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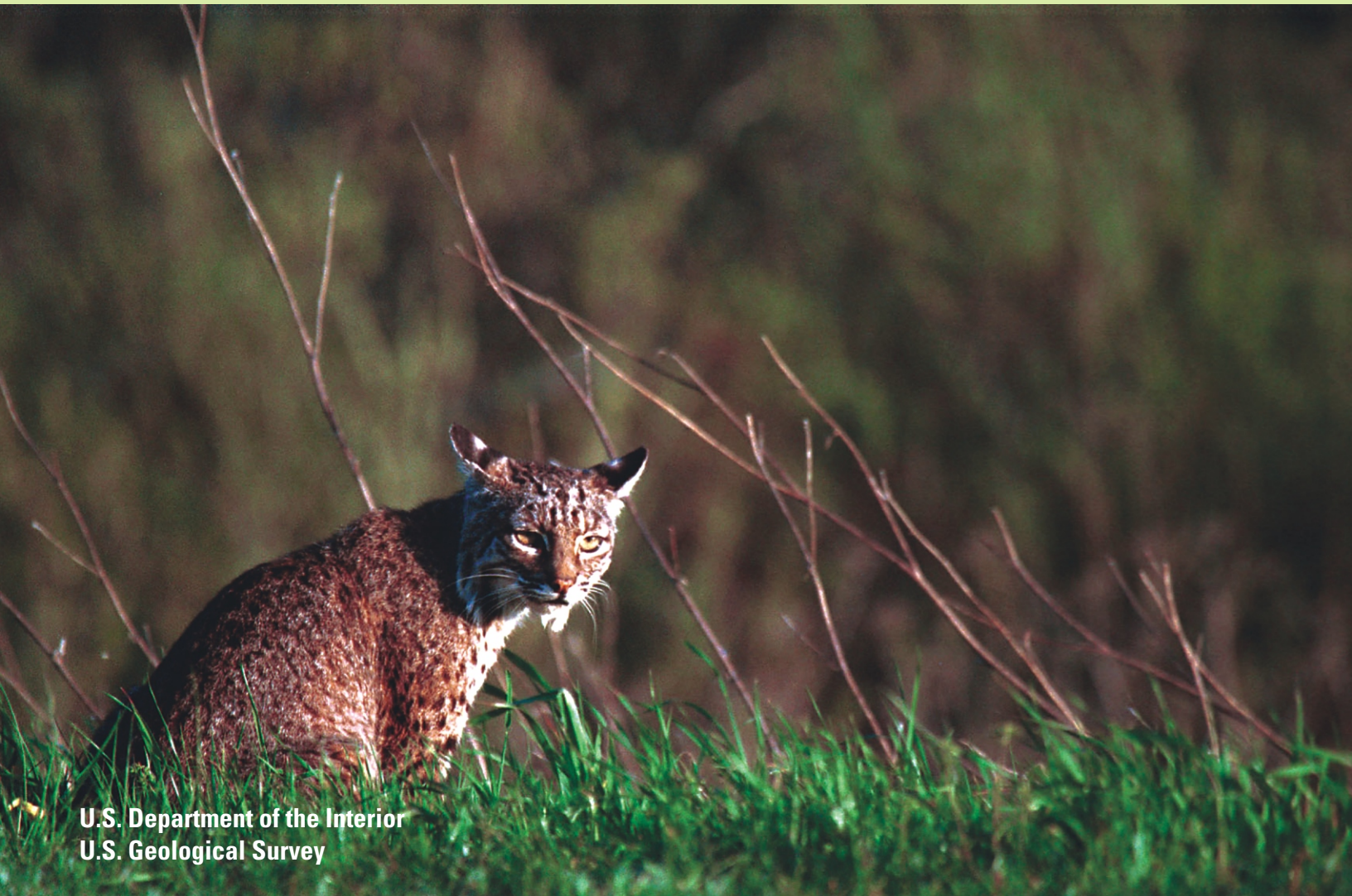
Pilot Inventory of Mammals, Reptiles, and Amphibians, Golden Gate National Recreation Area, California, 1990–1997

Open-File Report 2005-1381



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Cover. Photograph of bobcat (Lynx rufus) in Golden Gate National Recreation Area, Marin County, California. (Photograph by Marcia Semenoff-Irving, U.S. Geological Survey)

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By Marcia Semenoff-Irving and Judd A. Howell

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Pilot Inventory of Mammals, Reptiles, and Amphibians, Golden Gate National Recreation Area, California, 1990–1997

By Marcia Semenoff-Irving and Judd A. Howell

Abstract

The United States Geological Survey Golden Gate Field Station conducted a baseline inventory of terrestrial vertebrates within the Golden Gate National Recreation Area (GGNRA), Marin, San Francisco, and San Mateo Counties, California between 1990 and 1997. We established 456 permanent study plots in 6 major park habitats, including grassland, coastal scrub, riparian woodland, coastal wetland, broad-leaved evergreen forest, and needle-leaved evergreen forest.

We tested multiple inventory methods, including live traps, track plate stations, and artificial cover boards, across all years and habitats. In most years, sampling occurred in 3–4 primary sampling sessions between July and September. In 1994, additional sampling occurred in February and May in conjunction with an assessment of Hantavirus exposure in deer mice *(Peromyscus maniculatus*).

Overall, we detected 32 mammal, 14 reptile, and 6 amphibian species during 25,222 trap-nights of effort. The deer mouse—the most abundant species detected--accounted for 67% of total captures. We detected the Federal Endangered salt marsh harvest mouse (*Reithrodontomys raviventris*) at one coastal wetland plot in 1992.

This project represents the first phase in the development of a comprehensive terrestrial vertebrate inventory and monitoring program for GGNRA. This report summarizes data on relative abundance, frequency of occurrence, distribution across habitat types, and trap success for terrestrial vertebrates detected during this 7-year effort. It includes comprehensive descriptions of the inventory methods and sampling strategies employed during this survey and is intended to help guide the park in the implementation of future long-term ecological monitoring programs.

Introduction

In 1988, the National Park Service (NPS) issued a Service-wide directive aimed at developing inventory and monitoring standards for all park units containing significant natural resources. Parks were directed to address the NPS policy requiring park managers to assess the status and condition of the natural resources under their management. This policy states:

> T*he National Park Service will assemble baseline inventory data describing the natural resources under its stewardship and will monitor those resources at regular intervals to detect or predict changes. The resulting information will be analyzed to detect changes that may require intervention and to provide reference points for comparison with other, more altered environments (NPS Management Policies, Chapter 4:4, 1988).*

In response to this directive, GGNRA established a program to collect baseline inventory data on terrestrial vertebrates in key habitats within the park. The primary objectives of this inventory were to:

1. Develop standardized and repeatable inventory and monitoring protocols for terrestrial vertebrates with GGNRA.
2. Establish a system of permanent study plots at which long-term ecological monitoring could be repeated over time.
3. Collect baseline data on the occurrence and relative abundance of mammals, reptiles, and amphibians within the park for future reference, analyses and interpretation.

This inventory was designed to provide the groundwork for the establishment of a biological diversity-based monitoring program within the park (Howell 1993). Data on species composition and relative abundance would be collected in multiple habitat types defined by differing levels of human use and disturbance. Data collected over a range of

ecological conditions would provide resource managers with a better understanding of how species diversity and richness were affected by changing land use patterns and management activities. The methodologies developed and data collected during this inventory phase would be used to guide the park in monitoring ecosystem-level diversity (NPS-75). Ecosystem-level monitoring is defined as a primary objective of the Natural Resource Program of the Golden Gate National Recreation Area (National Park Service 1999).

Methods

Study Area

The Golden Gate National Recreation Area encompasses 29,948 ha of biologically diverse terrain in the coastal mountains west of the San Francisco Bay. Soils in the park derive from a complex of radiolarian chert, sandstone, and basalt of the Franciscan Assemblage. Elevations range from sea level to 701 m at the summit of Mt Tamalpais. A complex mosaic of plant alliances dominated by expansive annual grasslands and large patches of broad-leaved evergreen scrub characterize vegetation. North- and northeast-facing slopes support both broad-leaved evergreen forests of coast live oak (*Quercus agrifolia*) and California bay (*Umbellularia californica*) and needle-leaved evergreen forests of Douglas fir (*Pseudotsuga menziesii*) and coast redwood (*Sequoia sempervirons*). The park is surrounded by dense urban development and receives approximately fourteen million recreational visitors per year.

Between 1990 and 1992, we established an initial set of study plots in the Marin Headlands district of the park (Figure 1, 1a). We re-sampled a random subset of these sites again in 1997. Historically, the Headlands supported numerous dairy ranches. Between 1974 and 1984, the National Park Service suspended all grazing operations in the district to accommodate the recovery of native plant populations and to allow for recreational use by park visitors.

Between 1993 and 1995, we established a second set of plots in the park's Olema district, north of the Marin Headlands (Figure 1). The Olema Valley follows the trace of the San Andreas Fault system and is bordered on the east by the northwest-trending Bolinas Ridge. The northern half of the ridge continues to support small cattle ranches administered by Point Reyes National Seashore (PORE).

In 1995, we shifted sampling to sites south of the Golden Gate Bridge (Figure 1). We established inventory plots in the Presidio of San Francisco and on Sweeney Ridge, located 19 km south of San Francisco. The Presidio is a historic military base supporting remnant patches of native vegetation within a cultural landscape of Eucalyptus (*Eucalyptus sp.*) and Monterey pine (*Pinus radiata*). Sweeney Ridge is a 424-ha parcel of Franciscan sandstone densely covered with broad-leaved evergreen scrub.

In 1996, our sampling area expanded to include the Phleger Estate and the San Francisco Watershed (Figure 1). The Phleger Estate is a 499-ha parcel of second-growth coast redwood acquired by the park in 1995. The San Francisco Watershed is an 8,094-ha parcel administered by the city and county of San Francisco and held as a recreational and scenic easement by GGNRA. The Watershed has been protected from development for over 100 years and is characterized by mature native plant communities.

Site Selection and Placement

Marin Headlands

In 1990, we randomly selected 400 potential sites from the pixel centers of a habitat map derived from a Landsat thematic mapper (TM) image (Howell 1993). We hand-plotted the UTM coordinates for each point on a 7.5-minute USGS topographic quadrangle. We located 201 sites in the field using USGS maps, compasses, calibrated range finders, and 100-m tapes. We staked plot centers with pieces of metal rebar wired with serially numbered aluminum tags.

Olema Valley, Bolinas Ridge

In 1993, we randomly chose 9 points from the cell centers of a 50-m grid superimposed on a USGS 7.5-minute topographic quadrangle. These points fell in a small, ungrazed parcel on Bolinas Ridge. We established 4 parallel transects in an adjacent ungrazed parcel using the same 50-m grid overlay to choose a random starting elevation for each transect. Transects bisected the ecotone between woodland and non-woodland (grassland and coastal scrub) habitats. At each random elevation, we placed study plots at 30-m intervals along a contour using a Brunton compass and level. Each transect consisted of 5 woodland and 5 non-woodland plots. In 1994, we used the same procedures to establish 4 additional transects on 2 grazed parcels to the north. All plots were marked with metal rebar or wooden survey stakes wired with serially numbered aluminum tags.

Presidio, Sweeney Ridge, San Francisco Watershed, and Phleger Estate

In 1995, we established plots on the Presidio of San Francisco, Sweeney Ridge, and the Phleger Estate, using the same methods developed for the Bolinas Ridge transects. We randomly selected transect starting points using a 50-m grid superimposed on a 7.5-minute USGS topographic quadrangle. In the field, we placed plots at 30-m intervals along each selected contour. In 1996, we established new plots on Sweeney Ridge and in the San Francisco Watershed by ran-

domly selecting transect starting points along a ridge-top fire road. Transects ran at 90° angles to the road. In all locations, we marked plot centers with metal rebar or wooden survey stakes wired with serially numbered aluminum tags.

Vertebrate Sampling

Study Plot Setup and Sampling Strategy

In all years, we conducted 3–4 primary sampling sessions between July and September. In 1994, we added 2 short-term sessions (3–4 sampling days each) in February and May to coincide with an assessment of Hantavirus exposure in local deer mouse populations.

In all years, we established plot centers and installed pitfall traps prior to the start of each session. We placed and activated Sherman live traps, artificial cover boards, and track plates on the first morning of each new session (Figure 2). We did not pre-bait traps prior to their activation. During each session, we conducted sampling for 8-10 consecutive days. On the final day, we removed Sherman live traps and track plates from the field. We left cover boards and pitfall traps in place, sealing pitfall lids with wire and covering them with rocks and soil.

In all years, trained volunteers collected field data under the direct supervision of 1–3 biological science technicians.

Trapping Methods

Live traps

We sampled small mammals by placing a 20-cm Sherman live trap (H.B. Sherman Traps, Inc., Tallahassee, Florida), baited with peanut butter and rolled oats, 5 m from the center stake. We marked small mammals with metal ear tags (size 1005-1, National Band and Tag Co., Newport, KY) and released them on site. We identified captured animals to species, determined sex and age (juvenile, subadult, or adult), and recorded standard morphological measurements, including weight, total body length, tail length, ear length, and hind foot length. We checked live traps once daily for each of 8-10 consecutive sampling days and re-baited when necessary. We replaced all damaged or non-functioning traps as needed.

Pitfall traps

We established 1 pitfall trap at each study plot to sample reptiles, amphibians, and small mammals. Traps consisted of one 5-gal bucket buried flush with the ground and covered by a 30-cm x 30-cm plywood lid raised 5 cm above the rim. We placed the trap 5 m from the center stake, along the same contour. We lined pitfalls with leaf litter and cotton to prevent desiccation in amphibians and hypothermia in small mammals. We baited an inside wall of each trap with peanut butter and rolled oats and re-baited when necessary. We checked pitfalls daily for 8–10 consecutive days. We identified captured mammals to species, determined sex and age (juvenile, subadult, or adult), and recorded standard morphological measurements, including weight, total body length, tail length, ear length, and hind foot length. We marked small mammals with metal ear tags. We identified reptiles and amphibians to species and released them without marking.

Artificial Cover Boards

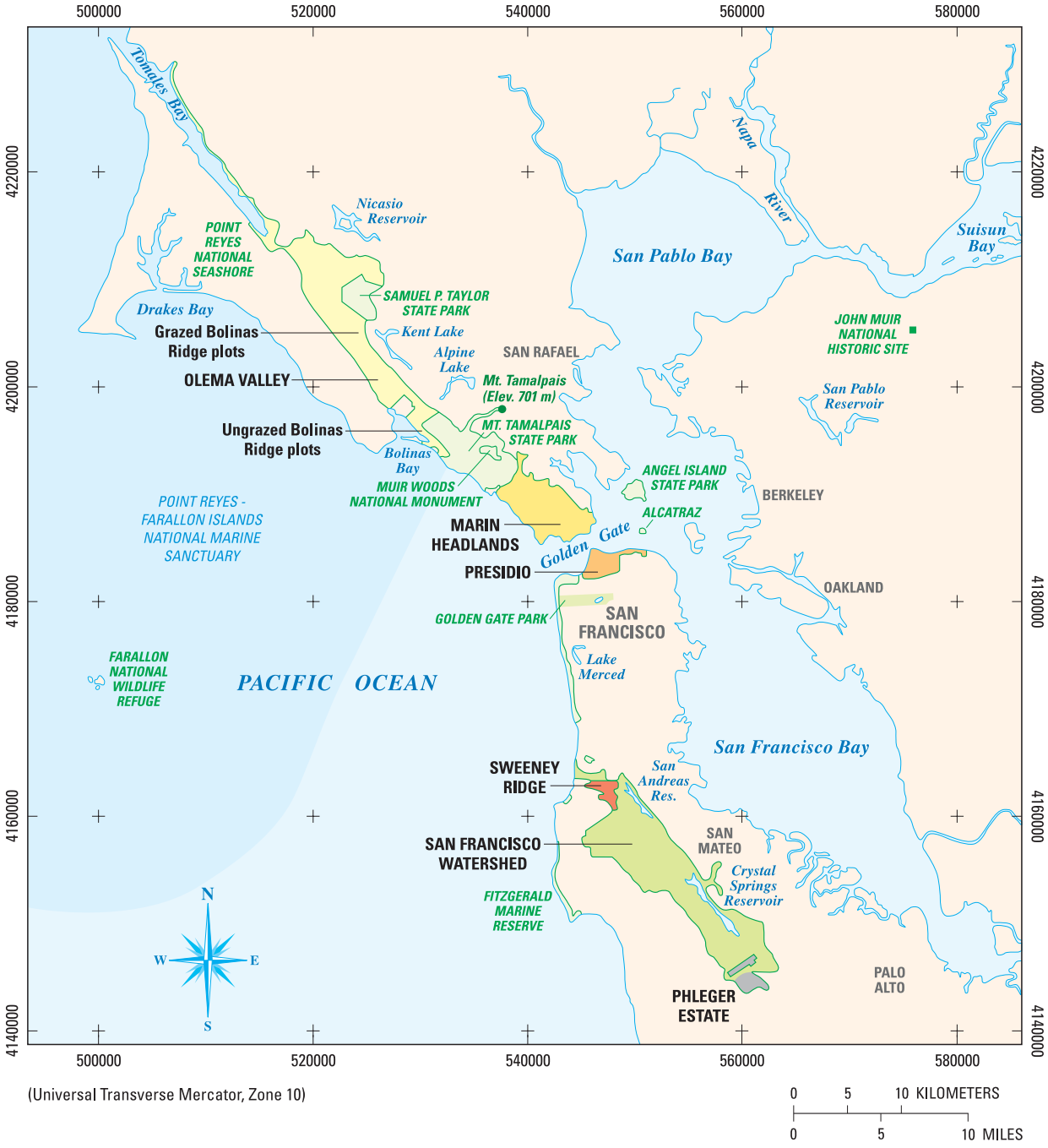
We used 30-cm x 30-cm plywood cover boards to sample reptiles and amphibians. In some years, we substituted 2-in x 4-in blocks of wood for the plywood squares. In all years, we placed cover boards next to the center stake. In most years, we lifted and checked boards daily. In 1991; however, we checked boards only on the last day of the 8–10-day sampling period. In all years, we left artificial cover boards in place at the end of the sampling period. We identified reptiles and amphibians to species and released them without marking.

Track Plate

Carnivores and larger mammals were sampled using track plate stations. A track plate station consisted of a 40-cm x 80-cm aluminum sheet, sooted with cotton cloth and kerosene smoke, baited with a punctured can of cat food or tuna, and placed 5 m from the center stake. Track plates were checked daily for 8–10 consecutive days and cat food cans were replaced when necessary. In general, we did not re-soot track plates during the sampling period. We circled new tracks with lines scratched in the soot. We lifted tracks that could not be identified in the field with pieces of wide, clear tape pressed onto the soot. We transferred lifted tracks to data sheets for later identification.

Pitfall-Drift Fence Arrays

In 1995, we added pitfall-drift fence arrays to increase the capture potential for reptiles and amphibians. An array consisted of two 1-gal buckets buried flush with the ground and placed 5 m apart. We placed a sheet of aluminum siding, flush with the ground, between the 2 pitfall traps to direct the movement of animals into the traps. We installed 1 array per study plot, checking it daily for 8–10 consecutive days. We identified captured small mammals to species, determined sex and age (juvenile, subadult, or adult), and recorded standard morphological measurements, including weight, total body length, tail length, ear length, and hind foot length. We marked small mammals with metal ear tags. We identified



EXPLANATION

STUDY SITES IN THE GOLDEN GATE NATIONAL RECREATION AREA

- OLEMA VALLEY and BOLINAS RIDGE (Sampled 1993-1995)
- MARIN HEADLANDS (Sampled 1990-1992 and 1997)
- PRESIDIO OF SAN FRANCISCO (Sampled 1990-1992 and 1997)
- SWEENEY RIDGE (Sampled 1995-1996)
- SAN FRANCISCO WATERSHED (Sampled 1995-1996)
- PHLEGER ESTATE (Sampled 1995-1996)
- OTHER AREAS IN THE GOLDEN GATE NATIONAL RECREATION AREA

Figure 1. Vertebrate inventory study sites in the Golden Gate National Recreation Area, 1990-1997.

Figure 1a. U.S. Geological Survey satellite photograph of the San Francisco Bay area showing the vertebrate inventory study sites in Golden Gate National Recreation Area, 1990-1997. (Study sites and other areas of Golden Gate National Recreation Area are shown as yellow outlines.)

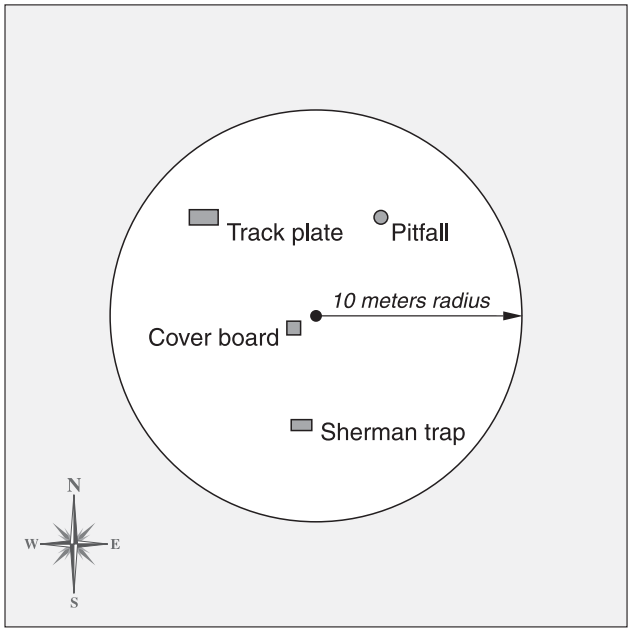


Figure 2. Vertebrate sampling device layout.

reptiles and amphibians to species and released them without marking. We removed all pitfall-drift fence arrays at the end of the sampling period.

Time-Area Searches

In 1996, we used time-area searches to detect reptiles and amphibians on redwood plots in the Phleger Estate. A 3-person team searched under logs, debris, and leaf litter within a 10-m^2 plot, centered on the plot center stake. Teams searched for a 15-minute period and recorded all species detected.

Incidental Observations

We recorded all species or their sign (tracks, scat, nest, or burrow), observed during the 8-10-day sampling period as incidental observations. We made observations on the study plots themselves or on the established, daily routes taken between study plots during the sampling period.

Species Identification

We identified species using standard field guides and reference specimens obtained from the California Academy of Sciences.

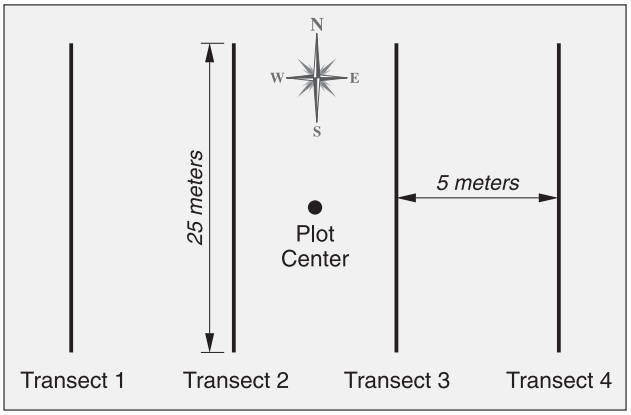


Figure 3. Vegetation sampling transect layout.

Vegetation Sampling

We conducted vegetation surveys on vertebrate study plots during each of the wildlife sampling sessions. We assigned sites to an initial cover class of grass-dominant or shrub-dominant, based upon preliminary visual assessments. At each plot, we established 4 parallel 25-m transects at 5-m intervals from the center stake (Figure 3). Transects consisted of meter tapes held flush with the ground. We sampled grass-dominant plots using the point-line intercept method (Canfield, 1941) to record cover at meter intervals along each transect. We used foliar intercept (Westfield, 1981) on shrub-dominant plots to record individual foliar overlap of all species intersected by transects. We recorded the presence of species not intersected by transects. We defined absolute cover of a species on grassland plots as the total number of hits for that species divided by the total number of points sampled. We expressed absolute cover on shrub-dominant plots as the total intercept length of a species divided by the total line length (100 m).

Data Analysis

We summarized terrestrial vertebrate relative abundance, frequency of occurrence, and trap success by habitat type and year for each species detected during the systematic surveys. Because of the variable sampling efforts and methodologies employed among years, habitat groups, and study areas during this pilot inventory, readers must exercise caution when comparing results among any of these parameters. Further analyses, including the modeling of wildlife-habitat relationships and assessments of sampling power will be presented in future reports.

We calculated relative abundance of captured animals as the number of new individuals caught during a given sampling period (usually 8–10 days). For small mammals, we considered only ear-tagged individuals. For reptiles and amphibians, we considered each new capture as a new individual. For track plate detections, we considered each new occurrence of a track as a new individual. We defined frequency of occurrence of a species as the proportion of sites with at least 1 capture or detection of that species. We defined trap success for Sherman live traps, pitfall traps, pitfall-drift fence arrays, and artificial cover boards as the total number of captures of a species expressed as a percentage of the total number of trap-nights for each respective capture method. Similarly, we defined detection success for track plates as the total number of detections of a species expressed as a percentage of the total number of track plate trap-nights.

Results

Study Plot Establishment

We established and sampled 456 study plots in 6 major habitat groups composed of grassland, coastal scrub, riparian woodland, coastal wetland, broad-leaved evergreen forest, and needle-leaved evergreen forest (Table 1). These habitats comprised approximately 80% of the park's total area. Plots sampled during the 1990 and 1991 seasons were surveyed in 1991 for positional accuracy. We determined UTM coordinates for the remaining plots using a PLGR 96 military-grade GPS receiver. We did not collect coordinates for 211 sites due to technical problems with the GPS unit or to insufficient satellite availability. We estimated the UTM coordinates for these plots by manually placing the points on digital 7.5-minute USGS quadrangles in ARCVIEW 3.1 (ESRI, Inc., Redlands, CA).

Vegetation Sampling

We sampled plant species abundance on 304 of 456 plots. We did not complete vegetation sampling on the remaining plots due to seasonal time constraints. In general, sampling failed to detect spring forbs and early season grasses. In addition, the dried state of much of the vegetation made species identification difficult. Consequently, we identified several grasses and forbs to genus only.

We identified 237 species within the habitats sampled. Sixty-nine percent of identified species were native to California, including 23 perennial grasses, 54 perennial herbs, 23 annual herbs, and 24 native shrubs. All detected annual grass species were exotic.

