Focused Surveys for the Pacific Pocket Mouse

(*Perognathus longimembris pacificus*)

in

Orange County, California

Prepared for:

Nature Reserve of Orange County

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Introduction

Purpose of the Report

The purpose of this report is to document the results of confirmation trapping surveys for the Pacific Pocket Mouse (*Perognathus longimembris pacificus*; PPM) performed by the San Diego Natural History Museum (SDNHM) at two sites (Figure 1) in Orange County, California. These surveys represent the second phase of a two-phase effort aimed at discovering extant but unknown populations of PPM within the Coastal Subregion of Orange County. The subject trapping surveys were conducted under U.S. Fish and Wildlife Service (USFWS) 10(a)1(A) permit TE-787716-6, and a Memorandum of Understanding with the California Department of Fish and Game.

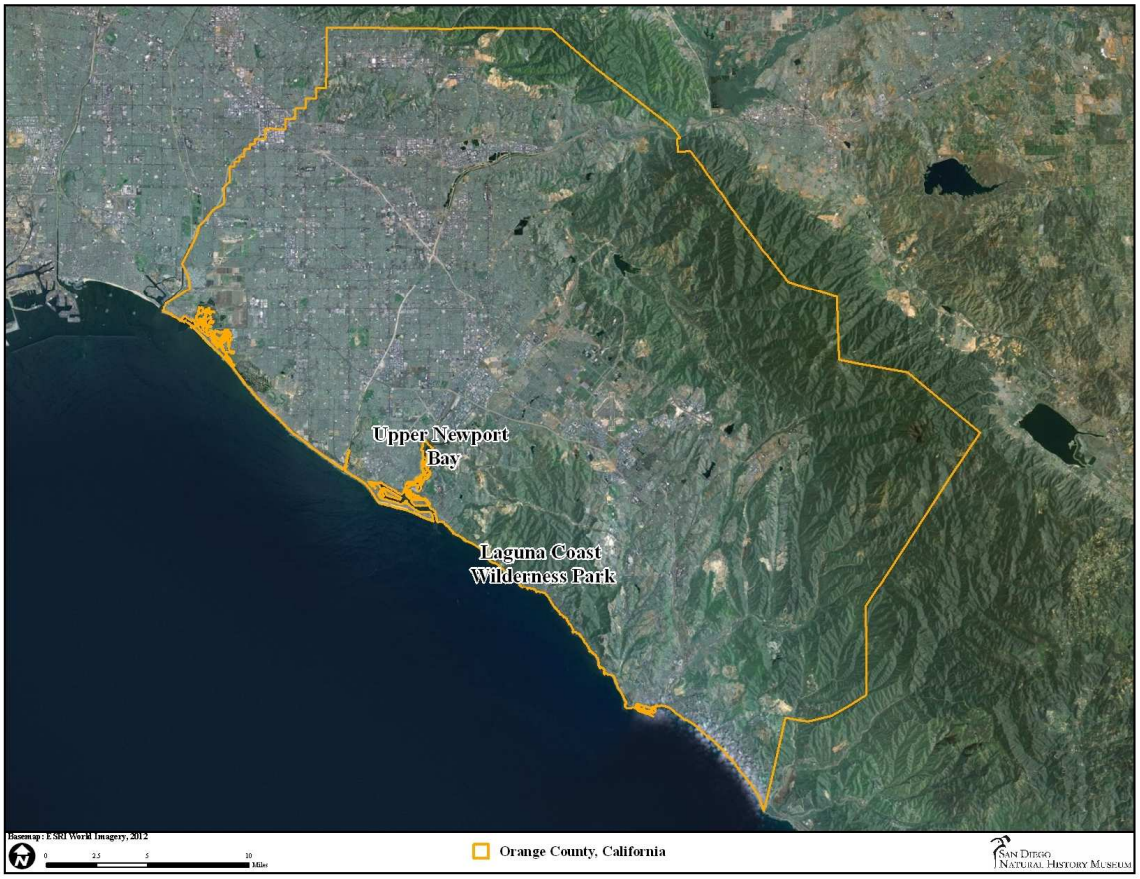

Figure 1. Locations of Laguna Coast Wilderness Park and Upper Newport Bay

Background

The *Recovery Plan for the Pacific Pocket Mouse* (U.S. Fish and Wildlife Service 1998) identifies Recovery Action 1.2 to "Undertake Surveys of Unknown Populations". Recovery Action 1.3 directs those pursuing recovery of PPM to "Continue to Refine a Standardized Survey Approach". Since the Recovery Plan was adopted, many focused surveys have occurred outside of known populations and a number of studies have been performed to improve the reliability and cost efficiency of survey methods. However, despite almost 100 live-trapping surveys performed since the subspecies was rediscovered at Dana Point in 1993 (U. S. Fish and Wildlife Service 2010), just 3 additional populations have been discovered, all within the bounds of Marine Corps Base Camp Pendleton.

