

# **CARMEL RIVER AVIAN MONITORING PROGRAM**

**Monterey Peninsula Water Management District**

**Summer 2003**

## **Study Sites:**

Schulte Bridge  
Red Rock  
Rancho San Carlos  
Carmel River Mouth

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## **INTRODUCTION**

The establishment of two dams followed by 80 years of intensified floodplain development has dramatically altered the Carmel River and its riparian corridor. The Monterey Peninsula Water Management District (MPWMD) responded in 1984 by initiating multiple restoration projects on the Carmel River watershed to restore critical riparian habitat and hydrologic function. In 2000 the MPWMD contracted the Carmel River Avian Monitoring Program for one year to Big Sur Ornithology Lab (BSOL), a program of Ventana Wilderness Society (VWS). The Avian Monitoring Program resumed in summer 2002 and continued through 2003 to study the responses of avian species to habitat restoration efforts.

Riparian areas have been identified as the single most important habitat for the conservation of Neotropical and resident landbirds in California (Manley and Davidson 1993). Mitsch and Gosselink (1993) estimated that at the time of their writing only 15% of riparian habitat remained in coastal California. Bird populations have been shown to be an important indicator of overall habitat quality (Marzluff and Sallabanks 1998). Specifically, monitoring of breeding birds can be used as a tool to assess habitat quality (Ralph et al. 1993) at sites subject to change due to restoration efforts, river diversion and channelization projects, and/or flooding events, all of which may significantly alter habitat. Clearing of land for agriculture and development, distribution of natural waterways, over-grazing, and invasion of exotic plant species all have contributed to destruction of riparian areas and the subsequent decline in riparian bird species.

For riparian-associated birds in California, a Partners in Flight (PIF) conservation plan was developed to provide specific management recommendations (RHJV 2000). This “Riparian Bird Conservation Plan” identified 14 species of landbirds as “Riparian Focal Species”, whose breeding requirements represent the full range of successional stages of riparian ecosystems. Each Riparian Focal Species typically meets one or more of the following criteria:

- 1.) uses riparian vegetation as its primary breeding habitat,
- 2.) is a species of special concern on either state or federal level,
- 3.) has experienced a reduction in its historic breeding range, and/or
- 4.) is a common breeder in riparian habitat.

This report details the background, methods, and results of the Avian Monitoring Program conducted at four riparian habitat restoration or proposed restoration sites along the Carmel River from 01 May through 08 August 2003. For the purpose of this report, avian species richness, abundance, breeding status, and presence of riparian focal species were used as indicators of habitat quality. The primary purpose of this study was to determine abundance and diversity of breeding birds at each site in order to assess habitat quality of restored and proposed restoration sites.

## **METHODS**

The study was initiated at six sites in the summer of 2000 (see Ritchie 2000). After analysis of results from that baseline inventory, project managers decided to eliminate further monitoring at two sites (Rancho Canada and DeDampierre) and to reduce the amount of

area searches and banding effort at all sites. In 2003 the Schulte Bridge study area was established approximately 200 meters upstream from the 2000 and 2002 All Saints site to encompass the larger, less linear portion of the restoration site. The following site descriptions include habitat characteristics from vegetation surveys in 2000 (Ritchie 2000) that are slightly modified to fit current conditions.

### ***Study Sites***

#### Red Rock (RERO)

The study area is located on the Carmel River, 1 kilometer west of the intersection of Robinson Canyon Road and Carmel Valley Road, and 300 meters south of Carmel Valley Road (North 36°31', West 121°49') (Appendix 1.1). Robinson Canyon Road leads to River Meadows Road, which dead-ends at a private gate 20 meters southwest of the plot's center. From that point, the study plot extends 260 meters upstream to the Sambosa Buddhist Center and 340 meters downstream.

The winding rectangular plot ranges in elevation from 27-34 meters and encompasses a transitional river stretch ranging from perennial to seasonally dry. This site is characterized mostly by bare sandy banks supporting clumps of young alder (*Alnus rubra*), strips of willow (*Salix lasiolepis* and *Salix* spp.), and narrow zones of mature riparian habitat dominated by willows taller than 5 meters. Habitat restoration efforts at this site took place in 1997 and 1998. Three to four freshwater pools located at this site slowly dry in late summer to an exposed perennial spring-fed pool.

Willows make up the primary component whereas black cottonwood (*Populus trichocarpa*) and mulefat (*Baccharis balsamifera*) are secondary features. The open sandy riverbank is primarily vegetated with non-native annual grasses, burrweed (*Xanthium strumarium*), fennel (*Foeniculum vulgare*), horseweed (*Conyza canadensis*), and sweet white clover (*Melilotus alba*). Poison oak (*Toxicodendron diversilobum*), eucalyptus (*Eucalyptus* spp), buckeye (*Aesculus californica*), box elder (*Acer negundo*), western sycamore (*Platanus racemosa*), and bay laurel (*Umbellularia californica*) also occur here to a lesser degree. Residential and agricultural lands border the river in some places, resulting in eroded terraces and cut-away banks denuded of non-herbaceous vegetation.

#### Schulte Bridge (SCBR)

The study area is located along the Carmel River just upstream from the Schulte Road bridge. The Schulte Road bridge is approximately 470 meters south of the intersection of Carmel Valley Road and Schulte Road. From the bridge, the study area extends about 500 meters upstream to create a wide functional floodplain that becomes inundated with water during annual flooding events (North 36°31', West 121°50') (Appendix 2.1).

The study area is currently dominated by a mixed-canopy (4-6 meters) of willow and black cottonwood with an understory composed of poison oak, mugwort (*Artemisia douglasiana*), mulefat, and blackberry (*Rubus* spp.). Habitat restoration efforts at this site took place in 1995. The low stream bank at this site acts as an area for natural recruitment and continues to be colonized by black cottonwoods, sycamores, and willows. In addition to natural

recolonization, willow and cottonwood poles were planted during early restoration efforts in the late 1990's.

#### Rancho San Carlos (RASC)

The study area is located on the Carmel River downstream of the Rancho San Carlos Road bridge, which bounds its eastern/upstream end. The bridge is located approximately 260 meters south of the intersection of Carmel Valley Road and Rancho San Carlos Road. The study area continues downstream for about 450 meters and is bordered by the Hacienda Carmel residential community (North 36°32', West 121°52') (Appendix 3.1).

This rectangular study area, ranging in elevation from 14-18 meters, contains the widest undeveloped tract of riparian vegetation on the lower Carmel River. The vegetation is dominated by willows and black cottonwood growing to 15 meters in height in the upper canopy, and is sub-dominated by coast live oak (*Quercus agrifolia*). Shrubs and ground cover characterized by cape ivy (*Senecio mikanooides*), poison oak, blackberry, coyote bush (*Baccharis pilularis*), stinging nettle (*Urtica dioica*), wild cucumber (*Marah fabaceus*), mugwort, tarragon (*Artemisia dracuncululus*), and poison hemlock (*Conium maculatum*) make up the largest percentage of total vegetation in the study area. The RASC study site is seasonally flooded yet dry throughout most of the year.

#### Carmel River Mouth (CARM-mature and CARM-restored)

The study area is located on the south bank of the Carmel River approximately 200 meters upstream from the river mouth, 800 meters downstream from the Coast Highway 1 bridge, and about 200 meters downstream from the Carmel River Wastewater Treatment Plant (North 36° 32', West 121° 55'). At 2-3 meters in elevation, this triangular plot extends approximately 40 meters along the river edge and 250 meters inland.

The study area incorporates two distinct habitat types: a mature riparian stand (CARM-mature) growing upwards of 12 meters along the riverbank, and restored riparian habitat (CARM-restored) dominated by willow to the south (Appendix 4.1, Appendix 5.1, respectively). Ruderal assemblages of native and introduced weedy species, dominated by Bermuda-buttercup (*Oxalis pes-caprae*) and field mustards (*Brassica rapa* and *Hirschfeldia incana*), and coastal brackish marsh edge the south perimeter of the study area.

In 1996 California Department of Transportation began a restoration project at this site. Simultaneously, VWS in collaboration with California Department of Parks and Recreation established an Avian Monitoring Program to document bird diversity, population dynamics, and survivorship trends in relation to riparian restoration efforts. From 1996 to 1998, mist-nets were operated only in the mature riparian forest along the river. From 1998 to present, permanent mist-nets were operated both in the adjacent restoration site bordering the brackish marsh and in the mature riparian zone (Hamilton et al. 2002).

