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Bat Inventory of the San Diego County Multiple Species Conservation Program Area

Interim Report

Prepared for:

County of San Diego
California Department of Fish and Game

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

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ABSTRACT

Twenty-three of the 45 bat species known to occur in North America have been documented in San Diego County over time. Although historical information exists for many of these species, there is very little information regarding their current status and distribution. In the past several decades, there have been extensive changes to the coastal plain, inland valley, and foothill areas as a result of rapid population growth and associated urban expansion. Many native habitats and species appear to have declined or have been extirpated from these areas. In response, a network of lands for preservation of native species is currently being planned and executed throughout the county as part of the Natural Community Conservation Plan. We are currently conducting a 3-year survey of San Diego County Multiple Species Conservation Program (MSCP) area lands using acoustic techniques, spotlights, and mist nets to detect and identify bats at foraging sites. We are supplementing this effort with surveys of selected potential roost sites such as caves, tunnels, bridges, and abandoned buildings using acoustic, visual, and capture techniques. It is our purpose to provide current information on species' ranges and seasonal activity patterns in the San Diego County MSCP area. This data will be valuable for comparison of current versus historical distribution of bat species, provide baseline data for biological monitoring of the NCCP preserve system, and aid in future conservation planning. Preliminary data are presented.

INTRODUCTION

To conserve natural resources on public lands, inventory and monitoring of native plant and animal species has become a priority for various agencies and local governments in San Diego County. Twenty-three bat species representing three families have been documented in San Diego County over time (Miner and Stokes, in prep., Table 1). Two of these species, the lesser long-nosed bat (*Leptonycteris curasoae*) and the little brown bat (*Myotis lucifugus*), are known only from single records (Bond 1977, Constantine 1998) that represent considerable species range extensions, and are likely vagrants. Therefore, 21 species are thought to regularly occur in San Diego County year-round or seasonally. However, current information is lacking regarding the distribution and seasonal trends of bats within San Diego County, including the MSCP area.

The United States Geological Survey (USGS) is currently conducting a bat inventory study of the San Diego County Multiple Species Conservation Program (MSCP) area. The goals of the USGS are to:

1. Gather baseline data on the presence, distribution and activity levels of bat species in MSCP/NCCP preserve areas,
2. Record all relevant information in a GIS database,
3. Identify significant roosts and foraging habitats that are in need of immediate protection,
4. Recommend long-term monitoring sites based on data collected during this project,

5. Provide preliminary evaluation of the functionality of the MSCP preserve system for bat species based on data gathered on species distribution and richness, and,
6. Aid in the development of management plans for areas used by certain sensitive species deemed dependent on habitats in the preserve by providing data and making management recommendations.

This information will aid local resource agencies in making management decisions that could affect bats and contribute to regional efforts focusing on the current status and distribution of bat species.

STUDY AREA AND METHODS

Study Area

Twenty three sites within the San Diego County MSCP area were surveyed for bats (Figure 1, Table 2). These sites were associated with six major drainages: 1. San Dieguito River, 2. Poway Creek, 3. San Diego River, 4. Sweetwater River, 5. Otay River, and 6. Tijuana River.

Site Descriptions

San Dieguito River Watershed

Boden Canyon Ecological Reserve (SITE 3), California Department of Fish and Game
The Boden Canyon Ecological Reserve is located in the foothills above the San Dieguito River. It contains a small portion of Santa Ysabel Creek and a much larger portion of one of its tributaries, along with the surrounding hillsides. The tributary of Santa Ysabel Creek consist of an upper portion and a lower portion divided into an upper and lower portion by a large artificially created stock pond. The upper portion has seasonal surface water in the creek. The lower portion has perennial surface water that is restricted to a few small ponded areas along the creek during dry conditions. The main tributary forms a confluence with the Santa Ysabel Creek at the southern end of the lower portion of the reserve. Both Santa Ysabel Creek and its tributary are lined with oak woodland, sycamores, and other riparian vegetation and coastal sage scrub covers the hillsides. There are a number of exposed rocky outcrops on the surrounding hillsides.

4S Ranch (SITE 1), County of San Diego
Situated on the north side of Black Mountain, Lusardi Creek bisects 4S Ranch. The creek is dammed at two points, which form two large ponded areas (each approximately 200 meters long) separated by approximately a kilometer. The easternmost pond has a strong odor and irregular color. Rushes surround the edges of the ponds. A thin riparian

strip comprised of willows, elderberry, and laurel sumac characterizes the unponded areas of the creek. Non-native species including fan palm, tamarisk, and fennel also occur in the immediate area. A housing development project was underway adjacent to the northern portion of the riparian edge of the ponds and a newer neighborhood abutted the property at the western edge. At the north side of the creek, a mosaic of chaparral/coastal sage scrub was intermixed with a disturbed low-growing non-native dominated vegetative community overlaid by a small dirt road network. Downstream from 4S Ranch, just west of the Lusardi Creek parcel boundary, the creek drains into the San Dieguito River. Along this stretch, willow dominates the riparian zone.

Poway Creek Watershed

Los Penasquitos Canyon Preserve (SITE 10), City of San Diego
The Los Penasquitos Preserve extends to within 3 kilometers of the Pacific Coast were it is hydrologically linked by the perennial Penasquitos Creek. The preserve contains riparian, grassland, coastal sage scrub, and chemise chaparral, habitat types. Penasquitos Creek historically had a seasonal hydroperiod but has become perennial as a result of the effects of urbanization. Currently, the riparian corridor, extending the length of the preserve, is composed of large mature willows stands with oaks occupying the slightly higher slopes and coastal sage scrub primarily on the north facing canyon slope and chemise covering the south-facing slope. Grasslands also occupy the low-lying canyon bottom.