Given the intensity of labor and high costs associated with conventional small mammal live-trapping surveys, scent-dogs have recently been explored as a cost effective method to search for new populations of PPM. Canine survey methods were piloted during 2009 and 2010 on Camp Pendleton (Brehme et al. 2010, Brehme et al. 2012) and results from these studies indicated that scent-dogs are promising to use for exploratory surveys for PPM due to their ability to discriminate the scent of PPM scat from the scat of co-occurring small mammals, and their ability to cover multiple kilometers of terrain in a single day.

Because of the promise of this technique, the Nature Reserve of Orange County proposed to use scent-dog surveys in combination with conventional live-trapping surveys to search for unknown populations of PPM within the Orange County Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP) Coastal Reserve System. This area has been modeled as having large expanses of suitable habitat for PPM by a habitat suitability model developed by Spencer et al. (2001) to identify prospective receiver sites for supporting PPM translocation. The habitat suitability model uses combinations of soil and vegetation to rank areas of potential habitat for PPM, and ranked far more area within the Coastal Reserve as having "high" and "very high" suitability for PPM than would be economically practicable to survey using conventional live-trapping methods. Thus, NROC proposed a two phase survey approach for the Coastal Reserve which included: using canine surveys during Phase I to maximize survey coverage of modeled habitat; and conventional live-trapping surveys during Phase II, to confirm the presence of PPM at locations where PPM scat was collected, or to search more intensively for PPM at locations otherwise identified by the dog-surveyor team as having high potential to support PPM. This report addresses the results of the Phase II live-trapping surveys.

Site Selection

In 2011, the United States Fish and Wildlife Service (USFWS) GIS Branch applied Spencer et al.'s (2001) PPM habitat suitability model to generate a fine scale habitat suitability map for the Orange County Coastal Subregion Reserve. This habitat suitability map was used to direct the Phase I canine survey team to areas modeled as having "high" and "very high" habitat suitability for PPM. The canine surveys were performed between June 14 and June 24, 2011, by a dog and handler team from the University of Washington, Center of Conservation Biology, Conservation Canines program (Smith 2011). The methods involved having a handler familiar with PPM habitat attributes direct a scent-dog trained to detect PPM scat to areas of the most promising habitat (i.e., sandy soils, open vegetation community) and allowing the dog to roam through the habitat in search of PPM scent/scat. Upon detection of the appropriate scent, the dog halted and gave an alert signal to the handler. The handler then recorded the coordinates of the location using a Global Positioning System (GPS) device and, with the aid of the dog, searched the vicinity and collected any scat that was evident. Collected scat samples were sent to the University of Washington where they were analyzed using a laboratory fecal DNA assay that is able to discriminate PPM scat from the scat of common co-occurring small mammals (Smith 2011). At a number of recorded locations, no scat was found.

Excluding data recorded at Dana Point (where a known population of PPM was visited to reinforce the dog's training), 41 locations were recorded and 29 scat were collected during Phase I (Smith 2011). Fecal DNA assays failed to confirm that any of the collected scat was from PPM. While it is possible that PPM scat was present but went uncollected, it is also possible that the scent-dog inadvertently became cross-trained on one or more other scents during the course of the surveys, and was responding to that scent (or scents) at the recorded locations. Because the canine survey methodology relies on reinforcing the dog's search behavior by rewarding the dog once it has found the appropriate scent, and PPM scat cannot reliably be visually discriminated from the scat of co-occurring rodents, the handler faces considerable uncertainty when providing the dog a reward during PPM surveys. This was observed to be especially challenging for the handler and dog alike, and increased the potential for cross-training to occur (William B. Miller, personal observation). Nevertheless, the canine surveys were successful at identifying a number of locations within the Coastal Reserve that possess similar habitat attributes to known occupied PPM habitat elsewhere.

Approximately half (19) of the recorded locations and two-thirds (19) of the collected scat were obtained at Turtle Ridge in the City of Irvine Open Space. As a contribution to the Coastal Reserve PPM survey effort, in July 2011 the USFWS performed an intensive

live-trapping survey for PPM at Turtle Ridge covering the areas where the canine survey team recorded scent detections (Appendix 1). This effort did not confirm the presence of PPM at this site.

Because PPM scat was not confirmed at any of the remaining 22 locations recorded by the dog-handler team (Smith 2011), and more locations were recorded than there was budget for live-trapping surveys, the present effort prioritized confirmation trapping in two areas. The first area included several closely spaced locations along adjoining ridgelines within the Laguna Coast Wilderness Park (Figure 2) that could be trapped simultaneously, and were judged by William Miller of the USFWS and the surveyor as having the highest potential of the recorded locations to support PPM. The second location was Upper Newport Bay (Figure 3), where the canine survey team recorded multiple scent detections and the habitat was modeled to have "very high" suitability for PPM. Although this site is in the Coastal Reserve, it could be subject to future temporary disturbance from a proposed habitat restoration effort by the Friends of Newport Bay.