The study area is dominated by willows in both the restored and mature zones. However, in the mature riparian stand, willows grow to a much greater height and are accompanied by black cottonwood in the canopy layer. A sublayer of black cottonwood and poison oak grades into lower shrubs of blackberry, twinberry (*Lonicera involucrata*), and horsetail (*Equisetum* spp.). Within this mature stand, willows grow gnarled and decumbent, creating a

dense understory with vines. In the restored area, willows up to 7-8 meters in height comprise thick monocultured stands and there is essentially no understory species. Planted adjacent to these stands are small (less than 3 meters) black cottonwoods, California rose bushes (*Rosa californica*), lilacs (*Ceanothus* spp.), and other native perennial wildflowers and shrubs as well as volunteer non-native annual grasses and perennial cudweeds (*Gnaphalium* spp.).

Seasonal flooding and drought conditions dramatically affect the study area. Freshwater from the Carmel River seasonally floods the mature riparian forest zone; a levee confines overflow from reaching the restoration site. Occasionally, saltwater intrudes into the brackish marsh and floods the southwest portion of the study area. In late summer and fall, the section of the Carmel River adjacent to the study area remains dry.

### ***Monitoring Avian Productivity and Survivorship Program***

Beginning in May 2003, we collected data from all sites according to guidelines established by the Institute for Bird Populations' Monitoring Avian Productivity and Survivorship (MAPS) program (Ralph et al. 1993, DeSante et al. 2000). This program outlines standardized protocols for operating mist-nets and banding birds, and collecting standardized demographic and morphometric data. The MAPS protocol is primarily designed for use during the breeding season, consisting of ten 10-day periods from 01 May to 08 August (in the coastal California region).

A network of several hundred organizations throughout North America employs the MAPS protocol to standardize mist-netting/banding efforts for studying trends in landbird populations. Mark-recapture data collected using the MAPS protocol provide annual indices of adult population size and post-fledging productivity, as well as the proportion of resident adult birds and recruitment of young birds into the adult population. Five consecutive years of standardized data collection following the MAPS protocol provide reliable productivity indices and survivorship estimates, and ten consecutive years can elucidate significant population increases or decreases.

In addition to censusing birds using mist-netting and banding, we also employed standardized area search surveys. Incorporating mist-netting and banding with area searches reduced bias and provided a more complete and accurate account of avian abundance and habitat use than did either method alone.

### ***Mist-Netting/Banding Using MAPS Protocol***

We censused each site once during each 10-day period throughout the breeding season with the exception of the Carmel River Mouth, which we operated once each week (every Friday). We operated all sites for five hours, beginning 15 minutes after sunrise, using 10 nets (12 meters long and 2.5 meters wide), except for the Carmel River Mouth where we operated 13 total nets (5 nets at CARM-mature and 8 nets at CARM-restored). We checked nets and extracted birds at strict 40-minute intervals. All data collected from the Avian Monitoring Project at the Carmel River were submitted to the national data repository at the Bird Banding Laboratory (BBL) of the Biological Resources Division of the U.S. Geological Survey in Washington D.C.

For each individual bird, we applied a uniquely numbered aluminum leg band issued by BBL, and recorded capture status (new capture, recapture, or unbanded), species, age and sex, ageing and sexing criteria (degree of skull pneumaticization, presence or absence of external breeding characteristics, feather molt, wear, and plumage), amount of fat, wing length, weight, date, time, and net of capture. Determination of age and sex classes followed the Identification Guide to North American Birds (Pyle 1997). Hummingbirds and game birds were not banded but similar morphometric and phenological data were recorded. Net opening and closing times were recorded each day to allow for calculation of net hours. All data were recorded on a standardized datasheet (Appendix 6.1).

### ***Area Search***

An area search is a widely used survey method for measuring relative abundance and species composition of landbirds that are using a specific habitat. At each site we conducted one standardized area search during each MAPS period, for a total of 10 area searches per site, with the exception of the Carmel River Mouth where we conducted two area searches (restored and mature) each week. Each area search comprised a 20-minute survey confined within a boundary extending 50 meters from all net locations. To reduce bias, areas surveyed at each site were composed of similar habitat type and were of similar size.

Each area search was conducted during the first 3 hours of sunlight, when foraging activity was greatest. We recorded all species detected by visual cues, calls, and songs, in addition to observed breeding behavior, on a standardized datasheet (Appendix 6.2). Birds that were detected flying over the study area were excluded, unless they were obviously foraging in the confined survey area (e.g., raptor hunting low to the ground or swallows foraging for insects).

### ***Data Presentation and Analysis***

We compiled Species Richness for each site by totaling species detections from mist-net captures and area searches, respectively. We recorded breeding characteristics for each species by noting capture or detection of a fledgling, capture of a bird with a brood patch, discovery of a nest, and/or observation of a bird carrying food. We standardized capture rates using number of birds banded per 100 net hours, which we used as our index of population size.

The Species Diversity Index (SDI) was derived from the Shannon-Wiener index (Krebs 1989) and reflects both the number and relative proportion of those species present in a sample. This index serves as a measure of the degree of uncertainty of predicting the species of an individual picked at random from a mist-net or an area search survey. The diversity index increases as the number of species and equability among species increases. We used the following formula to calculate species diversity (Pielou 1966).

For the Sum of  $i = 1$  to  $i = S$ ,  $SDI = - \sum (p_i)(\log p_i)$ ,  $i = 1, 2, \dots S$   
 $S$  = the number of species in the sample, and  $p_i$  = the proportion of all individuals belonging to the  $i$ th species. The index varies from 0, in which all individuals belong to the same species, to a relatively high number with many species and an even distribution of individuals among species. In general, greater species diversity implies greater heterogeneity in the sample (Nur et al. 1999).

We analyzed mist-netting and banding data using capture rates for birds captured once at each site (including recaptured birds from previous years)<sup>3</sup>. Birds captured more than once during the 10 weeks or birds released unbanded (e.g., birds that escaped without a band) were excluded from the analysis to control for independence of observations (i.e., to prevent counting one individual more than once). For area search data, we calculated the SDI using the total number of individuals detected at each site divided by the number of visits.

## RESULTS

Area search detections were greater at SCBR than RERO and RASC, and the lowest at CARM (mature and restored) (Table 1). Mist-net capture rates varied widely among sites, with the highest capture rates at SCBR (46.29 birds/100 net hours) and the lowest at CARM-restored (23.41 birds/100 net hours) (Table 1). Among the three upriver sites, RASC had either the lowest or slightly above the lowest values for area search and mist-net SDI values, species richness values, number of riparian focal species, and number of breeding species (Table 1). However, the two CARM sites had lower SDI values, lower species richness, and fewer breeding species than the three upriver sites, RERO, SCBR, and RASC (Table 1). SDI calculations were higher for area searches compared to mist-netting and banding ( $t = 2.81, p = .048$ ).

Table 1. Comparison of avian distribution among study sites on the Carmel River in Monterey County during summer 2003.

Site	Area Search Detections	Mist-net Captures <sup>a</sup>	Total Mist-net Hours	Capture Rates <sup>a</sup>
RERO	437	216	478.32	45.16
SCBR	520	222	479.56	46.29
RASC	434	174	493.42	35.26
CARM <sub>MATURE</sub>	345	123	343.40	35.82
CARM <sub>RESTORED</sub>	212	131	559.70	23.41

Site	Species Diversity Index		Species Richness			Riparian Focal Species	Breeding Species <sup>c</sup>
	Area Search	Mist-net <sup>b</sup>	Area Search	Mist-net <sup>b</sup>	Combined		
RERO	3.31	2.83	47	31	50	7	26
SCBR	3.22	3.00	44	27	49	6	27
RASC	3.20	2.83	38	28	44	5	19
CARM <sub>MATURE</sub>	3.00	2.16	34	16	37	6	14
CARM <sub>RESTORED</sub>	2.79	2.77	26	23	32	7	15

a New and recaptured birds accounted for only once (does not include unbanded species).

b Total species captured (new, recaptured, and unbanded).

c Criteria used: fledgling, brood patch, nest, carrying food.

<sup>3</sup>Previous analyses in 2000 and 2002 only used new captures, whereas 2003 analyses not only included newly captured birds but also included birds captured for the first time that year that may have been banded from previous years.



Among all sites, more than one-half the 67 avian species documented in this study exhibited breeding characteristics, and five of those breeding species occurred at all sites (Table 2). In addition, we documented seven of the 14 California PIF Riparian Focal Species (Warbling Vireo, Swainson's Thrush, Yellow Warbler, Common Yellowthroat, Wilson's Warbler, Black-headed Grosbeak, and Song Sparrow). Of these seven species, the only species that did not exhibit breeding characteristics was the Common Yellowthroat, which in 2002 was documented breeding at SCBR and CARM. Evidence of breeding Yellow Warblers was observed exclusively at RERO in 2003.