San Diego River Watershed

Sycamore Canyon/Gooden Ranch Open Space Preserves (SITE 21), County of San Diego
Sycamore Canyon, which includes Gooden Ranch, is located in the inland valleys and foothills of Santee. Sycamore canyon is a tributary of the San Diego River. It has seasonal surface water except for a small seep-fed pond that is possibly perennial. There is riparian scrub vegetation such as mulefat and broom baccharis along the creek in addition to riparian trees including willows, cottonwoods, sycamores, and oaks. There are open grassy floodplains adjacent to the creek and the surrounding hillsides are covered in coastal sage scrub and chaparral. There are a few rocky outcrops in the upper portion of Sycamore Canyon. There are a number of man-made structures on site including a few abandoned buildings associated with Gooden Ranch.

El Monte County Park (SITE 7), County of San Diego
The El Monte County Park is located on the south side of the San Diego River just west of El Capitan Reservoir. It is a flat area in the floodplain of the San Diego River that is covered with non-native grass and has a few scattered large oaks and sycamores. The hillside south of the park has undisturbed coastal sage and chaparral vegetation with oaks of varying sizes.

Mission Trails Regional Park, San Diego River (SITE 11), City of San Diego
Mission Trails Regional Park, is bordered by Miramar Naval Air Station to the north and northwest and housing developments on all other sides. There are two bodies of water at Mission Trails Regional Park, which include Kumeyaay Lake and the San Diego River. The Kumeyaay Lakes are a series of large ponds created by historic sand extraction activities. The lakes remain filled today although the river has since been redirected. The ponds are surrounded by clumps of sycamore, willow and cottonwood and emergent vegetation including cattails and non-native aquatic primrose. The San Diego River intersects Mission Trail Regional Park flowing from Kumeyaay Lake, southwest through Mission Gorge. A thick willow, sycamore, cottonwood riparian zone parallels the river for almost its entire length. Slow-moderate flowing water forms a series of long, deep pools characterize the river for most of its length in the park. Areas adjacent to the river are dominated by oak woodland that transitions quickly into steep rugged slopes covered by chaparral and rocky outcrops.

Mission Valley, San Diego River - (SITE 12), City of San Diego
The San Diego River in Mission Valley has been highly modified to accommodate rapid urbanization, and more recently, as part of a flood control project. As recently as 4 decades ago, primary habitat modifications in Mission Valley adjacent to the San Diego River, included cattle grazing on the sparsely vegetated sandy flood plains, and to a more limited degree, loss of habitat to roadways and human structures. However currently, virtually all the native vegetation and associated animal communities in the entire valley bottom has been extirpated as a result of the conversion to commercial, residential, and to an increasingly limited degree, sand extraction operations. The historically seasonal San Diego River now flows year round as a result of urbanization and the associated runoff. The riparian corridor of the San Diego River primarily consists of mature willow woodlands which contain an entire suite of non-native invasive vegetation including, but not limited to, arundo, casterbean, and fennel.

Crestridge Ecological Reserve (SITE 6), California Department of Fish and Game
The Crestridge Ecological Reserve is located in the foothills above the El Cajon Valley. It consists of an eastern upper plateau portion that slopes westward down towards the valley. The upper portion is dominated by oak woodland that is surrounded by coastal sage covered hills with an abundance of exposed rock. There is a small seasonal creek that travels through the upper plateau down the western slope through Rios Canyon towards Los Coches Creek. This creek is heavily incised in the upper flat portion of the reserve and is fairly narrow and rocky as it flows down through Rios Canyon. It is lined with fairly large riparian trees such as sycamores and willows in the upper portion but as the creek flows down through Rios canyon the trees are reduced in numbers and size. There are a few abandoned buildings among the oaks in the upper portion of the reserve. Most of the western part of the reserve is located on the north side of Rios Canyon and consists of coastal sage covered hillsides with an abundance of exposed rock.

Sweetwater River Watershed

Sycuan Peak Ecological Reserve (SITE 22 and 23), California Department of Fish and Game

The Sycuan Peak Ecological Reserve incorporates the Sweetwater River and Lawson Creek. The reserve is located below the Loveland Reservoir. Sycamore, willow, and cottonwood characterized the dominant canopy vegetation with mulefat, poison oak, mugwart, and grape occurring in the understory. Pooled water in the drainage channels supported cattails, rush, and duckweed. In 2000, a fire burned through a large portion of the reserve leaving many of the slopes facing the drainages denuded. Chaparral and costal sage scrub remains on unburned slopes and a non native grassland/oak woodland occur at the confluence. Large rock outcrops occur along both canyons.

San Diego National Wildlife Refuge (SITE 17, 18, and 19), US Fish and Wildlife Service

The San Diego National Wildlife refuge consists of several parcels of relatively undisturbed land found in the inland valleys and western foothills of Rancho San Diego and Jamul. The Sweetwater River and several of its tributaries occur within several of these parcels. The Sweetwater River has permanent surface water in some reaches and seasonal surface water in other reaches and in its tributaries. The river and its tributaries are characterized by the presence of willows, cottonwoods, sycamores, and oaks along with riparian scrub type plants such as mulefat and broom baccharis. The upland portions of the refuge are characterized by flat grassy areas that transition into relatively steep slopes of coastal sage scrub and chaparral habitats with numerous rocky outcrops and a few natural caves.