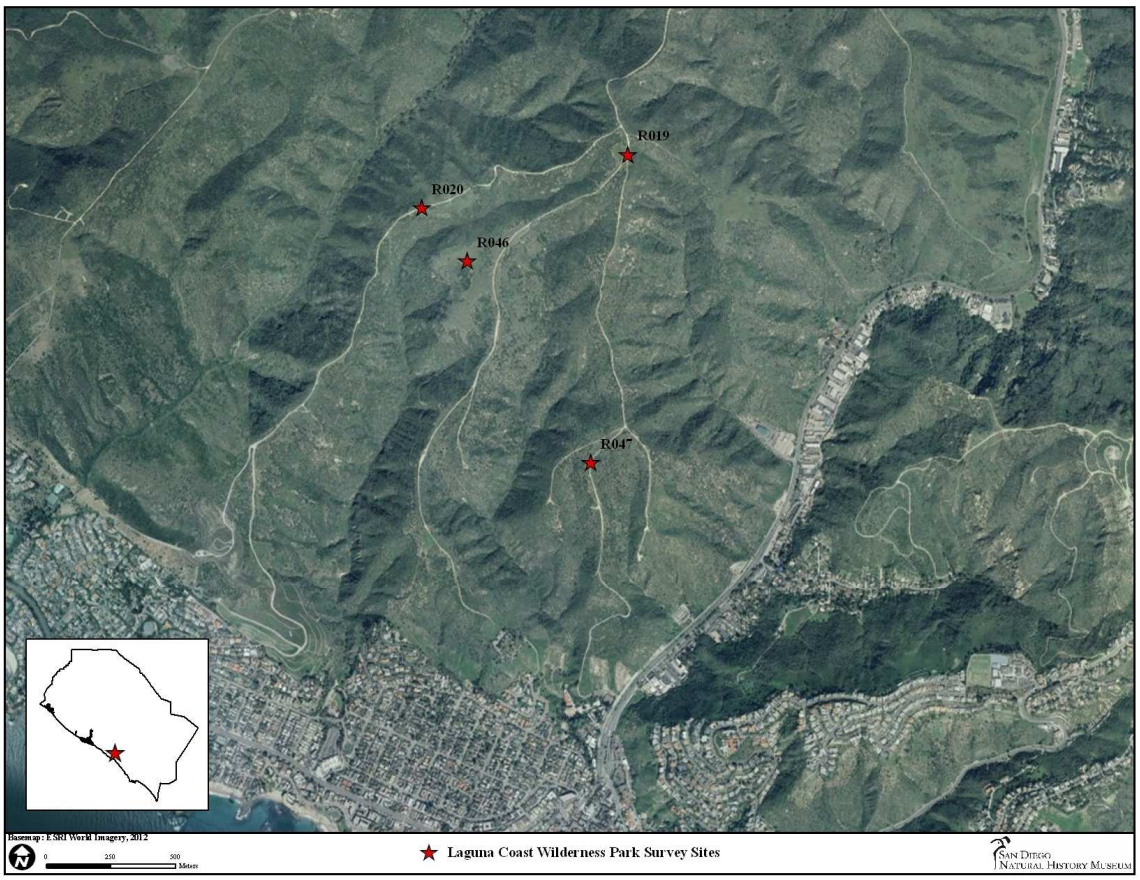

Figure 2. Study locations (USFWS identification #s) within Laguna Coast Wilderness Park

Figure 3. Study locations (USFWS identification #s) within Upper Newport Bay

Laguna Coast Wilderness Park and Upper Newport Bay are managed by Orange County Parks and both are part of the NCCP/HCP Coastal Reserve.

Study Area

Geography & Topography

Laguna Coast Wilderness Park is located in the San Joaquin Hills in southwestern Orange County in the Peninsular Geomorphic Range. The site comprises approximately 7,000 acres of moderately to steeply sloping terrain with a total elevation change of nearly 960 feet (from approximately 40 to 1,000 feet) above mean sea level (msl).

Upper Newport Bay is located in western Orange County and is part of the Peninsular Geomorphic Range. The water source is fed by tidal influence and San Diego Creek. San Diego Creek is primarily channelized and merges with Peters Canyon Wash about 4 miles upstream. Upper Newport Bay, which includes the Upper Newport Bay Nature

Preserve and Upper Newport Ecological Reserve is approximately 1,000 acres and is comprised mainly of coastal wetland and bluffs.

Geology and Soils

According to the Natural Resource Conservation Service's (NRCS) Web Soil Survey, two soil types comprise the Laguna Coast Wilderness Park locations and a single type comprises the Upper Newport Bay site (Table 1). A brief description of each soil type is provided in the text below.

