date first egg laid for four species – Song Sparrow, Swainson's Thrush, Warbling Vireo, and Wilson's Warbler – by combining data for nests of these species from both Point Reyes National Seashore and adjacent Golden Gate National Recreation Area (Table 21). This information provides a framework for the most critical period for songbirds breeding in the Park's riparian zones.

The earliest date first egg was laid was March 12, and the latest was July 5. This was the range for Song Sparrow laying, a resident species not required to undergo long migratory flights, and therefore possessing the widest latitude in nest initiation timing. The other three species, which are Neotropical migrants, exhibited narrower time frames for nest initiation, with the Swainson's Thrush having the narrowest window of opportunity for nest initiation– from May 16 to June 28.

Mean dates of first egg laid differ by species. Once the first egg is laid, it requires 30 days, on average, for a pair to raise and successfully fledge young. Thus, the breeding season in coastal Marin extends into mid-August, at least.

TABLE 21. Timing of nest initiation, based on date of first egg laid for four species breeding in PORE and GGNRA, 1997.

Species	N	Mean date first egg (SE)	Earliest first egg	Latest first egg
Song Sparrow	95	5/03 (3.0)	3/12	7/05
Wilson's Warbler	46	5/17 (2.5)	4/20	6/25
Warbling Vireo	30	5/23 (3.5)	4/20	6/26
Swainson's Thrush	62	6/05 (1.5)	5/16	6/28

Nest Mortality Factors

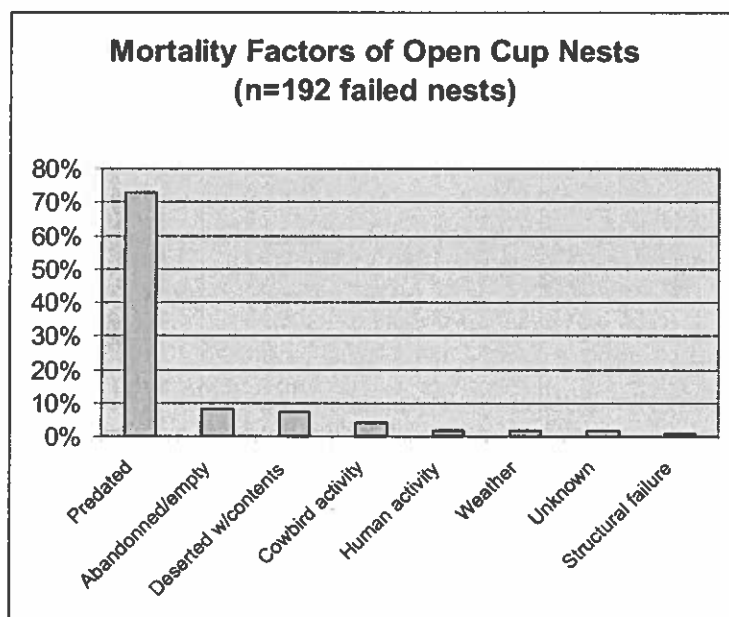
Eight nest mortality factors were identified for open-cup nesters on our nest plots 1997 – predation, abandonment of empty nest, abandonment of nest with eggs or young, Brown-headed Cowbird activity, disturbance by human activity, weather, structural failure, and unknown causes (Figure 3).

Predation is by far the most significant mortality factor, at 73%, followed by empty abandoned (8%) nests and nests deserted with contents (7%). Cowbird parasitism only accounts for 4% of the failure of open-cup nests overall. However, some species were more impacted by parasitism than others (see below).

Failure due to human activities occurred as a direct result of maintenance activities, namely trail maintenance at Muddy Hollow and fence building at Olema Creek.

Structural failure refers to collapse of the plant substrate supporting the nest. This occurred at 3 nests, Swainson's Thrushes in each case.

FIGURE 1. Mortality factors of 192 failed open-cup nests in PORE, 1997.



Nest Predator Species

Potential nest predator species observed on nest plots this year include avian, snake, and mammalian species. Snake species observed were Gopher and Garter Snakes. Potential avian predators observed include Scrub Jays, Stellar's Jays, American Crows, Common Ravens, and Bewick's Wrens. Predation by Scrub Jays and Stellar's Jays was witnessed, and these species were frequently observed following parent birds near nest sites. In one case, Bewick's Wren predation is suspected.

Potential mammalian predators observed on plots include chipmunks, Deer Mice, Bobcats, and at Coast Trail/Laguna, domestic cats. Damaged open-cup nest structures may indicate mammalian predator species (Best 1980). Proportion damaged open-cup nests are presented in Table 22, by site. Proportion damaged open-cup nests was highest at Muddy Hollow (0.49) and lowest at Bear Valley (0.17).