Table 2. Distribution of species detected using MAPS protocol and area search surveys at five study sites on the Carmel River in Monterey County during summer 2003.

SPECIES	SCBR	RERO	RASC	CARM Mature	CARM Restored
Green Heron	X	X			
Mallard	X				
Killdeer				X	
White-tailed Kite				X	
Sharp-shinned Hawk	X				
Red-shouldered Hawk	X	X	X	X	
Red-tailed Hawk	X		X		
California Quail	X	X	X		X
Band-tailed Pigeon	X				
Mourning Dove	X	X	X	X	X
Anna's Hummingbird	X	X	X	X	X
Allen's Hummingbird	X	X	X	X	X
Belted Kingfisher	X	X		X	
Acorn Woodpecker	X	X	X		
Downy Woodpecker	X	X	X	X	X
Hairy Woodpecker	X				
Nuttall's Woodpecker	X	X	X	X	
Northern Flicker	X	X	X	X	X
Western Wood Peewee			X		
Olive-sided Flycatcher			X		
Ash-throated Flycatcher		X			
Pacific-slope Flycatcher	X	X	X	X	X
Willow Flycatcher				X	X
Black Phoebe	X	X	X	X	X
<b>Warbling Vireo</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
Hutton's Vireo	X	X	X	X	X
Western Scrub-Jay	X	X	X	X	X
Steller's Jay	X	X			
American Crow	X	X	X	X	
Tree Swallow	X	X	X	X	
Violet-green Swallow		X	X	X	
Northern Rough-winged Swallow		X	X		
Cliff Swallow	X	X			
Barn Swallow	X	X	X		
Oak Titmouse	X	X	X		
Chestnut-backed Chickadee	X	X	X	X	X
Bushtit	X	X	X	X	X
Brown Creeper		X	X		

SPECIES	SCBR	RERO	RASC	CARM Mature	CARM Restored
Pygmy Nuthatch	X	X	X		
House Wren			X		
Bewick's Wren	X	X	X	X	X
Wrentit	X	X	X	X	X
American Robin	X	X	X		
<b>Swainson's Thrush</b>	X	X	X	X	X
Cedar Waxwing		X		X	
European Starling		X	X		X
Orange-crowned Warbler	X	X	X		X
Nashville Warbler	X				
Black-throated Gray Warbler	X				
Townsend's Warbler	X				
<b>Yellow Warbler</b>	X	X	X		X
<b>Common Yellowthroat</b>		X		X	X
<b>Wilson's Warbler</b>	X	X	X	X	X
<b>Black-headed Grosbeak</b>	X	X		X	X
Spotted Towhee	X	X	X	X	X
California Towhee	X	X	X	X	X
<b>Song Sparrow</b>	X	X	X	X	X
Brown-headed Cowbird			X	X	X
Dark-eyed (Oregon) Junco	X	X			
Red-winged Blackbird	X	X	X	X	X
Brewer's Blackbird		X			
Bullock's Oriole	X	X			
Western Tanager				X	X
Purple Finch	X	X	X	X	
House Finch		X	X	X	X
Lesser Goldfinch	X	X	X		X
American Goldfinch				X	X
<b>Total Species</b>	<b>49</b>	<b>50</b>	<b>44</b>	<b>37</b>	<b>32</b>
<b>Total Breeding</b>	<b>27</b>	<b>26</b>	<b>19</b>	<b>14</b>	<b>15</b>

Species in **boldface type** are California PIF Riparian Focal Species. An "X" in a cell indicates detection of a species. A shaded cell indicates a breeding species.

Complete census data for each site are presented in Appendices.

## DISCUSSION

Results from this study suggest that riparian restoration efforts of MPWMD have enhanced breeding habitat for a wide variety of common migratory and resident species, including California PIF Riparian Focal Species. Compared with RASC and the two CARM sites, the two sites undergoing active restoration, SCBR and RERO, stood out as having the highest area search detections, mist-net captures, capture rates, area search SDI values, area search species richness, combined species richness, and number of breeding species. Continued monitoring at all sites according to the MAPS protocol will further elucidate the benefits to birds and the ecosystems in general garnered by the habitat restoration efforts of the MPWPD.

During 2000 and 2002 Yellow Warblers were not documented breeding at any of the five sites. In 2003 an adult Yellow Warbler was observed feeding two very young fledglings at RERO. The Yellow Warbler is a California species of special concern and is extirpated or declining in much of its historical breeding range including the Central Coast (RHJV 2000). Although others have observed Yellow Warblers breeding along stretches of the Carmel River, a decline in the numbers of breeding Yellow Warblers in recent years is well documented and probably is the result of habitat fragmentation and cowbird parasitism (Roberson 2002). Yellow Warblers are vulnerable to Brown-headed Cowbird (*Molothrus ater*) nest parasitism and cattle grazing, but they respond quickly to management actions such as restoration and Brown-headed Cowbird control (RHJV 2000). The enhancement of low growing vegetation has positively benefited ground and shrub nesters, such as Yellow Warblers. Results from the 2003 field season suggest that the Carmel River sites collectively contain the vegetative structural integrity required for many riparian focal species to breed. However, further management could boost the number of breeding species and benefit breeding populations of all California PIF Riparian Focal Species.

Whereas SCBR and RERO stood out as having the highest overall avian measures of habitat quality, RASC was not far behind in some measures. The CARM study sites, on the other hand, had the lowest combined species richness (number of species detected by area searches and mist-netting) and number of breeding species. These findings contrast with results obtained from monitoring in summer of 2002, when results at CARM were similar to other sites. In 2003 CARM was the only site that showed a substantial decrease in the number of breeding species (24 species in 2002 compared with 18 species in 2003). If future monitoring continues to show a decline, the addition of a nest searching study would determine whether the decline in the number of breeding species is due to deteriorating habitat, encroachment of predators, increased nest parasitism by Brown-headed Cowbirds, or some other factor.

Capture rates were markedly lower at RASC in 2002 compared with other sites, and remained low in 2003. These low capture rates may be attributed to the relatively high, patchy canopy at this site, which confounds relatively low height mist-netting, or to the poor understory ridden with exotic vegetation (e.g., cape ivy), which may not support as many breeding birds. Similarly, in 2003 CARM-restored had even lower capture rates than RASC, in addition to having low species diversity indices for both mist-netting and area searches. These low avian measures of habitat quality, reflected by both census methods at CARM-restored likely reflect the lack of understory at the site.

Area search results produced higher calculated SDI values at all sites because more species were detected than during mist-netting and banding. Because the two census techniques resulted in different SDI values independent of the habitat quality, it is important to examine SDI values obtained from area searches separately from values obtained from mist-netting.

Rapid Ornithological Inventories in 2000 (Ritchie 2000) and 2002 (Scott et. al. 2002) and the establishment of standardized MAPS banding stations in 2003 have contributed substantial baseline data suggesting that the Carmel River riparian corridor provides important nesting habitat to a variety of avian species with different breeding requirements. Continued annual MAPS monitoring along the Carmel River will elucidate a more thorough understanding of breeding bird abundance and diversity throughout the entire breeding season (01 May to

08 August), compared with the narrower “snapshots” (5-week duration) obtained by ROI censusing in 2000 and 2002. In addition, future MAPS monitoring will shed light on how breeding populations of songbirds respond to changes in habitat quality affected by various restoration and water control measures overseen by MPWMD.

## **RECOMMENDATIONS**

### ***Continued MAPS Monitoring***

The MAPS protocol specifies a minimum of 5 years of MAPS mist-netting and banding data for effective statistical analysis of population and survivorship trends (Desante et al. 2000). We recommend continued MAPS monitoring in conjunction with area search surveys at the four study sites, SCBR, RERO, RASC, and CARM, in order to identify population fluctuations or declines.

### ***Nest Monitoring***

We recommend that in conjunction with MAPS banding and area searches, MPWMD establish a nest monitoring component to the monitoring scheme on the Carmel River in order to obtain detailed information about the population dynamics of both resident and migratory species. The demographic parameters that can be measured by nest monitoring include reproductive success and juvenile survival, dispersal, and recruitment. Nest monitoring also is the most direct measure of nest success in specific habitats, elucidating specific habitat features associated with successful nests. Nest monitoring coupled with nest site vegetative sampling would provide insight into habitat features needed by a variety of species, including Riparian Focal Species, which ultimately would increase our understanding of future restoration needs (e.g., vegetative composition). In addition, nest monitoring throughout the breeding season would provide concrete evidence about the significance of Brown-headed Cowbird parasitism and predation.