Laguna Coast Wilderness Park

Balcom-rock outcrop complex, 15 to 50 % slopes.
This soil type is frequently found on hills. It is well drained and frequency of ponding is none.

Myford sandy loam, thick surface, 2 to 9 % slopes. This steep soil generally occurs on side slopes of terraces. When the soil is bare runoff is rapid.

Upper Newport Bay

Marina loamy sand, 2 to 9 % slopes. This soil type is found in dunes, back slopes, and side slopes. Drainage is somewhat excessive and frequency of ponding is none.

Table 1. Soil and Vegetation Types/USFWS Identification

Site	USFWS ID #	Soil type	Dominant vegetation
LCW[1]	RO19	Balcom-rock outcrop complex	*Croton setigerus, Artemesia californica, Pseudognaphalium californica*
LCW	RO47	Myford sandy loam	*Artemesia californica, Rhus integrifolia, Eriogonum fasciculatum var foliolosum, Bromus diandrus*
LCW	RO46	Myford sandy loam	*Avena barbata, Bromus diandrus, Artemesia californica, Rhus integrifolia, Eriogonum fasciculatum var foliolosum*
LCW	RO20	Myford sandy loam	*Artemesia californica, Pseudonaphalium californica, Brassica nigra, Croton setigerus, Stephanomeria diegensis*
UNB[2]	RO21-24	Marina loamy sand	*Bromus madritensis ssp rubens, Centaurea melitensis, Eriogonum fasciculatum, Artemesia californica*

[1]Laguna Coast Wilderness [2]Upper Newport Bay

Methods

Plot Selection

Sites were initially recorded by the canine survey team as described above. Based on the failure to confirm PPM at any of those locations via fecal DNA assay (Smith 2011), Will Miller and Mark Pavelka of USFWS performed a reconnaissance at each recorded location to prioritize sites and delimit potential areas for trapping based on the extent and similarity of habitat variables to known occupied PPM habitat. The habitat variables considered included but were not limited to: vegetation composition, vegetation cover, burn history, soils, slope, presence of other mammalian species, and past, current and proposed land use. A second round of reconnaissance was conducted by Will Miller and Scott Tremor (SDNHM) to further refine site selection and plot location based on habitat attributes and available survey effort. Through this process, plot locations were selected within Laguna Coast Wilderness Park and Upper Newport Bay.

Survey plots within sites consisted of varying configurations and numbers of traps (Appendix 1). A combination of grids and meandering transects were employed, with the latter being the dominant survey method used to maximize survey coverage of appropriate habitat at each site (Table A1). Trap spacing varied between 6 and 10 meters. Transects were oriented to best fit the known habitat preferences. GPS coordinates of the starting point and end point of each transect were recorded. A total of 25 transects were established. USFWS protocol surveys were conducted at each transect. Each survey consisted of five consecutive nights of trapping. Modified 9 inch Sherman traps were used exclusively on this project. Traps were opened at dusk on day one and checked at midnight and then at dawn the following morning when they were closed. This process

occurred for five consecutive nights/mornings. Captured animals were identified to species, aged, sexual characteristics were noted (Table A2), then released at point of capture.

Schedule of Surveys

Survey efforts were scheduled (Table 2) to occur during the greatest probability to capture PPM. Typically late spring through mid-summer is the best period. All surveys were scheduled and completed within this time frame.

Table 2. Schedule of Surveys and Locations

Survey Type	USFWS ID #	Dates	Personnel[1]
Handler/scent sniffing dog		June 14- June 23, 2011	HS
Reconnaissance	RO19, RO20, RO46, RO47, RO21, RO22, RO23, RO24	February 15, 2012	WM, MP
Reconnaissance	RO19, RO20, RO46, RO47, RO21, RO22, RO23, RO24	March 21, 2012	ST, WM
Survey- Laguna Coast Wilderness	RO19, RO47	May 28- June 2, 2012	ST
Survey- Newport Back Bay	RO21, RO22, RO23, RO24	June 18-June 23, 2012	ST
Survey- Laguna Coast Wilderness	RO20, RO46	July 16- July 21, 2012	ST

[1] Personnel: ST= Scott Tremor, WM= Will Miller, MP= Mark Pavelka

Results and Discussion

No PPM were captured during these surveys.

Community composition varied among the sites, locations, and plots. Rodent populations are known to fluctuate between periods of high and low density (M'Closkey 1972, Boonstra et al. 1998). False absence is common and can be analyzed within the confines of the survey or biologically. First, limited funding or time does not allow surveys to occur over longer periods, seasons, or years. Second, detecting species during the low density periods can be difficult. Therefore, the species list (Table A2) produced through these surveys should not be considered complete.