We assigned a habitat type to each plot based upon the relative abundance of dominant species recorded for that plot. We made an on-site, visual estimate of habitat type on plots where vegetation sampling was not completed. For all plots, we designated habitat type based on the vegetation recorded or observed within 25 m of the plot's center stake. We characterized the following major habitat groups:

Grassland
1. Sites with less than 15 % shrub cover
2. Includes several vegetation series, including California annual grassland, purple needlegrass, and introduced perennial grassland

Coastal Scrub
1. Sites with greater than 15 % shrub cover
2. May contain both small- and broad-leaved evergreen shrubs and cold-deciduous shrubs
3. Included several series, including coyote brush and California sagebrush

Riparian Woodland
1. Scrub- or small tree-dominated sites along freshwater streams
2. Includes arroyo willow series and mixed willow series

Coastal Wetland
1. Sites bordering Rodeo Lagoon, Marin Headlands, CA
2. Contains several series, including saltgrass, slough sedge, pickleweed, and arroyo willow

Broad-leaved Evergreen Forest
1. Sites dominated by broad-leaved trees over 5 m tall
2. Includes California bay series, coast live oak series, and tanoak series

Needle-leaved Evergreen Forest
1. Sites dominated by needle-leaved trees over 5 m tall
2. Includes Douglas fir series and redwood series

Terrestrial Vertebrate Sampling

Sampling Years 1990–1997

We detected 52 terrestrial vertebrate species between 1990–1997, including 32 mammals, 14 reptiles, and 6 amphibians (Table 2). We recorded 6,289 captures during 25,222 total trap-nights of effort (Table 3). Deer mice (*Peromyscus maniculatus*), voles (*Microtus californicus*), dusky-footed woodrats (*Neotoma fuscipes*), and vagrant shrews (*Sorex vagrans*) were the most abundant small mammals captured with 29.86%, 11.85%, 4.40%, and 2.12% of total individuals captured, respectively. Deer mice (*Peromyscus sp*.) were the most abundant mammals detected on track plates (15.00% of total individual detections). Skunks (*Mephitis mephitis*, *Spilogale gracilis*, and skunk species uncertain) were the most abundant of the larger mammals detected (6.86% of total individual detections), followed by gray foxes (*Urocyon cinereoargenteus*) with 6.48% of total individual detections, raccoons (*Procyon lotor*) with 4.52%

Table 1. Inventory Plot Characteristics, Golden Gate National Recreation Area, 1990–1997

Year	Sampling Area	Plot Layout	N	Habitats Sampled	Inventory Techniques [1]
1990	Marin Headlands	Random	90	Grassland	PF SH TP WS
			53	Coastal scrub	PF SH TP WS
1991	Marin Headlands	Random	67	Grassland	PF SH TP WS
			43	Coastal scrub	PF SH TP WS
1992	Marin Headlands	Random start [2]	11	Broad-leaved forest	PF SH TP WS
		Random start [3]	34	Grassland	PF SH TP WS
		Random start [3]	8	Coastal scrub	PF SH TP WS
		Random	7	Riparian woodland	PF SH TP WS
		Random start [3]	10	Coastal wetland	PF SH TP WS
1993	Olema Valley	Random and	11	Grassland	PF SH TP WS
		Random start [3]	18	Coastal scrub	PF SH TP WS
			24	Needle-leaved forest	PF SH TP WS
1994	Olema Valley	Random and	15	Broad-leaved forest	PF SH TP
		Random start [3]	28	Grassland	PF SH TP WS
			13	Coastal scrub	PF SH TP WS
			21	Needle-leaved forest	PF SH TP WS
1994	Hantavirus Sampling	Random and	6	Broad-leaved forest	PF SH TP
	Olema/Marin Headlands	Random start [3]	24	Grassland	PF SH TP
			6	Coastal scrub	SH TP
			11	Needle-leaved forest	PF SH TP
1995	Olema Valley	Random start [3]	6	Broad-leaved forest	PF SH TP WS
			13	Grassland	PF SH TP WS 2X4
			7	Coastal scrub	PF SH TP WS 2X4
			18	Needle-leaved forest	DFA PF SH TP WS 2X4
1995	Presidio	Random start [3]	21	Coastal scrub	DFA PF SH TP 2X4
			2	Needle-leaved forest	DFA PF SH TP 2X4
1995	Sweeney Ridge	Random start [3]	9	Grassland	DFA PF SH TP
			26	Coastal scrub	PF SH TP
1996	Phleger Estate	Random start [3]	10	Needle-leaved forest	SH TP WS TA
	SF Watershed	Random start [3]	15	Coastal scrub	PF SH TP WS
	Sweeney Ridge	Random start [3]	18	Grassland	PF SH TP WS
			37	Coastal scrub	PF SH TP WS
1997	Marin Headlands	Random	51	Grassland	PF SH TP
			25	Coastal scrub	PF SH TP

[1] DFA (drift fence-pitfall array), PF (pitfall trap), SH (Sherman live-trap), TP (track plate), WS ("wood square" artificial cover board), 2x4 ("2x4" artificial cover board).

[2] Random start with subsequent plots placed 30 m in each of the cardinal directions.

[3] Random start with subsequent plots placed at 30-m intervals along linear transect.

Table 2. Vertebrate species detected in Golden Gate National Recreation Area, 1990–1997

Common Name	Species Name	Species Code	Systematic[1]	Incidental [2]
Amphibians				
California slender salamander	*Batrachoseps attenuatus*	BAAT	+	
Ensatina	*Ensatina eshcholtzi*	ENES	+	
Pacific treefrog	*Hyla regilla*	HYRE	+	
Bullfrog	*Rana catesbeiana*	RACA		+
Rough-skinned newt	*Taricha granulosa*	TAGR		+
California newt	*Taricha torosa*	TATO	+	+
Reptiles				
Rubber boa	*Charina bottae*	CHBO	+	+
Western pond turtle	*Clemmys marmorata*	CLMA		+
Racer	*Coluber constrictor*	COCO		+
Sharp-tailed snake	*Contia tenuis*	COTE		+
Western rattlesnake	*Crotalus viridis*	CRVI		+
Ringneck snake	*Diadophis punctatus*	DIPU	+	
Western skink	*Eumeces skiltonianus*	EUSK	+	
Skink species uncertain		EUSP	+	
Northern alligator lizard	*Gerrhonotus coeruleus*	GECO	+	+
Southern alligator lizard	*Gerrhonotus multicarinatus*	GEMU	+	+
Alligator lizard species uncertain		GESP	+	
Lizard species uncertain [3]		LZSP	+	
Gopher snake	*Pituophis melanoleucus*	PIME	+	+
Western fence lizard	*Sceloporus occidentalis*	SCOC	+	+
Western aquatic garter snake	*Thamnophis couchi*	THCO		+
Terrestrial garter snake	*Thamnophis elegans*	THEL	+	+
Common garter snake	*Thamnophis sirtalis*	THSI	+	+
Garter snake species uncertain		THSP	+	+
Snake species uncertain [3]		SNK	+	
Mammals				
Domestic dog	*Canis familiaris*	CAFA	+	
Coyote	*Canis latrans*	CALA	+	
Opossum	*Didelphis virginianis*	DIVI	+	
Domestic cat	*Felis catus*	FECA	+	
Black-tailed hare	*Lepus californicus*	LECA	+	+
Bobcat	*Lynx rufus*	LYRU	+	+
Striped skunk	*Mephitis mephitis*	MEME	+	
California vole	*Microtus californicus*	MICA	+	+
Long-tailed weasel	*Mustela frenata*	MUFR	+	
House mouse	*Mus musculus*	MUMU	+	
Dusky-footed woodrat	*Neotoma fuscipes*	NEFU	+	
Shrew mole	*Neurotrichus gibbsii*	NEGI	+	+
Black-tailed deer	*Odocoileus heminous*	ODHE	+	+
California mouse	*Peromyscus californicus*	PECA	+	
Deer mouse	*Peromyscus maniculatus*	PEMA	+	
Piñon mouse	*Peromyscus truei*	PETR	+	
Mouse species uncertain [3]		PE	+	

Table 2. Vertebrate species detected in Golden Gate National Recreation Area, 1990–1997—Continued

Common Name	Species Name	Species Code	Systematic[1]	Incidental [2]
Mammals—Continued				
Raccoon	*Procyon lotor*	PRLO	+	
Western harvest mouse	*Reithrodontomys megalotis*	REME	+	
Salt marsh harvest mouse	*Reithrodontomys raviventris*	RERA	+	
Western gray squirrel	*Sciurus griseus*	SCGR	+	
Broad-handed mole	*Scapanus latimanus*	SCLA		+
Small mammal species uncertain [3]		SMML	+	
Trowbridge shrew	*Sorex trowbridigii*	SOTR	+	
Vagrant Shrew	*Sorex vagrans*	SOVA	+	
Shrew species uncertain		SO	+	+
Spotted skunk	*Spilogale gracilis*	SPGR	+	
Skunk species uncertain [3]		SKNK	+	
Feral pig	*Sus scrofa*	SUSC		+
Brush rabbit	*Sylvilagus bachmani*	SYBA	+	+
Merriam chipmunk	*Tamias merriami*	TAME	+	
Sonoma chipmunk	*Tamias sonomae*	TASO	+	
Badger	*Taxidae taxus*	TATA		+
Pocket gopher	*Thomomys bottae*	THBO	+	+
Gray fox	*Urocyon cinereoargenteus*	URCI	+	+
Unknown species [3]		UNKN	+	

[1] Species detected using systematic survey methods, including live traps, pitfall traps, artificial cover boards, or track-plates.

[2] Species detected as an incidental observation during normal sampling sessions.

[3] Track plate detection of an animal not identifiable to species

Table 3. Detection statistics of vertebrates sampled using systematic survey methods, Golden Gate National Recreation Area, 1990–1997

Species	Code	Total Detections [1]	Individual Detections [2]	Percent of Individual Detections [3]
California slender salamander	BAAT	10	10	0.21
Domestic dog	CAFA	5	5	0.11
Coyote	CALA	5	5	0.11
Rubber boa	CHBO	1	1	0.02
Ringneck snake	DIPU	5	5	0.11
Opossum	DIVI	170	170	3.61
Ensatina	ENES	1	1	0.02
Western skink	EUSK	3	3	0.06
Skink species uncertain	EUSP	1	1	0.02
Domestic cat	FECA	18	18	0.38
Northern alligator lizard	GECO	13	13	0.28
Southern alligator lizard	GEMU	12	12	0.25
Alligator lizard species uncertain	GESP	1	1	0.02
Pacific treefrog	HYRE	1	1	0.02
Black-tailed hare	LECA	2	2	0.04

Table 3. Detection statistics of vertebrates sampled using systematic survey methods, Golden Gate National Recreation Area, 1990–1997—Continued

Species	Code	Total Detections [1]	Individual Detections [2]	Percent of Individual Detections [3]
Bobcat	LYRU	61	61	1.30
Lizard species uncertain	LZSP	4	4	0.06
Striped skunk	MEME	246	246	5.23
California vole	MICA	822	558	11.85
Long-tailed weasel	MUFR	1	1	0.02
House mouse	MUMU	2	2	0.04
Dusky-footed woodrat	NEFU	216	207	4.40
Shrew mole	NEGI	3	3	0.06
Black-tailed deer	ODHE	7	7	0.15
Mouse species uncertain	PE	706	706	15.00
California mouse	PECA	4	3	0.06
Deer mouse	PEMA	2,685	1,406	29.86
Piñon mouse	PETR	10	6	0.13
Gopher snake	PIME	2	2	0.04
Raccoon	PRLO	213	213	4.52
Western harvest mouse	REME	69	56	1.19
Salt marsh harvest mouse	RERA	7	2	0.04
Western gray squirrel	SCGR	3	3	0.06
Western fence lizard	SCOC	183	183	3.89
Skunk species uncertain	SKNK	73	73	1.55
Small mammal species uncertain	SMML	1	1	0.02
Snake species uncertain	SNK	46	46	0.98
Shrew species uncertain	SO	24	24	0.51
Trowbridge shrew	SOTR	75	75	1.59
Vagrant shrew	SOVA	102	100	2.12
Spotted skunk	SPGR	4	4	0.09
Brush rabbit	SYBA	26	26	0.55
Sonoma chipmunk	TASO	2	2	0.04
California newt	TATO	2	2	0.04
Pocket gopher	THBO	4	4	0.09
Terrestrial garter snake	THEL	1	1	0.02
Common garter snake	THSI	1	1	0.02
Garter snake species uncertain	THSP	1	1	0.02
Unknown species	UNKN	129	125	2.66
Gray fox	URCI	305	305	6.48
Total		**25,222**	**4,708**	**100**

[1] Total captures or detections of a species.

[2] Captures or detections of individual animals (not including recaptures).

[3] Individual captures or detections divided by the total number of individual detections (4,708) x 100.

of total individual detections, and opossums (*Didelphis virginianis*) with 3.61% of total individual detections. Western fence lizards (*Sceloporus occidentalis*) were the most abundant reptile species captured with 3.89% of total individual detections. Amphibian species were rarely detected within the habitats sampled. California slender salamanders (*Batrachoseps attenuatus*) were the most abundant amphibians, representing 0.21% of the individuals captured.

Over all years, pitfall traps accounted for 34% of total detections. We captured 10 mammal species, 6 reptile species, and 3 amphibian species in pitfall traps during 7,453 trap-nights of effort (Table 4). We captured 11 small mammal species in Sherman live traps over 6,974 trap-nights of effort. Overall, Sherman traps accounted for 29% of all species detections. Track plate stations accounted for 36% of all detections. We recorded 12 large mammal species, 6 small mammal species, 2 reptile species, and 1 amphibian species over 6,994 trap-nights. In general, we identified reptile and amphibian tracks to order or suborder only. However, we recorded vertebrates found on or beneath the aluminum sheets as track plate detections and identified them to species.

Combined trap success for live traps, pitfall traps, and pitfall-drift fence arrays was greatest for deer mice (18.61%), voles (5.47%), western fence lizards (1.12%), and vagrant shrews (0.71%) over 14,534 trap-nights of effort. Among track plate detections, deer mice accounted for 9.94% of all detections over 6,994 total trap-nights. Gray foxes (4.30%), striped skunks (3.52%), and raccoons (3.00%) were the most frequently detected larger mammals. Artificial cover boards (wood squares and 2 x 4s) accounted for only 26 captures over 3,693 trap-nights of effort. Ringneck snakes (*Diadophis puncatus*) and northern alligator lizards (*Gerrhonotus coeruleus*) displayed the greatest trap success rates at 0.14% and 0.11% , respectively. Although cover boards demonstrated low capture success rates overall, ringneck snakes and rubber boas (*Charina bottae*) were not detected by any other systematic sampling methods employed during this inventory.

Collectively, we detected 29 species in coastal scrub, 25 species in grassland, 18 species in needle-leaved evergreen forest, 10 species in riparian woodland, 10 species in coastal wetland, and 8 species in broad-leaved evergreen forest. We detected 16 species within single habitat types, and 5 species within all of the habitats sampled (Table 5). Across all habitat types, we detected 15 species on sites currently grazed by cattle and 38 species on sites removed from agricultural use either before or since the park's establishment. We detected 2 species exclusively on grazed plots--Pacific treefrog (*Hyla regilla*) and California newt (*Taricha torosa*)--both recorded in grazed broad-leaved evergreen forests. Conversely, we detected 24 species exclusively within ungrazed habitats. Marin Headland grassland plots produced the highest number of species detections with 24.

Table 4. Total trap success (live traps, pitfall traps, drift-fence arrays, artificial cover boards) and total detection success (track plates) for vertebrate species, Golden Gate National Recreation Area, 1990–1997

Species Code	DFA[1] Total Captures	PF[1] Total Captures	Trap Success--Combined PF,DFA	SH[1] Total Captures	Trap Success-Sherman live-trap	Total Trap Success--DFA, PF, SH	TP[1] Total Detections	Track Plate Detection Success	WS[1] Total Captures	2x4[1] Total Captures
BAAT	5	3	0.11	--	--	0.06	--	--	--	2
CAFA	--	--	--	--	--	--	5	0.07	--	--
CALA	--	--	--	--	--	--	5	0.07	--	--
CHBO	--	--	--	--	--	--	--	--	1	--
DIPU	--	--	--	--	--	--	--	--	5	--
DIVI	--	--	--	--	--	--	169	2.42	--	--
ENES	--	1	0.01	--	--	0.01	--	--	--	--
EUSK	--	2	0.03	--	--	0.01	--	--	1	--
EUSP	--	--	--	1	0.01	0.01	--	--	--	--
FECA	--	--	--	--	--	0.01	18	0.26	--	--
GECO	--	9	0.12	--	--	0.06	--	--	4	--
GEMU	4	4	0.11	--	--	0.06	3	0.04	1	--

Table 4. Total trap success (live traps, pitfall traps, drift-fence arrays, artificial cover boards) and total detection success (track plates) for vertebrate species, Golden Gate National Recreation Area, 1990–1997—Continued

Species Code	DFA[1] Total Captures	PF[1] Total Captures	Trap Success--Combined PF,DFA	SH[1] Total Captures	Trap Success-Sherman live-trap	Total Trap Success--DFA, PF, SH	TP[1] Total Detections	Track Plate Detection Success	WS[1] Total Captures	2x4[1] Total Captures
GESP	--	1	0.01	--	--	0.01	--	--	--	--
HYRE	--	--	--	--	--	--	1	0.01	--	--
LECA	--	--	--	--	--	--	2	0.03	--	--
LYRU	--	2[2]	--	--	--	--	59	0.84	--	--
LZSP	--	--	--	--	--	--	4	0.06	--	--
MEME	--	--	--	--	--	--	246	3.52	--	--
MICA	3	511	6.80	275	3.94	5.47	33	0.47	--	--
MUFR	--	--	--	--	--	--	1	0.01	--	--
MUMU	--	--	--	2	0.03	0.01	--	--	--	--
NEFU	--	5	0.07	33	0.46	0.26	176	2.52	2[2]	--
NEGI	--	2	0.03	1	0.01	0.02	--	--	--	--
ODHE	--	--	--	--	--	--	7	0.10	--	--
PE	--	4	0.05	7	0.10	0.08	695	9.94	--	--
PECA	--	1	0.01	3	0.04	0.03	--	--	--	--
PEMA	--	1,247	16.49	1437	20.60	18.61	--	--	1[2]	--
PETR	--	--	--	10	0.14	0.07	--	--	--	--
PIME	--	2	0.03	--	--	0.01	--	--	--	--
PRLO	--	1[2]	--	--	--	--	210	3.00	1[2]	--
REME	--	30	0.40	33	0.47	0.44	6	0.09	--	--
RERA	--	7	0.09	--	--	0.05	--	--	--	--
SCGR	--	--	--	--	--	--	3	0.04	--	--
SCOC	1	160	2.13	1	0.01	1.12	18	0.26	3	--
SKNK	1	--	--	--	--	--	72	1.03	--	--
SMML	--	--	--	--	--	--	1	0.01	--	--
SNK	--	--	--	--	--	--	46	0.66	--	--
SO	--	19	0.25	5	0.07	0.17	--	--	--	--
SOTR	--	60	0.79	15	0.22	0.52	--	--	--	--
SOVA	1	77	1.03	24	0.34	0.71	--	--	--	--
SPGR	--	--	--	--	--	--	4	0.06	--	--
SYBA	--	--	--	--	--	--	26	0.37	--	--
TASO	--	--	--	2	0.03	0.01	--	--	--	--
TATO	--	2	0.03	--	--	0.01	--	--	--	--
THBO	--	4	0.05	--	--	0.03	--	--	--	--
THEL	--	1	0.01	--	--	0.01	--	--	--	--
THSI	--	--	--	1	0.01	0.01	--	--	--	--
THSP	--	--	--	--	--	--	1	0.01	--	--
UNKN	--	5	0.07	4	0.06	0.06	116	1.64	4[2]	--
URCI	--	1[2]	--	--	--	--	301	4.30	3[2]	--
Total	**107**	**7,453**		**6,975**			**6,994**		**3,346**	**347**

[1] DFA (drift fence-pitfall array), PF (pitfall trap), SH (Sherman live-trap), TP (track plate), WS ("wood square" artificial cover board), 2x4 ("2x4" artificial cover board)

[2] Track found on pitfall lid or wood-square and recorded on datasheet.

Table 5. Total vertebrate detections (including recaptures) within sampled habitat types, Golden Gate National Recreation Area, 1990–1997

Study Plot Location	Current Grazing	Species	Broad-leaved Evergreen	Coastal Scrub	Grassland	Needle-leaved Evergreen	Riparian	Coastal Wetland
Marin Headlands	No	Domestic dog	--	--	1	--	--	1
		Coyote	--	1	--	--	--	--
		Opossum	1	7	2	--	6	1
		Western skink	--	--	1	--	--	--
		Domestic cat	--	4	9	--	--	--
		Southern alligator lizard	--	3	7	--	--	--
		Northern alligator lizard	--	--	2	--	--	--
		Black-tail hare	--	--	2	--	--	--
		Bobcat	--	14	36	--	1	--
		Lizard species	--	1	2	--	--	--
		Striped skunk	--	38	163	--	3	--
		California vole	--	196	309	--	4	4
		Long-tailed weasel	--	1	--	--	--	--
		House mouse	--	--	--	--	--	1
		Dusky-footed woodrat	--	55	13	--	9	1
		Black-tailed deer	--	5	1	--	1	--
		Mouse species	5	127	186	--	10	4
		Deer mouse	23	420	460	--	26	64
		Gopher snake	--	--	2	--	--	--
		Raccoon	17	18	56	--	13	47
		Western harvest mouse	--	19	8	--	--	--
		Salt marsh harvest mouse	--	--	--	--	--	7
		Western fence lizard	--	23	41	--	--	--
		Skunk species	--	3	19	--	--	--
		Snake species	--	11	25	--	--	--
		Shrew species	--	3	4	--	--	--
		Vagrant shrew	--	9	15	--	4	7
		Spotted skunk	--	3	1	--	--	--
		Brush rabbit	--	8	10	--	--	--
		Pocket gopher	--	1	1	--	--	--
		Common garter snake	--	--	1	--	--	--
		Garter snake species	--	--	1	--	--	--
		Unknown species	2	18	50	--	--	2
		Gray fox	32	59	99	--	13	12
		Total	**369**	**4,473**	**8,139**	**--**	**277**	**546**
Olema Valley	No	California slender salamander	--	--	--	10	--	--
		Ringneck snake	--	5	--	--	--	--
		Opossum	--	20	6	101	--	--
		Northern alligator lizard	--	--	--	1	--	--
		Southern alligator lizard	--	4	--	--	--	--
		Alligator lizard species	--	--	1	--	--	--
		Bobcat	--	1	1	--	--	--
		Lizard species	--	1	--	--	--	--
		Striped skunk	--	6	10	4	--	--
		California vole	--	8	28	6	--	--
		Dusky-footed woodrat	--	35	1	48	--	--
		Shrew mole	--	--	--	1	--	--
		Mouse species	--	12	6	42	--	--
		Deer mouse	--	62	27	179	--	--
		Raccoon	--	7	3	11	--	--
		Western harvest mouse	--	1	1	--	--	--

Table 5. Total vertebrate detections (including recaptures) within sampled habitat types, Golden Gate National Recreation Area, 1990–1997—Continued

Study Plot Location	Current Grazing	Species	Broad-leaved Evergreen	Coastal Scrub	Grassland	Needle-leaved Evergreen	Riparian	Coastal Wetland
		Western gray squirrel	--	--	--	2	--	--
		Western fence lizard	--	19	3	--	--	--
		Skunk species	--	10	1	1	--	--
		Snake species	--	--	1	--	--	--
		Shrew species	--	2	--	1	--	--
		Trowbridge shrew	--	19	4	42	--	--
		Brush rabbit	--	1	1	--	--	--
		Sonoma chipmunk	--	--	--	1	--	--
		Pocket gopher	--	1	--	--	--	--
		Unknown species	--	9	2	11	--	--
		Gray fox	--	32	11	23	--	--
		Total	**--**	**1,292**	**741**	**1,647**		
	Yes	Coyote	--	--	3	--	--	--
		Opossum	12	--	--	4	--	--
		Western skink	--	--	2	--	--	--
		Pacific treefrog	1	--	--	--	--	--
		Bobcat	--	--	1	--	--	--
		Striped skunk	--	--	4	--	--	--
		California vole	--	--	3	2	--	--
		Dusky-footed woodrat	1	--	--	4	--	--
		Mouse species	7	--	9	3	--	--
		Deer mouse	72	--	12	37	--	--
		Western fence lizard	--	--	6	--	--	--
		Skunk species	5	--	11	--	--	--
		Trowbridge shrew	4	--	--	1	--	--
		Sonoma chipmunk	--	--	--	1	--	--
		California newt	1	--	--	1	--	--
		Unknown species	17	--	10	--	--	--
		Gray fox	6	--	--	1	--	--
		Total	**474**		**630**	**206**		
Hantavirus Plots	No	Skink species	--	--	--	1	--	--
		Domestic cat	--	--	2	--	--	--
		Bobcat	--	1	--	--	--	--
		Striped skunk	--	--	2	--	--	--
		California vole	--	--	2	--	--	--
		House mouse	--	1	--	--	--	--
		Shrew mole	--	--	--	1	--	--
		Mouse species	--	1	9	1	--	--
		Deer mouse	--	18	53	8	--	--
		Western harvest mouse	--	--	1	--	--	--
		Shrew species	--	--	--	1	--	--
		Trowbridge shrew	--	--	--	1	--	--
		Vagrant shew	--	2	--	--	--	--
		Gray fox	--	1	5	2	--	--
		Total	**15**	**93**	**237**	**103**		
	Yes	Deer mouse	--	--	1	3	--	--
		Trowbridge shrew	1	--	2	--	--	--
		Pocket gopher	--	--	1	--	--	--
		Total	**18**		**25**	**9**		

Table 5. Total vertebrate detections (including recaptures) within sampled habitat types, Golden Gate National Recreation Area, 1990–1997—Continued

Study Plot Location	Current Grazing	Species	Broad-leaved Evergreen	Coastal Scrub	Grassland	Needle-leaved Evergreen	Riparian	Coastal Wetland
Phleger Estate	No	Opossum	--	--	--	1	--	--
		Domestic cat	--	--	--	1	--	--
		Bobcat	--	--	--	2	--	--
		Dusky-footed woodrat	--	--	--	3	--	--
		Mouse species	--	--	--	4	--	--
		Trowbridge shrew	--	--	--	10	--	--
		Raccoon	--	--	--	4	--	--
		Western gray squirrel	--	--	--	1	--	--
		Small mammal	--	--	--	1	--	--
		Gray fox	--	--	--	2	--	--
		Total				**227**		
Presidio	No	Opossum	--	9	--	--	--	--
		Domestic cat	--	1	--	--	--	--
		Southern alligator lizard	--	6	--	--	--	--
		Striped skunk	--	16	--	--	--	--
		Raccoon	--	25	--	10	--	--
		Western harvest mouse	--	30	--	--	--	--
		Western fence lizard	--	4	--	--	--	--
		Skunk species	--	22	--	1	--	--
		Snake species	--	4	--	--	--	--
		Unknown species	--	2	--	--	--	--
		Gray Fox	--	5	--	--	--	--
		Total		**823**		**80**		
Watershed	No	California vole	--	32	--	--	--	--
		Dusky-footed woodrat	--	1	--	--	--	--
		Shrew mole	--	1	--	--	--	--
		Mouse species	--	26	--	--	--	--
		Deer mouse	--	85	--	--	--	--
		Western harvest mouse	--	2	--	--	--	--
		Western fence lizard	--	7	--	--	--	--
		Shrew species	--	1	--	--	--	--
		Vagrant shrew	--	21	--	--	--	--
		Total		**507**				
Sweeney Ridge	No	Domestic dog	--	1	2	--	--	--
		Coyote	--	1	--	--	--	--
		Rubber boa	--	1	--	--	--	--
		Ensatina	--	1	--	--	--	--
		Domestic cat	--	1	--	--	--	--
		Northern alligator lizard	--	1	1	--	--	--
		Bobcat	--	2	2	--	--	--
		California vole	--	180	48	--	--	--
		Dusky-footed woodrat	--	22	23	--	--	--
		Mouse species	--	181	73	--	--	--
		California mouse	--	4	--	--	--	--
		Deer mouse	--	887	248	--	--	--
		Raccoon	--	1	1	--	--	--
		Western harvest mouse	--	4	3	--	--	--
		Western fence lizard	--	54	26	--	--	--
		Snake species	--	2	3	--	--	--
		Shrew species	--	12	--	--	--	--

Table 5. Total vertebrate detections (including recaptures) within sampled habitat types, Golden Gate National Recreation Area, 1990–1997—Continued

Study Plot Location	Current Grazing	Species	Broad-leaved Evergreen	Coastal Scrub	Grassland	Needle-leaved Evergreen	Riparian	Coastal Wetland
		Trowbridge shrew	--	1	--	--	--	--
		Vagrant shrew	--	41	3	--	--	--
		Brush rabbit	--	4	2	--	--	--
		Terrestrial garter snake	--	1	--	--	--	--
		Unknown species	--	4	2	--	--	--
		Gray fox	--	2	--	--	--	--
		Total	**2,888**	**1,403**				

Sampling Year 1990

We sampled 90 grassland and 53 coastal scrub plots for wildlife in 1990. These sites were randomly distributed within the Rodeo, Gerbode, and Tennessee Valleys in the Marin Headlands (Figures 4, 4a, 4b, 4c). We detected 18 species during 5,563 trap-nights of effort (Table 6). We detected 15 species on grassland plots and 16 species on coastal scrub plots. We also recorded skunks (species uncertain), snakes (species uncertain), and one unknown. We detected a mean of 2.72 species (SE = 0.19) on coastal scrub sites.