A long-term and multifaceted monitoring approach, including MAPS mist-netting and banding, area searches, and nest monitoring would increase understanding of bird diversity, population dynamics, and survivorship in relation to the riparian habitat restoration projects of the MPWMD.

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## LITERATURE CITED

- DeSante, D. F., K. M. Burton, P. Velez, D. Froehlich. 2000. MAPS Manual 2000 Protocol. The Institute for Bird Populations, P.O. Box 1346, Point Reyes Station, CA 94956-1346.
- Hamilton, S. L., J. W. Scott, and G. E. Emmons. 2002. Carmel River Lagoon Avian Monitoring Project Report, 1999-2002. Prepared for the California Department of Parks and Recreation. Ventana Wilderness Society, Big Sur, CA.
- Krebs, C. 1989. *Ecological Methodology*. Harper and Row, N.Y.
- Manley, P. and C. Davidson. 1993. A risk analysis of neotropical migrant birds in California, U.S. forest Service report, Region 5. San Francisco. CA.
- Marzluff, J. and R. Sallabanks. 1998. *Avian Conservation: research and management*. Island Press, Covelo, CA.
- Mitsch, J. W. and J. G. Gosselink. 1993. *Wetlands*, 2<sup>nd</sup> edition, Van Nostrand Reinhold, New York.
- Nur, N., S. L. Jones, and G. R. Geupel. 1999. *Statistical guide to data analysis of avian monitoring programs*. U.S. Department of the interior, Fish and Wildlife Service, BTP-R6001-1999, Washington, D.C.
- Pielou, E. C. 1966. The measurement of diversity in different types of biological collections. *J. Theor. Biol.* 13:131-144.
- Pyle, P. 1997. *Identification Guide to North American Birds*. Slate Creek Press, Bolinas, CA.
- Ralph, C. J., G. P. Geupel, T. E. Martin, P. Pyle, and D. DeSante. 1993. *Field Methods for Monitoring Landbirds*. Institute for Bird Populations, Inverness, CA.
- RHJV (Riparian Habitat Joint Venture). 2000. Version 1.0. The riparian bird conservation plan: a strategy for reversing the decline of riparian associated birds in California. California Partners in Flight. <http://www.prbo.org/CPIF/Riparian/Riparian.html>
- Ritchie, K. 2000. Carmel River Avian Monitoring Program, Summer 2000. Prepared for the Monterey Peninsula Water Management District. Ventana Wilderness Society, Big Sur, CA.
- Roberson, D. 2002. *Monterey Birds*, 2<sup>nd</sup> edition. Monterey Peninsula Audubon Society, Monterey, CA.
- Scott, J. W., S. L. Hamilton, and J. F. Matusik. 2002. Carmel River Avian Monitoring Program (2002): Carmel River Mouth, Rancho San Carlos, Schulte Bridge, Red Rock. Ventana Wilderness Society report to Monterey Peninsula Water Management District, Big Sur, CA.

Appendix 1.1 Red Rock Site Map



## Appendix 1.2 Red Rock Species List, with Breeding Evidence and Conservation Status

Species	Area Search	Individuals per Visit	Mist-net Captures	Total Detections	Breeding Evidence	Conservation Status
Mallard	1	0.13	0	1	None	na
Sharp-shinned Hawk	1	0.13	0	1	None	na
Red-shouldered Hawk	1	0.13	0	1	None	na
Red-tailed Hawk	2	0.25	0	2	None	na
California Quail	37	4.63	2	39	FLE	na
Band-tailed Pigeon	5	0.63	0	5	None	na
Mourning Dove	7	0.88	0	7	None	na
Anna's Hummingbird	10	1.25	13	23	DI	na
Allen's Hummingbird*	3	0.38	7	10	DI	na
Belted Kingfisher	2	0.25	0	2	None	na
Acorn Woodpecker	2	0.25	0	2	None	na
Downy Woodpecker	1	0.13	8	9	BP,FLE	na
Hairy Woodpecker	1	0.13	0	1	None	na
Nuttall's Woodpecker	4	0.50	3	7	BP	na
Northern Flicker	3	0.38	1	4	FLE	na
Pacific-slope Flycatcher	20	2.50	17	37	FLE	na
Black Phoebe	11	1.38	6	17	BP,FLE	na
Warbling Vireo	12	1.50	12	24	BP	RFS
Hutton's Vireo	4	0.50	6	10	BP	na
Western Scrub-Jay	30	3.75	14	44	BP,CF,FLE	na
Steller's Jay	1	0.13	0	1	None	na
American Crow	5	0.63	0	5	None	na
Tree Swallow	14	1.75	0	14	NE	na
Cliff Swallow	5	0.63	0	5	None	na
Barn Swallow	2	0.25	0	2	None	na
Oak Titmouse	14	1.75	14	28	BP,FLE	na
Chestnut-backed Chickadee	42	5.25	21	63	BP,FLE	na
Bushtit	37	4.63	13	50	BP,FLE	na
Pygmy Nuthatch	2	0.25	0	2	None	na
Bewick's Wren	44	5.50	32	76	BP,FLE	na
Wrentit	23	2.88	17	40	BP,FLE	na
American Robin	1	0.13	0	1	None	na
Swainson's Thrush	6	0.75	14	20	BP	RFS
Orange-crowned Warbler	3	0.38	27	30	BP,FLE	na
Nashville Warbler	0	0.00	1	1	None	na
Black-throated Gray Warbler	0	0.00	1	1	None	na
Townsend's Warbler	0	0.00	1	1	None	na
Yellow Warbler	0	0.00	1	1	None	RFS
Wilson's Warbler	8	1.00	23	31	BP,FLE	RFS
Black-headed Grosbeak	10	1.25	8	18	BP	RFS
Spotted Towhee	11	1.38	7	18	BP	na
California Towhee	14	1.75	5	19	BP,FLE	na
Song Sparrow	25	3.13	21	46	BP,FLE	RFS
Dark-eyed (Oregon) Junco	2	0.25	7	9	BP	na
Red-winged Blackbird	1	0.13	0	1	None	na
Bullock's Oriole	0	0.00	4	4	BP	na
Purple Finch	6	0.75	5	11	BP	na
Lesser Goldfinch	3	0.38	0	3	None	na
<b>Grand Total</b>	<b>437</b>	<b>54.50</b>	<b>311</b>	<b>748</b>		<b>6</b>
<b>Total Species</b>	<b>44</b>		<b>30</b>	<b>49</b>		
<b>Total Breeding</b>					<b>27</b>	

\*Note: Unspecified *Selasphorus* spp. combined with Allen's Hummingbird.

FLE Recently Fledged Young

DI Display

BP Brood Patch

CF Carry Food

NE Nest

RFS Partners in Flight Riparian Focal Species

### Appendix 1.3 Red Rock Mist-net Species List

Species	Capture Rates	First Captures	Captures			Unbanded	Sex			Age	
			New Captures	Recaptures			Male	CP	Female	BP	HY
California Quail	0.00	0	0	0	3	0	0	0	0	3	0
Mourning Dove	0.00	0	0	0	1	0	0	0	0	1	0
Anna's Hummingbird	0.00	0	0	0	23	17	0	6	0	14	9
Allen's Hummingbird	0.00	0	0	0	5	5	0	0	0	1	4
Nuttall's Woodpecker	0.21	1	1	0	0	1	0	0	0	1	0
Northern Flicker	0.42	2	2	0	0	0	0	1	1	1	1
Pacific-slope Flycatcher	2.30	11	11	1	0	0	0	4	4	4	8
Black Phoebe	1.25	6	6	2	0	0	0	0	0	7	1
Warbling Vireo	2.09	10	10	3	0	6	6	4	4	2	11
Hutton's Vireo	1.05	5	5	0	0	0	0	2	2	2	3
Western Scrub Jay	0.63	3	3	1	0	0	0	2	2	0	4
Violet-green Swallow	0.42	2	2	0	0	2	2	0	0	0	2
Northern Rough-winged Swallow	0.21	1	1	0	0	0	0	1	0	1	0
Cliff Swallow	0.42	2	2	0	0	0	0	1	2	0	2
Oat Titmouse	0.21	1	1	1	0	0	0	0	0	2	0
Chestnut-backed Chickadee	2.09	10	10	5	1	0	0	0	0	14	1
Bushtit	11.92	57	51	16	4	18	0	25	9	29	23
Bewick's Wren	4.18	20	19	7	0	0	0	0	0	22	3
Wrentit	0.84	4	4	0	0	0	0	0	4	0	4
American Robin	0.21	1	1	0	0	0	0	0	0	1	0
Swainson's Thrush	1.05	5	5	0	0	0	0	0	0	0	5
Orange-crowned Warbler	2.51	12	12	1	3	3	2	3	2	9	7
Yellow Warbler	1.05	5	5	0	0	4	0	1	0	0	5
Common Yellowthroat	0.21	1	1	0	0	0	0	0	0	1	0
Wilson's Warbler	2.72	13	13	0	0	7	1	4	1	8	5
Black-headed Grosbeak	1.67	8	8	0	0	3	1	5	1	4	4
Spotted Towhee	0.84	4	4	0	0	1	0	1	1	2	2
California Towhee	0.42	2	2	1	1	0	0	2	2	1	3
Song Sparrow	2.72	13	11	9	1	6	6	2	2	11	10
Dark-eyed (Oregon) Junco	0.63	3	3	1	0	2	2	0	0	2	2
Red-winged Blackbird	0.42	2	2	0	0	2	2	0	0	0	2
Brewer's Blackbird	0.42	2	2	0	0	0	0	2	2	0	2
Bullock's Oriole	0.63	3	2	2	0	2	2	2	2	0	4
Purple Finch	0.84	4	4	0	0	2	2	2	2	0	4
Lesser Goldfinch	0.63	3	3	0	0	2	1	1	0	0	3
<b>Total Captures</b>	<b>45.16</b>	<b>216</b>	<b>206</b>	<b>50</b>	<b>42</b>	<b>83</b>	<b>27</b>	<b>71</b>	<b>43</b>	<b>143</b>	<b>134</b>
<b>Total Species</b>	<b>n/a</b>	<b>30</b>	<b>30</b>	<b>14</b>	<b>9</b>	<b>17</b>	<b>11</b>	<b>20</b>	<b>17</b>	<b>24</b>	<b>28</b>