TABLE 22. Proportion of depredated open-cup nests exhibiting signs of damage (indicating mammal depredation) to all open-cup nest nests depredated, by site, 1997.

Site	# of Depredated Nests	# of Nests with Damage	Proportion of Nests with Damage
Muddy Hollow	57	28	0.49
Coast Trail	31	13	0.42
Olema Creek	29	13	0.45
Bear Valley	24	4	0.17

Cowbird Parasitism

Nest contents were carefully checked for eggs of the Brown-headed Cowbird, a parasitic species that lays its eggs in the nests of other passerine species, leaving the host parents to raise the cowbird young. In 1997, five species were confirmed parasitized in the Park - Nuttall's' White-crowned Sparrow, Pacific Slope Flycatcher, Song Sparrow, Swainson's Thrush, and Wilson's Warbler. Proportion of nests parasitized and outcome of those parasitized nests is presented in Table 23.

We suspect that Warbling Vireo nests were parasitized this year; however, nests of this species located in the Park were built high in the tree canopy, and despite our best efforts using a ladder and 20-foot mirror pole, we could not see into the nest cups to observe contents. If the nests had survived to fledging, or neared fledging, we may have observed cowbird young being fed in or near the nest. The high rate of nest failure, whether attributed to predation, parasitism, or abandonment, precluded this. However, we do have some observations of Warbling Vireo/Brown-headed Cowbird interactions. In one instance, a female Brown-headed Cowbird was observed mounting a Warbling Vireo nest under construction at Muddy Hollow.

Further investigation into the impact of Brown-headed Cowbirds on the Warbling Vireo in the Park is warranted, as this species is known to be parasitized in the West, as are other vireo species across North America (Lowther 1993).

Wilson's Warblers (WIWA) experienced the highest rate of observed parasitism, at 38%. Other parasitized species either fledged at least one host young, or were depredated. But Wilson's Warblers exhibited a third possible outcome - 30% of the parasitized WIWA nests were abandoned with eggs, while 39% were depredated, and 31% were successful (fledged at least one WIWA young). No Wilson's Warbler nests fledged cowbird young only.

TABLE 23. Outcome of nests parasitized by Brown-headed Cowbirds in PORE, 1997 (successful nests fledged at least one host young).

Species	Number of Nests	Proportion Parasitized	Outcome of parasitized nests		
			Proportion Successful	Proportion Depredated	Proportion Abandoned

Nuttall's White-crowned Sparrow	15	0.13	0.50	0.50	0
Pacific Slope Flycatcher	12	0.08	0	1.00	0
Song Sparrow	73	0.07	0.20	0.80	0
Swainson's Thrush	47	0.02	1.00	0	0
Wilson's Warbler	34	0.38	0.31	0.39	0.30

We calculated Mayfield estimates of nest survivorship for both parasitized (Table 24) and unparasitized (Table 25) Wilson's Warbler nests. Parasitized nests (n=13) had an estimated survivorship of 0.08, while unparasitized nests (n=15) had an estimated survivorship of 0.19. While nest survivorship was lower for parasitized Wilson's Warbler nests, survivorship was still very low for unparasitized nests of this species. It is apparent from these results that this species is suffering from negative impacts other than cowbird parasitism, chiefly nest predation.

TABLE 24. Mayfield estimates of total and daily survivorship (with standard error) of Wilson's Warbler nests that were parasitized and those that were not parasitized by Brown-headed Cowbirds in PORE, 1997.

Status	Number of Nests	Total Surv.	Daily Surv. (SE)
Parasitized	13	.08	.91(.030)
Unparasitized	15	.19	.94(.02)

NEST VEGETATION ASSESSMENT

Having collected copious nest vegetation data, we are now in the process of creating predictive models for nest site selection and nest success for four species in coastal Marin -- Song Sparrow, Swainson's Thrush, Warbling Vireo, and Wilson's Warbler -- using multiple logistic regression analysis. All predictive models and transcripts of presentations of this data will be made available to the National Park Service upon their completion.

Nest Substrate

Among many other variables, plant species supporting each nest was recorded. This variable is referred to as "nest substrate". The proportions of primary nest substrates are presented for 5 species, Warbling Vireo, Allen's Hummingbird, Swainson's Thrush, Song Sparrow, and Wilson's Warbler, in Figures 2 through 6.

The canopy-nesting Warbling Vireo (Figure 2) primarily used Red Alder as its nesting substrate, followed by willow species. The Allen's Hummingbird (Figure 3), in contrast, appears to be much more of a generalist in terms of nest site selection, using a wide variety of plant species, which include herbaceous, shrub, and tree species. Cow Parsnip was favored by Allen's Hummingbird, followed by Red Alder and California Blackberry.