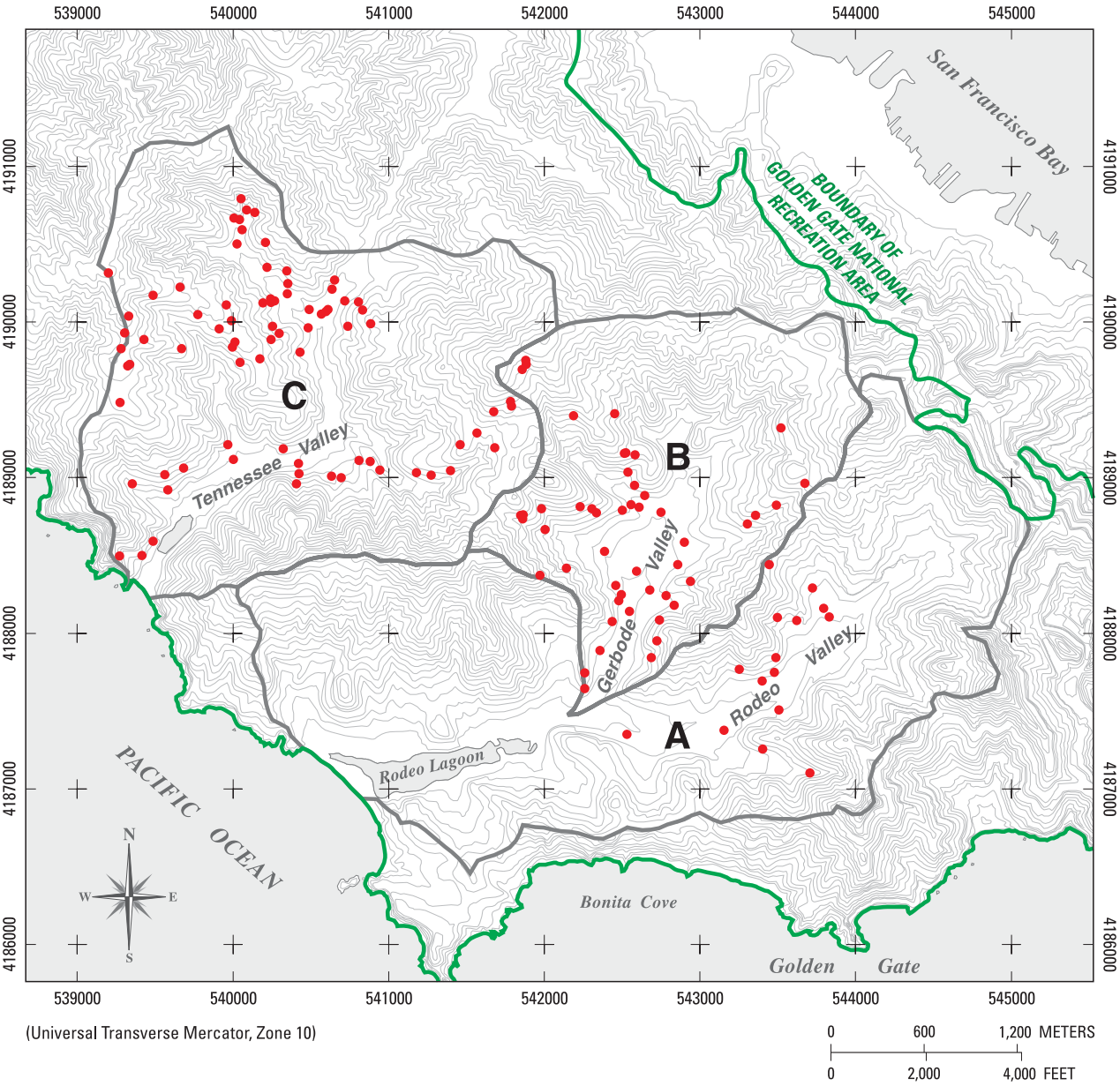
Overall, deer mice and voles were the most abundant species detected with 23.9% and 19.3% of individuals detected. Mean abundance of deer mice was greater in coastal scrub (mean = 2.00, SE = 0.29) than in grassland (mean = 0.62, SE = 0.13), while mean abundance of voles was greater on grassland plots (mean = 1.04, SE = 0.27) than on coastal scrub sites (mean = 0.70, SE = 0.25). Skunk species were the most abundant of the larger mammals (13.7 % of individual detections). Mean abundance of striped skunks was greater on grassland plots (mean = 0.83, SE = 0.11) than on coastal scrub plots (mean = 0.25, SE = 0.09). Gray foxes accounted for 9.4% of individual detections and were encountered on both grassland and coastal scrub sites.

Deer mice were the most frequently encountered mammals on coastal scrub sites in the Marin Headlands, detected at 62% of the scrub plots (Table 7). Gray foxes showed the greatest frequency of occurrence of larger mammals in coastal scrub (frequency = 0.30), followed by striped skunks (frequency = 0.15). Striped skunks were the most frequently detected species on grassland plots (frequency = 0.49), followed by gray foxes (frequency = 0.32), voles (frequency = 0.29) and deer mice (frequency = 0.26).

Overall, trap success (pitfalls and live traps combined) was greater on coastal scrub sites (26% of total captures) than on grassland sites (14% of total captures) (Table 8). On coastal scrub plots, trap success was greatest for deer mice (18% of total captures). On grassland sites, trap success was greatest for voles (8% of total captures).

Track plate detection success was greatest for striped skunks on grassland plots (9% of total detections) and lowest for opossums in both coastal scrub and grassland. We also recorded 1 domestic dog (*Canis familiaris*) and 8 domestic cats (*Felis catus*).

Artificial cover board detection success was low for both habitats sampled. In grassland, we detected 1 western skink and 1 western fence lizard. In coastal scrub, we recorded 1 northern alligator lizard and 1 western fence lizard. However, we did not record the western skink and northern alligator lizard using any of the other systematic sampling devices.



EXPLANATION

SAMPLED SUBREGIONS

A. RODEO VALLEY
B. GERBODE VALLEY
C. TENNESSEE VALLEY

INVENTORY PLOT LOCATION

BOUNDARY OF GOLDEN GATE NATIONAL RECREATION AREA

Figure 4. Vertebrate inventory plots: Marin Headlands, 1990.

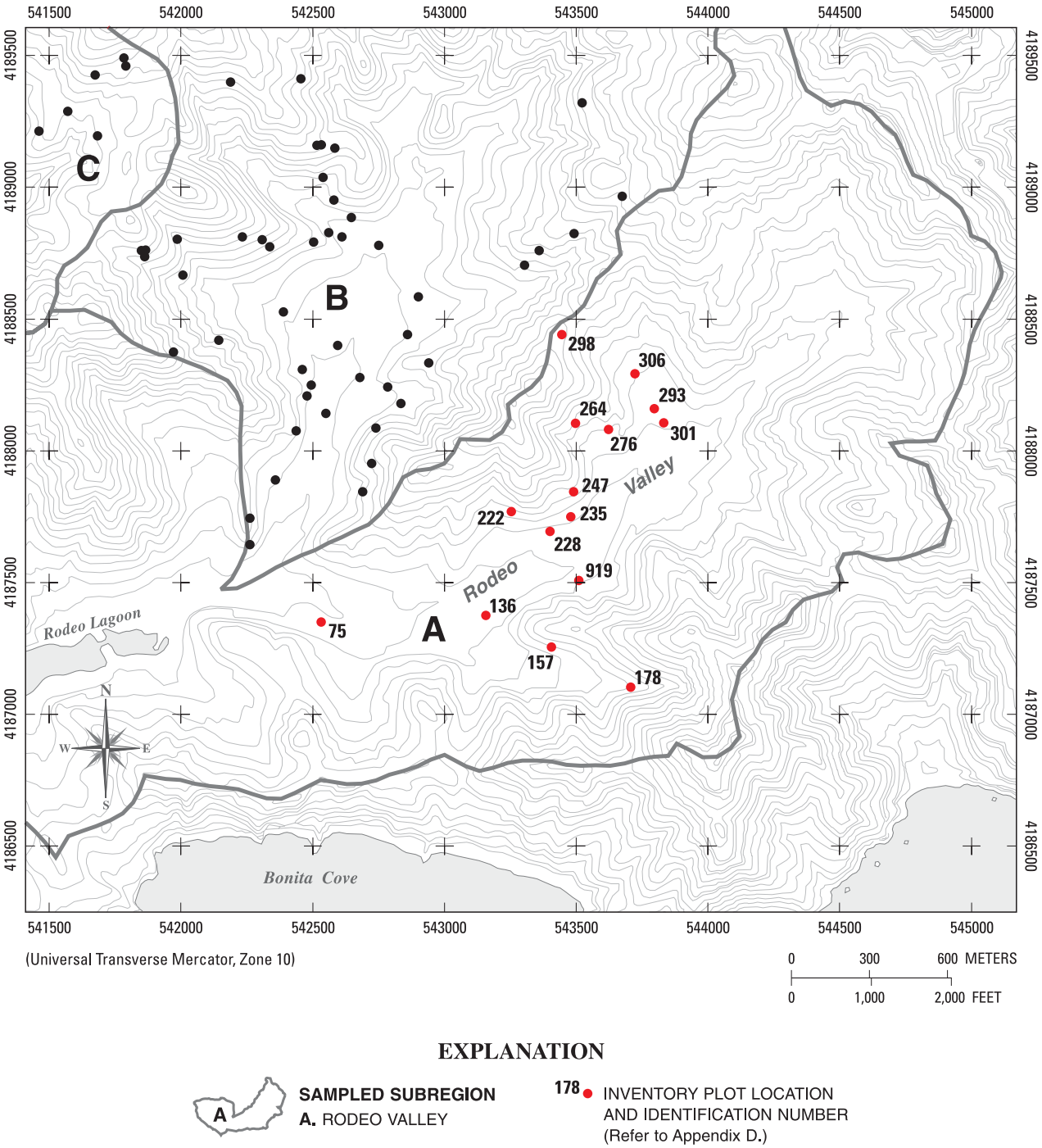


Figure 4a. Vertebrate inventory plots: detail of Rodeo Valley plots, 1990.

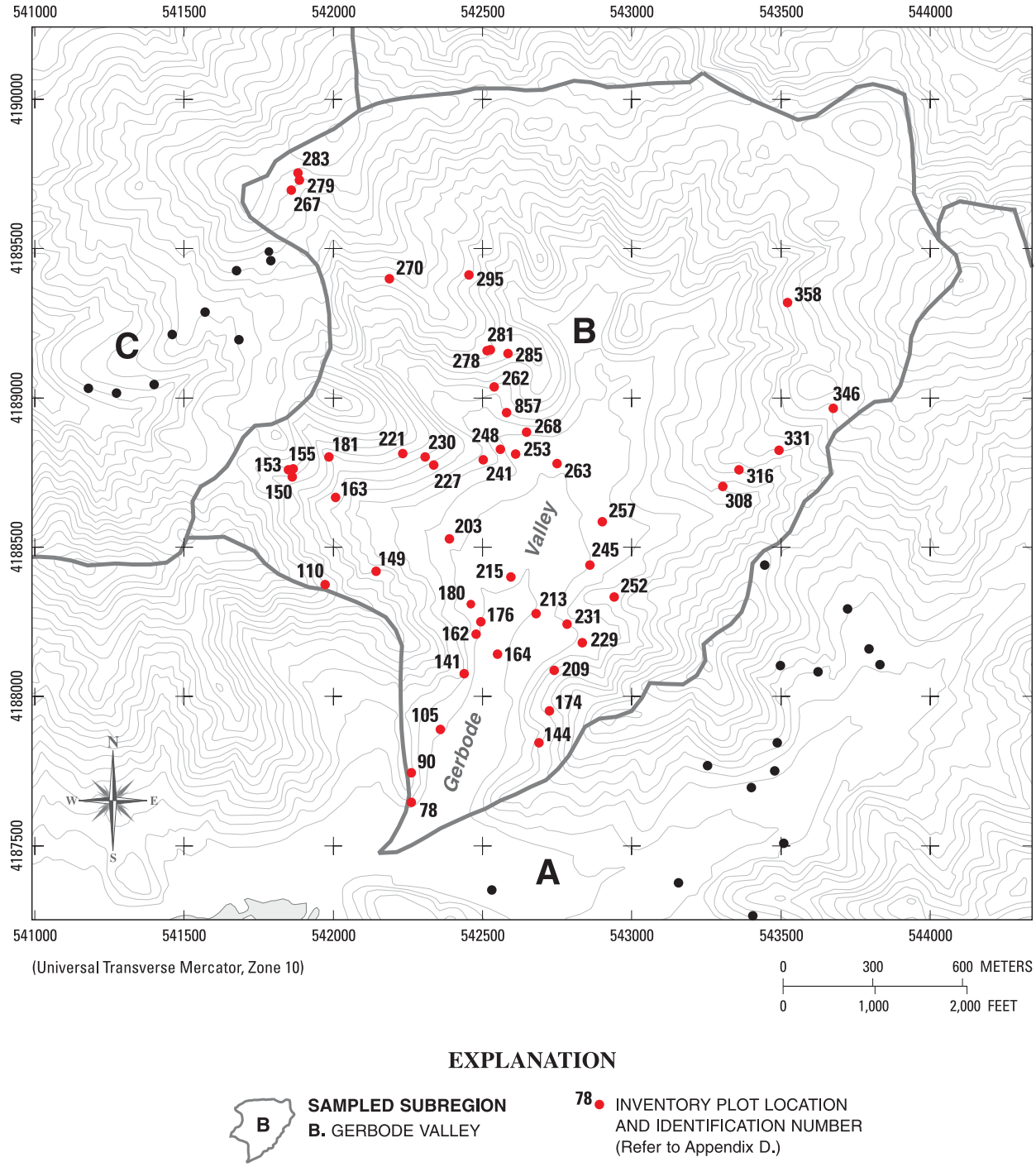
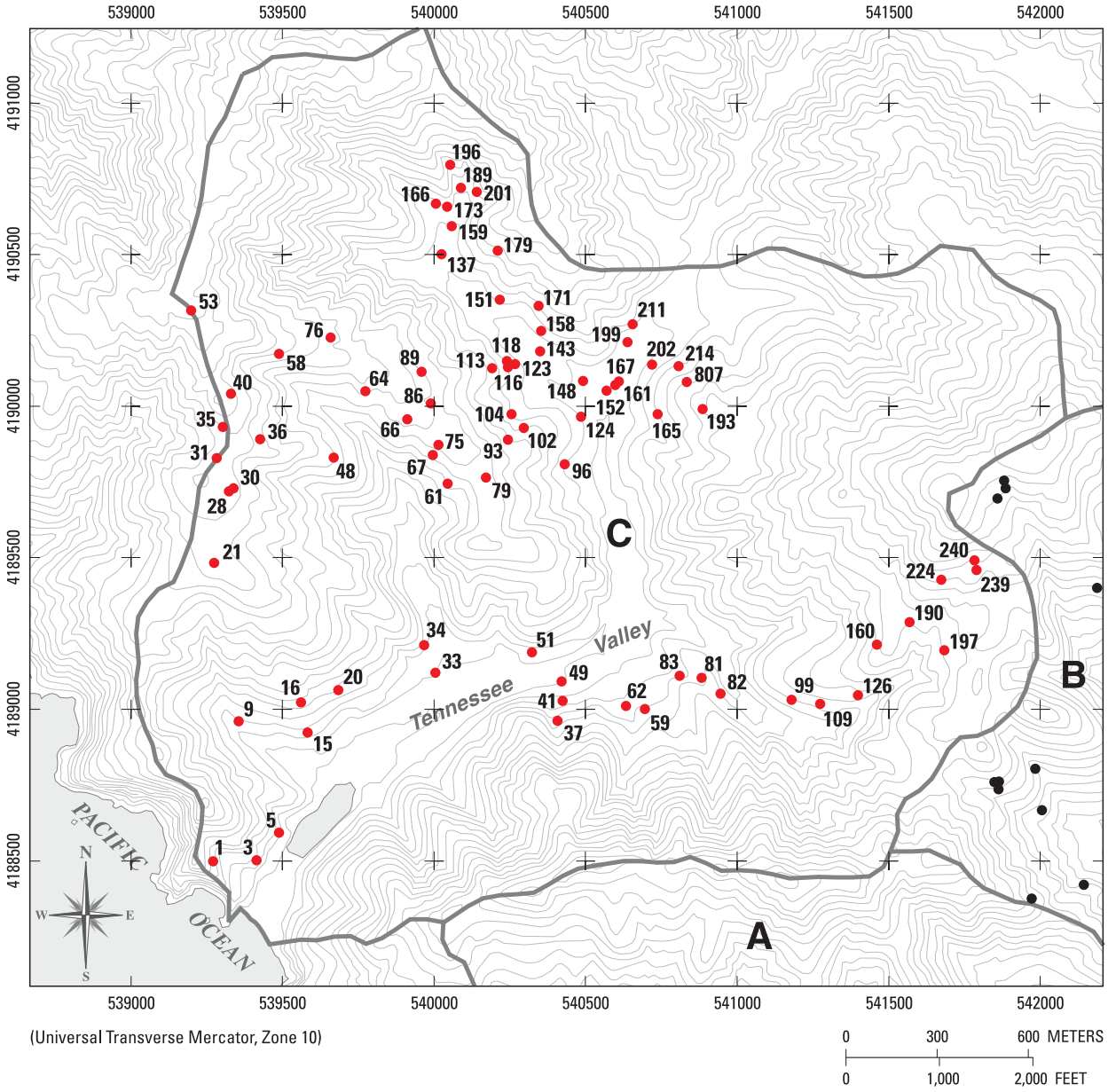


Figure 4b. Vertebrate inventory plots: detail of Gerbode Valley plots, 1990.



EXPLANATION

SAMPLED SUBREGION
C. TENNESSEE VALLEY

37 INVENTORY PLOT LOCATION AND IDENTIFICATION NUMBER (Refer to Appendix D.)

Figure 4c. Vertebrate inventory plots: detail of Tennessee Valley plots, 1990.

Table 6. Detection statistics of vertebrates sampled using systematic survey methods, Marin Headlands, 1990

Species	Species Code	Total Detections	Individual Detections	% of Individual Detections	Mean Abundance [1] Grassland Mean	± SE	Coastal Scrub Mean	± SE
Domestic dog	CAFA	1	1	0.1	0.01	0.01	0.00	0.00
Opossum	DIVI	3	3	0.4	0.02	0.02	0.02	0.02
Western skink	EUSK	1	1	0.1	0.01	0.01	0.00	0.00
Domestic cat	FECA	8	8	1.2	0.07	0.03	0.04	0.03
Northern alligator lizard	GECO	3	3	0.4	0.02	0.02	0.02	0.02
Bobcat	LYRU	24	24	3.5	0.19	0.07	0.13	0.05
Striped skunk	MEME	88	88	13.0	0.83	0.11	0.25	0.09
California vole	MICA	185	131	19.3	1.04	0.27	0.70	0.25
Dusky-footed woodrat	NEFU	11	11	1.6	0.02	0.02	0.17	0.08
Mouse species	PE	80	80	11.8	0.50	0.10	0.66	0.11
Deer mouse	PEMA	294	162	23.9	0.62	0.13	2.00	0.29
Raccoon	PRLO	24	24	3.5	0.18	0.05	0.15	0.05
Western harvest mouse	REME	24	16	2.4	0.04	0.03	0.23	0.13
Western fence lizard	SCOC	11	11	1.6	0.04	0.02	0.13	0.07
Skunk species	SKNK	5	5	0.7	0.06	0.03	0.00	0.00
Snake species	SNK	9	9	1.3	0.04	0.02	0.09	0.04
Shrew species	SO	7	7	1.0	0.04	0.03	0.06	0.04
Vagrant shrew	SOVA	2	2	0.3	0.00	0.00	0.04	0.04
Pocket gopher	THBO	1	1	0.1	0.01	0.01	0.00	0.00
Unknown species	UNKN	28	28	4.1	0.20	0.05	0.19	0.06
Gray fox	URCI	64	64	9.4	0.44	0.08	0.45	0.12
Total		**5,563**	**679**	**100**				

[1] Mean abundance of individuals.

Table 7. Frequency of occurrence (proportion of sites with at least one detection of a species), Marin Headlands, 1990

Species	Code	Coastal Scrub n = 53 Sites with detections	Coastal Scrub n = 53 Frequency	Grassland n = 90 Sites with detections	Grassland n = 90 Frequency
Domestic dog	CAFA	--	--	1	0.01
Opossum	DIVI	1	0.02	2	0.02
Western skink	EUSK	--	--	1	0.01
Domestic cat	FECA	2	0.04	5	0.06
Northern alligator lizard	GECO	1	0.02	2	0.02
Bobcat	LYRU	6	0.11	9	0.10
Striped skunk	MEME	8	0.15	44	0.49
California vole	MICA	14	0.26	26	0.29
Dusky-footed woodrat	NEFU	5	0.09	2	0.02
Mouse species	PE	25	0.47	25	0.28
Deer mouse	PEMA	33	0.62	23	0.26
Raccoon	PRLO	8	0.15	12	0.13
Western harvest mouse	REME	4	0.08	3	0.03
Western fence lizard	SCOC	4	0.08	4	0.04
Skunk species	SKNK	--	--	3	0.03

Table 7. Frequency of occurrence (proportion of sites with at least one detection of a species), Marin Headlands, 1990—Continued

Species	Code	Coastal Scrub n = 53		Grassland n = 90	
		Sites with detections	Frequency	Sites with detections	Frequency
Snake species	SNK	5	0.09	4	0.04
Shrew species	SO	2	0.04	3	0.03
Vagrant shrew	SOVA	1	0.02	--	--
Pocket gopher	THBO	--	--	1	0.01
Unknown species	UNKN	9	0.17	16	0.18
Gray fox	URCI	16	0.30	29	0.32

Table 8. Trap success (pitfall traps, Sherman live traps, wood squares) and track plate detection success, Marin Headlands, 1990

Habitat Type	Species	Code	Total Detections				Trap Success				
			PF	SH	TP	WS	PF	SH	PF+SH	TP	WS
Coastal Scrub	Opossum	DIVI	--	--	1	--	--	--	--	0.00	--
	Domestic cat	FECA	--	--	2	--	--	--	--	0.00	--
	Northern alligator lizard	GECO	--	--	--	1	--	--	--	--	0.00
	Bobcat	LYRU	--	--	7	--	--	--	--	0.01	--
	Striped skunk	MEME	--	--	13	--	--	--	--	0.02	--
	California vole	MICA	30	14	4	--	0.05	0.03	0.04	0.01	--
	Dusky-footed woodrat	NEFU	--	1	8	--	--	0.00	0.00	0.02	--
	Mouse species	PE	3	2	30	--	0.01	0.00	0.00	0.06	--
	Deer mouse	PEMA	68	128			0.12	0.24	0.18	--	--
	Raccoon	PRLO	--	--	7	1	--	--	--	0.01	0.00
	Western harvest mouse	REME	14	5	--	--	0.03	0.01	0.02	--	--
	Western fence lizard	SCOC	6	--	--	1	0.01	--	0.01	--	0.00
	Snake species	SNK	--	--	5	--	--	--	--	0.01	--
	Shrew species	SO	2	1	--	--	0.00	0.00	0.00	--	--
	Vagrant shrew	SOVA	2	--	--	--	0.00	--	0.00	--	--
	Unknown species	UNKN	--	--	9	1	--	--	--	0.02	0.00
	Gray fox	URCI	--	--	24	--	--	--	--	0.05	--
	Total trap-nights		**547**	**529**	**531**	**520**				**1,076**	
Grassland	Domestic dog	CAFA	--	--	1	--	--	--	--	0.00	--
	Opossum	DIVI	--	--	2	--	--	--	--	0.00	--
	Western skink	EUSK	--	--	--	1	--	--	--	--	0.00
	Domestic cat	FECA	--	--	6	--	--	--	--	0.01	--
	Northern alligator lizard	GECO	2	--	--	--	0.00	--	0.00	--	--
	Bobcat	LYRU	--	--	17	--	--	--	--	0.02	--
	Striped skunk	MEME	--	--	75	--	--	--	--	0.09	--
	California vole	MICA	64	69	4	--	0.07	0.08	0.08	0.00	--
	Dusky-footed woodrat	NEFU	--	--	2	--	--	--	--	0.00	--
	Mouse species	PE	--	1	44	--	--	--	--	0.05	--
	Deer mouse	PEMA	40	58	--	--	0.05	0.07	0.06	--	--
	Raccoon	PRLO	--	--	16	--	--	--	--	0.02	--
	Western harvest mouse	REME	2	3	--	--	0.00	0.00	0.00	--	--
	Western fence lizard	SCOC	3	--	--	1	0.00	--	0.00	--	0.00
	Skunk species	SKNK	--	--	5	--	--	--	--	0.01	--

Table 8. Trap success (pitfall traps, Sherman live traps, wood squares) and track plate detection success, Marin Headlands, 1990—Continued

Habitat Type	Species	Code	Total Detections				Trap Success				
			PF	SH	TP	WS	PF	SH	PF+SH	TP	WS
	Snake species	SNK	--	--	4	--	--	--	--	0.00	--
	Shrew species	SO	1	3	--	--	0.00	0.00	0.00	--	--
	Pocket gopher	THBO	1	--	--	--	0.00	--	0.00	--	--
	Unknown species	UNKN	--	--	18	--	--	--	--	0.02	--
	Gray fox	URCI	--	--	37	3	--	--	--	0.04	0.00
	Total trap-nights		**880**	**853**	**867**	**836**				**1,733**	

Sampling Year 1991

We sampled 67 grassland and 43 coastal scrub plots in the Marin Headlands in 1991 in the Marin Headlands, including 52 plots which had been sampled in 1990 (Figures 5, 5a, 5b, 5c). We detected 13 species during 3,465 total trap-nights of effort (Table 9). We also recorded lizards (species uncertain), snakes (species uncertain), skunks (species unclear), and 1 unknown. We detected 12 species on grassland plots and 10 species on coastal scrub plots. We recorded a mean of 2.52 species (SE = 0.18) on grassland plots and 2.91 species (SE = 0.26) on coastal scrub plots.