First Captures = New and recaptured birds accounted for only once (does not include unbanded species)

Capture Rates = Captures Per 100 Net Hours

CP = Cloacal Protuberance; BP = Brood Patch; HY = Hatch Year; AHY = After Hatch Year



Appendix 2.1 Schulte Bridge Site Map



## Appendix 2.2 Schulte Bridge Species List, with Breeding Evidence and Conservation Status

Species	Area Search	Individuals per Visit	Mist-net Captures	Total Detections	Breeding Evidence	Conservation Status
Green Heron	1	0.13	0	1	None	na
Red-shouldered Hawk	3	0.38	0	3	None	na
California Quail	55	6.88	3	58	FLE	na
Mourning Dove	13	1.63	1	14	FLE	na
Anna's Hummingbird	21	2.63	23	44	DI	na
Allen's Hummingbird	1	0.13	5	6	DI	na
Belted Kingfisher	2	0.25	0	2	None	na
Acorn Woodpecker	9	1.13	0	9	None	na
Downy Woodpecker	4	0.50	0	4	None	na
Nuttall's Woodpecker	4	0.50	1	5	None	na
Northern Flicker	5	0.63	2	7	BP,FLE	na
Ash-throated Flycatcher	1	0.13	0	1	None	na
Pacific-slope Flycatcher	17	2.13	12	29	BP	na
Black Phoebe	23	2.88	8	31	FLE	na
Warbling Vireo	19	2.38	13	32	BP	RFS
Hutton's Vireo	6	0.75	5	11	BP	na
Western Scrub-Jay	22	2.75	4	26	BP	na
Steller's Jay	1	0.13	0	1	None	na
American Crow	5	0.63	0	5	None	na
Tree Swallow	36	4.50	0	36	None	na
Violet-green Swallow	0	0.00	2	2	None	na
Northern Rough-winged Swallow	0	0.00	1	1	None	na
Cliff Swallow	5	0.63	2	7	BP	na
Barn Swallow	4	0.50	0	4	None	na
Oak Titmouse	2	0.25	2	4	None	na
Chestnut-backed Chickadee	38	4.75	16	54	FLE	na
Bushtit	60	7.50	71	131	BP,FLE	na
Brown Creeper	7	0.88	0	7	None	na
Pygmy Nuthatch	2	0.25	0	2	None	na
Bewick's Wren	24	3.00	26	50	FLE	na
Wrentit	7	0.88	4	11	BP	na
American Robin	9	1.13	1	10	FLE	na
Swainson's Thrush	0	0.00	5	5	None	RFS
Cedar Waxwing	3	0.38	0	3	None	na
European Starling	3	0.38	0	3	None	na
Orange-crowned Warbler	1	0.13	16	17	BP,FLE	na
Yellow Warbler	5	0.63	5	10	CF,FLE	RFS
Common Yellowthroat	2	0.25	1	3	None	RFS
Wilson's Warbler	2	0.25	13	15	BP	RFS
Black-headed Grosbeak	9	1.13	8	17	BP	RFS
Spotted Towhee	6	0.75	4	10	BP	na
California Towhee	10	1.25	4	14	BP,FLE	na
Song Sparrow	30	3.75	21	51	BP,FLE	RFS
Dark-eyed (Oregon) Junco	2	0.25	4	6	None	na
Red-winged Blackbird	9	1.13	2	11	None	na
Brewer's Blackbird	2	0.25	2	4	BP	na
Bullock's Oriole	4	0.50	4	8	BP	na
Purple Finch	7	0.88	4	11	BP	na
House Finch	10	1.25	0	10	None	na
Lesser Goldfinch	9	1.13	3	12	None	na
<b>Grand Total</b>	<b>520</b>	<b>65.00</b>	<b>298</b>	<b>818</b>		<b>7</b>
<b>Total Species</b>	<b>47</b>		<b>35</b>	<b>50</b>		
<b>Total Breeding</b>					<b>26</b>	

\*Note: Unspecified *Selasphorus* spp. combined with Allen's Hummingbird.

FLE	Recently Fledged Young	CF	Carry Food
DI	Display	NE	Nest
BP	Brood Patch	RFS	Partners in Flight Riparian Focal Species

### Appendix 2.3 Schulte Bridge Mist-net Species List

Species	Capture Rates	First Captures	Captures			Unbanded	Male	Sex		BP	Age	
			New Captures	Recaptures				CP	Female		HY	AHY
California Quail	0.00	0	0	0	2	0	0	0	0	1	1	
Anna's Hummingbird	0.00	0	0	0	13	8	0	5	0	5	8	
Allen's Hummingbird	0.00	0	0	0	7	0	0	4	0	5	1	
Downy Woodpecker	1.67	8	8	0	0	6	0	2	4	4	4	
Nuttall's Woodpecker	0.63	3	3	0	0	2	0	1	2	0	3	
Northern Flicker	0.21	1	1	0	0	0	0	1	0	1	0	
Pacific-slope Flycatcher	3.13	15	15	1	1	0	0	0	0	8	8	
Black Phoebe	1.25	6	6	0	0	0	0	1	1	5	1	
Warbling Vireo	1.25	6	6	5	1	2	2	4	4	1	10	
Hutton's Vireo	0.83	4	4	2	0	0	0	4	4	2	4	
Western Scrub-Jay	2.29	11	11	2	1	0	0	2	2	3	11	
Oak Titmouse	1.25	6	6	7	1	0	0	1	1	10	4	
Chestnut-backed Chickadee	3.54	17	17	2	2	1	1	5	5	6	13	
Bushtit	2.50	12	12	0	1	1	0	2	1	6	2	
Bewick's Wren	3.96	19	19	12	1	3	2	4	4	16	15	
Wrentit	1.46	7	7	10	0	0	0	0	11	5	11	
Swainson's Thrush	2.71	13	13	1	0	1	1	1	1	0	14	
Orange-crowned Warbler	4.59	22	22	5	0	8	7	7	5	11	16	
Nashville Warbler	0.21	1	1	0	0	1	0	0	0	0	1	
Black-throated Gray Warbler	0.21	1	1	0	0	1	1	0	0	0	1	
Townsend's Warbler	0.21	1	1	0	0	1	0	0	0	0	1	
Yellow Warbler	0.21	1	1	0	0	1	0	0	0	0	1	
Wilson's Warbler	4.59	22	22	0	1	6	4	4	2	10	13	
Black-headed Grosbeak	1.67	8	8	0	0	6	3	2	1	0	12	
Spotted Towhee	1.04	5	5	1	1	1	1	3	3	1	5	
California Towhee	0.83	4	4	0	1	2	2	1	1	2	3	
Song Sparrow	2.92	14	13	7	1	8	8	6	6	5	16	
Dark-eyed (Oregon) Junco	1.46	7	7	0	0	0	0	1	1	6	1	
Bullock's Oriole	0.63	3	3	1	0	2	2	2	1	1	3	
Purple Finch	1.04	5	5	0	0	3	3	2	1	0	5	
<b>Total Captures</b>	<b>46.29</b>	<b>222</b>	<b>221</b>	<b>56</b>	<b>34</b>	<b>64</b>	<b>37</b>	<b>65</b>	<b>61</b>	<b>114</b>	<b>188</b>	
<b>Total Species</b>	<b>n/a</b>	<b>27</b>	<b>27</b>	<b>13</b>	<b>14</b>	<b>20</b>	<b>13</b>	<b>23</b>	<b>21</b>	<b>22</b>	<b>29</b>	