FIGURE 4. Warbling Vireo nest substrate.

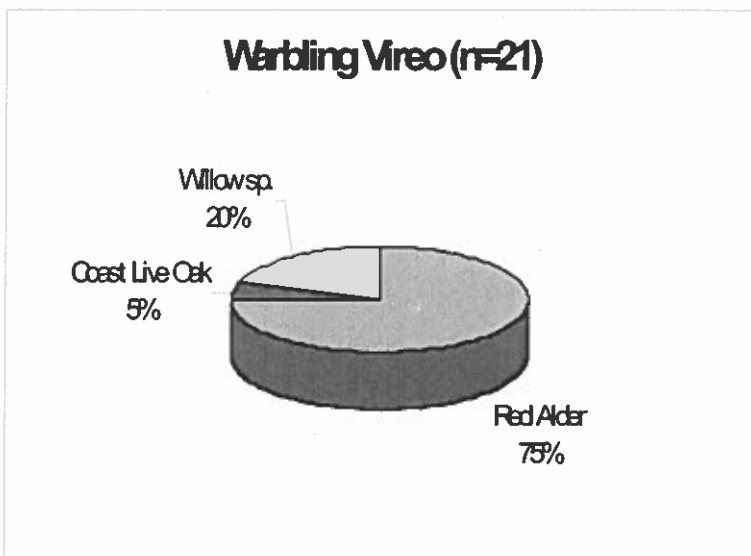
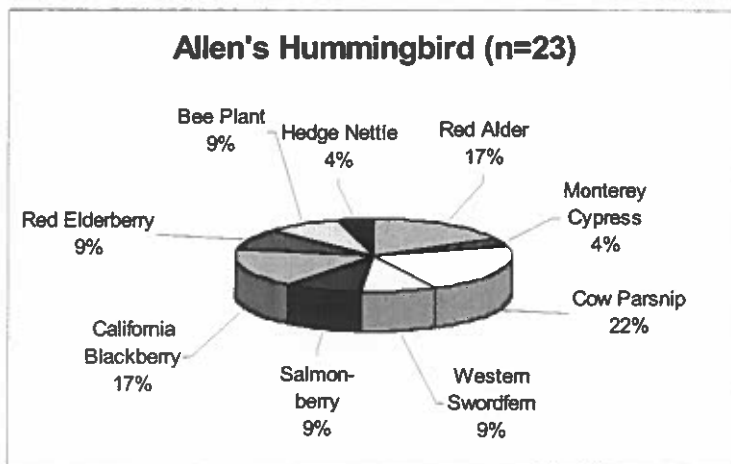


FIGURE 5. Allen's Hummingbird nest substrate



California Blackberry was the most favored nesting substrate for three bird species, Swainson's Thrush (Figure 4), Song Sparrow (Figure 5), and Wilson's Warbler (Figure 6). Other plant species preferred as nesting substrate by these understory nesters include Hedge Nettle, Salmonberry, Stinging Nettle, Sedge spp., and Gooseberry. Western Swordfern was a strongly preferred nest substrate for Wilson's Warbler; it supported 26% of the nests found of this species.

FIGURE 6. Swainson's Thrush nest substrate.

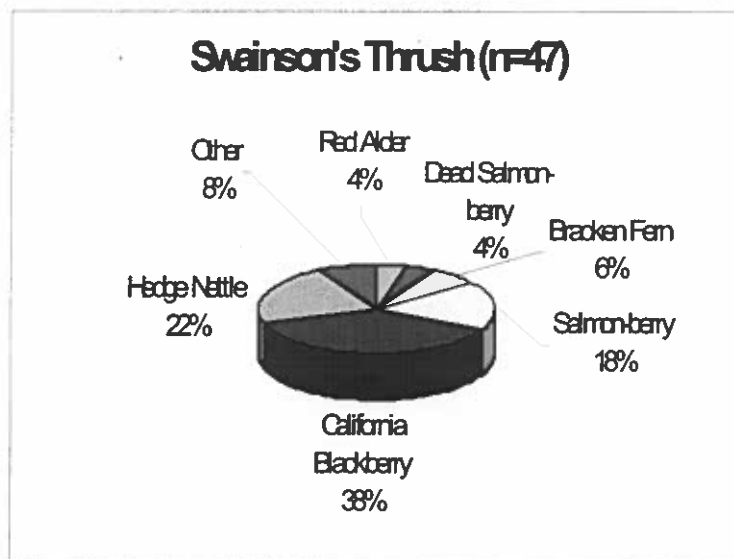


FIGURE 7. Song Sparrow nest substrate.