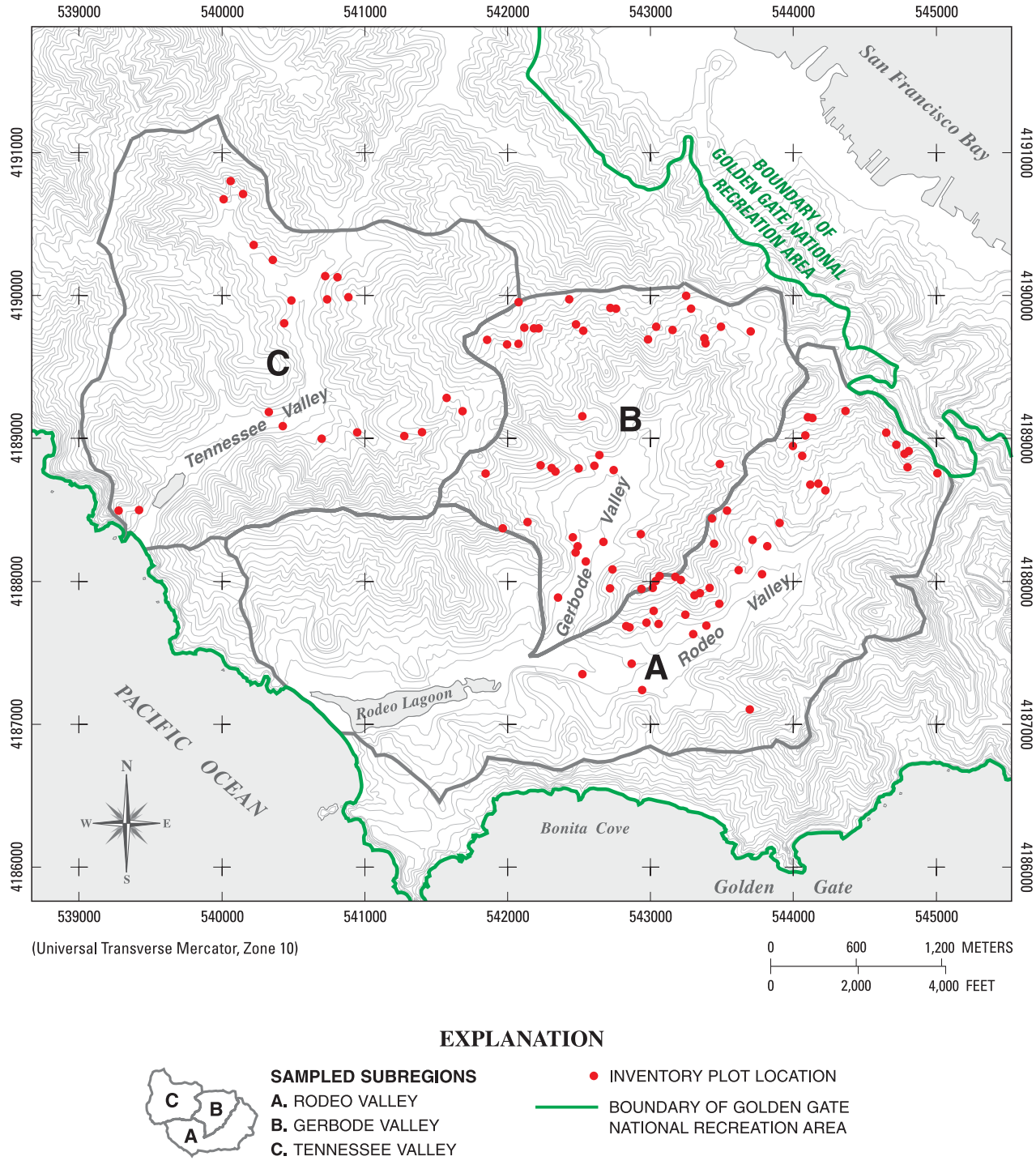
Across all sites, deer mice (27.7% of individual detections), gray foxes (14.7% of individual detections), and striped skunks (14.3% of individual detections) were the most abundant species detected. Mean abundance of deer mice was greater in coastal scrub (mean = 1.74, SE = 0.27) than in grassland (mean = 0.85, SE = 0.16). Gray foxes were more abundant in grassland (mean = 0.74, SE = 0.16) than in coastal scrub (mean = 0.57, SE = 0.13). Striped skunks were more abundant in grassland (mean = 0.67, SE = 0.11) than in coastal scrub (mean = 0.53, SE = 0.14).

As in 1991, deer mice were the most frequently encountered mammals on coastal scrub plots, detected at 67% of the sites sampled (Table 10). Striped skunks and gray foxes both occurred on 36% of the sites sampled. On grassland sites, striped skunks had the greatest frequency of occurrence (frequency = 0.46), followed by deer mice (frequency = 0.42) and gray foxes (frequency = 0.31).

Trap success for pitfall traps and Sherman live traps was lower in 1991 than in 1990. Trap success was greater on coastal scrub sites (15% of total captures) than on grassland sites (9% of total captures) (Table 11). In coastal scrub habitats, trap success was greatest for deer mice (12% of total captures). Voles accounted for only 1% of total captures over 880 trap-nights in coastal scrub. In grassland, trap success was also greatest for deer mice with 6% of total captures over 1,322 trap nights. Again, voles showed low combined trap success (2% of total captures). In both habitat types, Sherman live traps captured more deer mice than pitfall traps. While pitfall traps were more successful for capturing voles on grassland plots (70% of vole captures), Sherman live traps caught more voles on coastal scrub sites (78% of vole captures).

Track plate detection success was greatest for gray foxes on coastal scrub plots (7% of total detections) and striped skunks on grassland plots (6% of total captures). Detection success for larger mammals was lowest for spotted skunks in grassland (<1% of total detections). We also recorded 3 domestic cats.

Artificial cover board detection rates were low for both sampled habitats. We detected only 1 western fence lizard and 2 northern alligator lizards over 113 trap nights of effort. We captured both species in pitfall traps during the same sampling session.



EXPLANATION

SAMPLED SUBREGIONS

A. RODEO VALLEY
B. GERBODE VALLEY
C. TENNESSEE VALLEY

- INVENTORY PLOT LOCATION
- BOUNDARY OF GOLDEN GATE NATIONAL RECREATION AREA

Figure 5. Vertebrate inventory plots: Marin Headlands, 1991.

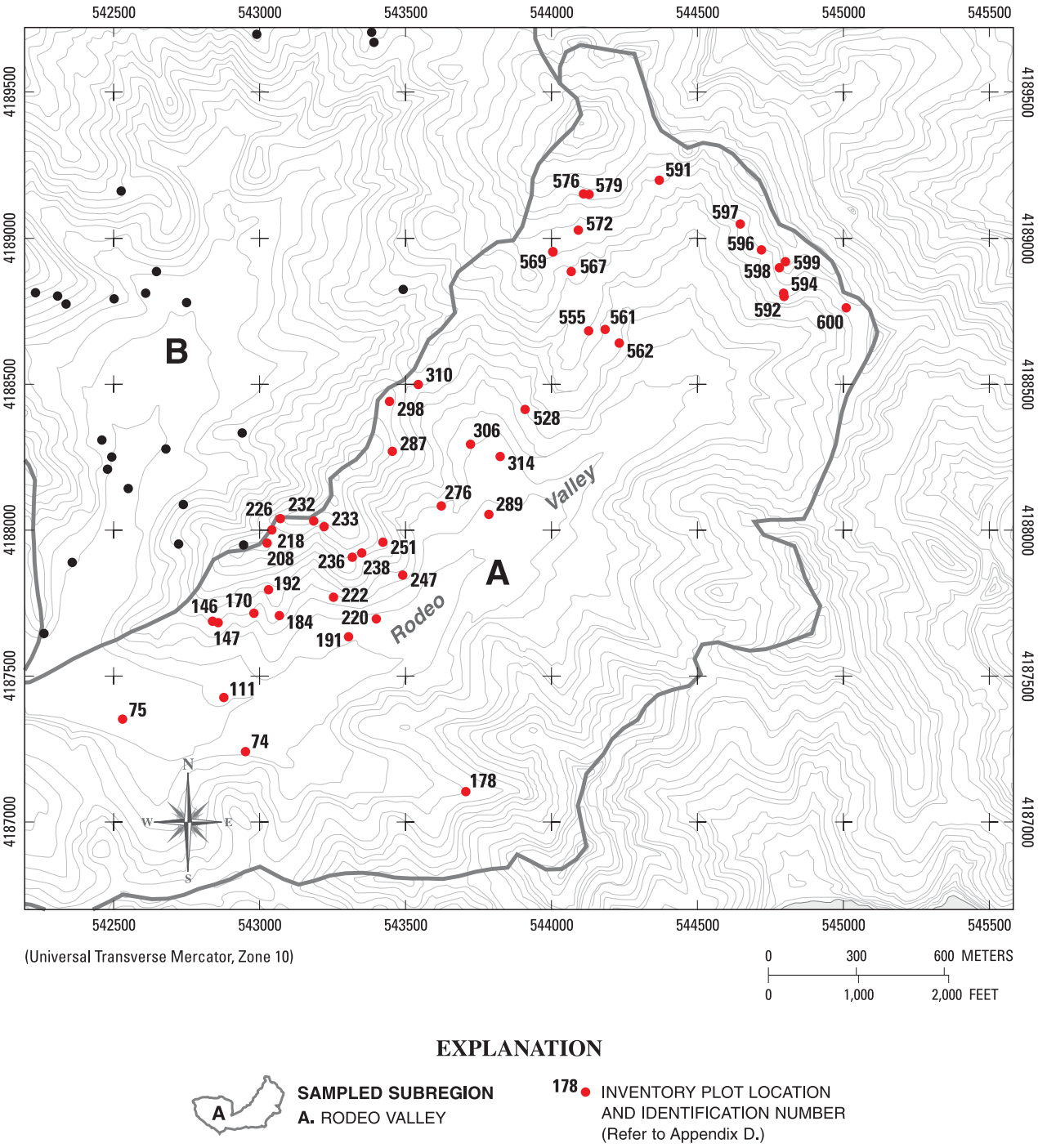
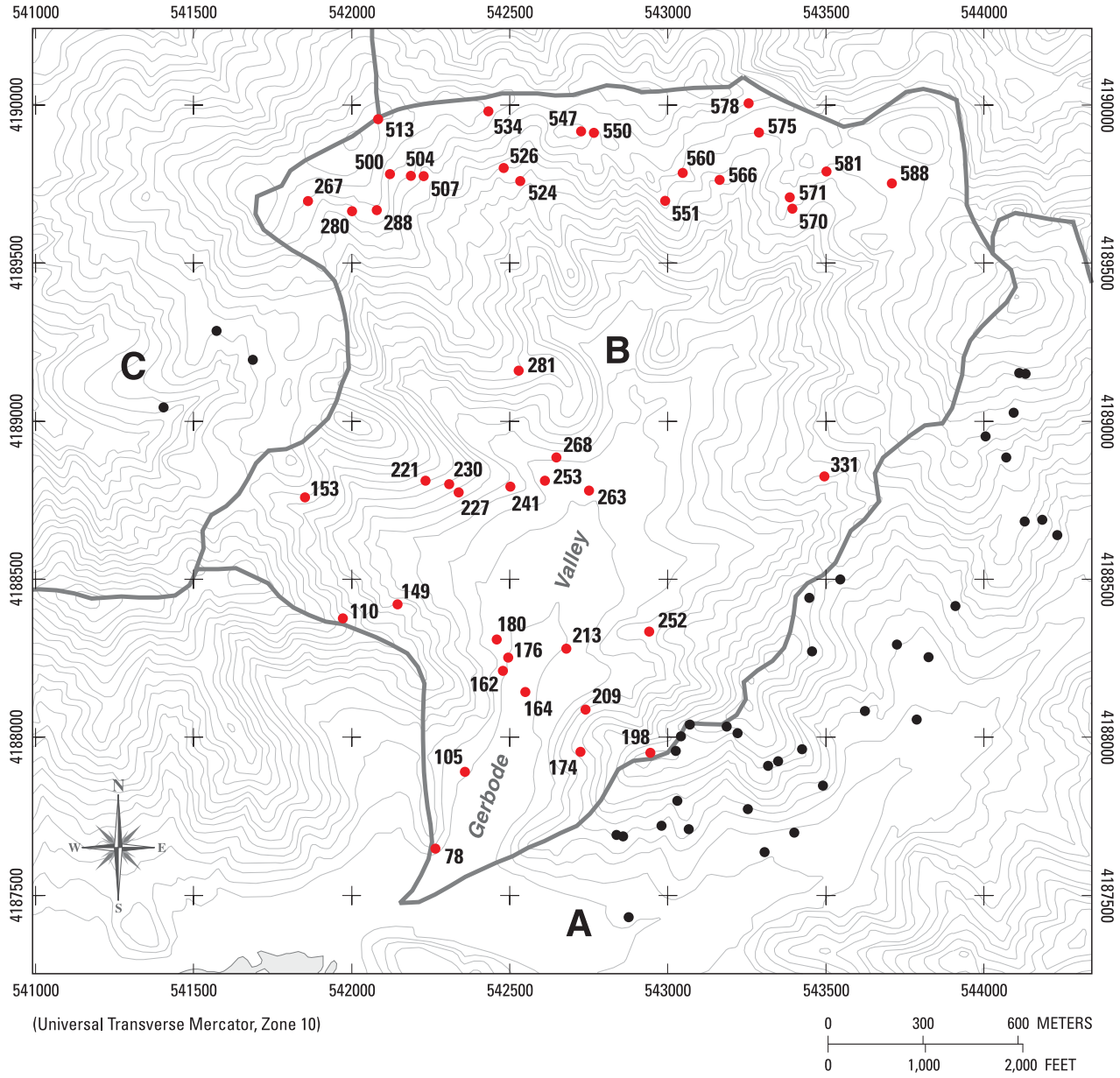


Figure 5a. Vertebrate inventory plots: detail of Rodeo Valley plots, 1991.



EXPLANATION

B

SAMPLED SUBREGION
B. GERBODE VALLEY

78 ● INVENTORY PLOT LOCATION AND IDENTIFICATION NUMBER (Refer to Appendix D.)

Figure 5b. Vertebrate inventory plots: detail of Gerbode Valley plots, 1991.

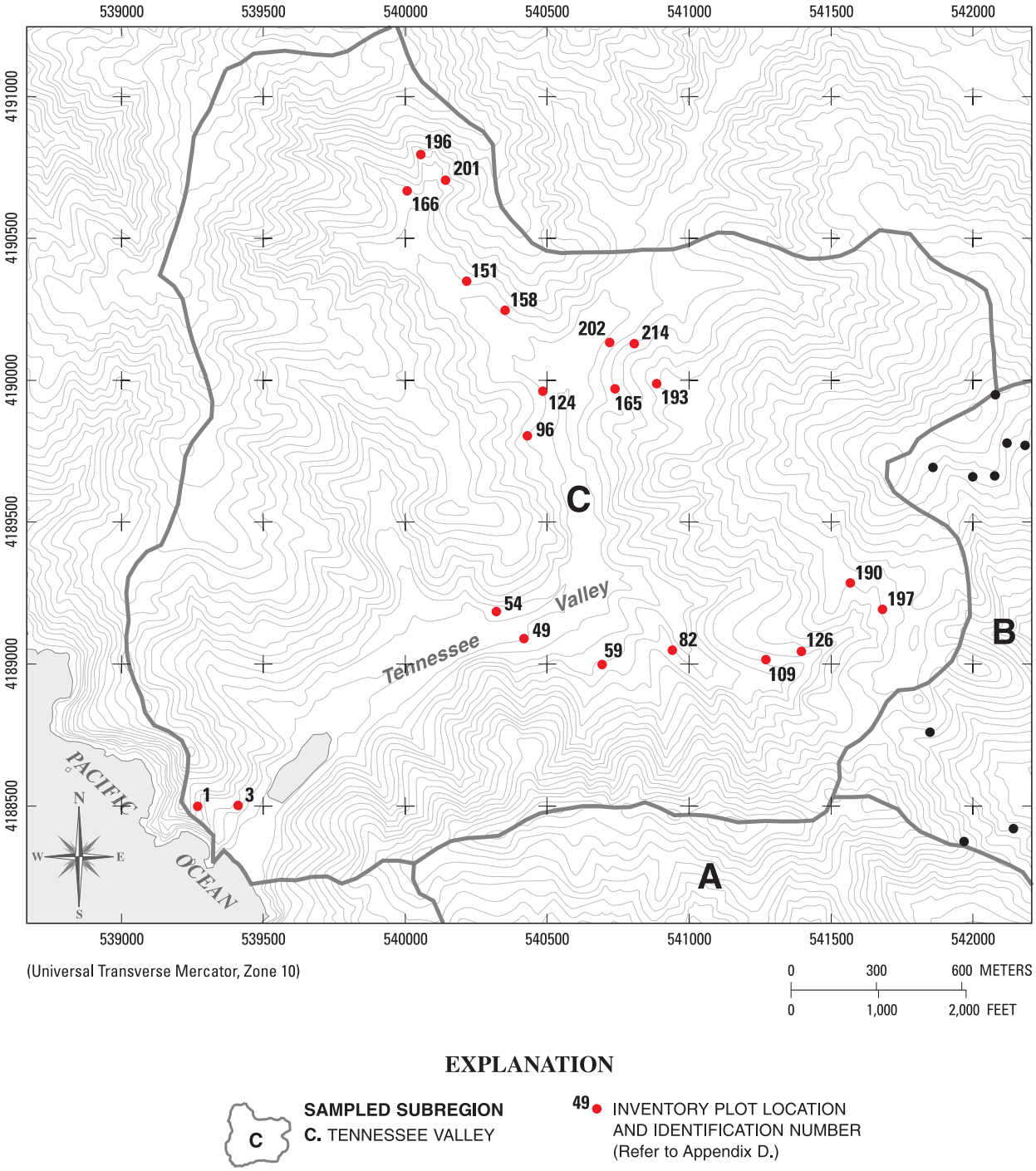


Figure 5c. Vertebrate inventory plots: detail of Tennessee Valley plots, 1991.

Table 9. Detection statistics of vertebrates sampled using systematic survey methods, Marin Headlands, 1991

Species Code	Total Detections	Individual Detections	% of Individual Detections	Mean Abundance [1]			
				Grassland		Coastal Scrub	
				Mean	SE	Mean	SE
FECA	3	3	0.6	0.01	0.01	0.05	0.03
GECO	3	3	0.6	0.04	0.03	0.00	0.00
GEMU	1	1	0.2	0.01	0.01	0.00	0.00
LYRU	18	18	3.8	0.18	0.05	0.14	0.08
LZSP	2	2	0.4	0.01	0.01	0.02	0.02
MEME	68	68	14.3	0.67	0.11	0.53	0.14
MICA	33	25	5.3	0.31	0.12	0.09	0.04
NEFU	23	22	4.6	0.00	0.00	0.51	0.17
PE	63	63	13.2	0.51	0.10	0.67	0.16
PEMA	187	132	27.7	0.85	0.16	1.74	0.27
PRLO	12	12	2.5	0.10	0.04	0.12	0.05
REME	1	1	0.2	0.01	0.01	0.00	0.00
SCOC	15	15	3.2	0.16	0.06	0.09	0.04
SKNK	4	4	0.8	0.04	0.03	0.02	0.02
SNK	15	15	3.2	0.15	0.06	0.12	0.05
SPGR	4	4	0.8	0.01	0.01	0.07	0.04
THSP	1	1	0.2	0.01	0.01	0.00	0.00
UNKN	17	17	3.6	0.15	0.04	0.16	0.07
URCI	70	70	14.7	0.57	0.13	0.74	0.16
Total	**3,465**	**476**	**100**				

[1] Mean abundance of individuals.

Table 10. Frequency of occurrence (proportion of sites with at least one detection of a species), Marin Headlands, 1991

Species	Code	Coastal Scrub n = 43		Grassland n = 67	
		Sites with detections	Frequency	Sites with detections	Frequency
Domestic cat	FECA	2	0.05	1	0.02
Northern alligator lizard	GECO	--	--	2	0.03
Southern alligator lizard	GEMU	--	--	1	0.02
Bobcat	LYRU	4	0.09	11	0.16
Lizard species	LZSP	1	0.02	1	0.02
Striped skunk	MEME	17	0.36	31	0.46
California vole	MICA	4	0.09	10	0.15
Dusky-footed woodrat	NEFU	11	0.26	--	--
Mouse species	PE	17	0.36	23	0.34
Deer mouse	PEMA	29	0.67	28	0.42
Raccoon	PRLO	5	0.12	7	0.11
Western harvest mouse	REME	--	--	1	0.02
Western fence lizard	SCOC	4	0.09	9	0.13
Skunk species	SKNK	1	0.02	3	0.06
Snakes species	SNK	5	0.12	8	0.12
Spotted skunk	SPGR	3	0.07	1	0.02
Garter snake species	THSP	--	--	1	0.02
Unknown species	UNKN	5	0.12	10	0.15
Gray fox	URCI	17	0.36	21	0.31

Table 11. Trap success (pitfall traps, Sherman live traps, wood squares) and track plate detection success, Marin Headlands, 1991

		Total Detections					Trap Success				
Habitat Type	**Species**	**Code**	**PF**	**SH**	**TP**	**WS**	**PF**	**SH**	**PF+SH**	**TP**	**WS**
Coastal Scrub	Domestic cat	FECA	--	--	2	--	--	--	--	0.00	--
	Bobcat	LYRU	2	--	4	--	0.01	--	0.00	0.01	--
	Lizard species	LZSP	--	--	1	--	--	--	--	0.00	--
	Striped skunk	MEME	--	--	23	--	--	--	--	0.05	--
	California vole	MICA	2	7	1	--	0.01	0.02	0.01	0.00	--
	Dusky-footed woodrat	NEFU	1	5	17	--	0.00	0.01	0.01	0.04	--
	Mouse species	PE	--	--	24	--	--	--	--	--	--
	Deer mouse	PEMA	18	91	--	--	0.04	0.21	0.12	--	--
	Raccoon	PRLO	--	--	5	--	--	--	--	0.01	--
	Western fence lizard	SCOC	3	--	--	1	0.01	--	0.00	--	0.02
	Skunk species	SKNK	--	--	1	--	--	--	--	0.00	--
	Snake species	SNK	--	--	5	--	--	--	--	0.01	--
	Spotted skunk	SPGR	--	--	3	--	--	--	--	0.01	--
	Unknown species	UNKN	--	--	7	--	--	--	--	0.02	--
	Gray fox	URCI	--	--	31	--	--	--	--	0.07	--
	Total trap-nights		**437**	**443**	**452**	**43**				**880**	
Grassland	Domestic cat	FECA	--	--	1	--	--	--	--	0.00	--
	Northern alligator lizard	GECO	1	--	--	2	0.00	--	0.00	--	0.03
	Southern alligator lizard	GEMU	1	--	--	--	0.00	--	0.00	--	--
	Bobcat	LYRU	--	--	12	--	--	--	--	0.02	--
	Lizard species	LZSP	--	--	1	--	--	--	--	0.00	--
	Striped skunk	MEME	--	--	45	--	--	--	--	0.06	--
	California vole	MICA	16	7	--	--	0.02	0.01	0.02	--	--
	Mouse species	PE	--	--	34	--	--	--	--	0.05	--
	Deer mouse	PEMA	16	67	--	--	0.02	0.10	0.06	--	--
	Raccoon	PRLO	--	--	7	--	--	--	--	0.01	--
	Western harvest mouse	REME	1	--	--	--	0.00	--	0.00	--	--
	Western fence lizard	SCOC	10	--	1	--	0.02	--	0.01	--	--
	Skunk species	SKNK	--	--	3	--	--	--	--	0.00	--
	Snake species	SNK	--	--	10	--	--	--	--	0.01	--
	Spotted skunk	SPGR	--	--	1	--	--	--	--	0.00	--
	Garter snake species	THSP	--	--	1	--	--	--	--	0.00	--
	Unknown species	UNKN	--	--	10	--	--	--	--	0.01	--
	Gray fox	URCI	--	--	38	--	--	--	--	0.05	--
	Total trap-nights		**664**	**658**	**698**	**70**			**1,322**		

Sampling Year 1992

We sampled 70 plots in the Marin Headlands in 1992 (Figures 6, 6a, 6b, 6c, 6d). We sampled 8 coastal scrub and 34 grassland sites in Tennessee Valley and Oakwood Valley, and 11 broad-leaved evergreen forest sites in Oakwood Valley. Stands of coast-live oak (*Quercus agrifolia*) and California bay (*Umbellularia californica*) dominated these latter sites. We sampled 17 sites in Rodeo Valley, including 7 sites along the willow-dominated riparian corridor bordering Rodeo Creek and 10 sites in the coastal wetlands surrounding Rodeo Lagoon.

We detected 19 species during 2,824 trap-nights of effort (Table 12). We also recorded unidentified snake and lizard species on track plates. We detected 12 species in grassland, 10 species in coastal scrub, 10 species in riparian woodland, 10 species in coastal marsh, and 4 species in broad-leaved evergreen forest. We captured and tagged 2 salt marsh harvest mice at a single Rodeo Lagoon plot. Riparian plots displayed the greatest mean number of species detected per plot (mean = 4.71, SE = 0.30), while broad-leaved evergreen plots had the lowest mean (mean = 2.62, SE = 0.28).

Deer mice were the most abundant species detected (23.9% of individuals detected), followed by raccoons (17.0% of individuals detected), and gray foxes (12.9% of individuals detected). Mean abundance of deer mice was

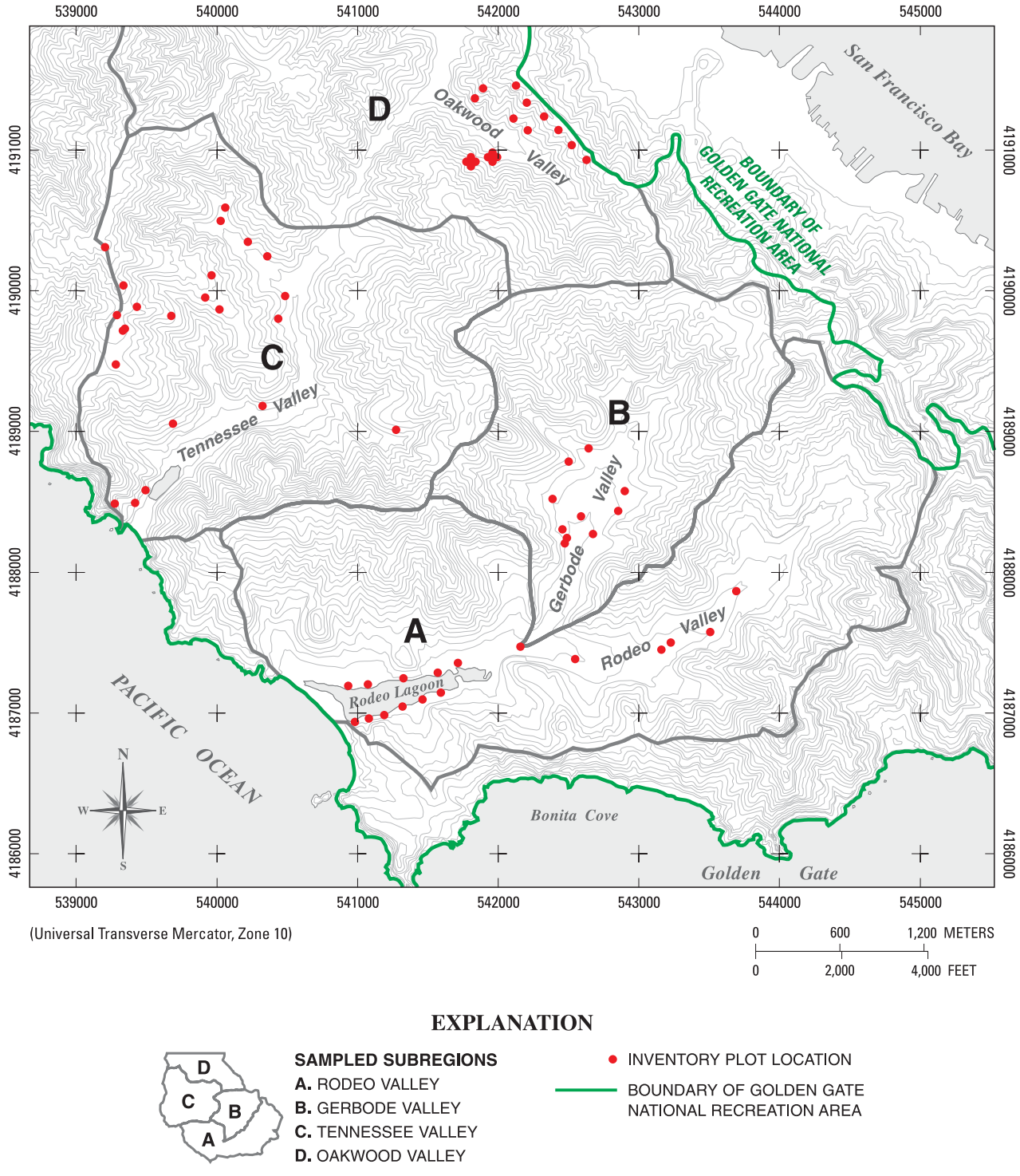


Figure 6. Vertebrate inventory plots: Marin Headlands, 1992.