There is limited information about the small mammal community within this area. Studies by M'Closkey (1972) at Buck Gully are now forty years old, and the Diffendorfer et al. (2004) surveys in Crystal Cove State Park, Laguna Coast Wilderness Park, and Aliso & Wood Canyons Park were not focused surveys for PPM. Both are valuable, either historically or for the habitat type they represent, but neither gives a complete perspective on the current conditions.

Laguna Coast Wilderness Park

A total of 284 captures of 5 species were recorded over both surveys at this site. PPM was the focus of these surveys, so most of the plots were established in CSS or non-native grassland. The latter habitat type is generally low in diversity and abundance of small mammals.

The species captured at this location would be expected for the habitat surveyed. The Dulzura pocket mouse (*Chaetodipus californicus*), Dulzura kangaroo rat (*Dipodomys simulans*), cactus mouse (*Peromyscus fraterculus*), and deer mouse (*Peromyscus maniculatus*) are all common residents of CSS. While the Western harvest mouse (*Reithrodontomys megalotis*) is common in grassland.

Most notable were the 173 captures of the deer mouse in both CSS and grassland. This species was the most abundant of all the species captured. Deer mice are often associated with disturbed habitat. Despite the abundance of deer mice, overall diversity was low for these habitats. Several species that were expected to occur but not detected include: San Diego Pocket Mouse (*Chaetodipus fallax*), brush mouse (*Peromyscus boylii*), and Bryant's woodrat (*Neotoma bryanti*).

The possible absence of expected species could be caused by many factors including: repeated fire, survey design, feral or off-leash dogs, feral or domestic cats, past and current land use. Recovery from these impacts on the small mammal community can be slow. Sparse distribution or low abundance of some species may be consistent with regional patterns for similar reasons.

The desert cottontail (*Sylvilagus audubonii*) and brush rabbit (*Sylvilagus bachmani*) were both detected on the property. The former appeared much more abundant and in some areas its feces littered the ground. At these locations the grasses appeared patchy rather than continuous as in other areas. The role of "volatile inhibitors" of grasses especially of non-natives may have important management implications (Bartholomew 1970).

Upper Newport Bay

A total of 103 captures of 4 species, 3 mammalian and 1 avian, at this location. The deer mouse (*Peromyscus maniculatus*) was the most common and expected for a more disturbed and isolated location. The second-most common Western harvest mouse (*Reithrodontomys megalotis*) is often associated with more open grassland habitat.
Upper Newport Bay has minimal connectivity to open space. The surrounding land use practices appear to have long-term implications on the rodent community. There were no captures of any Heteromyid rodents, and more comprehensive surveys should be conducted in what is good habitat for this species. The Dulzura kangaroo rat (*Dipodomys simulans*) and the Dulzura pocket mouse (*Chaetodipus californicus*) could be expected for this site. It is likely that the patch size, connectivity, and predation by cats and dogs have caused these species to either decline or become extirpated.

A total of 4 captures of the Bewick's Wren (*Thryomanes bewickii)* occurred at Upper Newport Bay. This species is an uncommon capture in small mammal trapping. The Bewick's Wren prefers to forage and nest in terrestrial cavities; the Sherman traps provided similar but artificial structure.

Recommendations

Laguna Coast Wilderness Park

1. Continue with focused surveys at high quality locations that were not sampled during this survey. This report is focused on the high priority locations that were sampled, however, the limited budget and time prevented all potential locations within the Park to be sampled. At other locations within southern California the species is often difficult to detect, found in small numbers and toward the end of the survey period (pers.obs.). Also, they are not always detected on the first survey at a given location but are found during follow-up surveys.

2. Establish a long-term monitoring program that is intended to sample all small mammal species and potentially disciplines. A voucher based survey (see: http://www.sdnhm.org/science/birds-and-mammals/projects/san-jacinto-resurvey/) will not only document what occurs at the location but also provide material for future genetic, diet, or disease studies, allowing a better perspective on management needs. Nearby studies (Fleming and Tremor 2011) may also be emulated to better follow long-term trends.

   Community composition is likely an important variable in the persistence of PPM. Better information, especially if translocations of PPM are to occur here, will facilitate that process.

3. Any experimental manipulations to the vegetation community should be sampled before and after. For similar reasons above, the response and recovery to any manipulation will likely affect community composition.

4. Investigate the role of rodents and rabbits in the Park with respect to control of non-native vegetation. Certain species may be missing or less abundant in these areas allowing the non-native vegetation to grow and spread unchecked.

Upper Newport Bay

1. Conduct a general small mammal inventory of suitable as well as marginal habitat to better understand species composition of the area. This study may help identify extirpations.

2. Establish a trapping protocol for feral and free range house cats. Amend signage to make nearby homeowners aware of the issue.

