

# Vertebrate Use of a Restored Riparian Site: A Case Study on the Central Coast of California

DIANNA M. QUEHEILLALT,<sup>1</sup> *Department of Biological Sciences, California State University, Sacramento, CA 95819, USA*

MICHAEL L. MORRISON,<sup>2</sup> *Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX 77843-2258, USA*

(JOURNAL OF WILDLIFE MANAGEMENT 70(3):859–866; 2006)

## Key words

*Carmel River, Carmel River Mitigation Bank, focal species, habitat use, restoration, riparian, vertebrates.*

Riparian vegetation is used by vertebrate species for overwintering, breeding, and migration stopover (Stevens et al. 1977, Henke and Stone 1979, Knopf et al. 1988, Knopf and Samson 1994). The importance of riparian vegetation in the southwest United States is amplified by its disproportionate use by wildlife (Knopf and Samson 1994). Rapid growth of human populations has adversely affected wildlife habitat because lands are now being converted to farms, pastures, and urban developments. Less than 1% of the original riparian vegetation of the western United States remains intact (Knopf et al. 1988, Knopf and Samson 1994).

Many riparian areas have undergone severe groundwater depletions resulting from damming of rivers (Kondolf and Curry 1981, Zentner 1981). The Carmel River in the Santa Lucia drainage basin, USA, is a prime example of the effects of depleted groundwater on a watershed. The Carmel River stream corridor has declined substantially in riparian vegetation because of groundwater losses related to the Los Padres and San Clemente dams, agricultural uses, and housing developments along the river's edge (Kondolf and Curry 1981).

Loss of riparian areas, such as those along the Carmel River, has led to an ever-increasing need to restore these areas. Historically, restoration has centered primarily on the establishment of vegetation (Palmer et al. 1997), with little or no attention given to subsequent vertebrate use of sites. More recently there has been increasing attention given to the wildlife component of restoration (Patten 1997, Kus 1998, Brown 1999, McCoy and Mushinsky 2002). Restoration ecologists, however, often assume that after the riparian vegetation has become established, vertebrates will colonize the restored site (Palmer et al. 1997, Morrison 2002). To understand whether an area supports growing populations of vertebrates, it is imperative to understand the suitability of an area as habitat for terrestrial vertebrates. The presence of high densities of vertebrates alone does not always ensure high quality of habitat (Van Horne 1983, Pulliam 1988, Robinson et al. 1995). To assess habitat quality for a population or community, use of the habitat must first be determined. Our primary objective was to determine use by vertebrates of a riparian restoration site (Carmel-by-the-Sea, California, USA). Our study can be used as an example of how the effectiveness of an ongoing restoration project can be assessed and modified.

<sup>1</sup> Present Address: Department of Wildlife Ecology, University of Maine, Orono, ME 04469-5755, USA

<sup>2</sup> E-mail: mlmorrison@ag.tamu.edu

## Site History and Restoration

In the late 1800s, the Carmel River flowed year-round, and the riparian zone supported a forest with an adjacent lagoon (Palou 1874). According to Williams (1991) the first record regarding alteration of the floodplain occurred in 1911, when a levy was built along the south side of the river mouth. Subsequently, from 1924 to 1974, the land was farmed for artichokes. In 1974, the California Department of Parks and Recreation (CDPR) bought 62.7 hectares of the land and created the Carmel River State Beach (California Department of Transportation, unpublished report, 1996). In 1996, the California Department of Transportation (CalTrans) began to restore the Carmel River Bank Mitigation Site (hereafter CRMB; California Department of Transportation, unpublished report, 1996). CalTrans restored the site to mitigate for future "unavoidable impact to wetlands and riparian habitats associated with transportation projects in the Monterey area" (California Department of Transportation, unpublished report, 1996). Under the restoration plan, 15.0 ha of woody riparian species and 2.4 ha of freshwater wetland species were planted in 1996 to 1998. The vegetation communities at the CRMB are now immature riparian forest, coastal marsh, and central-coast riparian scrub. As the vegetative structure and composition varies among these patches, the CRMB site offers an opportunity to examine associations between vertebrate species assemblages and riparian vegetation over time and space.

## Study Area

The Carmel River Mitigation Bank (CRMB), Monterey County, California, USA (36°32'16"N, 121°54'53"W), is 17.4 hectares adjacent to the Carmel River mouth, south of the Carmel River, and west of Highway 1. Average annual temperature ranges from 9 to 18°C, and total precipitation averages 0.51 m, which is within the monthly averages for the duration of our study (NOAA 2002).

## Study Units

Based on soil type and vegetative composition, we established 5 distinct units at, or adjacent to, the CRMB site. Units 1, 2, and 3 were on the CRMB site, whereas units 4 and 5 were adjacent to the site but along the river. Units 1, 2, and 3 were immature riparian forest communities, planted on Metz fine sandy loam (California Department of Transportation, unpublished report, 1996). Unit 1 was 65,000 m<sup>2</sup>, unit 2 was 28,000 m<sup>2</sup>, and unit 3 was 17,400 m<sup>2</sup> in area. Units 4 and 5 were mature riparian forest communities, 47,420 m<sup>2</sup> and 24,780 m<sup>2</sup> in area, respectively, on a