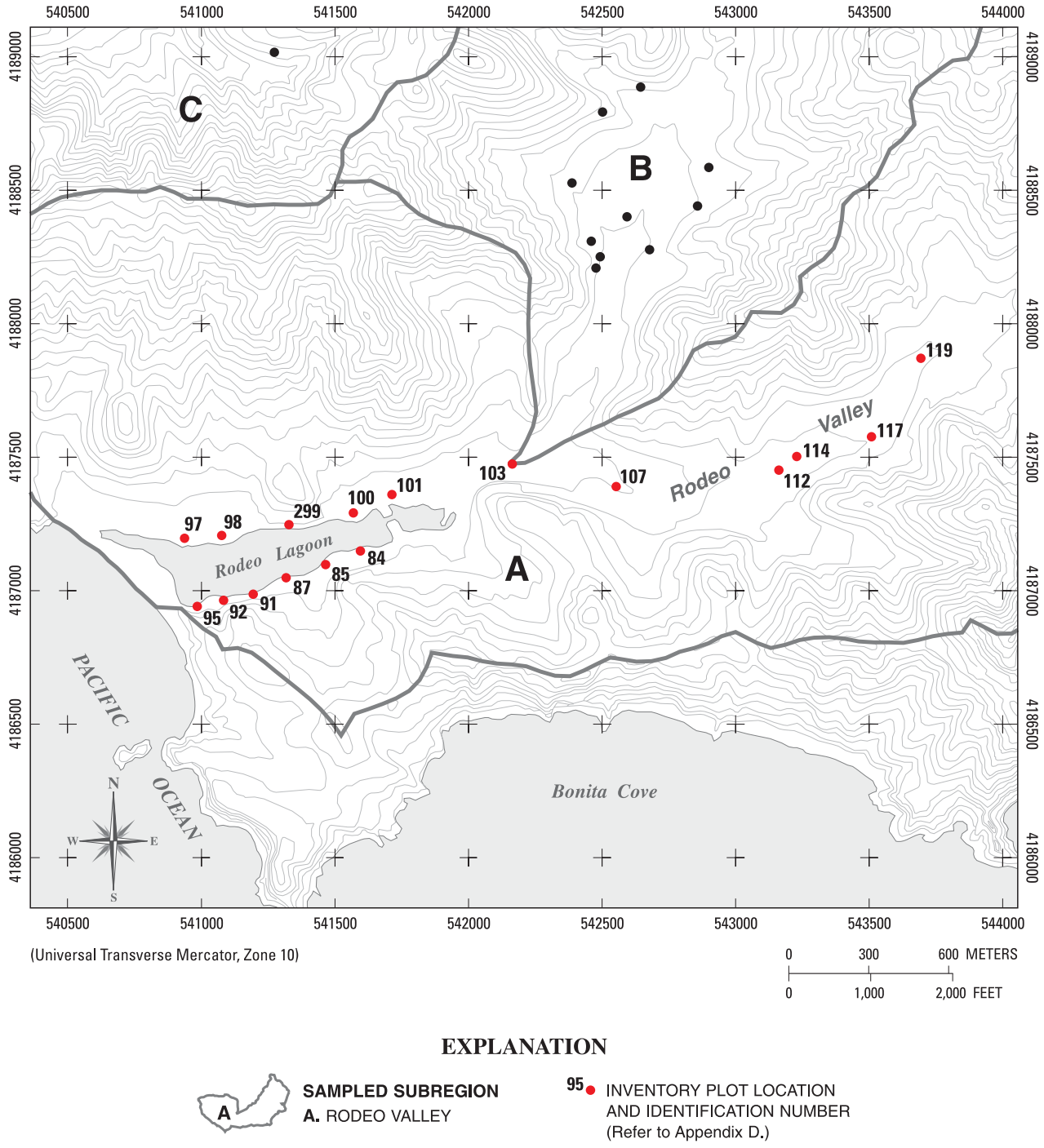
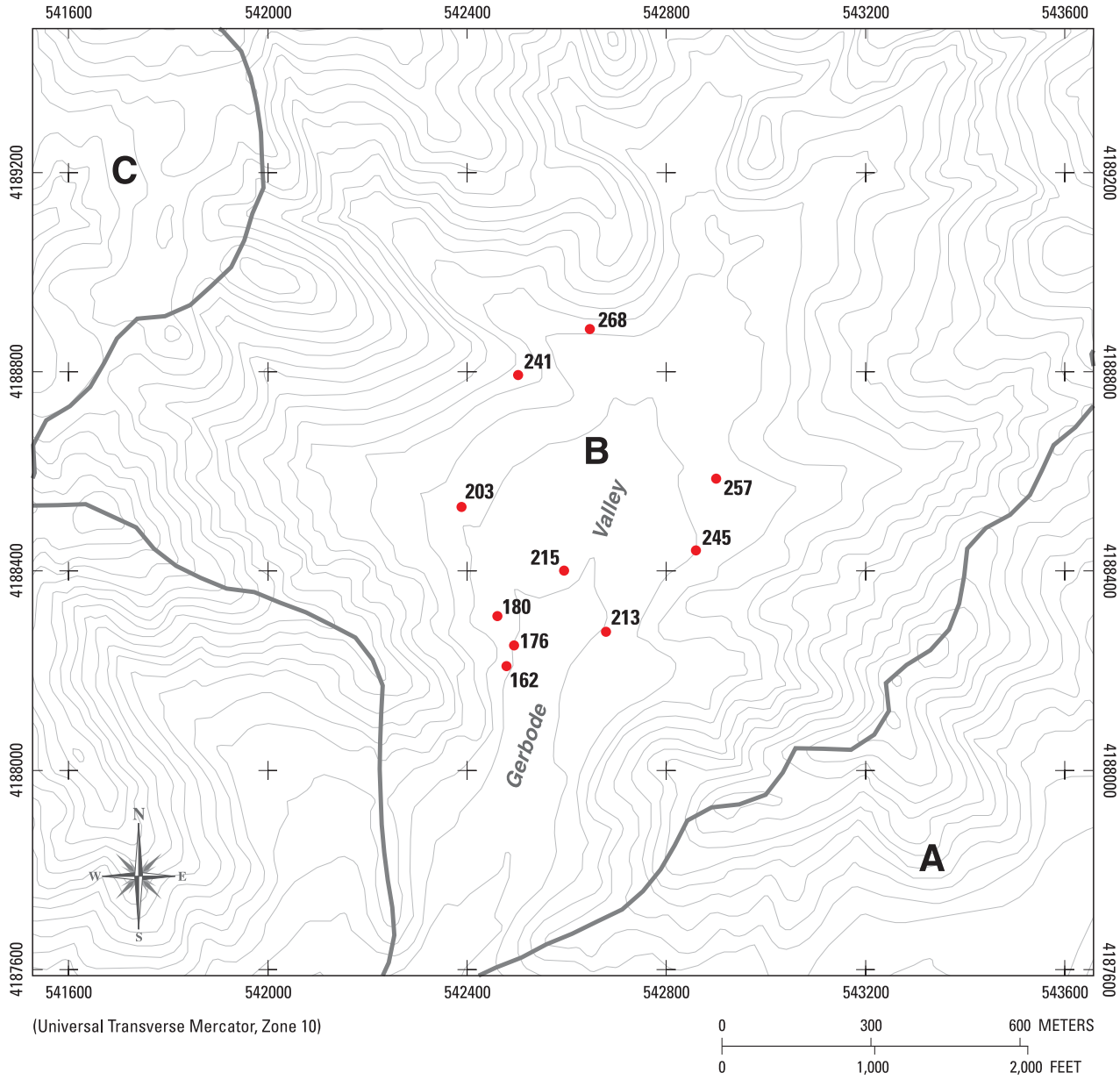


Figure 6a. Vertebrate inventory plots: detail of Rodeo Valley plots, 1992.

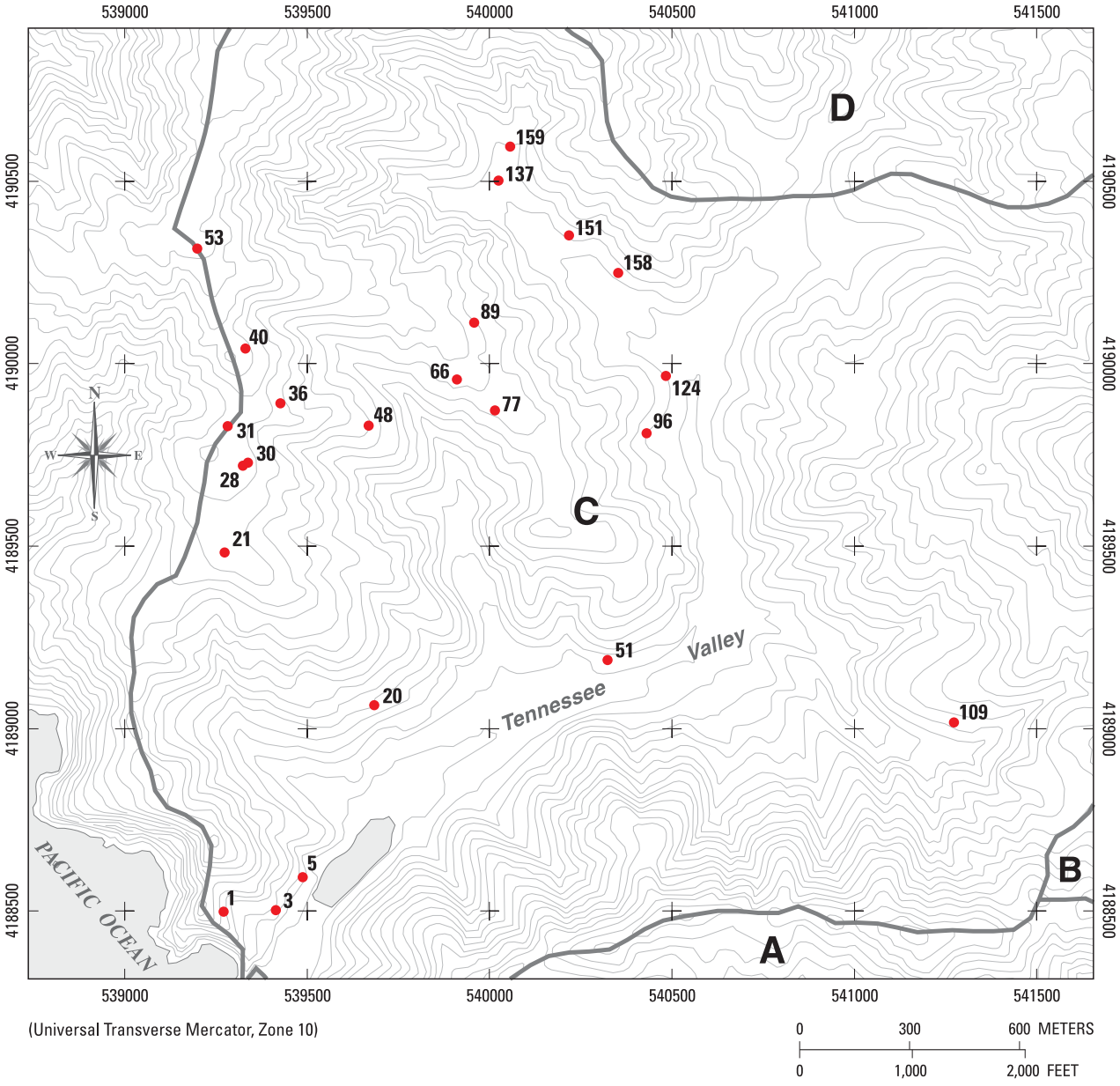


EXPLANATION

B **SAMPLED SUBREGION**
B. GERBODE VALLEY

162 ● INVENTORY PLOT LOCATION AND IDENTIFICATION NUMBER (Refer to Appendix D.)

Figure 6b. Vertebrate inventory plots: detail of Gerbode Valley plots, 1992.



EXPLANATION

C

SAMPLED SUBREGION
C. TENNESSEE VALLEY

20 ● INVENTORY PLOT LOCATION AND IDENTIFICATION NUMBER (Refer to Appendix D.)

Figure 6c. Vertebrate inventory plots: detail of Tennessee Valley plots, 1992.

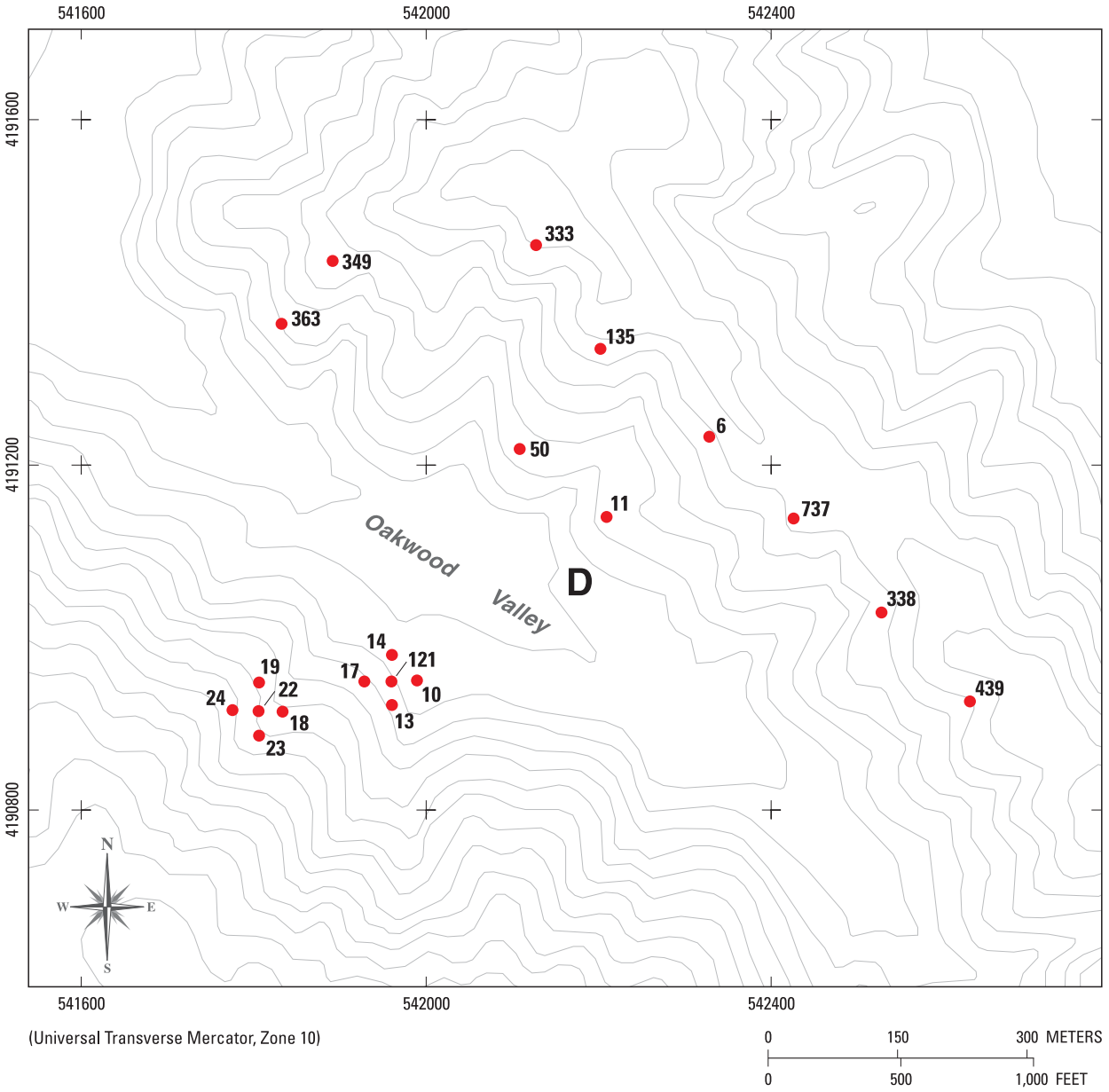


Figure 6d. Vertebrate inventory plots: detail of Oakwood Valley plots, 1992.

Table 12. Detection statistics of vertebrates sampled using systematic survey methods, Marin Headlands, 1992

Species Code	Total Detections	Individual Detections	% of Individual Detections	Mean Abundance [1]							
				Grass		Scrub		Riparian		Coastal Marsh	
				Mean	SE	Mean	SE	Mean	SE	Mean	SE
CAFA	1	1	0.2	--	--	--	--	--	--	0.10	0.10
DIVI	9	9	1.5	--	--	0.13	0.13	0.86	0.40	0.10	0.10
FECA	2	2	0.3	0.06	0.04	--	--	--	--	--	--
GECO	4	4	0.6	0.06	0.04	0.25	0.16	--	--	--	--
GEMU	1	1	0.2	0.03	0.03	--	--	--	--	--	--
LYRU	6	6	1.0	0.15	0.07	--	--	0.14	0.14	--	--
LZSP	1	1	0.2	0.03	0.03	--	--	--	--	--	--
MEME	41	41	6.6	1.06	0.21	0.25	0.16	0.43	0.30	--	--
MICA	92	71	11.5	1.21	0.39	2.88	0.90	0.43	0.30	0.40	0.16
MUMU	1	1	0.2	--	--	--	--	--	--	0.10	0.10
NEFU	11	10	1.6	--	--	0.13	0.13	1.14	0.70	0.10	0.10
ODHE	1	1	0.2	--	--	--	--	0.14	0.14	--	--
PE	82	82	13.2	0.97	0.24	3.00	0.63	0.57	0.43	0.10	0.10
PEMA	271	148	23.9	2.03	0.44	2.75	0.73	3.00	0.85	3.80	0.87
PRLO	105	105	17.0	0.79	0.26	0.13	0.13	1.86	0.99	4.70	0.84
REME	2	1	0.2	0.03	0.03	--	--	--	--	--	--
RERA	7	2	0.3	--	--	--	--	--	--	0.20	0.20
SCOC	4	4	0.6	--	--	0.50	0.50	--	--	--	--
SNK	6	6	1.0	0.18	0.09	--	--	--	--	--	--
SOVA	29	27	4.4	0.38	0.22	0.50	0.33	0.57	0.43	0.60	0.34
THSI	1	1	0.2	0.03	0.03	--	--	--	--	--	--
UNKN	18	15	2.4	0.29	0.09	0.13	0.13	--	--	0.20	0.13
URCI	80	80	12.9	0.62	0.17	0.25	0.16	1.86	0.70	1.20	0.61
Total	**2,824**	**619**	**100**								

[1] Mean abundance of individuals.

greatest around Rodeo Lagoon (mean = 3.80, SE = 0.87) and lowest in broad-leaved evergreen forest (mean = 1.18, SE = 0.42). Raccoon mean abundance was greatest around Rodeo Lagoon (mean = 4.7, SE = 0.84) and lowest in coastal scrub (mean = 0.13, SE = 0.13). High raccoon abundance around Rodeo Lagoon may have been an artifact of trap placement. Traps ran at 30-m intervals along a transect bordering the lagoon. A single raccoon, attracted by the canned bait, may have moved between track plate stations, thereby increasing the number of tracks recorded during the sampling session.

Deer mice were detected at all riparian and coastal wetland plots (Table 13). They also showed the greatest frequency of occurrence for species in coastal scrub (frequency = 0.88), followed by voles (frequency = 0.75). In grassland, deer mice and striped skunks were both detected at 59% of the sites sampled. In broad-leaved evergreen forest, gray foxes showed the greatest frequency of occurrence (frequency = 0.82). The Federally Endangered salt marsh harvest mouse was detected at a single site bordering Rodeo Lagoon.

Trap success for pitfall traps and Sherman live traps was greatest on coastal scrub sites (57% of total captures) (Table 14). On these plots, trap success was greatest for deer mice (30% of total captures). Trapping was the least effective on broad-leaved evergreen forest plots, which showed a trap success of 13% of total captures. Deer mice showed the greatest relative trap success across all the habitat types sampled. In general, Sherman live traps were more effective than pitfall traps in capturing deer mice. On the sites bordering Rodeo Lagoon; however, deer mice capture success was greater for pitfall traps. Additionally, pitfall traps accounted for all 7 captures of salt marsh harvest mice.

Track plate detection success was greatest for raccoons bordering Rodeo Lagoon (42% of total detections) and gray foxes in broad-leaved evergreen forest (32% of total detections). Both bobcats and opossums displayed low detection success rates (< 1% of total detections).

Artificial cover board detection success was low across all habitats sampled. Only 1 northern alligator lizard was detected on a coastal scrub plot.

Table 13. Frequency of occurrence (proportion of sites with at least one detection of a species), Marin Headlands, 1992

	Broad-leaved evergreen n = 11		Coastal scrub n = 8		Grassland n = 34		Riparian n = 7		Coastal Marsh n = 10	
Code	Sites with detections	Freq	Sites with detections	Freq	Sites with detections	Freq	Sites with detections	Freq	Sites with detections	Freq
CAFA	--	--	--	--	--	--	--	--	1	0.10
DIVI	1	0.09	1	0.13	--	--	4	0.57	1	0.10
FECA	--	--	--	--	2	0.06	--	--	--	--
GECO	--	--	2	0.25	2	0.06	--	--	--	--
GEMU	--	--	--	--	1	0.03	--	--	--	--
LYRU	--	--	--	--	4	0.12	1	0.14	--	--
LZSP	--	--	--	--	1	0.03	--	--	--	--
MEME	--	--	2	0.25	20	0.59	2	0.29	--	--
MICA	--	--	6	0.75	14	0.41	2	0.29	4	0.40
MUMU	--	--	--	--	--	--	--	--	1	0.10
NEFU	--	--	1	0.13	--	--	3	0.43	1	0.10
ODHE	--	--	--	--	--	--	1	0.14	--	--
PE	5	0.46	7	0.88	16	0.47	2	0.29	1	0.10
PEMA	6	0.55	7	0.88	20	0.59	7	1.00	10	1.00
PRLO	6	0.55	1	0.13	9	0.27	3	0.43	10	1.00
REME	--	--	--	--	1	0.03	--	--	--	--
RERA	--	--	--	--	--	--	--	--	1	0.10
SCOC	--	--	1	0.13	--	--	--	--	--	--
SNK	--	--	--	--	4	0.12	--	--	--	--
SOVA	--	--	2	0.25	4	0.12	2	0.29	3	0.30
THSI	--	--	--	--	1	0.03	--	--	--	--
UNKN	2	--	1	0.13	9	0.27	--	--	2	0.20
URCI	9	--	2	0.25	12	0.35	6	0.86	5	0.50

Table 14. Trap success (pitfall traps, Sherman live traps, wood squares) and track plate detection success, Marin Headlands, 1992

			Total Detections				Trap Success				
Habitat Type	Species	Code	PF	SH	TP	WS	PF	SH	PF+SH	TP	WS
Broad-leaved evergreen	Opossum	DIVI	--	--	1	--	--	--	--	0.01	--
	Mouse species	PE	--	--	5	--	--	--	--	0.05	--
	Deer Mouse	PEMA	6	17	--	--	0.07	0.19	0.13	--	--
	Raccoon	PRLO	--	--	17	--	--	--	--	0.17	--
	Unknown species	UNKN	--	--	1	1	--	--	--	0.01	0.01
	Gray fox	URCI	--	--	32	--	--	--	--	0.32	--
	Total trap-nights	**Total**	**91**	**89**	**100**	**89**			**180**		
Coastal scrub	Opossum	DIVI	--	--	1	--	--	--	--	0.01	--
	Northern alligator lizard	GECO	1	--	--	1	0.01	--	0.01	--	0.01
	Striped skunk	MEME	--	--	2	--	--	--	--	0.03	--
	California vole	MICA	19	15	1	--	0.22	0.21	0.21	0.01	--
	Dusky-footed woodrat	NEFU	--	--	1	--	--	--	--	0.01	--
	Mouse species	PE	--	--	24	--	--	--	--	0.31	--
	Deer mouse	PEMA	18	30	--	--	0.21	0.42	0.30	--	--
	Raccoon	PRLO	--	--	1	--	--	--	--	0.01	--
	Western fence lizard	SCOC	4	--	--	--	0.05	--	0.03	--	--

Table 14. Trap success (pitfall traps, Sherman live traps, wood squares) and track plate detection success, Marin Headlands, 1992—Continued

Habitat Type	Species	Code	Total Detections				Trap Success				
			PF	SH	TP	WS	PF	SH	PF+SH	TP	WS
	Vagrant shrew	SOVA	3	1	--	--	0.03	0.01	0.03	--	--
	Unknown species	UNKN	--	--	1	--	--	--	--	0.01	--
	Gray fox	URCI	--	--	2	--	--	--	--	0.03	--
	Total trap-nights		**87**	**72**	**77**	**72**			**159**		
Grassland	Domestic cat	FECA	--	--	2	--	--	--	--	0.01	--
	Northern alligator lizard	GECO	2	--	--	--	0.01	--	0.00	--	--
	Southern alligator lizard	GEMU	--	--	1	--	--	--	--	0.00	--
	Bobcat	LYRU	--	--	5	--	--	--	--	0.01	--
	Lizard species	LZSP	--	--	1	--	--	--	--	0.00	--
	Striped skunk	MEME	--	--	36	--	--	--	--	0.10	--
	California vole	MICA	24	25	--	--	0.07	0.08	0.07	--	--
	Mouse species	PE	--	--	39	--	--	--	--	0.11	--
	Deer mouse	PEMA	39	71	--	--	0.11	0.22	0.17	--	--
	Raccoon	PRLO	--	--	27	--	--	--	--	0.08	--
	Western harvest mouse	REME	--	2	--	--	--	0.01	0.00	--	--
	Snake species	SNK	--	--	6	--	--	--	--	0.02	--
	Vagrant shrew	SOVA	8	6	--	--	0.02	0.02	0.02	--	--
	Common garter snake	THSI	--	1	--	--	--	0.00	0.00	--	--
	Unknown species	UNKN	1	1	10	1	0.00	0.00	0.00	0.03	0.00
	Gray fox	URCI	--	--	21	--	--	--	--	0.06	--
	Total trap-nights		**345**	**316**	**348**	**315**			**661**		
Riparian	Opossum	DIVI	--	--	6	--	--	--	--	0.07	--
	Bobcat	LYRU	--	--	1	--	--	--	--	0.01	--
	Striped skunk	MEME	--	--	3	--	--	--	--	0.04	--
	California vole	MICA	1	1	2	--	0.01	0.02	0.02	0.02	--
	Dusky-footed woodrat	NEFU	3	1	5	--	0.04	0.02	0.03	0.06	--
	Black-tailed deer	ODHE	--	--	1	--	--	--	--	0.01	--
	Mouse species	PE	--	--	10	--	--	--	--	0.12	--
	Deer mouse	PEMA	12	14	--	--	0.18	0.22	0.20	--	--
	Raccoon	PRLO	--	--	13	--	--	--	--	0.16	--
	Vagrant shrew	SOVA	3	1	--	--	0.04	0.02	0.03	--	--
	Gray fox	URCI	--	--	13	--	--	--	--	0.16	--
	Total trap-nights		**67**	**63**	**83**	**64**			**130**		
Coastal Marsh	Domestic dog	CAFA	--	--	1	--	--	--	--	0.01	--
	Opossum	DIVI	--	--	1	--	--	--	--	0.01	--
	California vole	MICA	2	--	2	--	0.02	--	0.01	0.02	--
	House mouse	MUMU	--	1	--	--	--	0.00	0.00	--	--
	Dusky-footed woodrat	NEFU	--	--	1	--	--	--	--	0.01	--
	Mouse species	PE	--	--	4	--	--	--	--	0.04	--
	Deer mouse	PEMA	37	27	--	--	0.33	0.12	0.19	--	--
	Raccoon	PRLO	--	--	47	--	--	--	--	0.42	--
	Salt marsh harvest mouse	RERA	7	--	--	--	0.06	--	0.02	--	--
	Vagrant shrew	SOVA	3	4	--	--	0.03	0.02	0.02	--	--
	Unknown species	UNKN	--	--	2	--	--	--	--	0.02	--
	Gray fox	URCI	--	--	12	--	--	--	--	0.11	--
	Total trap-nights		**113**	**227**	**113**	**93**			**340**		

Sampling Year 1993

We sampled 11 grassland, 18 coastal scrub, and 24 needle-leaved evergreen plots in 1993 (Figures 7, 7a, 7b). All plots were located on 2 ungrazed parcels, Morse's Gulch and Stinson Gulch on Bolinas Ridge in the Olema Valley. We collected trap data during 2 trapping sessions in July and August. We detected 15 species during 1,872 trap-nights of effort (Table 15). We detected 12 species in coastal scrub, 11 species in grassland, and 11 species in needle-leaved evergreen forest. We also recorded skunks (species uncertain), snakes (species uncertain), shrews (species uncertain), and 1 unidentified species.