Singing Hills Memorial Estates (SITE 20), The Environmental Trust

The Singing Hills Memorial Estates is located in the foothills above the Sweetwater River just west of Dehesa Valley. It consists of fairly steep south facing slopes covered with coastal sage scrub and chaparral. There is an abundance of exposed rock including a series of large, pillar-like granite boulders that line the ridge near the top of the slopes. At the base of the slopes there is a small remnant creek lined with a few willows and sycamores. There is also cemetery where non-native grass, trees, and a small artificial perennial pond occurs.

Otay River Watershed

Hollenbeck Canyon Wildlife Area (SITE 8 and 9), California Department of Fish and Game

The Hollenbeck Canyon Wildlife Area incorporates Dulzura Creek and three tributaries, Pringle and Hollenbeck Creeks and one unnamed tributary, dubbed the Honey Springs drainage. Dulzura Creek parallels Highway 94 currently initiating from the Barrett Flume and draining from the Hollenbeck Canyon Wildlife Area, under Highway 94, southward

into Ranch Jamul Ecological Reserve. Pringle Creek, Honey Springs drainage, and Hollenbeck Creek, feed into Dulzura from the northeast. Pooled water at the eastern end of Dulzura Creek became intermittent and then dries as it progressed downstream. Large articles of trash, were strewn along Dulzura Creek. In contrast, Pringle and Hollenbeck Creek were free of such debris. Pringle and Hollenbeck Creeks both contained shallow pooled water for most of their length early in the year and dried at the lower extent of their reaches later in summer. Honey Springs drainage was shallow and intermittent. Riparian canopy along Dulzura and its tributaries included willow, oak, and sycamore with poison oak, wild rose, and arundo in the understory. Oak woodland occurred at the lower half of Hollenbeck Canyon. A few clusters of ranches with outbuildings exist along the Honey Springs Drainage. Rugged hilly terrain (Jamul Mountains) covered with chaparral and rock outcrops surrounded the riparian areas.

Rancho Jamul Ecological Reserve (SITE 16), California Department of Fish and Game
The Rancho Jamul Ecological Reserve is located in the foothills and valleys of Jamul. It is a large reserve that contains portions of Jamul Creek and Dulzura Creek along with portions of some of their tributaries. The creeks and their tributaries are surrounded by broad flat valleys and rolling hills. The creeks are heavily incised with relatively sandy streambeds throughout most of their lengths within the reserve. They have seasonal flow with the exception of Dulzura Creek, which sometimes flows year round when water is being release from the Barrett Reservoir down into the Otay Reservoirs. The creeks are lined sporadically with large sycamores and a few oaks and willows dominate some reaches of the creeks. The riparian vegetation is noticeably restricted to the immediate vicinity of the creeks and there are no trees in the outer portions of the floodplains. Most of the surrounding valleys are flat broad fallowed agricultural fields that were also grazed and are now covered in non-native grasses and shrubs. Many of the hillsides consist of disturbed grassland and coastal sage scrub; however, there are few slopes with undisturbed coastal sage scrub and chaparral vegetation. There are a number of artificially created cattle ponds that are networked by a complex of irrigation ditches. Only one of these ponds (known as the "Pump Pond") holds water throughout the year. There is a concrete cistern that also holds year around water. In addition to several buildings that are currently occupied, there are a few other man-made structures found on the reserve including a historic brick kiln, an unidentified concrete chimney-like structure, several culverts, and a bridge.

Otay Mountain – Cedar Canyon (SITE 13), Bureau of Land Management
Cedar Canyon, located on the north side of Otay Mountain. It is a seasonal tributary of Dulzura Creek that is narrow and rocky in its upper reaches and transitions into a relatively broad low gradient stream with a rock and cobble bed. Tecate Cypress lines the upper reaches and the lower reaches are dominated by oak woodland that grows on flat terraces adjacent to the creek. Coastal sage scrub and chaparral dominates the steep rocky slopes above the creek. There is an old horse trough with year round water located among some oak trees in the lower portion of the canyon. At the base of the canyon there is a private campground known as Thousand Trails that owns the property surrounding the confluence of Cedar Canyon with Dulzura Creek.

Otay Mountain – O'Neil Canyon (SITE 14), Bureau of Land Management
O'Neil canyon is a drainage located on the west side of Otay Mountain. It is a seasonal tributary of the Otay River that is fairly narrow and rocky throughout most of its length until very near the confluence with the Otay River where it begins to flatten and broaden and has a primarily cobble bed. It is lined with Tecate Cypress along its upper reaches where the trees can be quite dense but there are very few riparian trees except a few sycamores and willows that dot the middle and lower reaches. The slopes above the creek consist of coastal sage scrub and some maritime succulents. There are numerous rocky outcrops along the slopes and portions of the creek are rock walled.

Tijuana River Watershed

Cottonwood Creek - Marron Valley (SITE 5), City of San Diego
The portion of Cottonwood Creek in Marron Valley is the lowest portion of the drainage before it joins the Tijuana River. It traverses through Marron Valley with the dominant soil type being depositional sand. However, because Cottonwood Creek through Marron Valley is below Barrett Dam, there is continuous the net loss of transported sandy bed load in this reach, transforming the channel from a wide sandy braided channel to a more defined rock and boulder strewn channel. Currently the vegetation in the seasonal creek bed mainly consists of mulefat and scrub willow, while the adjacent sand terraces support coastal sage scrub. This area has just been cleared of cattle that have grazed the valley bottom for decades.