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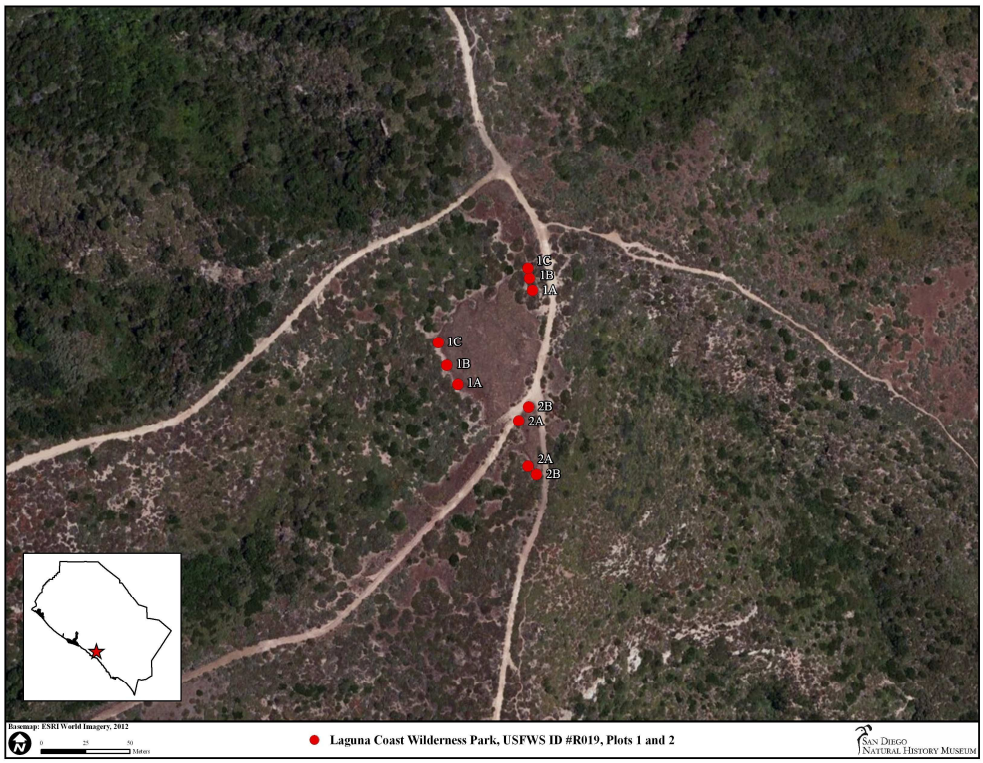
Appendix 1

Appendix 1.A. Plot locations

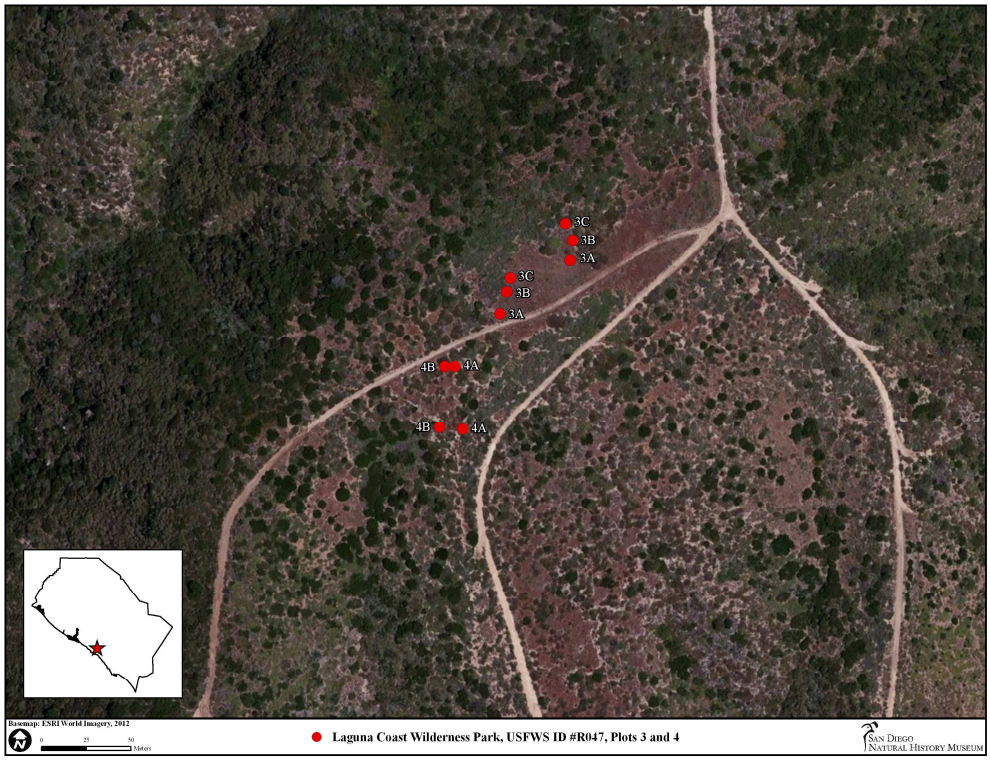
Site	USFWS ID #	Plot/ transect	Traps/ transect	Latitude (DD)[3]	Longitude (DD)[3]	Latitude (DD)[3]	Longitude (DD)[3]
LCW[1]	RO19	1A	20	33.56783	-117.78178	33.56831	-117.78133
LCW	RO19	1B	20	33.56792	-117.78184	33.56837	-117.78134
LCW	RO19	1C	20	33.56804	-117.78190	33.56842	-117.78136
LCW	RO19	2A	8	33.56765	-117.78141	33.56742	-117.78135
LCW	RO19	2B	12	33.56772	-117.78135	33.56738	-117.78130
LCW	RO47	3A	14	33.55815	-117.78220	33.55788	-117.78262
LCW	RO47	3B	15	33.55799	-117.78258	33.55825	-117.78218
LCW	RO47	3C	11	33.55834	-117.78223	33.55806	-117.78256
LCW	RO47	4A	10	33.55761	-117.78289	33.55729	-117.78284
LCW	RO47	4B	10	33.55761	-117.78295	33.55730	-117.78298
LCW	RO46	1A	23	33.56440	-117.78888	33.56397	-117.78734
LCW	RO46	1B	23	33.56448	-117.78882	33.56408	-117.78727
LCW	RO46	1C	8	33.56433	-117.78774	33.56472	-117.78750
LCW	RO46	1D	10	33.56389	-117.78749	33.56328	-117.78761
LCW	RO46	1E	10	33.56352	-117.78692	33.56411	-117.78687
LCW	RO46	1F	10	33.56429	-117.78678	33.56485	-117.78639
LCW	RO46	1G	10	33.56362	-117.78669	33.56413	-117.78654
LCW	RO20	1A	15	33.56591	-117.78873	33.56591	-117.78964
LCW	RO20	1B	15	33.56654	-117.78881	33.56628	-117.78960
UNB[2]	RO24	1A	13	33.65087	-117.87410	33.65055	-117.87507
UNB	RO24	1B	13	33.65082	-117.87406	33.65048	-117.87502
UNB	RO21, 22,23	2A	13	33.65045	-117.87410	33.65031	-117.87489
UNB	RO21, 22,23	2B	13	33.65040	-117.87407	33.65026	-117.87487
UNB	RO21, 22,23	3	23	33.65012	-117.87560	33.65033	-117.87252
UNB	RO21, 22,23	4	16	33.65222	-117.87091	33.65134	-117.87307