The mean number of species detected per plot was greatest in needle-leaved evergreen forest (mean = 4.33, SE = 0.23). In grassland, the mean number of species per plot was 2.91 (SE = 0.51), while coastal scrub plots displayed a mean of 2.94 (SE = 0.37).

Overall, deer mice and Trowbridge shrews (*Sorex trowbridigii*) were the most abundant small mammals captured with 23.2% and 13.4% of individuals captured. Voles accounted for only 6.6% of individual detections. Mean abundance of deer mice (mean = 2.88, SE = 0.45) and Trowbridge shrews (mean = 1.67, SE = 0.51) was greatest in needle-leaved evergreen forest. Dusky-footed woodrats accounted for 12.1% of individual detections and also showed their greatest mean abundance on needle-leaved evergreen forest plots. Opossums were the most abundant of the larger mammals detected (19.3% of individual detections). Mean abundance of opossums was also greatest in needle-leaved evergreen forest (mean = 3.04, SE = 0.38). Detections for raccoons (1.3% of individual detections) and gray foxes (1.8% of individual detections) were low across all habitats. Similarly, striped skunks accounted for only 3.7% of individual detections.

Deer mice were the most frequently encountered small mammals across all habitat types (Table 16). Shrews were also captured in all habitats, but were most frequently found on needle-leaved evergreen plots (frequency = 0.50). Both shrews and dusky-footed woodrats were found on 28% of the 18 coastal scrub plots. Opossums showed their greatest frequency of occurrence on needle-leaved evergreen plots (frequency = 0.88) and were the most frequently encountered larger mammal on coastal scrub plots (frequency = 0.33). On grassland plots, striped skunks were the most frequently encountered mammal species (frequency = 0.46). Gray foxes showed their greatest frequency of occurrence on coastal scrub plots (frequency = 0.22).

Trap success for pitfalls and Sherman live traps was greatest on needle-leaved evergreen plots (43% of total captures) (Table 17). Deer mice (31% of total captures) and Trowbridge shrews (8% of total captures) showed the greatest trap success over 520 trap-nights of effort in this type. Although slightly more deer mice were captured in Sherman live traps (59%), 83% of shrews were captured in pitfall traps. Interestingly, all woodrats (14 captures) were captured in Sherman-live traps. Overall trap success was greater on grassland plots (29% of total captures) than on coastal scrub plots (22% of total captures). Deer mice and voles showed similar trap success rates on grassland plots over 217 trap-nights of effort. More voles were captured in pitfall traps (75% of vole captures); more deer mice were captured using Sherman live traps (67% of mice captures). On coastal scrub plots, Sherman live traps also captured more deer mice (65% of mouse captures).

Track plate detection success was greatest for opossums in needle-leaved evergreen forest (27 % of total detections). Striped skunks had the greatest detection success on grassland plots (9% of total detections), while woodrats showed the greatest track plate detection success in coastal scrub habitats (7% of total detections).

No artificial cover board detections were recorded during 173 trap-nights of effort.

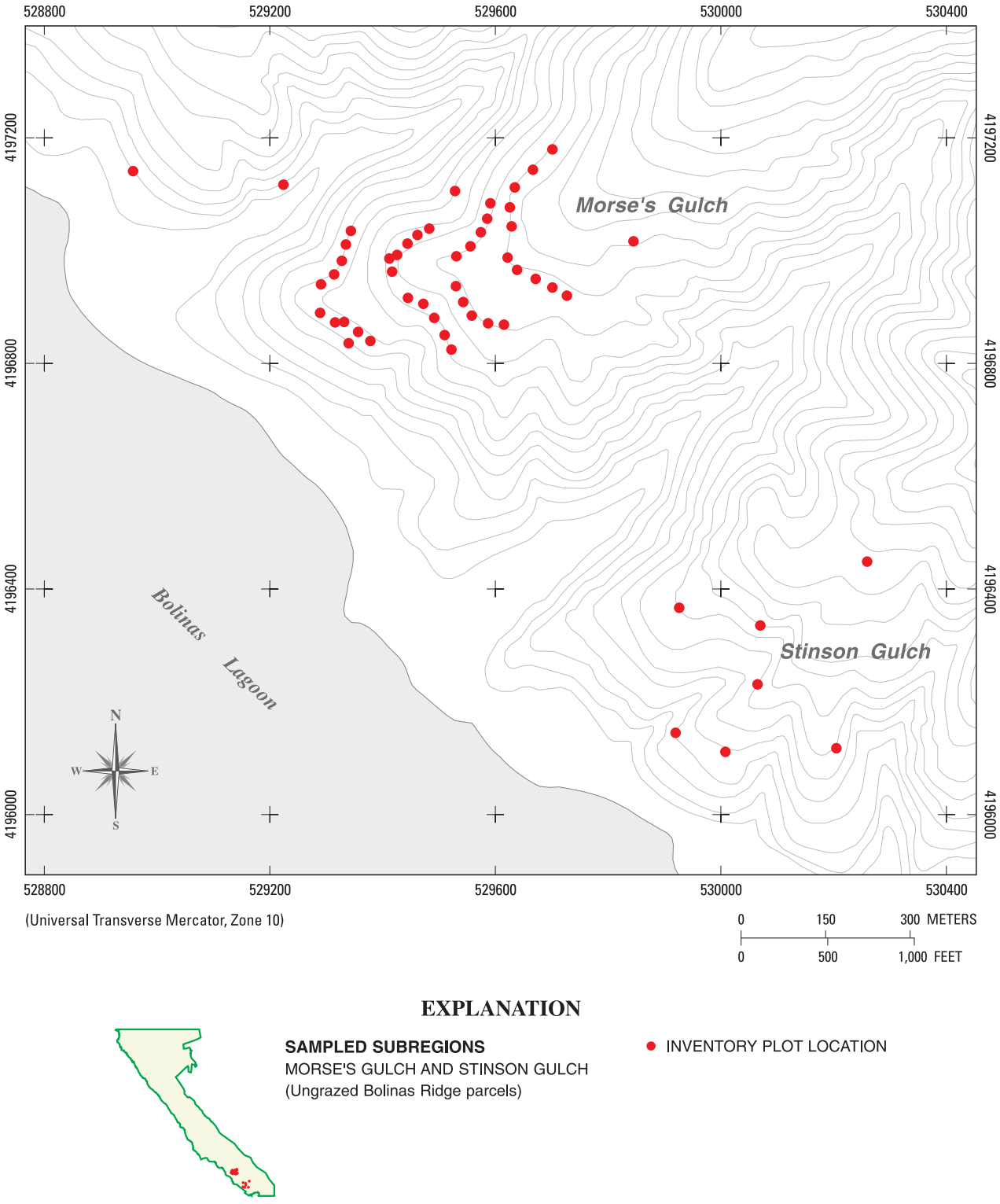
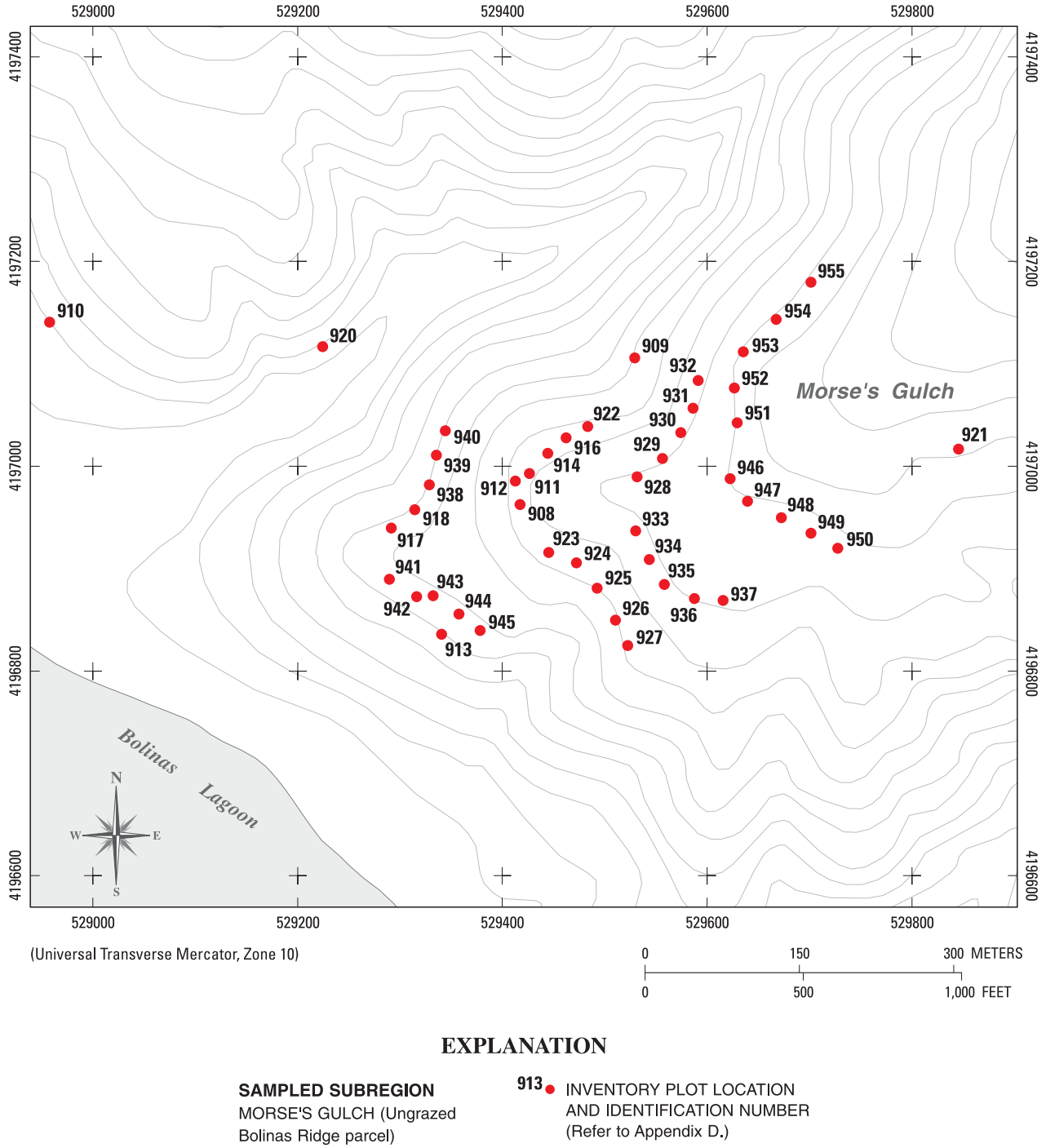


Figure 7. Vertebrate inventory plots: Morse's Gulch and Stinson Gulch, ungrazed Bolinas Ridge in the Olema Valley, 1993.

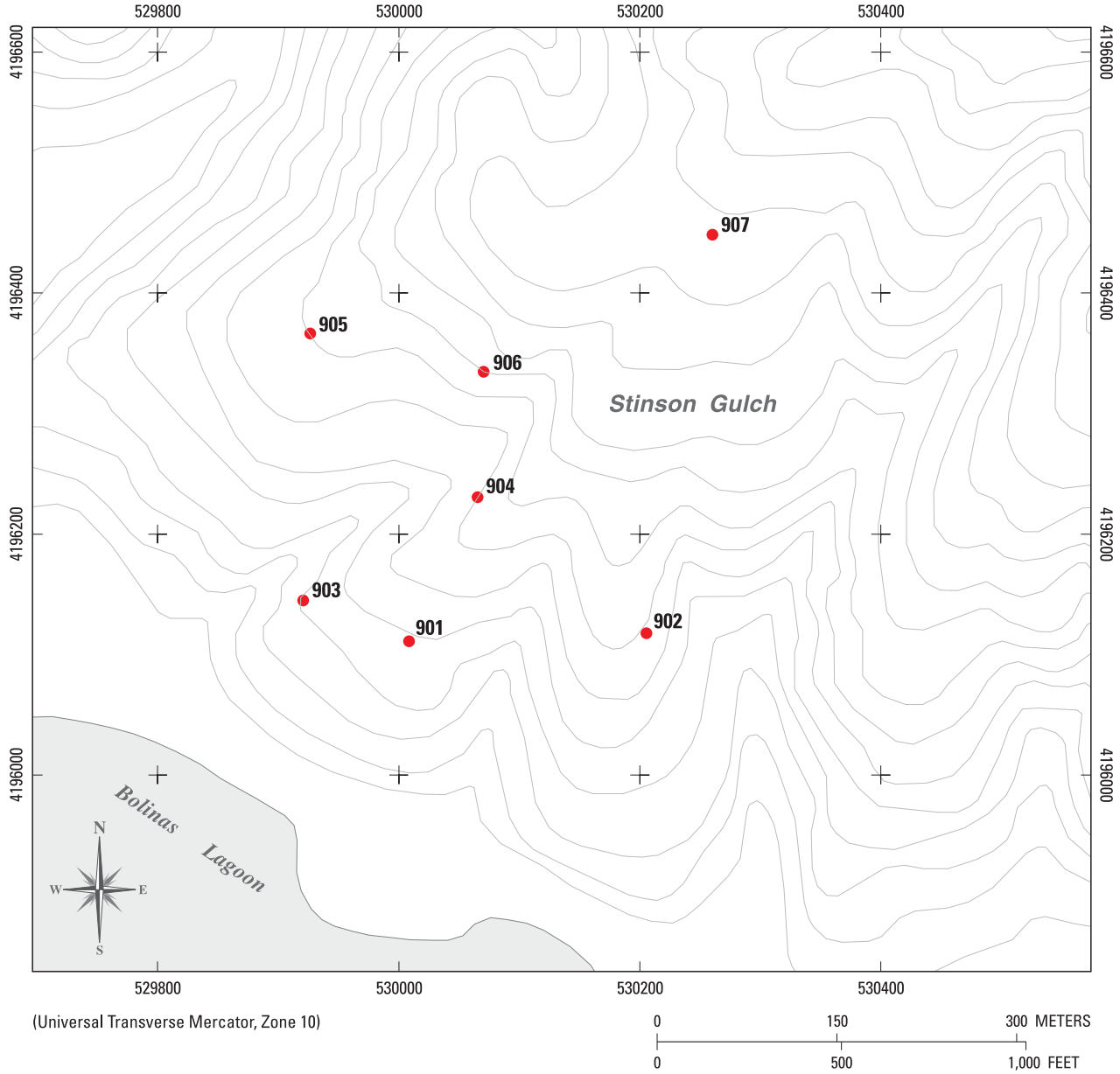


EXPLANATION

SAMPLED SUBREGION
MORSE'S GULCH (Ungrazed Bolinas Ridge parcel)

913 ● INVENTORY PLOT LOCATION AND IDENTIFICATION NUMBER (Refer to Appendix D.)

Figure 7a. Vertebrate inventory plots: detail of Morse's Gulch plots, ungrazed Bolinas Ridge in the Olema Valley, 1993.



EXPLANATION

SAMPLED SUBREGION
STINSON GULCH (Ungrazed Bolinas Ridge parcel)

901 INVENTORY PLOT LOCATION AND IDENTIFICATION NUMBER (Refer to Appendix D.)

Figure 7b. Vertebrate inventory plots: detail of Stinson Gulch plots, ungrazed Bolinas Ridge in the Olema Valley, 1993.

Table 15. Detection statistics of vertebrates sampled using systematic survey methods, Bolinas Ridge, 1993

Code	Total detections	Individual detections	% of individual detections	Mean Abundance [1]					
				Grassland		Coastal scrub		Needle-leaved evergreen forest	
				Mean	SE	Mean	SE	Mean	SE
DIVI	88	88	19.3	0.36	0.20	0.61	0.23	3.04	0.38
GECO	1	1	0.2	--	--	--	--	0.04	0.04
GESP	1	1	0.2	0.09	0.09	--	--	--	--
LYRU	2	2	0.4	0.09	0.09	0.06	0.06	--	--
MEME	17	17	3.7	0.91	0.37	0.22	0.10	0.13	0.07
MICA	41	30	6.6	1.73	1.43	0.39	0.24	0.17	0.17
NEFU	62	55	12.1	0.09	0.09	0.89	0.41	1.58	0.33
NEGI	1	1	0.2	--	--	--	--	0.04	0.04
PE	45	45	9.9	0.27	0.19	0.39	0.20	1.46	0.32
PEMA	234	106	23.2	1.36	0.73	1.22	0.47	2.88	0.45
PRLO	6	6	1.3	0.09	0.09	0.06	0.06	0.17	0.08
REME	1	1	0.2	--	--	0.06	0.06	--	--
SCOC	12	12	2.6	0.18	0.12	0.56	0.26	--	--
SKNK	3	3	0.7	0.00	0.00	0.17	0.17	--	--
SNK	1	1	0.2	0.09	0.09	--	--	--	--
SO	3	3	0.7	--	--	0.11	0.11	0.04	0.04
SOTR	61	61	13.4	0.36	0.28	0.94	0.44	1.67	0.51
SYBA	2	2	0.4	0.09	0.09	0.06	0.06	--	--
TASO	1	1	0.2	--	--	--	--	0.04	0.04
UNKN	12	12	2.6	0.09	0.09	0.22	0.10	0.29	0.11
URCI	8	8	1.8	0.18	0.12	0.28	0.14	0.04	0.04
Total	**1,872**	**456**	**100**						

[1] Mean abundance of individuals.

Table 16. Frequency of occurrence (proportion of sites with at least one detection of a species), Bolinas Ridge, 1993

		Coastal scrub n = 18		Grassland n = 11		Needle-leaved evergreen n = 24	
Species	Code	Sites with detections	Frequency	Sites with detections	Frequency	Sites with detections	Frequency
Opossum	DIVI	6	0.33	3	0.27	21	0.86
Northern alligator lizard	GECO	--	--	--	--	1	0.04
Alligator lizard species	GESP	--	--	1	0.09	--	--
Bobcat	LYRU	1	0.06	1	0.09	--	--
Striped skunk	MEME	4	0.22	5	0.46	3	0.13
California vole	MICA	3	0.17	4	0.36	1	0.04
Dusky-footed woodrat	NEFU	5	0.28	1	0.09	17	0.71
Shrew mole	NEGI	--	--	--	--	1	0.04
Mouse species	PE	4	0.22	2	0.18	16	0.67
Deer mouse	PEMA	8	0.44	5	0.46	19	0.79
Raccoon	PRLO	1	0.06	1	0.09	4	0.17
Western harvest mouse	REME	1	0.06	--	--	--	--
Western fence lizard	SCOC	4	0.22	2	0.18	--	--
Skunk species	SKNK	1	0.06	--	--	--	--
Snake species	SNK	--	--	1	0.09	--	--
Shrew species	SO	1	0.06	--	--	1	0.04
Trowbridge shrew	SOTR	5	0.28	2	0.18	12	0.50
Brush rabbit	SYBA	1	0.06	1	0.09	0	
Sonoma chipmunk	TASO	--	--	--	--	1	0.04
Unknown species	UNKN	4	0.22	1	0.09	6	0.25
Gray fox	URCI	4	0.22	2	0.18	1	0.04

Table 17. Trap success (pitfall traps, Sherman live traps, wood squares) and track plate detection success, Bolinas Ridge, 1993

			Total Detections				Trap Success				
Habitat Type	**Species**	**Code**	**PF**	**SH**	**TP**	**WS**	**PF**	**SH**	**PF+SH**	**TP**	**WS**
Coastal Scrub	Opossum	DIVI	--	--	11	--	--	--	--	0.06	--
	Bobcat	LYRU	--	--	1	--	--	--	--	0.01	--
	Striped skunk	MEME	--	--	4	--	--	--	--	0.02	--
	California vole	MICA	2	2	3	--	0.01	0.01	0.01	0.02	--
	Dusky-footed woodrat	NEFU	--	4	13	--	--	0.02	0.01	0.07	--
	Mouse species	PE	--	--	7	--	--	--	--	0.04	--
	Deer mouse	PEMA	16	30	--	--	0.08	0.17	0.12	--	--
	Raccoon	PRLO	--	--	1	--	--	--	--	0.01	--
	Western harvest mouse	REME	1	--	--	--	0.01	--	0.00	--	--
	Western fence lizard	SCOC	10	--	--	--	0.05	--	0.03	--	--
	Skunk species	SKNK	--	--	3	--	--	--	--	0.02	--
	Shrew species	SO	2	--	--	--	0.01	--	0.01	--	--
	Trowbridge shrew	SOTR	12	5	--	--	0.06	0.03	0.04	--	--
	Brush rabbit	SYBA	--	--	1	--	--	--	--	0.01	--
	Unknown species	UNKN	1	--	3	--	0.01	--	0.00	0.02	--
	Gray fox	URCI	--	--	5	--	--	--	--	0.03	--
	Total trap-nights		**212**	**181**	**189**	**73**			**393**		
Grassland	Opossum	DIVI	--	--	4	--	--	--	--	0.04	--
	Alligator lizard species	GESP	1	--	--	--	0.01	--	0.00	--	--
	Bobcat	LYRU	--	--	1	--	--	--	--	0.01	--
	Striped skunk	MEME	--	--	10	--	--	--	--	0.09	--
	California vole	MICA	21	7	--	--	0.18	0.07	0.13	--	--
	Dusky-footed woodrat	NEFU	--	1	--	--	--	0.01	0.00	--	--
	Mouse species	PE	--	--	3	--	--	--	--	0.03	--
	Deer mouse	PEMA	9	18	--	--	0.08	0.18	0.12	--	--
	Raccoon	PRLO	--	--	1	--	--	--	--	0.01	--
	Western fence lizard	SCOC	2	--	--	--	0.02	--	0.01	--	--
	Snake species	SNK	--	--	1	--	--	--	--	0.01	--
	Trowbridge shrew	SOTR	4	--	--	--	0.03	--	0.02	--	--
	Brush rabbit	SYBA	--	--	1	--	--	--	--	0.01	--
	Unknown species	UNKN	--	--	1	--	--	--	--	0.01	--
	Gray fox	URCI	--	--	2	--	--	--	--	0.02	--
	Total trap-nights		**119**	**98**	**106**	**25**			**217**		
Needle-leaved evergreen	Opossum	DIVI	--	--	73	--	--	--	--	0.27	--
	Northern alligator lizard	GECO	1	--	--	--	0.00	--	0.00	--	--
	Striped skunk	MEME	--	--	3	--	--	--	--	0.01	--
	California vole	MICA	4	2	--	--	0.01	0.01	0.01	--	--
	Dusky-footed woodrat	NEFU	--	13	31	--	--	0.05	0.03	0.11	--
	Shrew mole	NEGI	1	--	--	--	0.00	--	0.00	--	--
	Mouse species	PE	--	--	35	--	--	--	--	0.13	--
	Deer mouse	PEMA	72	89	--	--	0.26	0.37	0.31	--	--
	Raccoon	PRLO	--	--	4	--	--	--	--	0.01	--
	Shrew species	SO	1	--	--	--	0.00	--	0.00	--	--
	Trowbridge shrew	SOTR	33	7	--	--	0.12	0.03	0.08	--	--
	Sonoma chipmunk	TASO	--	1	--	--	--	0.00	0.00	--	--
	Unknown species	UNKN	--	--	7	--	--	--	--	--	--
	Gray fox	URCI	--	--	1	--	--	--	--	--	--
	Total trap-nights		**279**	**241**	**274**	**75**			**520**		

Sampling Year 1994

We sampled 105 plots in 1994 (Figures 8, 8a, 8b, 8c, 9). We sampled 48 of these (10 in the Marin Headlands and 38 on Bolinas Ridge in the Olema Valley) in conjunction with the testing of Hantavirus exposure in deer mice. We sampled the Marin Headlands plots and 20 of the Bolinas Ridge plots for 3 consecutive days in May. We sampled the remaining Bolinas Ridge plots for 4 consecutive days in February. We re-sampled the May Bolinas Ridge plots in July as part of the normal summer sampling schedule. We also sampled 56 additional sites on Bolinas Ridge during the 3 primary sampling sessions conducted between July and September. The Bolinas Ridge plots consisted of ungrazed coastal scrub, grazed and ungrazed grassland, ungrazed broad-leaved evergreen forest, and grazed and ungrazed needle-leaved evergreen forest.

We detected 13 species during the Hantavirus sampling sessions in February and May. Deer mice were the most abundant species encountered and had the highest frequency of occurrence (Table 18). Only 1 species--the shrew mole (*Neurotrichus gibbsii*)--was not captured during the normal summer sampling session. We recorded domestic cats, house mice, and vagrant shrews only within the Marin Headlands.

We detected 19 species during the summer sampling session on Bolinas Ridge, including the first confirmed detection of a coyote (*Canis latrans*) during this pilot inventory (Table 19). We also recorded lizards (species uncertain), skunks (species uncertain), and 1 unknown species over 2,142 trap-nights of effort. Overall, we detected 14 mammal species, 3 reptile species, and 2 amphibian species. We detected 11 species in ungrazed coastal scrub, 8 species on grazed grassland, 7 species in ungrazed needle-leaved evergreen forest, 7 species in grazed needle-leaved evergreen forest, 6 species in grazed broad-leaved evergreen forest, and 5 species on ungrazed grassland.

Across all plots, the mean number of species was greatest in coastal scrub (mean = 2.92, SE = 0.64) and lowest in grassland (mean = 1.79, SE = 0.21) (Table 20). Overall, the mean number of species detected on grazed plots (mean = 2.30, SE = 0.18) was similar to that found on ungrazed plots (mean = 2.32, SE = 0.26). When taking into account both habitat type and treatment, more species were detected on grazed grassland plots (mean = 1.95, SE = 0.27) than on ungrazed grassland plots (mean = 1.44, SE = 0.34). Similarly, the average number of species detected was greater on grazed needle-leaved evergreen sites (mean = 2.50, SE = 0.50) than on ungrazed needle-leaved evergreen plots (mean = 2.33, SE = 0.21).

Across all habitat types and treatments, deer mice (17.8 % of individual detections) and opossums (17.1 % of individual detections) were the most abundant species detected (Table 19). Mean abundance of deer mice was greatest in grazed needle-leaved evergreen forest (mean = 1.83, SE = 0.65) and lowest in ungrazed grassland (no detections) (Table 21). Opossum mean abundance was greatest in ungrazed needle-leaved evergreen forest (mean = 1.67, SE = 0.39) and lowest in grazed grassland (no detections). Similarly, gray fox mean abundance was greatest on ungrazed needle-leaved evergreen forest plots (mean = 1.07, SE = 0.40). We did not encounter gray foxes on any of the grazed plots, regardless of habitat type.

Opossums were the most frequently encountered species on ungrazed sites (n = 37, frequency = 0.49), while deer mice were the most frequently encountered species on grazed sites (n = 40, frequency = 0.50). Opossums showed the greatest frequency of occurrence on ungrazed coastal scrub plots (frequency = 0.39), while gray foxes occurred more frequently on ungrazed grassland plots (frequency = 0.33). Opossums were also found on the majority of ungrazed needle-leaved evergreen plots (frequency = 0.73). Skunks (species uncertain) showed the greatest frequency of occurrence on grazed grassland plots (frequency = 0.42), while deer mice were the most frequently encountered species on grazed broad-leaved evergreen plots(frequency = 0.67) and on grazed needle-leaved evergreen sites (frequency = 0.67).

Trap success for pitfalls and Sherman live traps was lower than in previous years (Table 22). Overall, trap success was greater on grazed sites (15% of total captures) than on ungrazed sites (5% of total captures). Trap success was greatest on grazed needle-leaved evergreen forest (29%) and lowest on ungrazed grassland (6%). Deer mice showed the greatest trap success across all sites except for ungrazed grassland plots, where no deer mice were detected. Only a single western harvest mouse (*Reithrodontomys megalotis*) was captured over 158 trap-nights on ungrazed grassland plots. On grazed needle-leaved evergreen forest plots, deer mice were trapped 23% of the time. Overall, more deer mice were captured in Sherman live traps than in pitfall traps. Sherman live traps also accounted for all woodrat captures within all habitat types. Pitfall traps were responsible for capturing 1 pocket gopher (*Thomomys bottae*), 2 shrews, 7 western fence lizards, 1 southern alligator lizard (*Gerrhonotus mulitcarinatus*), 2 western skinks (*Eumeces skiltonianus*), and 1 California newt (*Taricha torosa*).