First Captures = New and recaptured birds accounted for only once (does not include unbanded species)

Capture Rates = Captures Per 100 Net Hours

CP = Cloacal Protuberance; BP = Brood Patch; HY = Hatch Year; AHY = After Hatch Year

Appendix 3.1 Rancho San Carlos Site Map



Appendix 3.2 Rancho San Carlos Species List, with Breeding Evidence and Conservation Status

Species	Area Search	Individuals per Visit	Mist-net Captures	Total Detections	Breeding Evidence	Conservation Status
Red-shouldered Hawk	6	0.75	0	6	None	na
Red-tailed Hawk	1	0.13	0	1	None	na
California Quail	42	5.25	0	42	FLE	na
Mourning Dove	12	1.50	2	14	None	na
Anna's Hummingbird	21	2.63	8	29	DI	na
Allen's Hummingbird	0	0.00	3	3	None	na
Acorn Woodpecker	10	1.25	0	10	None	na
Downy Woodpecker	3	0.38	3	6	BP	na
Nuttall's Woodpecker	4	0.50	1	5	None	na
Northern Flicker	2	0.25	0	2	None	na
Western Wood Pewee	6	0.75	0	6	None	na
Olive-sided Flycatcher	0	0.00	1	1	None	na
Pacific-slope Flycatcher	8	1.00	9	17	BP	na
Black Phoebe	5	0.63	2	7	BP	na
Warbling Vireo	11	1.38	1	12	BP	RFS
Hutton's Vireo	4	0.50	2	6	None	na
Western Scrub-Jay	23	2.88	3	26	BP,CF	na
American Crow	9	1.13	0	9	None	na
Tree Swallow	10	1.25	1	11	None	na
Violet-green Swallow	0	0.00	2	2	None	na
Northern Rough-winged Swallow	2	0.25	0	2	None	na
Barn Swallow	1	0.13	0	1	None	na
Oak Titmouse	0	0.00	1	1	None	na
Chestnut-backed Chickadee	39	4.88	17	56	BP,FLE	na
Bushtit	42	5.25	27	69	BP,FLE	na
Brown Creeper	2	0.25	0	2	None	na
Pygmy Nuthatch	3	0.38	0	3	None	na
House Wren	1	0.13	5	6	BP,FLE	na
Bewick's Wren	29	3.63	23	52	BP,FLE	na
Wrentit	20	2.50	16	36	BP,FLE	na
American Robin	7	0.88	2	9	None	na
Swainson's Thrush	7	0.88	10	17	BP	RFS
European Starling	8	1.00	0	8	None	na
Orange-crowned Warbler	0	0.13	7	7	BP,FLE	na
Yellow Warbler	1	0.00	2	3	None	RFS
Wilson's Warbler	8	1.00	28	36	BP,FLE	RFS
Spotted Towhee	0	0.00	2	2	None	na
California Towhee	14	1.75	6	20	BP,FLE	na
Song Sparrow	33	4.13	39	72	BP,FLE	RFS
Brown-headed Cowbird	1	0.13	1	2	None	na
Red-winged Blackbird	4	0.50	0	4	None	na
Purple Finch	8	1.00	4	12	BP	na
House Finch	18	2.25	3	21	None	na
Lesser Goldfinch	9	1.13	4	13	BP	na
<b>Grand Total</b>	<b>434</b>	<b>54.25</b>	<b>235</b>	<b>669</b>		<b>5</b>
<b>Total Species</b>	<b>38</b>		<b>31</b>	<b>44</b>		
<b>Total Breeding</b>					<b>19</b>	

\*Note: Unspecified *Selasphorus* spp. combined with Allen's Hummingbird.

FLE	Recently Fledged Young	CF	Carry Food
DI	Display	NE	Nest
BP	Brood Patch	RFS	Partners in Flight Riparian Focal Species

### Appendix 3.3 Rancho San Carlos Mist-net Species List

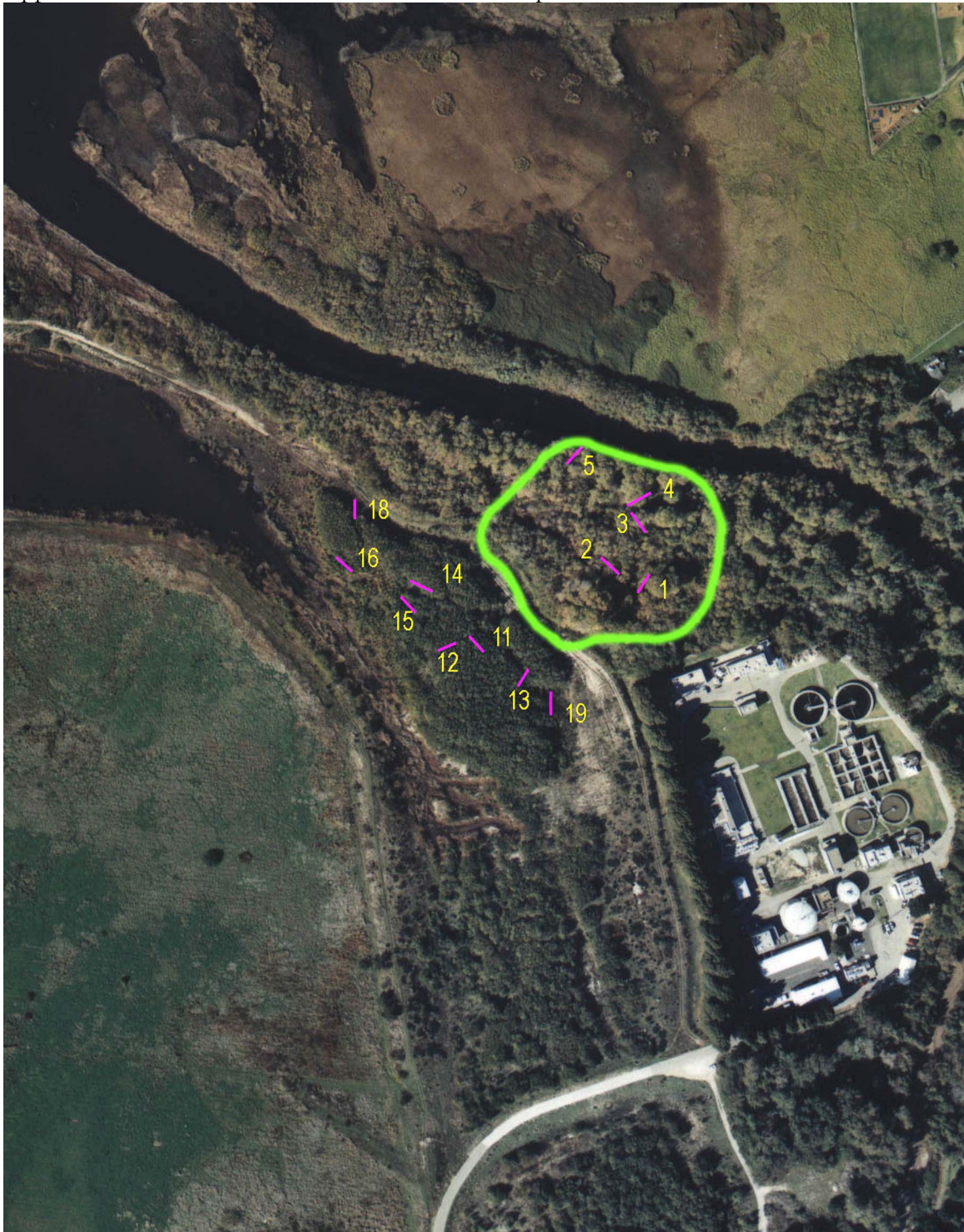
Species	Capture Rates	First Captures	Captures			Unbanded	Sex			Age	
			New Captures	Recaptures			Male	CP	Female	BP	HY
Mourning Dove	0.00	0	0	0	2	1	0	0	0	0	2
Anna's Hummingbird	0.00	0	0	0	8	2	0	2	0	2	6
Allen's Hummingbird	0.00	0	0	0	3	0	0	2	0	1	1
Downy Woodpecker	0.61	3	3	0	0	1	0	2	2	1	2
Nuttall's Woodpecker	0.20	1	1	0	0	1	0	0	0	0	1
Olive-sided Flycatcher	0.20	1	1	0	0	0	0	0	0	0	1
Pacific-slope Flycatcher	1.22	6	6	3	0	1	1	2	2	2	7
Black Phoebe	0.41	2	2	0	0	0	0	1	1	0	2
Warbling Vireo	0.20	1	1	0	0	0	0	1	1	0	1
Hutton's Vireo	0.41	2	2	0	0	0	0	0	0	2	0
Western Scrub-Jay	0.41	2	2	1	0	0	0	1	1	0	3
Tree Swallow	0.20	1	1	0	0	1	1	0	0	0	1
Violet-green Swallow	0.41	2	2	0	0	2	2	0	0	0	2
Oak Titmouse	0.20	1	1	0	0	0	0	0	0	1	0
Chestnut-backed Chickadee	2.43	12	9	8	0	1	1	6	6	3	14
Bushtit	4.46	22	19	6	2	8	0	7	3	8	12
House Wren	1.01	5	5	0	0	0	0	1	1	3	2
Bewick's Wren	3.04	15	14	8	1	0	0	3	3	15	7
Wrentit	1.82	9	4	12	0	0	1	0	12	3	13
American Robin	0.41	2	2	0	0	1	1	0	0	1	1
Swainson's Thrush	2.03	10	10	0	0	4	4	1	1	0	10
Orange-crowned Warbler	1.42	7	7	0	0	0	0	3	3	4	3
Yellow Warbler	0.41	2	2	0	0	2	0	0	0	0	2
Wilson's Warbler	4.46	22	22	6	0	14	6	10	6	7	21
Spotted Towhee	0.41	2	2	0	0	1	1	1	1	0	2
California Towhee	1.01	5	5	0	1	4	4	1	1	0	5
Song Sparrow	5.47	27	20	19	0	15	15	9	9	14	25
Brown-headed Cowbird	0.20	1	1	0	0	0	0	1	0	0	1
Purple Finch	0.81	4	4	0	0	2	2	2	2	0	4
House Finch	0.61	3	3	0	0	2	0	0	0	1	2
Lesser Goldfinch	0.81	4	4	0	0	2	2	2	2	0	4
<b>Total Captures</b>	<b>35.26</b>	<b>174</b>	<b>155</b>	<b>63</b>	<b>17</b>	<b>65</b>	<b>41</b>	<b>58</b>	<b>57</b>	<b>68</b>	<b>157</b>
<b>Total Species</b>	<b>n/a</b>	<b>28</b>	<b>28</b>	<b>8</b>	<b>6</b>	<b>19</b>	<b>13</b>	<b>20</b>	<b>18</b>	<b>16</b>	<b>29</b>