Methods

Two types of bat surveys were conducted during USGS bat inventories of the San Diego County MSCP area:

1. Foraging (F) bat surveys: a combination of mist-netting (C), acoustic (A), and visual (V) techniques were used for a minimum of three hours beginning at sunset (Denoted in Table 3 "survey methods" as F[A,C,V]) to survey for foraging bats. Multiple survey visits (five) were conducted at each of five sites characterized by the presence of perennial water, woodland, and exposed rock. Foraging bat surveys were conducted on 39 nights at 17 sites from May 6, 2002 through February 5, 2003.

2. Roosting (R) bat surveys: diurnal and nocturnal surveys of suspected roosts using one or combination of acoustic (A), visual (V), and capture (C) techniques were conducted (Denoted in Table 3 "survey methods" as R[A,C,V]). Roosting bat surveys were conducted on 11 days/nights at 6 sites from May 10, 2002 through October 29, 2002.

Weather variables (cloud cover, air temperature, wind speed, and relative humidity) were recorded at start and end of foraging bat surveys. All data was collected on an electronic personal digital assistant (PDA) allowing rapid and error-free data transfer into database.

PRELIMINARY RESULTS

- Fifteen bat species were detected in the San Diego County MSCP area from May 6, 2002 through February 5, 2003 (Table 1).

- The proportion of sites at which each of the 15 bat species was detected varied from greater than 70% (Mexican free-tailed bat *Tadarida brasiliensis*) to less than 10% (California Leaf-nosed Bat *Macrotus californicus*, Figure 2).

- Big brown bats (*Eptesicus fuscus*) were detected at 13 of 23 sites and pallid bats (*Antrozous pallidus*) were detected at only 3of 23 sites during 2002 USGS bat inventories (Table 2).

- Of the five foraging bat survey sites that had multiple visits the number of bat species detected at each site varied from 8 to 13 with the greatest number of species detected at each of two sites (Cottonwood Creek [CC (MV)], Hollenbeck Canyon [HBCWA]) located in the southern portion of San Diego County where inland valleys interface with western foothills (Figure 3).

PRELIMINARY CONCLUSIONS AND DISCUSSION

Historically, both the big brown bat and pallid bat were considered to be equally common to abundant in the coastal plains, inland valleys, and western foothills of San Diego County (Krutzsch 1948). These two species provide for a comparison of how changes to the western San Diego County landscape over the past 50 years or so may have differentially affected bats. Based on our preliminary results, the coastal form of the pallid bat appears to have experienced a considerable range contraction within western San Diego County since the late 1940s while the big brown bat has not. This is attributed to the specialized foraging needs of the pallid bat compared to the big brown bat. The pallid bat is primarily a terrestrial foraging species that depends on being able to locate and capture large bodied terrestrial arthropods such as Jerulsalem Crickets (*Stenopalmatus* sp.) at ground level while the big brown bat is more of a generalist feeder that captures its prey by aerial hawking in a variety of different habitats (Barbour and Davis 1969).

Southern inland valleys and foothills of San Diego County MSCP area are currently supporting at least part of the needs of a rich bat population including species that are presumed rare such as the California leaf-nosed bat (*Macrotus californicus*), Townsend's big-eared bat (*Corynorhinus townsendii*), pallid bat (*Antrozous pallidus*), and big free-tailed bat (*Nyctinomops macrotis*). However, Coastal canyon preserves such as Los Penasquitos Canyon Preserve and Mission Trails Regional Park are also supporting at least part of the needs of a fairly rich bat population (8 and 9 species respectively) in an

otherwise urbanized landscape indicating the importance of these urban preserves to the bat community.

Protection of roost sites within the MSCP area is warranted. These roost sites include natural and artificial caves and tunnels located in the vicinity of Cottonwood Creek, Dulzura Creek, Sweetwater River, and the San Diego River. Several of these caves and tunnels are supporting at least part of the roosting needs of populations of sensitive bat species including Townsend's big-eared bats and California leaf-nosed bats. It is recommended that, as a priority, future bat research efforts within the MSCP area include a focused study to determine the extent of bat usage of these mines, tunnels, and caves. This will allow for protection of the cave and cave-like roosts that have been determined as most important to populations of sensitive bat species in a prioritized manner.

There are several structures in the southern portion of the MSCP area that are supporting night roosting bats. One of these structures was surveyed during this research and it has been determined that it is being used by several sensitive bat species (pallid bat, Townsend's big-eared bat, long-eared myotis) as a night roost at least. It is recommended that this information be made available to the appropriate managers so that they are aware of the bat use of the surveyed structure they are responsible for as well as other structures in the area that were not surveyed. This will allow them to consider bats in any management plans they may have for those structures. As projects develop that may impact these particular structures or any structures that might be supporting roosting bats it is recommended that focused roost surveys be conducted on a case-by-case basis. Case-by-case focused roost surveys conducted by competent bat biologists (biologists should be permitted to handle bats in the state of California) will be required to adequately determine the full extent of bat usage of any particular structure. Detailed information regarding bat use of a structure and how a particular project or activity may impact that structure will be required before specific management recommendations can be made.