Track plate detection success was greatest for opossums (19%) and gray foxes (12%) on ungrazed needle-leaved evergreen forest plots. Both species demonstrated low track detection successes on ungrazed grassland. We did not detect opossums in grazed grasslands or gray foxes on any grazed sites. We recorded 3 coyote detections and 1 bobcat (*Lynx rufus*) detection in grazed grassland. We did not detect these two species in other habitat/treatment types. Interestingly, we recorded the only detection of a Pacific tree frog on a track plate in grazed broad-leaved evergreen forest. In this instance, we found the frog on the track plate and recorded it as a track plate detection.

Artificial cover board detection success was low. We detected only 1 southern alligator lizard during 219 trap-nights of effort.

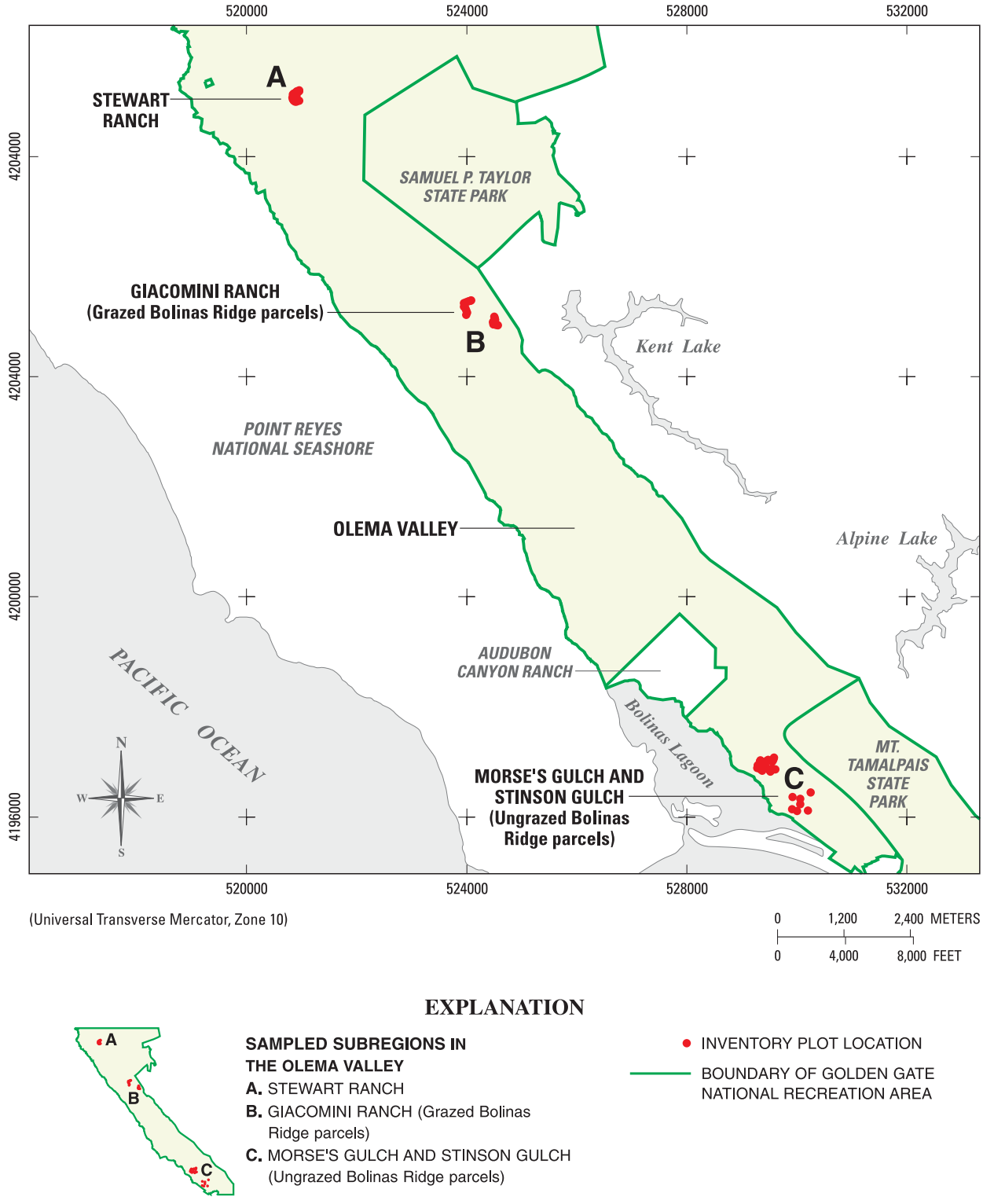


Figure 8. Vertebrate inventory plots: Olema Valley, 1994.

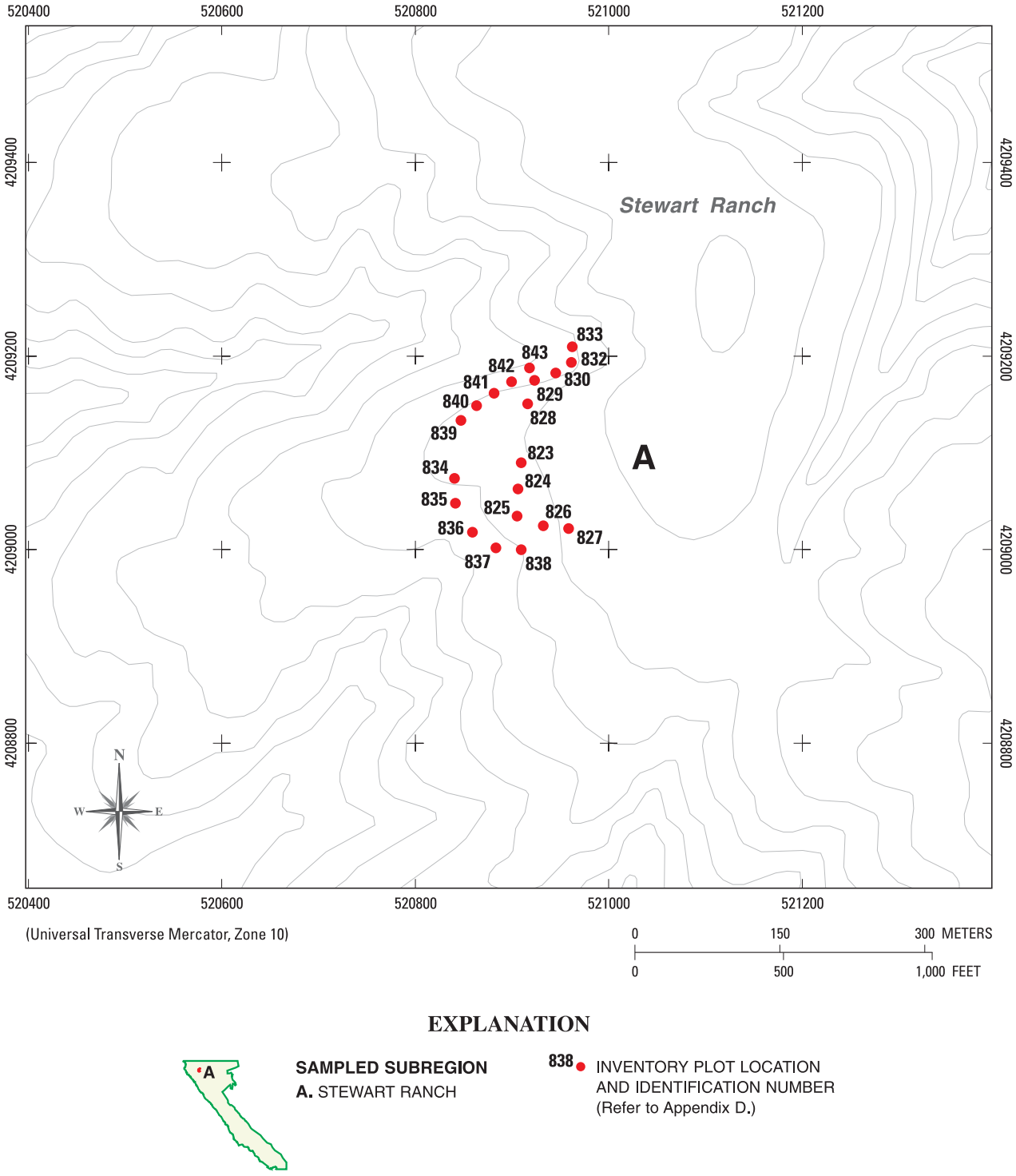


Figure 8a. Vertebrate inventory plots: detail of Stewart Ranch plots in the Olema Valley, 1994.

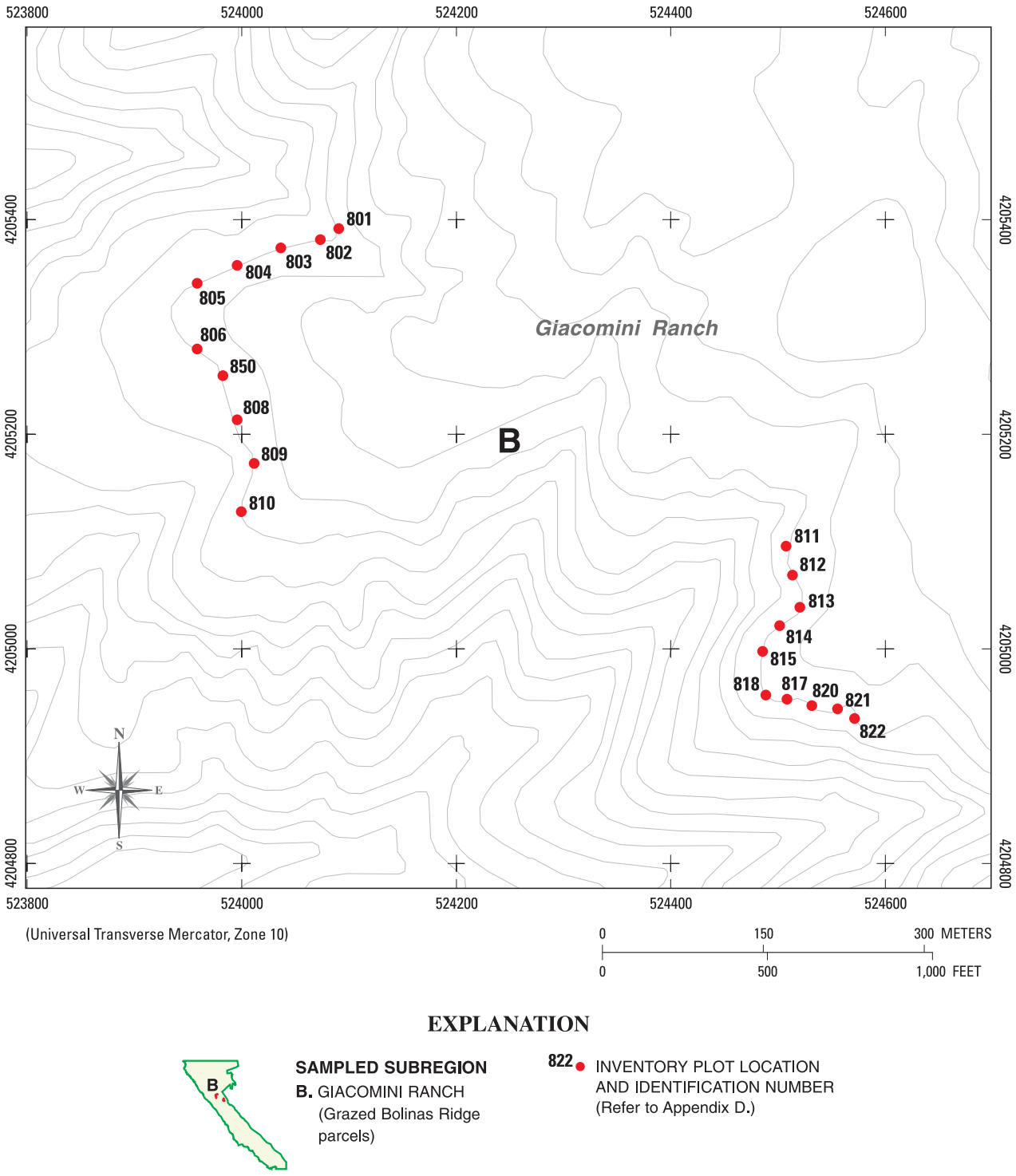
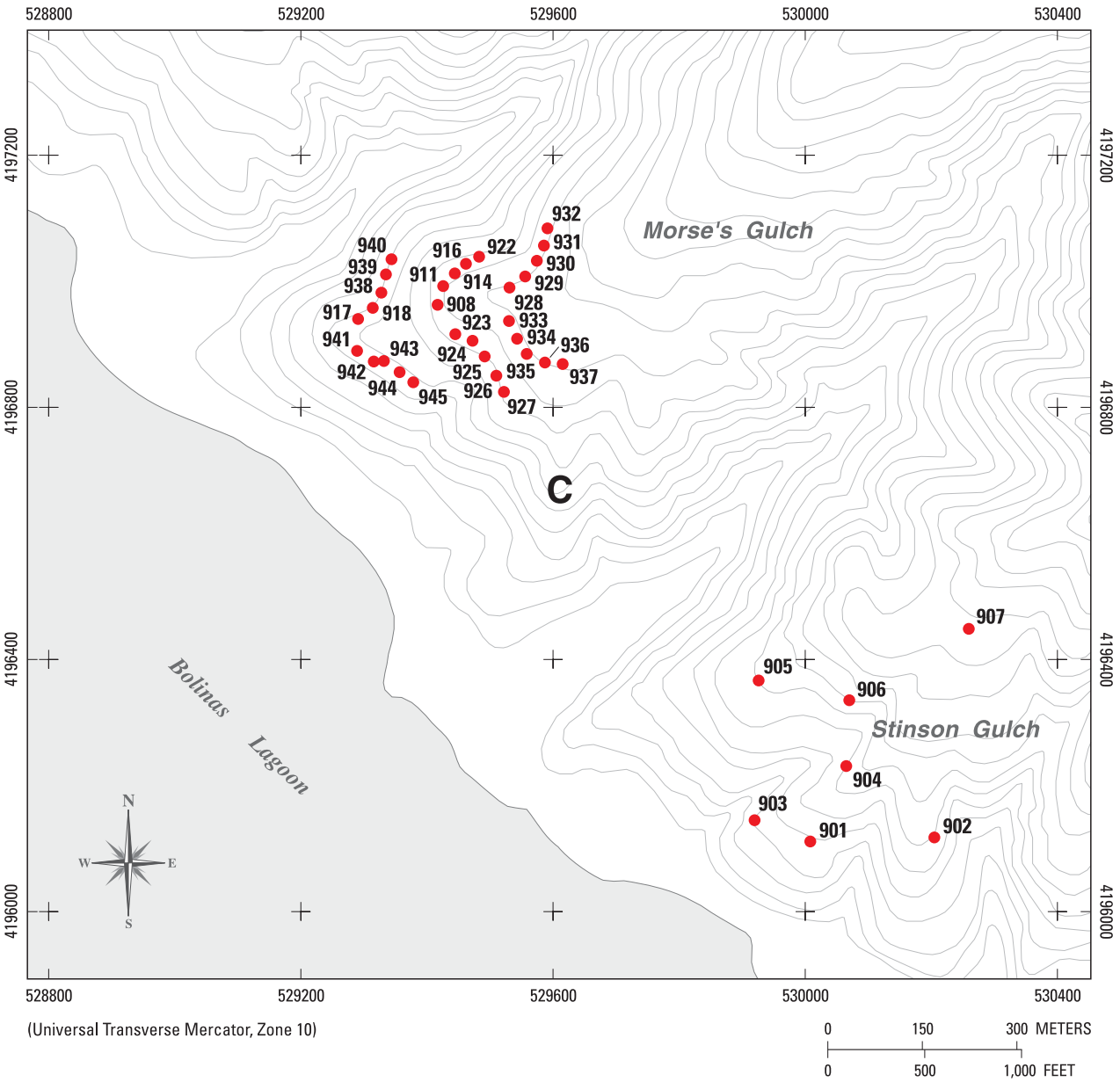


Figure 8b. Vertebrate inventory plots: detail of Giacomini Ranch plots, grazed Bolinas Ridge in the Olema Valley, 1994.



EXPLANATION

SAMPLED SUBREGIONS

C. MORSE'S GULCH AND STINSON GULCH (Ungrazed Bolinas Ridge parcels)

902 ● INVENTORY PLOT LOCATION AND IDENTIFICATION NUMBER (Refer to Appendix D.)

Figure 8c. Vertebrate inventory plots: detail of Morse's Gulch and Stinson Gulch plots, ungrazed Bolinas Ridge in the Olema Valley, 1994.

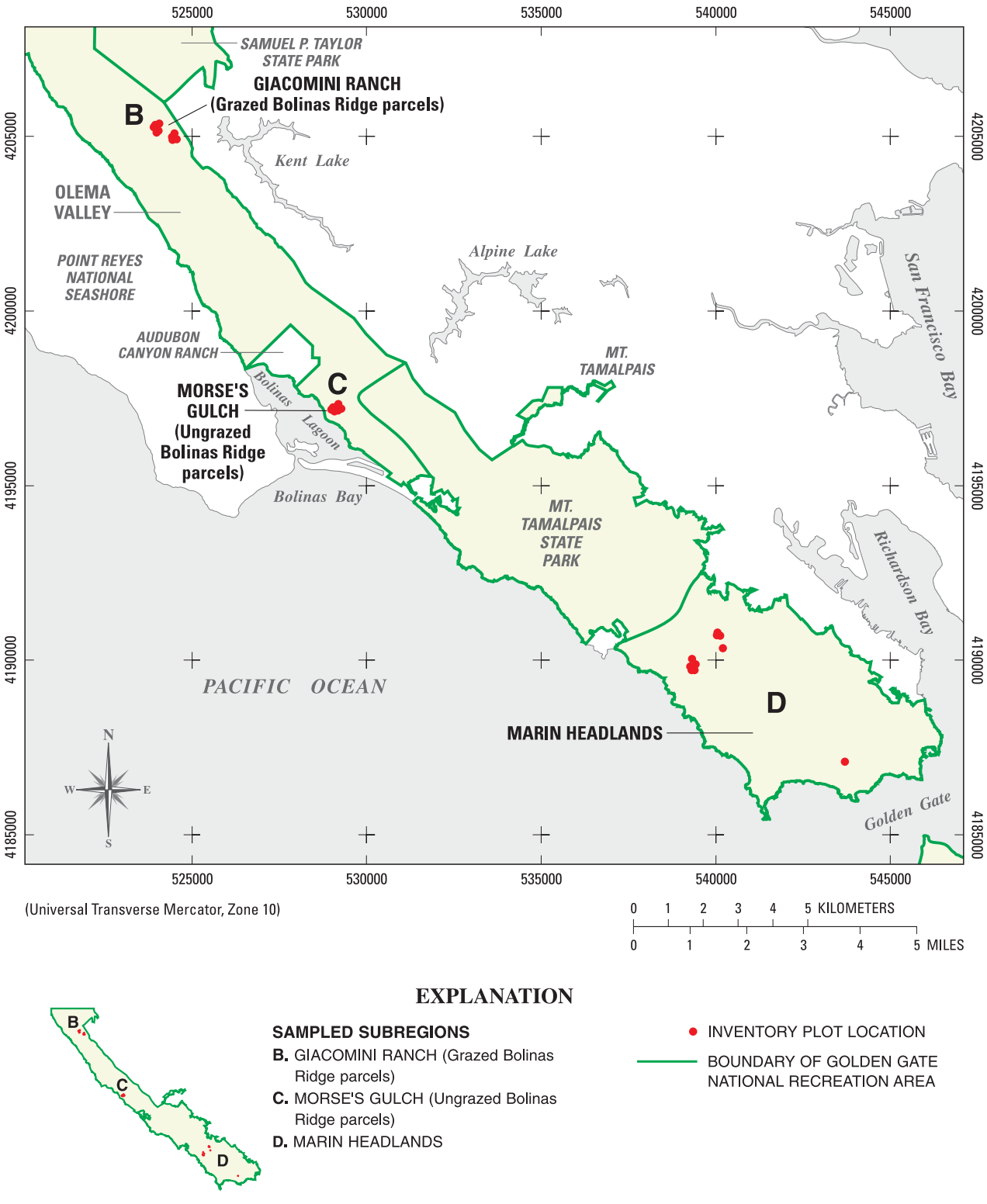


Figure 9. Vertebrate inventory plots: Hantavirus sampling plots, 1994.

Table 18. Detection statistics of vertebrates sampled during Hantavirus testing, 1994

Species	Total Detections	Individual Detections	% of Individual Detections	Mean Abundance[1]	
				Mean	SE
EUSP	1	1	0.9	0.02	0.02
FECA	2	2	1.7	0.04	0.03
LYRU	1	1	0.9	0.02	0.02
MEME	2	2	1.7	0.04	0.03
MICA	2	2	1.7	0.04	0.03
MUMU	1	1	0.9	0.02	0.02
NEGI	1	1	0.9	0.02	0.02
PE	11	11	9.4	0.21	0.07
PEMA	83	79	67.5	1.65	0.35
REME	1	1	0.9	0.02	0.02
SO	1	1	0.9	0.02	0.02
SOTR	4	4	3.4	0.08	0.05
SOVA	2	2	1.7	0.04	0.04
THBO	1	1	0.9	0.02	0.02
URCI	8	8	6.8	0.17	0.06
Total	**500**	**117**	**100**		

[1] Mean abundance of individuals.

Table 19. Detection statistics of vertebrates sampled during summer sampling session, Bolinas Ridge, 1994

Species	Code	Total Detections	Individual Detections	% of Individual Detections
Coyote	CALA	3	3	1.1
Opossum	DIVI	47	47	17.1
Western skink	EUSK	2	2	0.7
Southern alligator lizard	GEMU	4	4	1.5
Pacific treefrog	HYRE	1	1	0.4
Bobcat	LYRU	1	1	0.4
Lizard species	LZSP	1	1	0.4
Striped skunk	MEME	6	6	2.2
California vole	MICA	6	6	2.2
Dusky-footed woodrat	NEFU	16	16	5.8
Mouse species	PE	31	31	11.3
Deer mouse	PEMA	88	49	17.8
Raccoon	PRLO	6	6	2.2
Western harvest mouse	REME	1	1	0.4
Western gray squirrel	SCGR	2	2	0.7
Western fence lizard	SCOC	11	11	4.0
Skunk species	SKNK	19	19	6.9
Trowbridge shrew	SOTR	7	7	2.5
Sonoma chipmunk	TASO	1	1	0.4
California newt	TATO	2	2	0.7
Pocket gopher	THBO	1	1	0.4
Unknown species	UNKN	34	34	12.4
Gray fox	URCI	24	24	8.7
Total		**2,142**	**275**	**100**

Table 20. Number of species detected in sampled habitat /treatment types during summer sampling session, Bolinas Ridge, 1994

Habitat Type	Treatment	N	Mean	SE
Grassland	Ungrazed	9	1.44	0.34
	Grazed	19	1.95	0.27
	Total	**28**	**1.79**	**0.21**
Coastal scrub	Ungrazed	13	2.92	0.64
	Total	**13**	**2.92**	**0.64**
Broad-leaved evergreen	Grazed	15	2.67	0.23
	Total	**15**	**2.67**	**0.23**
Needle-leaved evergreen	Ungrazed	15	2.33	0.21
	Grazed	6	2.50	0.50
	Total	**21**	**2.38**	**0.20**
All habitat types	Ungrazed	37	2.32	0.26
	Grazed	40	2.30	0.18
	Total	**77**	**2.31**	**0.15**

Table 21. Species mean abundance (individual detections) and frequency of occurrence of species detected during summer sampling session, Bolinas Ridge, 1994

Habitat/treatment type	Species	Code	Mean Abundance [1]		Sites with detections	Frequency
			Mean	SE		
Ungrazed grassland n = 9	Opossum	DIVI	0.22	0.15	2	0.22
	Mouse species	PE	0.33	0.24	2	0.22
	Raccoon	PRLO	0.22	0.15	2	0.22
	Western harvest mouse	REME	0.11	0.11	1	0.11
	Western fence lizard	SCOC	0.11	0.11	1	0.11
	Skunk species	SKNK	0.11	0.11	1	0.11
	Unknown species	UNKN	0.11	0.11	1	0.11
	Gray fox	URCI	0.33	0.17	3	0.33
Ungrazed coastal scrub n = 13	Opossum	DIVI	0.46	0.18	5	0.38
	Southern alligator lizard	GEMU	0.23	0.17	2	0.15
	Lizard species	LZSP	0.08	0.08	1	0.08
	Striped skunk	MEME	0.15	0.10	2	0.15
	California vole	MICA	0.08	0.08	1	0.08
	Dusky-footed woodrat	NEFU	0.85	0.44	4	0.31
	Mouse species	PE	0.38	0.31	2	0.15
	Deer mouse	PEMA	0.23	0.17	2	0.15
	Raccoon	PRLO	0.23	0.12	3	0.23
	Western fence lizard	SCOC	0.38	0.27	2	0.15
	Skunk species	SKNK	0.15	0.10	2	0.15
	Trowbridge shrew	SOTR	0.15	0.10	2	0.15
	Pocket gopher	THBO	0.08	0.08	1	0.08
	Unknown species	UNKN	0.38	0.14	5	0.39
	Gray fox	URCI	0.38	0.18	4	0.31

Table 21. Species mean abundance (individual detections) and frequency of occurrence of species detected during summer sampling session, Bolinas Ridge, 1994—Continued

Habitat/treatment type	Species	Code	Mean Abundance [1]		Sites with detections	Frequency
			Mean	SE		
Ungrazed needle-leaved evergreen n = 15	Opossum	DIVI	1.67	0.39	11	0.73
	Striped skunk	MEME	0.07	0.07	1	0.07
	Dusky-footed woodrat	NEFU	0.20	0.11	3	0.20
	Mouse species	PE	0.40	0.13	6	0.40
	Deer mouse	PEMA	0.27	0.18	2	0.13
	Raccoon	PRLO	0.07	0.07	1	0.07
	Western gray squirrel	SCGR	0.13	0.09	2	0.13
	Unknown species	UNKN	0.27	0.15	3	0.20
	Gray fox	URCI	1.07	0.40	6	0.40
Grazed grassland n = 19	Coyote	CALA	0.16	0.12	1	0.05
	Western skink	EUSK	0.11	0.07	2	0.11
	Bobcat	LYRU	0.05	0.05	1	0.05
	Striped skunk	MEME	0.16	0.12	2	0.11
	California vole	MICA	0.16	0.16	1	0.05
	Mouse species	PE	0.47	0.19	6	0.32
	Deer mouse	PEMA	0.47	0.19	6	0.32
	Western fence lizard	SCOC	0.26	0.13	4	0.21
	Skunk species	SKNK	0.58	0.18	8	0.42
	Unknown species	UNKN	0.37	0.16	5	0.26
Grazed broad-leaved evergreen forest n = 15	Opossum	DIVI	0.80	0.34	7	0.47
	Pacific treefrog	HYRE	0.07	0.07	1	0.07
	Dusky-footed woodrat	NEFU	0.07	0.07	1	0.07
	Mouse species	PE	0.33	0.16	4	0.27
	Deer mouse	PEMA	1.47	0.32	10	0.67
	Skunk species	SKNK	0.33	0.21	3	0.20
	Trowbridge shrew	SOTR	0.27	0.12	4	0.27
	California newt	TATO	0.07	0.07	1	0.07
	Unknown species	UNKN	1.13	0.31	9	0.60
Grazed needle-leaved evergreen forest n = 6	Opossum	DIVI	0.33	0.21	2	0.33
	California vole	MICA	0.33	0.21	2	0.33
	Dusky-footed woodrat	NEFU	0.17	0.17	1	0.17
	Mouse species	PE	0.50	0.22	3	0.50
	Deer mouse	PEMA	1.83	0.65	4	0.67
	Trowbridge shrew	SOTR	0.17	0.17	1	0.17
	Sonoma chipmunk	TASO	0.17	0.17	1	0.17
	California newt	TATO	0.17	0.17	1	0.17

[1] Mean abundance of individuals.