[1] Laguna Coast Wilderness, [2] Upper Newport Bay, [3] Start or end point of transect

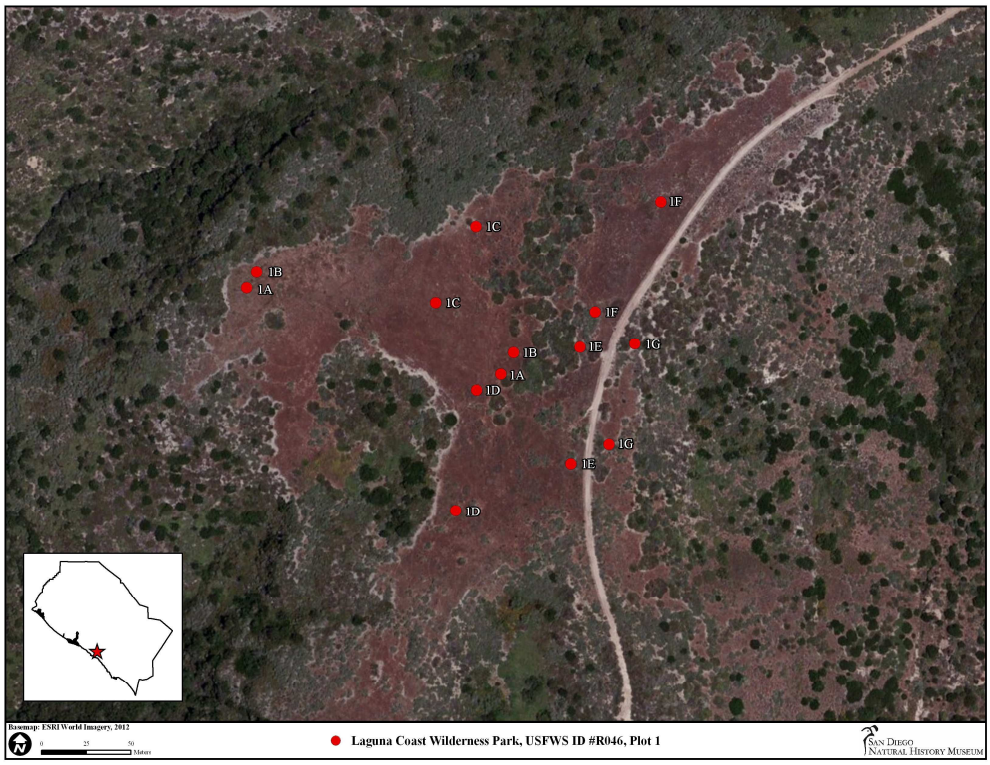
Appendix 1.B. Mapped plot locations for USFWS ID#R019