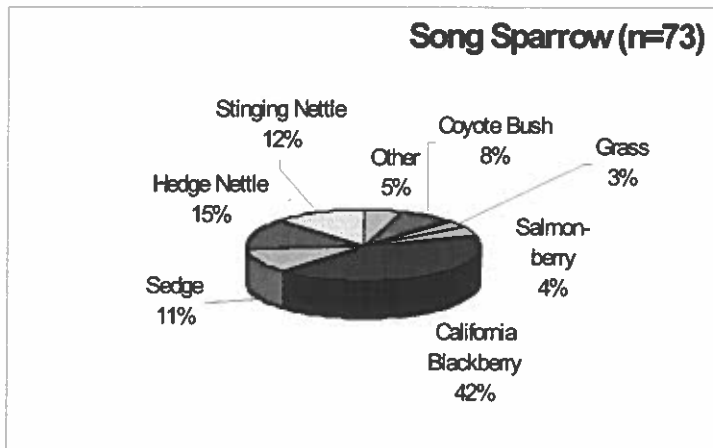
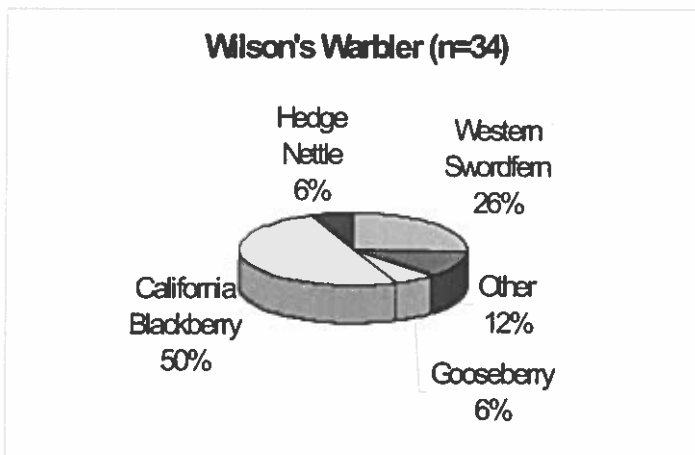


FIGURE 8. Wilson's Warbler nest substrate.



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Appendix 1

Dates of point count visits, Point Reyes National Seashore, 1997

BV	UO	LO	CT	MH	PI	AH	CC	MR	TN	TS	PN	PS	CP	PG	G5
5/3	4/29	5/3	4/28	4/28	5/31	5/6	5/5	6/25	5/16	5/13	5/19	5/20	5/2	5/5	5/6
5/28	5/28	6/1	5/27	5/27	6/12	5/31	6/10	7/3	6/3	6/3	6/2	6/2	5/30	5/30	5/31
6/24	6/24	6/27	6/23	6/23	6/26	6/26	7/3		7/2	6/28	7/1	7/1	7/7	6/26	6/26

Study Site Codes:

BV = Bear Valley
 UO = Upper Olema
 LO = Lower Olema
 CT = Coast Trail
 MH = Muddy Hollow
 PI = Pine Gulch
 AH = Arroyo Hondo
 CC = Coast Camp
 MR = M Ranch
 TN = Tomales Point North
 TS = Tomales Point South
 PN = Point Reyes Headlands North
 PS = Point Reyes Headlands South
 PG = Palomarin Grids
 G5 = Palomarin, Grid 5
 CP = Coast Trail, Palomarin

Bird species, by site, breeding in Pt. Reyes National Seashore, 1997. Incorporates data from nest monitoring, point counts, mist-netting, spot-mapping, and personal observation.