There are also a number of rocky outcrops and cliffs within the MSCP area that are supporting colonies of free-tailed bats including sensitive species such as the Western mastiff bat and the pocketed free-tailed bat. Key areas where rocky habitats identified as potential or verified bat roosts include near Boden Canyon Ecological Reserve, near Lake Hodges, near San Vicente Reservoir, El Cajon Mountain, Mission Trails Regional Park, Crestridge Ecological Reserve, Singing Hills Memorial Estates, near Loveland Reservoir, the San Diego National Wildlife Refuge, the Jamul Mountains, and the San Ysidro Mountains. These rocky habitats are probably less vulnerable to development or disturbance than are the caves and other man-made roosts that are more accessible to people. However, these rocky habitats are potentially vulnerable to destruction or disturbance from road building and improvement projects, water impoundment projects, rock mining, and recreational rock climbing activities. It is recommended that future bat research efforts within the MSCP area include a focused study to determine where specifically significant rocky outcrop and cliff roosts of sensitive bat species actually occur and what the extent of their use is (seasonality of use, use by reproductive females or not, numbers of bats, etc). It is also recommended that focused bat roost surveys of potential rocky outcrop/cliff habitats that may be impacted by developments or other

projects be conducted on a case-by-case basis. Detailed information regarding bat use of specific rocky outcrops/cliffs and how a particular project or activity may impact those habitats will be required before specific management recommendations can be made.

The sites where foraging bat surveys were conducted appear to be supporting, at least in part, the foraging needs of a community of a variable number of bat species. Some of these sites (such as Hollenbeck Canyon and Cottonwood Creek) are supporting at least part of the needs of a large number of bat species while other sites (such as the San Diego River in Mission Valley and the 4-S Ranch) are supporting at least part of the needs of fewer bat species but bats are feeding there nonetheless. Habitat components of foraging sites that might be most important to feeding bats include 1) open, accessible fresh water (for drinking and insect productivity), 2) riparian trees (such as oaks, sycamores, cottonwoods, and willows), 3) native scrub (such as coastal sage scrub and chaparral), and 4) native grassland. It is suspected that, in general, the value of a particular foraging site to the bat community increases as the number and amount of these habitat components found on site increase. Sites that have a high diversity and abundance of these habitat components are likely to be more valuable to foraging bats than sites that lack these components. However, it is important to realize that any foraging sites must be located in the vicinity of suitable bat roosting habitat and within the range of any particular species' flight distance for the sites to have any value to bats. Therefore, foraging sites that have a high diversity and abundance of the habitat components mentioned above that are located near diverse and abundant roosting habitats should be considered as having a very high value to the bat community. It is these types of sites that warrant the greatest amount of protection and management consideration.

A landscape level approach will likely be required to facilitate effective bat research and conservation in any setting. Ultimately, protection and management of the bat community that is occurring entirely or partially within the MSCP area of San Diego County is going to require a coordinated effort between the various land owners and managers whose properties are encompassed by the MSCP area. For example, the Townsend's big-eared bat, a sensitive bat species, appears to be using one particular tunnel managed by the City of San Diego and a series of relatively nearby abandoned mines as day roosts throughout the entire or some portion of the year. Some of these mines are located on Otay Moutnain and are managed by the Bureau of Land Management while others are located on McGinty Mountain and are currently managed by The Nature Conservancy, but will ultimately be managed by the United States Fish and Wildlife Service. There is at least one structure that is being used as a night roost by these bats, probably year-round. It is managed by Cal-Trans but is located on California Department of Fish and Game land. These bats have been detected at two foraging sites in the general vicinity of these roosts. One of these foraging sites is Cottonwood Creek in Marron Valley, which is managed by the City of San Diego. The other foraging site is the San Diego National Wildlife Refuge, which is managed by the United States Fish and Wildlife Service. It is not known if all these observed bats are part of the same colony or population since the bats were not marked for identification. If these bats are indeed part of the same colony or population then all of these agencies/land managers would have to play a role in the maintenance and preservation of this particular colony or population of bats. If any one of these

agencies/land managers failed to appropriately protect the habitats identified as important to this particular colony or population of bats it could result in their decline or extirpation. It is recommended that future bat research efforts within the MSCP area include radio telemetry studies that focus on the identification of various roosting and foraging habitat components that make up the "ecological neighborhood" of a particular colony or population of sensitive bat species that has been identified by our research or future research efforts. These habitats could then be ranked with a conservation value that is determined by biological and sociopolitical criteria and monitored throughout time (Ball 2002). Sensitive colonial species that should be studied in this way include the pallid bat, Townsend's big-eared bat, California leaf-nosed bat, and Western mastiff bat.

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Table 1. This table represents the 15 bat species detected within the San Diego County MSCP area of the 23 bat species known to occur in San Diego County.