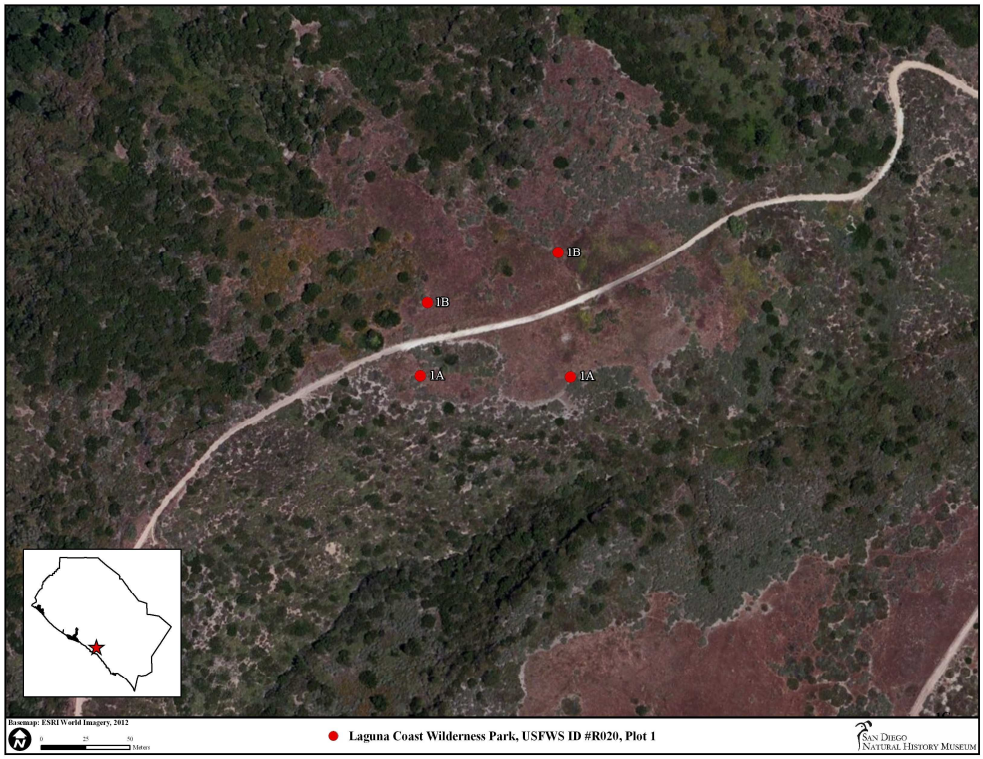
Appendix 1.C. Mapped plot locations for USFWS ID#R047



Appendix 1.D. Mapped plot locations for USFWS ID#R046



Appendix 1.E. Mapped plot locations for USFWS ID#R020



Appendix 1.F. Mapped plot locations for USFWS ID#R024

Appendix 1.G. Mapped plot locations for USFWS ID#R021, R022, R023

Appendix 1.H. Number of each species captured/transect

Location USFWS		Plot/ transect	Number captured/species						
			Chaetodipus californicus	*Dipodomys simulans*	*Peromyscus fraterculus*	*Peromyscus maniculatus*	*Reithrodontomys megalotis*	*Microtus californicus*	*Thryomanes bewickii*
LCW[1]	RO19	1A		6		12			
LCW	RO19	1B	1	7		4			
LCW	RO19	1C		11	1	7			
LCW	RO19	2A		6					
LCW	RO19	2B	6	2					
LCW	RO47	3A		5		6	1		
LCW	RO47	3B		1		8	1		
LCW	RO47	3C		1	1	3	6		
LCW	RO47	4A		1		9			
LCW	RO47	4B		3		7			
LCW	RO46	1A		1		20			
LCW	RO46	1B				33			
LCW	RO46	1C		10		9			
LCW	RO46	1D		2		8			
LCW	RO46	1E		13	1	13			
LCW	RO46	1F		2		7			
LCW	RO46	1G		7		9			
LCW	RO20	1A	5	3		13	1		
LCW	RO20	1B		3		5	3		
UNB[2]	RO24	1A					1		
UNB	RO24	1B							
UNB	RO21, 22,23	2A				10			
UNB	RO21, 22,23	2B				7			
UNB	RO21, 22,23	3				28	36	1	2
UNB	RO21, 22,23	4				13	3		2

[1] Laguna Coast Wilderness, [2] Upper Newport Bay

APPENDIX 2. USFWS Memorandum of Results for PPM Surveys at Turtle Ridge, Irvine, California (attached)