HABITAT AND SITE																		
Species	Migratory Status	Riparian									Coastal Scrub							
		BV	LO	AH	PI	UO	AK	MH	CT	CC	CP	PG	G5	PN	PS	TN	TS	BS
Allen's Hummingbird	1A		*p	n	n	n		n	n	p	p	n						n
American Goldfinch	1B	n			b	n		n	n	*p	p	n		n	p		p	
American Robin	1B	n			b			n	n									
Anna's Hummingbird	1B				n,p	n		n	n		*p							
Ash-throated Flycatcher	1A				n	n												
Barn Swallow	1A											n			p	p		
Bewick's Wren	3	n		p		p		n		p	p	n	*p			p	p	
Brown-headed Cowbird	1B	n			p			p	n	*p		n		n	p			
Black-headed Grosbeak	1A	n	p		b	m		n	n									
Black Phoebe	3							n										
Brown Towhee	3	n				n							n				p	
Brewer's Blackbird	1B									*p							p	
California Quail	3			*o					n	*p	p		p	*p	p			
Chestnut-backed Chickadee	3	n	p	p	p	n		n	n			n	n					
Cliff Swallow	1A	n										n						
Common Bushit	3			n		n		n	n			n	n					
Common Yellowthroat	1B	n	p		b	n		n	n	b								
Downy Woodpecker	3	n			n	n		n	n							p	p	
European Starling	3																	
Grasshopper Sparrow	1A											n	n	p				
Golden-crowned Kinglet	1B			p														
Hairy Woodpecker	3	n																
Horned Lark	2														p,n			
House Finch	3												n		p			
House Sparrow	3	n													p			
Hutton's Vireo	3	n			n			n		b								
Marsh Wren	1B	p						p										
Mourning Dove	3	n														p	p	
Nuttall's White-cr. Sparrow	3							p			p	n	n	n	p			n
Nuttall's Woodpecker	3	n				n												
Orange-crowned Warbler	1A	*p			b			n	p,b	*p								
Olive-sided Flycatcher	1A							n	*o									
Plain Titmouse	3	*p																
Pacific-slope Flycatcher	1A	n	p	n	b	m		n	n									
Purple Finch	1B	*n			b				*b			p						
Rufous-crowned Sparrow	1B										p		n					
Red-shafted Flicker	2										p	n						
Red-tailed Hawk	1B												n					

Appendix 2 (continued)

HABITAT AND SITE																		
Species	Migratory Status	Riparian									Coastal Scrub							
		BV	LO	AH	PI	UO	AK	MH	CT	CC	CP	PG	G5	PN	PS	TN	TS	BS
Red-winged Blackbird	1B	n	p															
Savannah Sparrow	1B																	
Scrub Jay	3																	
Song Sparrow	1B	n	p	p	b	n	p	n	n	p	n	n	n					
Spotted Towhee	1B										p	n	n	n	p	p	p	n
Stellar's Jay	3			*p						*p	p	n	p,n					
Swainson's Thrush	1A	n	p	p	b	n	p	n	n	p	*p							
Tree Swallow	1B	*n				n		n	n			n						
Warbling Vireo	1A	n	p	n	b	n		n	n									
Western Bluebird	1B					n		n	n			n						
Western Wood-Pewee	1A	n				n		n	n									
Wilson's Warbler	1A	n	p	p	b	n	p	n	n	p		p	n			p	p	
Winter Wren	2		p	n					n,b			p				p	p	
Wrentit	3	n	p		b	m	p			p	p	n						
Yellow Warbler	1A					n												

Migratory Status (Finch, Droege, Gauthreaux, Greenberg, 1991):

- 1A= Neotropical migrant that breeds primarily in the Nearctic Region and winters generally south of the United States
- 1B= Neotropical migrant that winters primarily in the United States, but some populations do winter south of the U.S.
- 2=Short distance migrant
- 3=Resident

Methods used to determine breeding status:

- n=nesting behavior - nest located and/or nesting material/food carries to nest observed
- b=brood patch - female captured in mist-nets with brood patch or egg in oviduct
- p=point counts - detected singing at least twice within 50 m. of same point
- m=spot-maps - territorial behavior documented several times in same location
- o=personal observation - territorial behavior observed in same location over multiple visits
- *indicates probable, but unconfirmed, breeder

Appendix 3

Number of territories mapped for four bird species on 3 sites, Muddy Hollow, Coast Trail, and Olema Creek. Approximate plot size shown with plot name.

Species	NEST PLOT		
	Coast Trail 4.8 ha	Muddy Hollow 19.5 ha	Olema Creek 13.5 ha
Song Sparrow	19	64	46
Swainson's Thrush	19	37	43
Warbling Vireo	3	8	12
Wilson's Warbler	22	60	32

Appendix 4

Narrative description of point count locations

Tomales Point South (Points are 250 meters apart)