Bats of San Diego County (23 Species)					
Bat Species				Legal Status[1]	Detected through 2/5/03
Family	Scientific name	Common name	Species code	CSC, FSC, FSS, BLM, FE	MSCP
Phyllostomatidae	*Macrotus californicus*	California leaf-nosed bat	MACA	CSC, FSS, BLM	X
	Choeronycteris mexicana	Mexican long-tongued bat	CHME	CSC	NOT DETECTED
	Leptonycteris curasoae	Lesser long-nosed bat	LECU	FE	NOT DETECTED
Vespertilionidae	*Myotis lucifugus*	Little brown bat	MYLU	none	NOT DETECTED
	Myotis yumanensis	Yuma myotis	MYYU	FSC, BLM	X
	Myotis evotis	Long-eared myotis	MYEV	FSC, BLM	X
	Myotis thysanodes	Fringed myotis	MYTH	CSC*, FSC, BLM	NOT DETECTED
	Myotis volans	Long-legged myotis	MYVO	CSC*, FSC, BLM	NOT DETECTED
	Myotis californicus	California myotis	MYCA	none	X
	Myotis ciliolabrum	Small-footed myotis	MYCI	FSC, BLM	X
	Lasionycteris noctivagans	Silver-haired bat	LANO	none	NOT DETECTED
	Pipistrellus hesperus	Western pipistrelle	PIHE	none	X
	Eptesicus fuscus	Big brown bat	EPFU	none	X
	Lasiurus blossevillii	Red bat	LABL	CSC*, FSS	X
	Lasiurus xanthinus	Yellow bat	LAXA	CSC*	NOT DETECTED
	Lasiurus cinereus	Hoary bat	LACI	none	X
	Euderma maculatum	Spotted bat	EUMA	CSC, FSC, BLM	NOT DETECTED
	Corynorhinus townsendii	Townsend's big-eared bat	COTO	CSC, FSC, FSS, BLM	X
	Antrozous pallidus	Pallid bat	ANPA	CSC, FSS, BLM	X
Molossidae	*Tadarida brasiliensis*	Mexican free-tailed bat	TABR	none	X
	Nyctinomops femorosaccus	Pocketed free-tailed bat	NYFE	CSC	X
	Nyctinomops macrotis	Big free-tailed bat	NYMA	CSC	X
	Eumops perotis	Western mastiff bat	EUPE	CSC, FSC, BLM	X

[1] Legal status categories include California Species of Special Concern (CSC), species proposed to become California Species of Special Concern (CSC*, Betsy Bolster pers. comm.), Federal Species of Concern (FSC), Forest Service Sensitive (FSS), Bureau of Land Management Sensitive (BLM), and Federally Endangered (FE). Source: Calif. Dept. of Fish and Game, Special Animals List, July 2002.

Table 2. San Diego County MSCP area bat survey sites including their approximate coordinates.

Site Number	Site Name	Site Code	Lat (wgs84)	Long (wgs84)
1	4S Ranch	4SR	33.0004166666666	117.103533333333
2	Barrett Cave	BC	sensitive	sensitive
3	Boden Canyon Ecological Reserve (Lower)	BCER (L)	33.0901666666666	116.89565
4	Boden Canyon Ecological Reserve (Upper)	BCER (U)	33.1399833333333	116.894316666666
5	Cottonwood Creek (Marron Valley)	CC (MV)	32.5692833333333	116.763466666666
6	Crestridge Ecological Reserve	CRER	32.8286	116.857483333333
7	El Monte County Park	EMCP	32.8918666666666	116.847483333333
8	Hollenbeck Canyon Wildilfe Area	HBCWA	32.6787	116.822633333333
9	Jamul Mountains	JM	32.6725333333333	116.760566666666
10	Los Penasquitos Canyon Preserve	LPCP	32.9273666666666	117.176383333333
11	Mission Trails Regional Park (San Diego River)	MTRP (SDR)	32.82125	117.06225
12	Mission Valley (San Diego River)	MV (SDR)	32.7731	117.140633333333
13	Otay Mountain (Cedar Canyon)	OTM (CC)	32.6445166666666	116.848433333333
14	Otay Mountain (Oneil Canyon)	OTM (OC)	32.5874666666666	116.9117
15	Rancho Jamul Ecological Preserve (Night Roost)	RJER (NR)	sensitive	sensitive
16	Rancho Jamul Ecological Preserve (Jamul Creek)	RJER (JC)	32.6650333333333	116.867766666666
17	San Diego National Wildlife Refuge-boulders	SDNWR (B)	32.7252166666666	116.94305
18	San Diego National Wildlife Refuge-Campbell Lane	SDNWR (CL)	32.7675833333333	116.879933333333
19	San Diego National Wildlife Refuge-URDS dam pool	SDNWR (URDS)	32.7198833333333	116.9505
20	Singing Hills Memorial Estates-boulders	SHME (B)	32.7922666666666	116.88275
21	Sycamore Canyon Open Space Preserve/Gooden Ranch	SYC/GR	32.9227333333333	116.987283333333
22	Sycuan Peak Ecological Reserve (Lawson Creek)	SPER (LC)	32.7707666666666	116.7984
23	Sycuan Peak Ecological Reserve (Sweetwater River)	SPER (SR)	32.7699333333333	116.816666666666

Table 3. Bat species detections by methods, date, and survey site. Abbreviations were required to fit table on one page. Site number refers to Table 2 and Figure 1(map), site code is abbreviation of survey site (see Table 2), survey methods are abbreviated (see methods section in text), and bat species are represented by species code (see Table 1).