First Captures = New and recaptured birds accounted for only once (does not include unbanded species)

Capture Rates = Captures Per 100 Net Hours

CP = Cloacal Protuberance; BP= Brood Patch; HY = Hatch Year; AHY = After Hatch Year

Appendix 4.1 Carmel River Mouth-Mature Site Map



Appendix 4.2 Carmel River Mouth-Mature Species List, with Breeding Evidence and Conservation Status

Species	Area Search	Individuals per Visit	Mist-net Captures	Total Detections	Breeding Evidence	Conservation Status
Killdeer	1	0.1	0	1	None	na
White-tailed Kite	1	0.1	0	1	None	na
Red-shouldered Hawk	3	0.3	0	3	NE	na
Mourning Dove	15	1.5	2	17	None	na
Anna's Hummingbird	15	1.5	13	28	None	na
Allen's Hummingbird	0	0	1	1	None	na
Belted Kingfisher	2	0.2	0	2	None	na
Downy Woodpecker	7	0.7	0	7	NE	na
Nuttall's Woodpecker	3	0.3	1	4	None	na
Northern Flicker	2	0.2	0	2	None	na
Pacific-slope Flycatcher	7	0.7	2	9	BP	na
Willow Flycatcher	0	0	1	1	None	na
Black Phoebe	0	0	2	2	None	na
Warbling Vireo	11	1.1	0	11	NE	RFS
Hutton's Vireo	1	0.1	0	1	None	na
Western Scrub-Jay	13	1.3	0	13	None	na
American Crow	3	0.3	0	3	None	na
Tree Swallow	11	1.1	0	11	NE	na
Violet-green Swallow	2	0.2	0	2	None	na
Chestnut-backed Chickadee	41	4.1	20	61	BP,NE,FLE	na
Bushtit	24	2.4	0	24	NE,FLE	na
Bewick's Wren	23	2.3	18	41	BP	na
Wrentit	11	1.1	4	15	BP	na
Swainson's Thrush	24	2.4	22	46	BP,FLE	RFS
Cedar Waxwing	4	0.4	9	13	None	na
Common Yellowthroat	1	0.1	0	1	None	RFS
Wilson's Warbler	45	4.5	53	98	BP,CM,NE,FLE	RFS
Black-headed Grosbeak	12	1.2	3	15	BP,NE,FLE	RFS
Spotted Towhee	3	0.3	2	5	None	na
California Towhee	1	0.1	1	2	BP	na
Song Sparrow	33	3.3	19	52	BP,NE,FLE	RFS
Brown-headed Cowbird	9	0.9	0	9	None	na
Red-winged Blackbird	6	0.6	0	6	None	na
Western Tanager	1	0.1	1	2	None	na
Purple Finch	1	0.1	0	1	None	na
House Finch	4	0.4	1	5	None	na
American Goldfinch	5	0.5	0	5	None	na
<b>Total Detections</b>	<b>345</b>	<b>34.5</b>	<b>175</b>	<b>520</b>		<b>6</b>
<b>Total Species</b>	<b>34</b>		<b>19</b>	<b>37</b>		
<b>Total Breeding Species</b>					<b>14</b>	

\*Note: Unspecified *Selasphorus* spp. combined with Allen's Hummingbird.

FLE	Recently Fledged Young	CF	Carry Food
DI	Display	NE	Nest
BP	Brood Patch	RFS	Partners in Flight Riparian Focal Species



### Appendix 4.3 Carmel River Mouth-Mature Mist-net Species List

Species	Capture Rates	First Captures	Captures			Unbanded	Sex			Age	
			New Captures	Recaptures			Male	CP	Female	BP	HY
Mourning Dove	0.00	0	0	0	2	1	0	1	0	0	2
Anna's Hummingbird	0.00	0	0	0	13	8	0	5	0	9	4
Allen's Hummingbird	0.00	0	0	0	1	0	0	1	0	1	0
Nuttall's Woodpecker	0.29	1	1	0	0	1	0	0	0	0	1
Pacific-slope Flycatcher	0.58	2	2	0	0	0	0	1	1	0	2
Willow Flycatcher	0.29	1	1	0	0	0	0	0	0	0	1
Black Phoebe	0.58	2	2	0	0	0	0	0	0	2	0
Chestnut-backed Chickadee	4.08	14	3	16	1	6	6	2	2	3	16
Bewick's Wren	3.20	11	7	11	0	0	0	9	9	6	12
Wrentit	1.16	4	1	3	0	0	1	0	3	0	4
Swainson's Thrush	4.95	17	11	10	1	7	7	3	3	2	20
Cedar Waxwing	2.62	9	9	0	0	2	0	7	0	0	9
Wilson's Warbler	11.07	38	35	18	0	27	18	14	9	16	37
Black-headed Grosbeak	0.87	3	3	0	0	1	0	2	2	1	2
Spotted Towhee	0.58	2	2	0	0	1	1	0	0	1	1
California Towhee	0.29	1	1	0	0	0	0	1	1	0	1
Song Sparrow	4.66	16	12	7	0	4	4	4	4	10	9
Western Tanager	0.29	1	1	0	0	1	0	0	0	0	1
House Finch	0.29	1	1	0	0	1	0	0	0	0	1
<b>Total Captures</b>	<b>35.82</b>	<b>123</b>	<b>92</b>	<b>65</b>	<b>18</b>	<b>60</b>	<b>37</b>	<b>50</b>	<b>34</b>	<b>51</b>	<b>123</b>
<b>Total Species</b>		<b>16</b>	<b>16</b>	<b>6</b>	<b>5</b>	<b>12</b>	<b>6</b>	<b>12</b>	<b>9</b>	<b>10</b>	<b>17</b>

First Captures = New and recaptured birds accounted for only once (does not include unbanded species)

Capture Rates = Captures Per 100 Net Hours

CP = Cloacal Protuberance; BP= Brood Patch; HY = Hatch Year; AHY = After Hatch Year