- #1:** 50 meters, 66° from cattle guard at entry to Elk Preserve.
- #2:** Approx. 30 meters NW of "cattle guard" sign, next to lichen-covered coyote bush stub, at start of gravel pullout.
- #3:** Walk along road and cross at flagged coyote bush next to tiny rock outcrop - head 35 meters at 302° into grass. Point next to thistle patch.
- #4:** Continue at 302°, 250 meters over hillock, point at coyote bush marked with orange flag, near vegetation enclosure.
- #5:** Continue at 302° for 250 meters, ending up 50 meters down into gully along elk path, just down from rocky overhang.
- #6:** Head up out of gully towards phone pole on east rim of gully, continue past pole on a bearing of 260°. Point is about 20 meters before road.
- #7:** Continue 250 meters at 302°, point is 50 meters before hillock, overlooking Pierce Ranch.
- #8:** Continue 250 meters at 302°, 50 meters before road, on hairpin curve.
- #9:** Continue 250 meters at 302°, point is across road from #8, 80 meters beyond the road, across a gully from a sandpit.
- #10:** Continue 250 meters at 302°, crossing the road at end of willow draw and heading uphill.
- #11:** Continue 250 meters at 302°, cross trail and gully - point is halfway up grassy slope to trail on other side of gully.
- #12:** Continue 250 meters at 21°.
- #13:** Head down into and across gully on elk path, continue on elk paths roughly 21°, end up overlooking salmonberry draw, facing west you'll see a white rock pit with the inlet to the right.
- #14:** Continue 250 meters at 37°, point is 50 meters before marshy spot.
- #15:** Continue 50 meters, point is along drainage on coyote bush - site on the end of willow patch where it meets marsh.

Tomales Point North (Points are 250 meters apart)

- #16:** Start at trailhead from historic Pierce Ranch - first point is 2 kilometers, about a 35 minute walk. Just up over the crest of the hill after passing through "Windy Gap" (see trail map) you'll come to small rock outcrop along the trail. Here you'll head up off the trail at 54°, 50 meters, to point #16.
- #17:** 250 meters, 300°, head toward rock outcrop with triangular rock (in the distance.)
- #18:** Walk at 300° towards perched boulder, point is 50 meters at 347° past perched boulder, along remains of old rock fenceline, at small pointy rock with pale green lichens. Point is on slope facing ocean.

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#19: Continue 250 meters at 300°, towards next perched boulder on slope facing ocean, at small rock with lichens, point is 25 meters at 310° from small perched rock pile.

#20: Continue 250 meters at 300°, siting on pointy rock on horizon.

#21: Continue 250 meters at 300°, siting on 2 lupine bushes closest to hillcrest. Flagging is wired onto low coyote bush about 30 meters before 2 lupines.

#22: Continue 250 meters at 300°, siting on pointy rock, point is about 80 meters beyond perched rock at the start of a lupine patch on a small dead lupine. Site on haystack rocks in the ocean, along the shore.

#23: Continue at 20°, 250 meters, crossing path and heading down grassy plain to edge of canyon on low flat coyote bush clump - site on rightmost eucalyptus in clump of eucalyptus across bay.

#24: Continue 265 meters at 298° toward small knob after tall rocky knob, point is on green coyote bush among small lupines.

#25: Continue 250 meters at 298°, on coyote bush, 4 meters before Douglas Iris patch, 7 meters SW of a stake with a yellow cap.

#26: Continue 250 meters at 320°, siting on left crown of Monterey Cypress, point is on big grass clump, toward end of bunch grass area.

#27: Continue 250 meters at 320°, still siting on left crown of Monterey Cypress.

#28: Continue 250 meters at 320°, point is in center of low wet rush patch.

#29: Continue uphill same distance and bearing, point is near top of hill.

#30: Same distance and bearing, over hill. Point overlooks old stock pond below.

Point Reyes Headlands North (Points are 250 meters apart)

Points are on the E Ranch - be cautious of bulls in pasture. They never bothered us, although we were alerted by the rancher to be careful. Consider yourself warned and proceed boldly.

#1: Fence is marked at first point, south of ranch buildings. Go into pasture (on the ocean side of the road) about 50 meters.

#2: Go back out along road and continue south. Fence is marked at left curve sign. Point is on edge of a rush draw, ocean side of the road.

#3: Cross road, away from the ocean, at Drake's Beach sign - point is 10 meters in from the fence, on the tallest coyote bush.

#4: Stay on the east side of the road - point is at the pasture gate.

#5: Walk 100 meters along fence, cross road, then 150 meters due west to edge of fern draw.

#6: Head northwest, cross sedge draw - point is at edge of baccharis scrub.

#7: Up over hill to the northwest, on low spreading baccharis.

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- #8: Site on the tallest dune on the horizon and proceed 250 meters.
- #9: Cross marshy area and continue 50 meters beyond, along a cow path through lupine.
- #10: Cross a sandy draw, point is 30 meters past draw, at the end of the last dune.
- #11: Stay parallel to the fenceline that runs along west side of pasture, proceed 250 meters.
- #12: Continue same direction 250 meters.
- #13: Site on tallest fencepost along road in distance - point is at the edge of canyon.
- #14: Go uphill along canyon to fenceline at culvert. Climb up to the road and do point from there.
- #15: Turn right and walk 250 meters along road to bend in road - fence is marked, do the point right there.