Site Number	Site Code	Date	Survey Methods	Species														
				ANPA	COTO	EPFU	EUPE	LABL	LACI	MACA	MYCA	MYCI	MYEV	MYYU	NYFE	NYMA	PIHE	TABR
1	4SR	23-Jul-02	F(A,V)				A							A,V		A		A
2	BC	25-Jul-02	R(C,V)		V									V				
		19-Sep-02	R(C,V)		V					C,V		V		V				
3	BCER (L)	7-May-02	F(A,C,V)				A	A	A,C,V		A,V				A			A
		20-Nov-02	F(A,C,V)						A						A		A,V	A
4	BCER (U)	3-Jun-02	F(A,C,V)			A					A,C	A	A		A			A
5	CC (MV)	2-Jul-02	F(A,C,V)		C	A,C	A				A	A		A,C	A		A	
		12-Aug-02	F(A,C,V)	A		A,C	A					A		A,C	A		A,V	A
		12-Sep-02	F(A,C,V)	A, V		A	A				A	A		A,C	A		A	A
		29-Oct-02	F(A,C,V)				A			A				A	A	A	A	
		14-Jan-03	F(A,C,V)								A			A	A	A	A	A
6	CRER	10-Jun-02	F(A,C,V)			A					A	A						A
7	EMCP	21-May-02	F(A,C,V)			A,C,V	A								A		A,V	A
8	HBCWA	9-May-02	F(A,C,V)			A,C	A		A,V			A,C	A,C				A	A
		25-Jun-02	F(A,C,V)			A,C	A					A,C		A,C	A		A,C	A
		5-Aug-02	F(A,C,V)	C		A,C	A				A	A,C	A		A		A,C	A
		23-Oct-02	F(A,C,V)				A						A	C	A		A,V	
		7-Jan-03	F(A,C,V)					A	A,C				A					
9	JM	18-Jun-02	R(A,V)				A								A		A	A
10	LPCP	13-May-02	F(A,C,V)			A			C		V			A				A
		6-Aug-02	F(A,C,V)			A	A	A			A,C,V			A				A
		2-Oct-02	F(A,C,V)								A,V							A
		7-Nov-02	F(A,C,V)								A							A
		5-Feb-03	F(A,C,V)					V										
11	MTRP (SDR)	8-May-02	F(A,C,V)											A,C,V	A		A,V	A
		24-Jun-02	F(A,C,V)			A								A	A		A,V	A,V
		30-Jul-02	F(A,C,V)			A								A	A		A,C	A
		26-Aug-02	F(A,C,V)			A								A	A		A,C	A
		24-Oct-02	F(A,C,V)				A		A					A	A	A	A	A
		9-Jan-03	F(A,C,V)					A							A	A	A	A
12	MV (SDR)	16-May-02	F(A,V)											A,V				A,V
13	OTM (CC)	31-Jul-02	F(A,C,V)			A	A					A		A	A		A,V	A,V
14	OTM (OC)	16-Jul-02	R(C,V)											C,V				
15	RJER (NR)	10-May-02	R(C,V)	V							V			V				
		18-Jun-02	R(C,V)									V		V				
		31-Jul-02	R(C,V)		V								V	V				
		29-Oct-02	R(C,V)										V	V				
16	RJER (JC)	6-May-02	F(A,C,V)			A,V						A		A,V	A		A	A
17	SDNWR (B)	4-Jun-02	R(C,V)														C,V	
		3-Oct-02	R(A,V)		A		A	A			A			A	A		A	A
18	SDNWR (CL)	11-Dec-02	F(A,C,V)												A			
19	SDNWR (URDS)	4-Jun-02	F(A,C,V)			A	A	C						A,C	A		A,C	A
		8-Aug-02	F(A,C,V)			A	A	A,C						A	A		A,V	A
		10-Oct-02	F(A,C,V)				A	A	A					A	A		A	A
		14-Nov-02	F(A,C,V)					A				A		A	A		A	A
		29-Jan-03	F(A,C,V)						A,C				A		A	A		
20	SHME (B)	21-Aug-02	R(A,V)			A,V	A					A			A		A	A
21	SYC/GR	14-May-02	F(A,C,V)			A,C								A,V	A			A,V
22	SPER (LC)	11-Jun-02	F(A,C,V)			A	A	A				A			A		A	A
23	SPER (SR)	23-May-02	F(A,C,V)				A					C			A,V			