Appendix 5.1 Carmel River Mouth-Restored Site Map



## Appendix 5.2 Carmel River Mouth-Restored Species List, with Breeding Evidence and Conservation Status

Species	Area Search	Individuals per Visit	Mist-net Captures	Total Detections	Breeding Evidence	Conservation Status
California Quail	5	0.5	0	5	None	na
Mourning Dove	3	0.3	0	3	None	na
Anna's Hummingbird	13	1.3	2	15	NE	na
Allen's Hummingbird	1	0.1	5	6	None	na
Downy Woodpecker	3	0.3	4	7	BP	na
Northern Flicker	2	0.2	0	2	None	na
Pacific-slope Flycatcher	3	0.3	5	8	BP	na
Willow Flycatcher	0	0	1	1	None	na
Black Phoebe	1	0.1	4	5	None	na
Warbling Vireo	0	0	1	1	BP	RFS
Hutton's Vireo	0	0	1	1	None	na
Western Scrub-Jay	15	1.5	3	18	NE	na
Chestnut-backed Chickadee	32	3.2	19	51	BP,FLE	na
Bushy-tit	13	1.3	7	20	BP	na
Bewick's Wren	16	1.6	18	34	BP,NE,FLE	na
Wrentit	1	0.1	0	1	None	na
Swainson's Thrush	2	0.2	29	31	BP	RFS
European Starling	16	1.6	8	24	None	na
Orange-crowned Warbler	3	0.3	1	4	None	na
Yellow Warbler	1	0.1	7	8	None	RFS
Common Yellowthroat	7	0.7	4	11	None	RFS
Wilson's Warbler	11	1.1	14	25	FLE	RFS
Black-headed Grosbeak	18	1.8	4	22	BP,NE,FLE	RFS
Spotted Towhee	1	0.1	1	2	None	na
California Towhee	7	0.7	3	10	BP,NE	na
Song Sparrow	29	2.9	19	48	BP,CF,NE,FLE	RFS
Brown-headed Cowbird	2	0.2	0	2	None	na
Red-winged Blackbird	5	0.5	4	9	BP	na
Western Tanager	0	0	1	1	None	na
House Finch	0	0	2	2	None	na
Lesser Goldfinch	2	0.2	0	2	None	na
American Goldfinch	0	0	3	3	BP	na
<b>Total Detections</b>	<b>212</b>	<b>21.2</b>	<b>170</b>	<b>382</b>		<b>7</b>
<b>Total Species</b>	<b>26</b>		<b>26</b>	<b>32</b>		
<b>Total Breeding Species</b>					<b>15</b>	

\*Note: Unspecified *Selasphorus* spp. combined with Allen's Hummingbird.

FLE	Recently Fledged Young	CF	Carry Food
DI	Display	NE	Nest
BP	Brood Patch	RFS	Partners in Flight Riparian Focal Species

### Appendix 5.3 Carmel River Mouth-Restored Mist-net Species List

Species	Capture Rates	First Captures	Capture			Unbanded	Male	Sex		BP	Age	
			New Captures	Recaptures				CP	Female		HY	AHY
Anna's Hummingbird	0.00	0	0	0	2	1	0	1	0	0	2	
Allen's Hummingbird	0.00	0	0	0	5	2	0	2	0	3	2	
Downy Woodpecker	0.71	4	4	0	0	1	0	2	2	2	2	
Pacific-slope Flycatcher	0.36	2	2	2	1	0	0	1	1	1	3	
Willow Flycatcher	0.00	0	0	1	0	0	0	0	0	0	1	
Black Phoebe	0.71	4	4	0	0	0	0	0	0	2	2	
Warbling Vireo	0.18	1	1	0	0	0	0	1	1	0	1	
Hutton's Vireo	0.18	1	1	0	0	0	0	0	0	1	0	
Western Scrub Jay	0.54	3	2	1	0	0	0	0	0	0	3	
Chestnut-backed Chickadee	2.50	14	11	8	0	1	1	1	1	10	7	
Bushtit	1.25	7	6	1	0	2	0	4	4	0	6	
Bewick's Wren	2.14	12	10	7	1	1	1	3	3	8	9	
Swainson's Thrush	2.86	16	12	17	0	13	13	8	8	1	28	
European Starling	1.43	8	8	0	0	4	0	0	0	8	0	
Orange-crowned Warbler	0.18	1	1	0	0	0	0	1	0	0	1	
Yellow Warbler	1.07	6	6	0	1	4	0	1	0	0	6	
Common Yellowthroat	0.54	3	1	3	0	3	3	0	0	1	3	
Wilson's Warbler	2.50	14	14	0	0	6	2	4	0	4	10	
Black-headed Grosbeak	0.71	4	4	0	0	3	2	1	1	1	3	
Spotted Towhee	0.18	1	1	0	0	1	1	0	0	0	1	
California Towhee	0.54	3	3	0	0	0	0	1	1	2	1	
Song Sparrow	3.04	17	10	9	0	4	4	2	2	10	9	
Red-winged Blackbird	0.71	4	4	0	0	1	1	3	3	0	4	
Western Tanager	0.18	1	1	0	0	0	0	1	0	0	1	
House Finch	0.36	2	2	0	0	2	0	0	0	0	2	
American Goldfinch	0.54	3	3	0	0	0	0	3	1	2	1	
<b>Total Captures</b>	<b>23.41</b>	<b>131</b>	<b>111</b>	<b>49</b>	<b>10</b>	<b>49</b>	<b>28</b>	<b>40</b>	<b>28</b>	<b>56</b>	<b>108</b>	
<b>Total Species</b>		<b>23</b>	<b>23</b>	<b>9</b>	<b>5</b>	<b>16</b>	<b>9</b>	<b>18</b>	<b>12</b>	<b>15</b>	<b>24</b>	

First Captures = New and recaptured birds accounted for only once (does not include unbanded species)

Capture Rates = Captures Per 100 Net Hours

CP = Cloacal Protuberance; BP= Brood Patch; HY = Hatch Year; AHY = After Hatch Year

Appendix 6.1 Monitoring Avian Productivity and Survivorship (MAPS) Banding Data Sheet

**MAPS Banding Sheet**      Page # \_\_\_\_\_      Band Size \_\_\_\_\_

Year \_\_\_\_\_      ACE \_\_\_\_\_      SEX \_\_\_\_\_      HOW AGED & HOW SEXED \_\_\_\_\_

<input type="checkbox"/> LOCATION	<b>COOE</b> New Band N, Band Destroyed <input type="checkbox"/> L Band Changed C, Band Lost Double Banded A *Old # in here	<b>AGE</b> 4 All Second Year B 3 Third Year 7 2 All Third Year 8 1 Indeterminable 0 5 Unattempted 9	<b>SEX</b> M Male F Female I Indeterminable U X Unattempted	<b>HOW AGED &amp; HOW SEXED</b> J Jun Plumage J Feather Wear P Plumage P Molt/Shell M Molt Eye Color	<b>WING LENGTH</b> W Wing Length T Tail Length O Other* Note Required																	
<b>BAND PHASE II</b>	<b>SPECIES NAME</b>	<b>SPECIES ALPHA CODE</b>	<b>AGE</b>	<b>HOW AGED</b>	<b>SEX</b>	<b>HOW SEXED</b>	<b>SKULL</b>	<b>C.P.</b>	<b>B.P.</b>	<b>FAT</b>	<b>B.M.T.</b>	<b>FF.M.T.</b>	<b>FF.W.R.</b>	<b>AN.P.L.</b>	<b>WING</b>	<b>WEIGHT</b>	<b>STATUS</b>	<b>DATE</b> MO DAY	<b>CAP TIME</b>	<b>STATION</b>	<b>NET</b>	<b># SACN</b>

Banders \_\_\_\_\_

Appendix 6.2 Big Sur Ornithology Lab (BSOL) Area Search Form

**AREA SEARCH FORM**

Area # \_\_\_\_\_ Visit # \_\_\_\_\_ Date: \_\_\_\_\_  
 Start Time: \_\_\_\_\_ End Time: \_\_\_\_\_  
 Temperature \_\_\_\_\_ °C Cloud Cover \_\_\_\_\_ % Wind Speed \_\_\_\_\_ (BFT)  
 Observers: \_\_\_\_\_  
Explanation if Start Time to End Time is not 30 min:

Species	Tally of Individuals Song, Visual, Call, one letter per individual	Behavior (check if applicable)*								
		Total	FO	CO	DI	PA	CM	CF	NE	FLE

# of species \_\_\_\_\_ # of individuals \_\_\_\_\_  
 FO-foraging, CO-copulation, DI-territorial display, PA-par, CM-carrying material, CF-carrying food, NE-nest, FLE- fledgling  
 Notes and flyovers: \_\_\_\_\_  
 \_\_\_\_\_