Point Reyes Headlands South (Points are 250 meters apart)

Points are on A and B Ranch.

- #16: From mile marker 41.43, 142° into pasture about 75 meters - point on phone pole in pasture.
- #17: 260° 250 m. Site on right side on Mont. Cypress clump. Point is along road.
- #18: 260° 250 m. Site on leftmost dune on horizon.
- #19: 191° 250 m. 50 m. before fenceline on ridge.
- #20: 191° 250m. Top of next ridge after fence.
- #21: 191° 250 m. At top of next ridge.
- #22: 191° 250 m. Site to left of leftmost phone pole over top of ridge toward canyon.
- #23: 191° 250 m. Point is above meadow.
- #24: 107° 250 m. up drainage 30 m. up from concrete channel.
- #25: Continue up cow path to power pole between metal shed and concrete trough.
- #26: At Dips sign, mile 42.68, just before A Ranch.
- #27: At reflector on side of road, across from metal wire gate.
- #28: 16 fenceposts north of mile marker 42.38.
- #29: Mile marker 42.15
- #30: 74° 250m. from point 29 – follow cow path toward power pole.

Muddy Hollow (Points are approximately 200 meters apart)

Points are in both directions from Muddy Hollow parking lot. Points #70 - #61 are south, down Muddy Hollow Trail. Points #71 - #77 are north, up the Bayview Trail.

#70: Through gate at parking lot, point is about 30 meters down trail, left side of trail on horizontal willow.

#69: Point is just before 3rd pole, left side of trail on small alder.

#68: On dead alder, right side of trail, between broken alder stumps in a patch of nettles, across the road from low willow patch. Flagging on back side of tree.

#67: Fifth alder before new pump shed, right side of road.

#66: Just before end of alders on right side of road. Point is on small alder, 4th tree before scrubby meadow.

#65: On dead alder among live willows, where trail turns to creek - point is on right side, 25 meters off trail.

#64: On willow within dead standing alder forest. Walk up along trail that is now the new creek bed. If this is too impassable, follow trail detour and cut back in and up creek where trail meets up with creek.

#63: Point is at 3 burned alders on right side of trail, where there is one small live alder on left side of trail. Willow tangle on right side. At willow that's been trimmed and leans over trail, take small path back to stream bank. Point is at orange stake in ground - don't cross creek.

#62: Point is past second cattail marsh, on small dead willow on right side of road. There's a steep tree-less bank on left.

#61: Dead leaning willow at edge of pond, just before full view of pond. Aluminum tag is visible on second dead willow from the end of willows, right side of trail.

The following points once again start from the Muddy Hollow parking lot, but are along the Bayview Trail to the north.

#71: Along Muddy Hollow Road walking towards Bayview Trailhead, at first scrubby clearing on right, turn in - point is about 25 meters into clearing, along willows.

#72: Head up the Bayview Trail, point is on right side of trail where you first re-enter alders.

#73: At big scrub meadow, point is set back on alders about 20 meters off trail.

#74: At first bridge, left side of trail before crossing creek.

#75: About 20 meters before fork in trail, point is on large alder right along trail.

#76: Where trail turns to go uphill and out of riparian, get off trail and follow creek - point is just beyond large fallen Bay.

#77: Follow flagging trail for about 175 meters, then cross creek, climb up stream bank and follow more flagging - point is on elderberry bush with pink and blue flagging.

Bear Valley (Points are approximately 200 meters apart)

#45: 100 meters up Olema Marsh Road.

#30: At intersection, Limantour Road and Bear Valley Road, on willow at gravel drainage ditch.

#31: Walk along horse trail - marker in small Live Oak along trail indicates that point is back along riparian vegetation

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about 15 meters off trail.

#32: Continue along horse trail - at overhanging vegetation, old oak and Bay, point is on left side of trail.

#33: Continue along horse trail, then take first opening left into willows, down through grassy area, to where grassiness narrows into trail-width, point is here on willows.

#34: Travel along willows - point is set back in nook, before first willow "gate."

#35: Through first willow "gate," point is halfway to second willow "gate," behind big sawgrass patch

#36: Through second willow gate, behind sawgrass patch - there is a patch of coyote bush here, next to sawgrass. Point is on willow.

#37: Through third willow "gate," at edge of cattail marsh.

#38: Cross through alder that's across marsh from point #37. Continue up drainage to small cattail marshes, just past clump of Bays.

#39: On small alder, across creek from wooden post in new chain-link maintenance yard fence.

#40: Small oak behind offices, where lawn borders riparian zone.

#41: At barn corral, on willow.