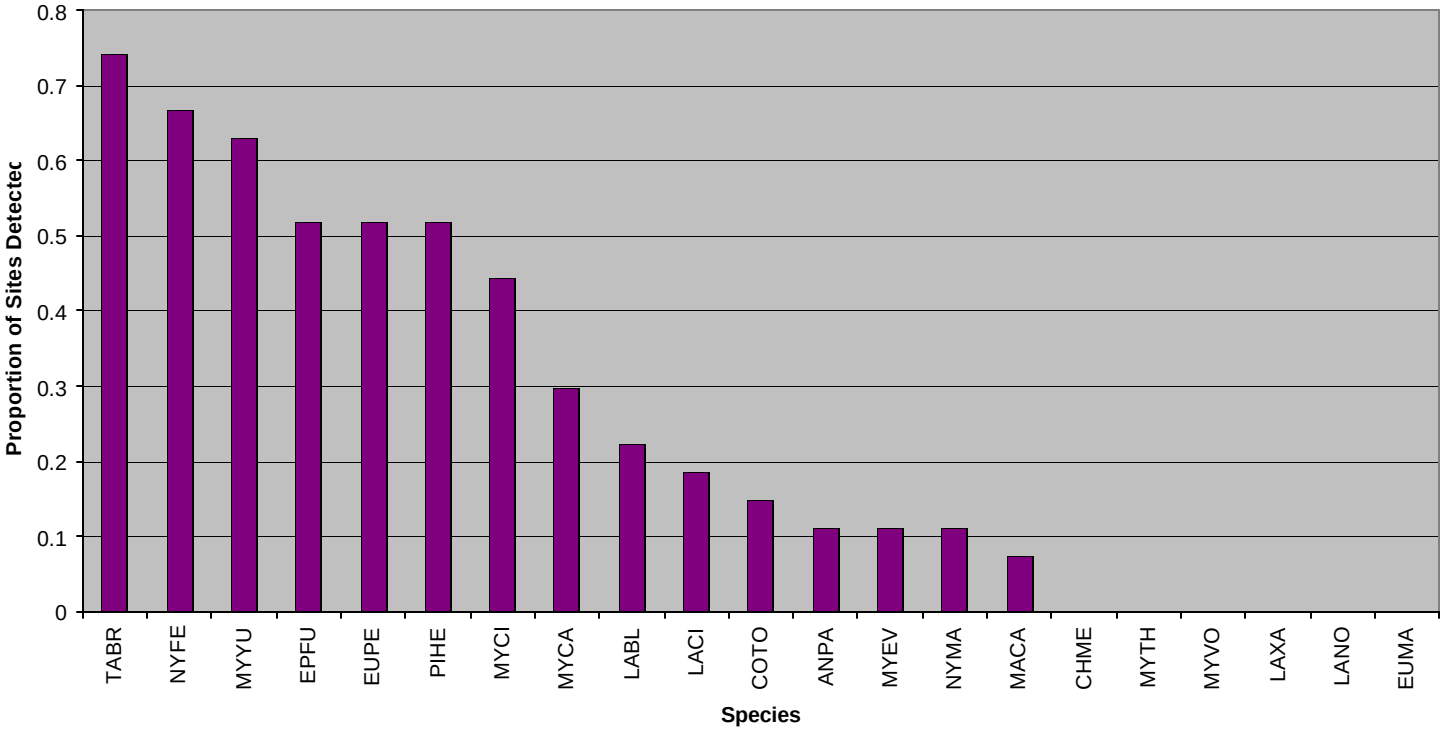

Figure 2. Proportion of sites within the San Diego County MSCP area at which each bat species was detected. Species are abbreviated using species code (see Table 1).

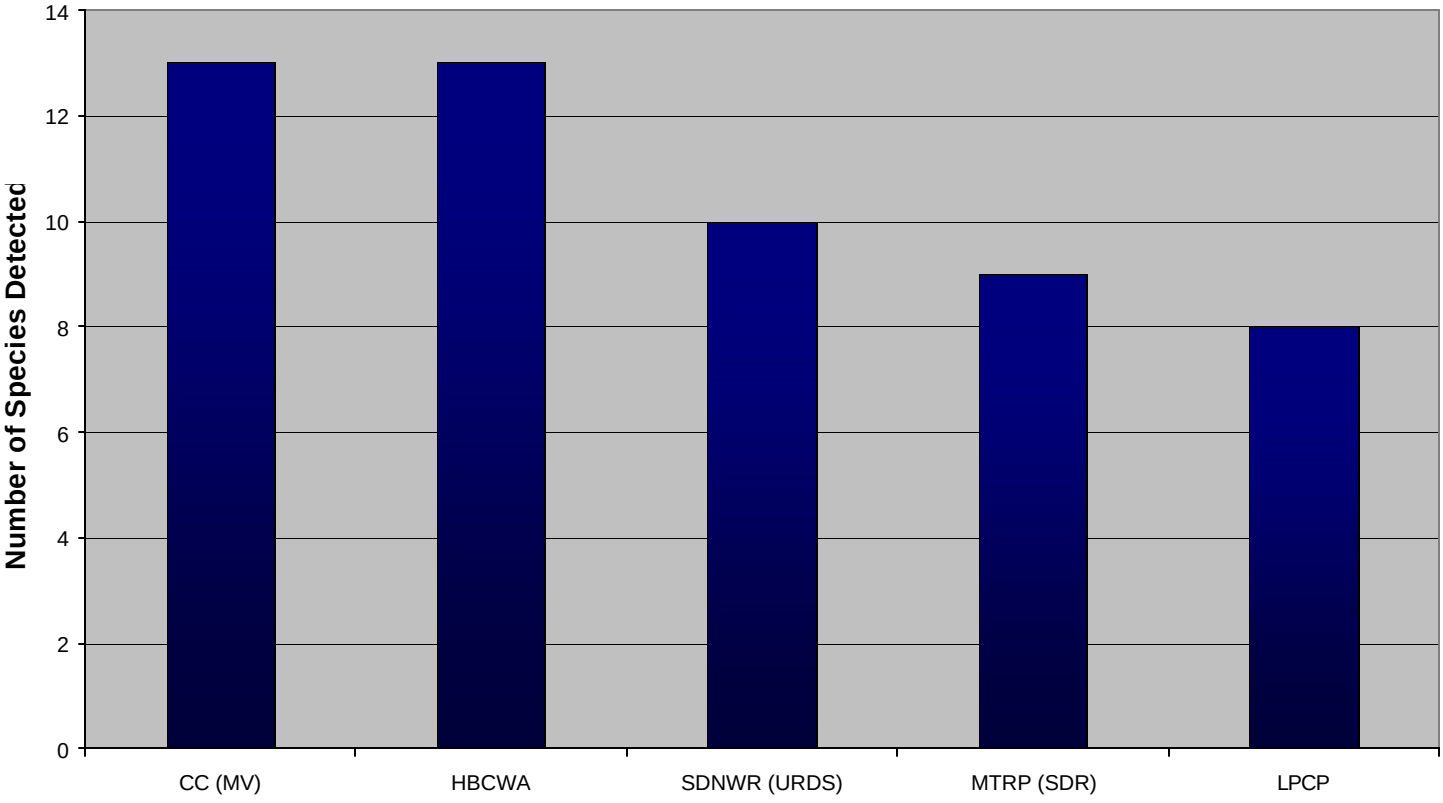

Figure 3. Number of bat species detected at each of the five sites surveyed on multiple dates. Survey sites are abbreviated using site codes (see Table 2).