#42: At end of corral, in alders, off paved "Earthquake Trail", down towards creek.

#43: Follow paved trail until it curves around, get off and follow riparian zone - point is on alder between two Bays.

#44: Cut through field and large oaks - point is along grazed riparian, on alder across from solitary huge oak.

Upper Olema Creek (Points are approximately 200 meters apart)

#90: Across pasture from large pullout on Bear Valley Road between Olema and Bear Valley Headquarters.

#89: Just upstream from red cattle feed bin - 8 posts down from wood crossbeam and posts.

#88: Just upstream from creek bend and big Live Oaks, at new barbed wire fence.

#87: On right in small grassy opening in next pasture after cattle crossing.

#86: On willow nest to small planted Oaks.

#85: On willow down stream from red feed bin, up from oak forest and gap in willows.

#84: Opposite fence on big willow, downstream from clearing.

#83: On giant Live Oak, opposite fence where trail dips into woods.

Heading downstream, take middle trail past Poison Oak patches - follow willow drainage.

#82: On willow at P.O. clump, where trail goes into open pasture.

#81: At small willow on side of grassy hill, upstream from fence 40 m.

#80: On alder among willows near dead fallen snag, in willow cove.

#79: On willow near blackberry clump. Downstream from house and barbed wire fence with phone pole.

#78: At corner where willows along stream meet willow along road.

Lower Olema

46: Across from first euc tree to the northerly end of white "bat house."

47: Walk south along riparian corridor. Point in line with 4th telephone pole after bat house.

48: South along riparian corridor, point directly in line with oak which is next to road.

49: Walk 150 meters, then cross creek. Crossing is in line with willow patch which is next to a mound. Point is 240° at 17 meters from lone doug fir.

50: Walk 200 m. from #49 point is at end of U shaped corridor, 220° 25 m. from low flat coyote bush on mound.

51: Walk along trail toward highway – point is 150 25 m. from willow/blackberry patch, right along trail.

52: Cross creek before lone doug fir – point is 20 before barbed wire fence which is alongside driveway. Crossing marked w/pink flagging. Cross next to big willow.

53: Go over barbed wire fence, follow euc grove. The point is at end of first euc grove, tag is on willow which is 11 m. before second grove.

54: Cross creek at alder grove. Point is 7 m. at 374° from bay tree which is approx. 5m tall.

55: Point is 62° , 3m. from oak tree. Tag on alder.

56: Walk past treeless part of creek, point at beginning of last willow patch.

Points 57-60 are at Five Brooks

57: Walk on easterly side of trail adjacent to pond. Point located at north side of pond, 142° 9 m from doug fir along trail.

58: On south side of pond across from sheet metal barn and cement retaining wall.

59: Off Olema Valley Trail, way past 200 m. from #58. Point 20 m. from beginning of first alder grove, 15 m. in from trail.

60: Along trail, tag on bay tree. Point is 13 m past fallen bay tree where trail takes right turn.

Coast Trail/Laguna (Points are approximately 200 meters apart)

#17-19: These points are across from hostel, spaced 200 m. apart between parking lot and Coast Trailhead.

#20: Along Coast Trail, at start of scrub.

#21: In second meadow

#22: On alder at edge of swamp, end of meadow.

#23: On willow in patch between large, old snags.

#24: On sapling in old snags - trail flagged.

#25: At end of cattail swamp, on coyote bush.

#26: 4 meters before culvert, at end of coffeeberry patch, flag under coyote bush along trail.

#27: On small dead alder behind cattails, at bend in trail.

#28: On small alder off trail 15 meters, at end of open alder stand, before willow/alder stand.

#29: At last 100 meters of alder.

Bear Valley (Points are approximately 200 meters apart)

41: At barn corral, on willow.

42: At end of corral, in willows.

43: On alder between two bays, deer trail to creek.

44: Creek side of single oak.

40: Small oak behind Resources office.

39: On small alder creekside, opposite maintenance yard. Across from single wood post in chain link fence.

38: At cattail marsh before protrusion of snags and bays

37: Cross creek – point is at far side of marsh at division between patch of sawgrass and cattail.

36: First puff of willow to right after first willow “gateway.” At coyote bush patch next to sawgrass patch.

35: Second puff of willow after next willow “gateway”. Behind big north corner sawgrass patch.

34: In small corner after 3rd willow “gateway,” in sawgrass.

33: After crossing creek, off horse trail, take first opening into willows and bear left down grassy lane. Point is at edge of open yard-like area.

32: After reaching horse trail, at “tree gate” of overarching oak and bay.

31: At small Live Oak, walk back to riparian edge.

30: Far side of drainage ditch at Limantour gate, on willow