Table 22. Trap success (pitfall traps, Sherman live traps, wood squares) and track plate detection success, summer sampling session, Bolinas Ridge, 1994

		Total Detections				Trap Success				
Habitat/Treatment Type	**Code**	**PF**	**SH**	**TP**	**WS**	**PF**	**SH**	**PF+SH**	**TP**	**WS**
Ungrazed coastal scrub	DIVI	--	1	5	--	--	0.01	0.00	0.04	--
	GEMU	1	--	2	1	0.01	--	0.00	0.02	0.01
	LZSP	--	--	1	--	--	--	--	0.01	--
	MEME	--	--	2	--	--	--	--	0.02	--
	MICA	--	1	--	--	--	0.01	0.00	--	--
	NEFU	--	3	7	1	--	0.03	0.01	0.06	0.01
	PE	--	--	5	--	--	--	--	0.04	--
	PEMA	--	9	--	--	--	0.08	0.04	--	--
	PRLO	--	--	3	--	--	--	--	0.03	--
	SCOC	5	--	--	--	0.05	--	0.02	--	--
	SKNK	--	--	2	--	--	--	--	0.02	--
	SOTR	2	--	--	--	0.02	--	0.01	--	--
	THBO	1	--	--	--	0.01	--	0.00	--	--
	UNKN	--	--	4	1	--	--	--	0.04	0.01
	URCI	--	--	5	--	--	--	--	0.04	--
Total trap-nights		**107**	**113**	**114**	**85**			**220**		
Ungrazed grassland	DIVI	--	--	2	--	--	--	--	0.03	--
	PE	--	--	3	--	--	--	--	0.04	--
	PRLO	--	--	2	--	--	--	--	0.03	--
	REME	--	1	--	--	--	0.01	0.01	--	--
	SCOC	--	--	1	--	--	--	--	0.01	--
	SKNK	--	--	1	--	--	--	--	0.01	--
	UNKN	--	--	1	--	--	--	--	0.01	--
	URCI	--	--	3	--	--	--	--	0.04	--
Total trap-nights		**80**	**78**	**78**	**67**			**158**		
Ungrazed needle-leaf evergreen forest	DIVI	--	--	25	--	--	--	--	0.19	--
	MEME	--	--	1	--	--	--	--	0.01	--
	NEFU	--	1	2	--	--	0.01	0.00	0.02	--
	PE	--	--	6	--	--	--	--	0.04	--
	PEMA	--	5	--	--	--	0.06	0.02	--	--
	PRLO	--	--	1	--	--	--	--	0.01	--
	SCGR	--	--	2	--	--	--	--	0.02	--
	UNKN	--	1	3	--	--	0.01	0.00	0.02	--
	URCI	--	--	16	--	--	--	--	0.12	--
Total trap-nights		**134**	**137**	**135**	**64**			**271**		
Grazed grassland	CALA	--	--	3	--	--	--	--	0.02	--
	EUSK	2	--	--	--	0.01	--	0.01	--	--
	LYRU	--	--	1	--	--	--	--	0.01	--
	MEME	--	--	3	--	--	--	--	0.02	--
	MICA	3	--	--	--	0.02	--	0.01	--	--
	PE	--	--	9	--	--	--	--	0.06	--
	PEMA	6	6	--	--	0.04	0.04	0.04	--	--
	SCOC	2	--	3	--	0.01	--	0.01	0.02	--
	SKNK	--	--	11	--	--	--	--	0.08	--
	UNKN	--	--	7	--	--	--	--	0.05	--
Total trap-nights		**146**	**152**	**145**	**3**			**298**		

Table 22. Trap success (pitfall traps, Sherman live traps, wood squares) and track plate detection success, summer sampling session, Bolinas Ridge, 1994—Continued

		Total Detections				Trap Success				
Habitat/Treatment Type	**Code**	**PF**	**SH**	**TP**	**WS**	**PF**	**SH**	**PF+SH**	**TP**	**WS**
Grazed needle-leaf	DIVI	--	--	2	--	--	--	--	0.04	--
evergreen forest	MICA	2	--	--	--	0.04	--	0.02	--	--
	NEFU	--	--	1	--	--	--	--	0.02	--
	PE	--	--	3	--	--	--	--	0.06	--
	PEMA	4	19	--	--	0.08	0.39	0.23	--	--
	SOTR	--	1	--	--	--	0.02	0.01	--	--
	TASO	--	1	--	--	--	0.02	0.01	--	--
	TATO	1	--	--	--	0.02	--	0.01	--	--
Total trap-nights		**49**	**49**	**49**				**98**		
Grazed broad-leaf	DIVI	--	--	12	--	--	--	--	0.10	--
evergreen forest	HYRE	--	--	1	--	--	--	--	0.01	--
	NEFU	--	--	1	--	--	--	--	0.01	--
	PE	--	--	5	--	--	--	--	0.04	--
	PEMA	7	32	--	--	0.06	0.26	0.16	--	--
	SKNK	--	--	5	--	--	--	--	0.04	--
	SOTR	3	1	--	--	0.03	0.01	0.02	--	--
	TATO	1	--	--	--	0.02	--	0.00	--	--
	UNKN	3	1	13	--	0.03	0.01	0.02	0.11	--
Total trap-nights		**118**	**123**	**116**				**241**		

Sampling Year 1995

We sampled 44 plots (19 grazed and 25 ungrazed) on Bolinas Ridge in the Olema Valley in 1995 (Figures 10, 10a, 10b). Plots consisted of 15 ungrazed needle-leaved evergreen sites, 10 grazed grassland sites, 7 ungrazed coastal scrub sites, 6 grazed broad-leaved evergreen sites, 3 ungrazed grassland sites, and 3 grazed needle-leaved evergreen sites. We also sampled 25 plots in the Presidio of San Francisco (Figures 10, 10c). We established 21 plots in coastal dune scrub and 4 plots in a planted, cultural forest of Monterey pine (*Pinus radiata*). Two of the forest plots were disturbed after establishment and were not sampled during this session. In addition, we sampled 26 coastal scrub plots and 9 grassland plots on Sweeney Ridge (Figures 10, 10d).

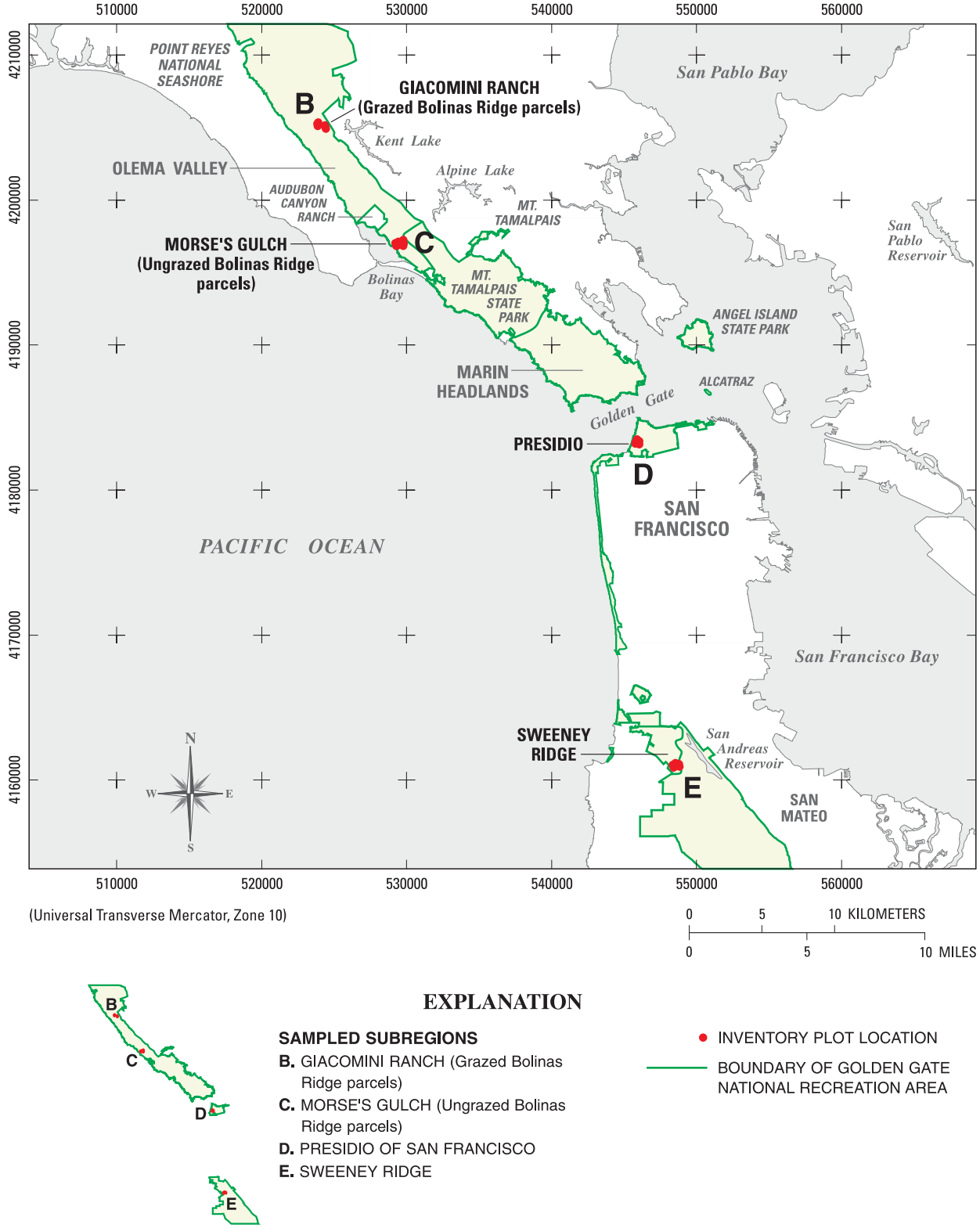
We detected 20 species in 1995 during 3,536 trap-nights of effort (Table 23). We recorded 13 species on Sweeney Ridge, 10 species on Bolinas Ridge, and 8 species in the Presidio. We also recorded skunks (species uncertain), snakes (species uncertain), shrews (species uncertain), and 2 unidentified species. Deer mice were the most abundant species detected across all sampling sites (32.3% of individual detections). Gray foxes were the most abundant larger mammal, accounting for 5.7% of individual detections.

Bolinas Ridge

We recorded 7 mammal species, 2 reptile species, and 1amphibian species on Bolinas Ridge during 976 trap-nights of effort (Table 24). We detected 2 new species in 1995—California slender salamanders (*Batrachoseps attenuatus*) and ringneck snakes (*Diadophis punctatus*)—captured in ungrazed needle-leaved evergreen and ungrazed coastal scrub habitats, respectively.

As in 1994, the mean number of species detected per plot was greatest in coastal scrub (mean = 2.71, SE = 0.36) and lowest in grassland (mean = 0.54, SE = 0.18) (Table 25). Overall, the mean number of species detected on ungrazed plots (mean = 1.80, SE = 0.26) was greater than on grazed plots (mean = 1.16, SE = 0.22). When considering both habitat type and treatment, the mean number of species detected was greater on ungrazed grasslands (mean = 0.67, SE = 0.33) than on grazed grasslands (mean = 0.50, SE = 0.22). As in 1994, the mean number of species detected on grazed needle-leaved evergreen sites (mean = 2.33, SE = 0.30) was greater than on ungrazed needle-leaved evergreen sites (mean = 1.60, SE = 0.33).

Across all habitat types and treatments, deer mice were the most abundant small mammal species detected (32% of



EXPLANATION

SAMPLED SUBREGIONS

- **B.** GIACOMINI RANCH (Grazed Bolinas Ridge parcels)
- **C.** MORSE'S GULCH (Ungrazed Bolinas Ridge parcels)
- **D.** PRESIDIO OF SAN FRANCISCO
- **E.** SWEENEY RIDGE

- INVENTORY PLOT LOCATION
- BOUNDARY OF GOLDEN GATE NATIONAL RECREATION AREA

Figure 10. Vertebrate inventory plots, 1995.

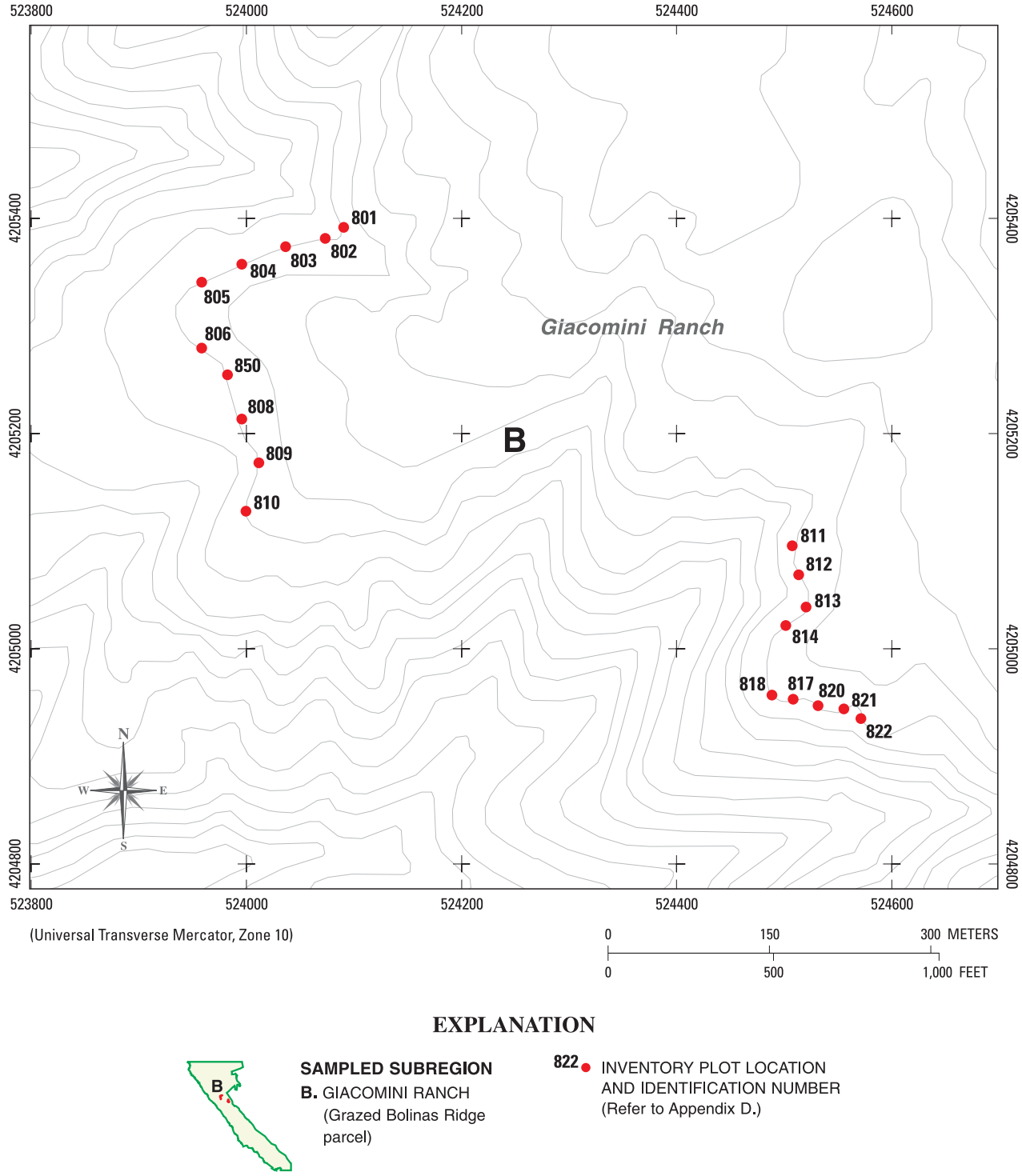


Figure 10a. Vertebrate inventory plots: detail of Giacomini Ranch plots, grazed Bolinas Ridge in the Olema Valley, 1995.

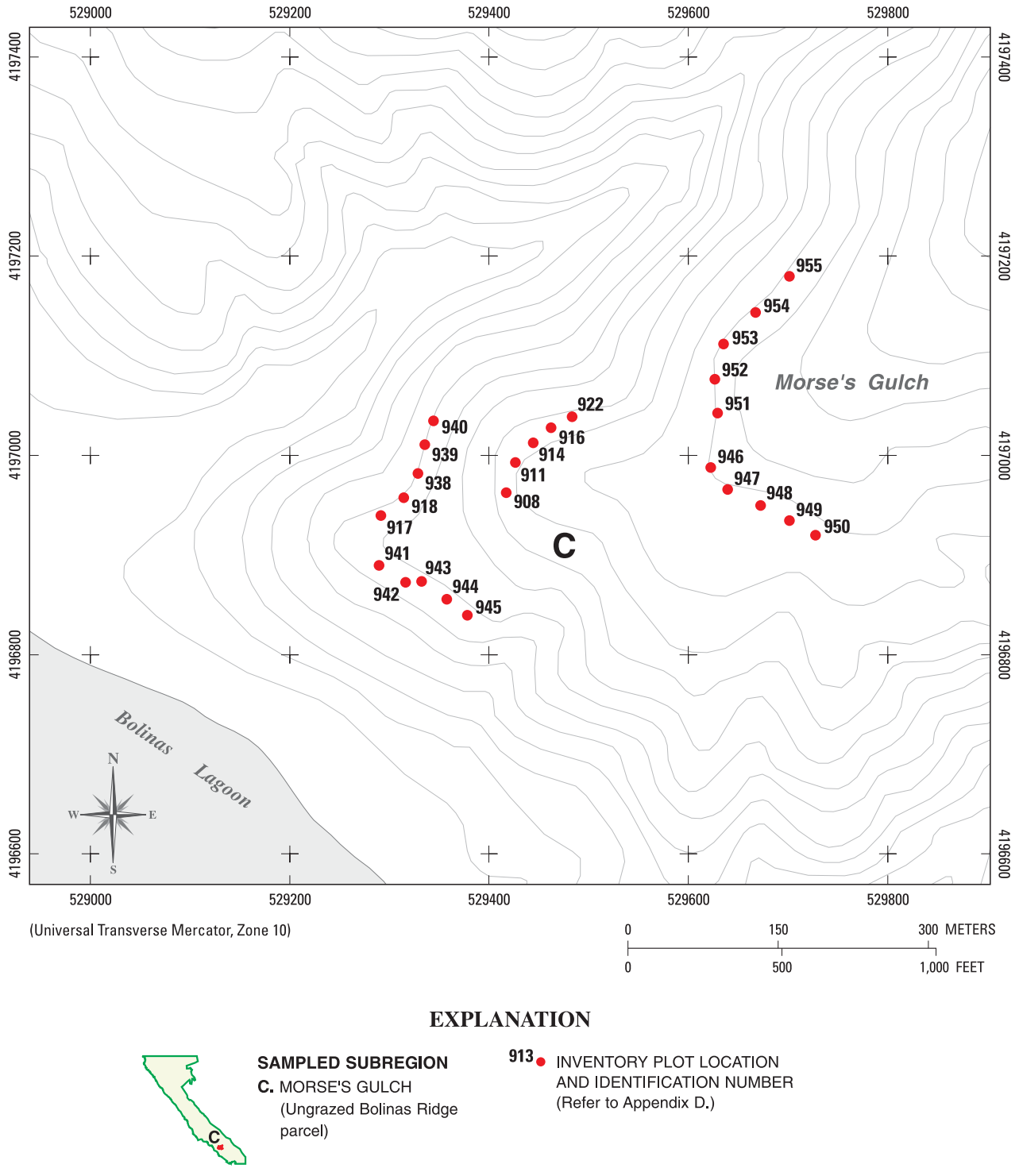
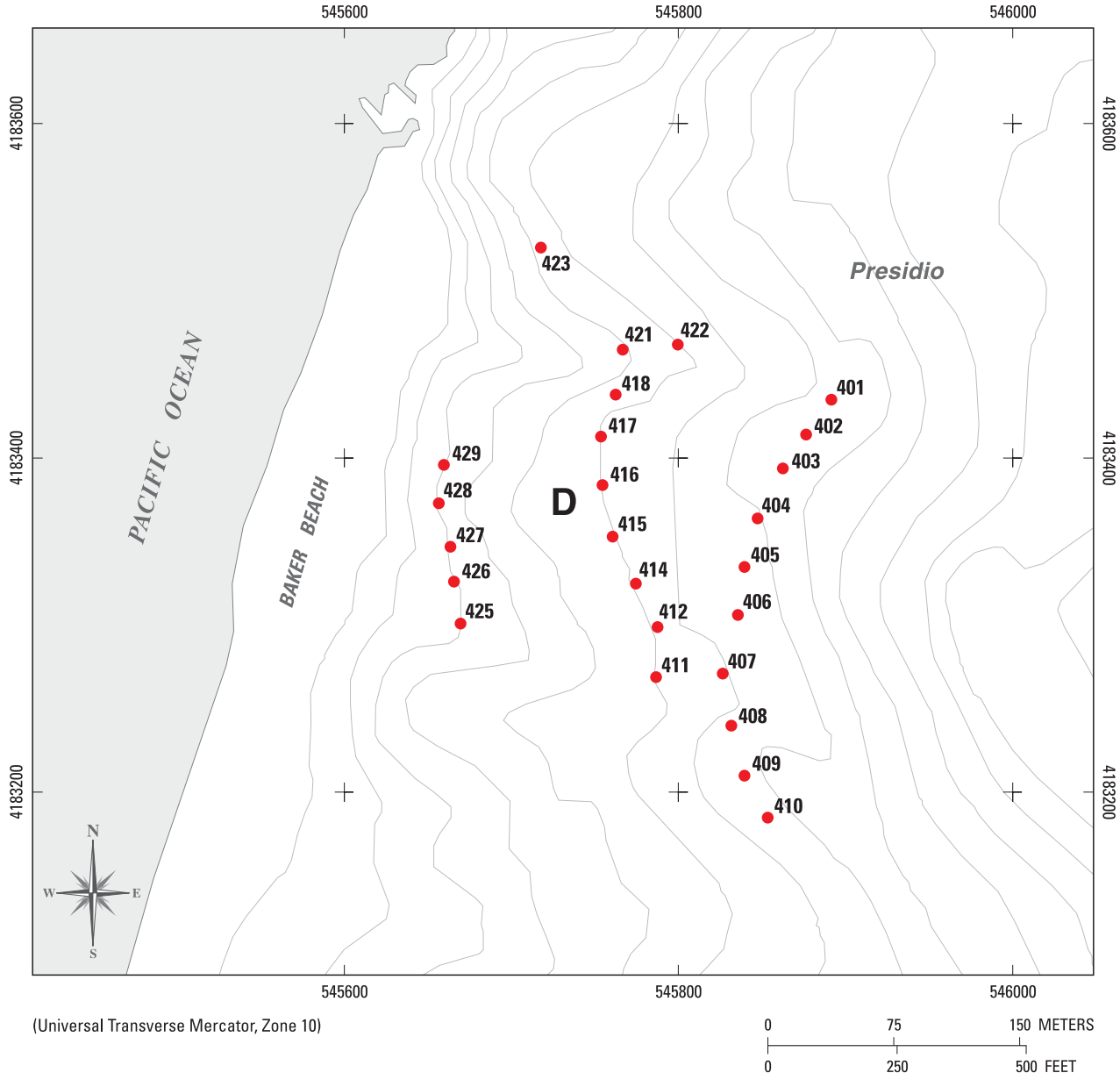


Figure 10b. Vertebrate inventory plots: detail of Morse's Gulch plots, ungrazed Bolinas Ridge in the Olema Valley, 1995.



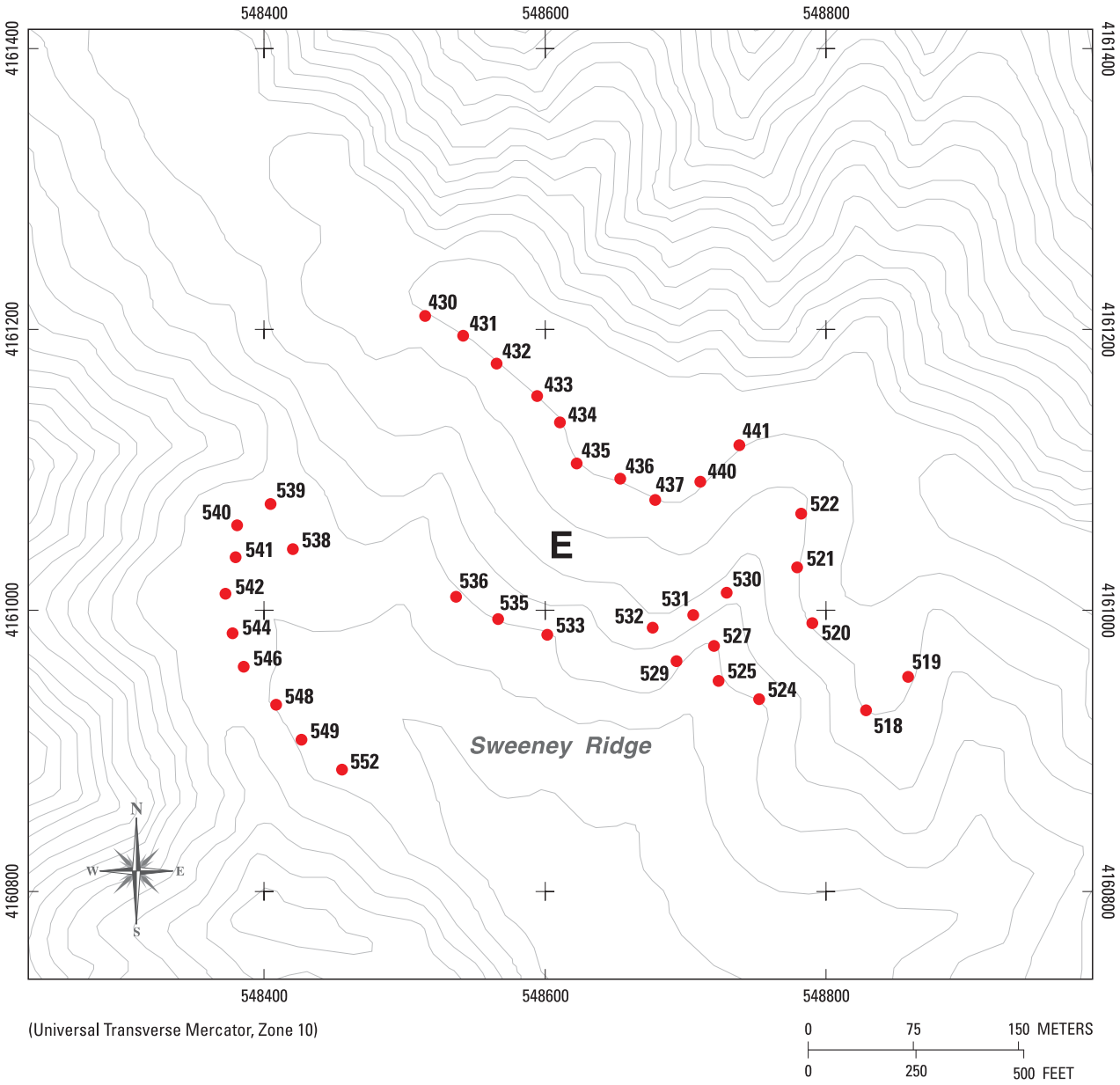
EXPLANATION

SAMPLED SUBREGION

D. PRESIDIO OF SAN FRANCISCO

410 ● INVENTORY PLOT LOCATION AND IDENTIFICATION NUMBER (Refer to Appendix D.)

Figure 10c. Vertebrate inventory plots: detail of Presidio plots, 1995.



EXPLANATION

SAMPLED SUBREGION
E. SWEENEY RIDGE

552 INVENTORY PLOT LOCATION AND IDENTIFICATION NUMBER (Refer to Appendix D.)

Figure 10d. Vertebrate inventory plots: detail of Sweeney Ridge plots, 1995.

Table 23. Detection statistics of vertebrates sampled using systematic survey methods, Bolinas Ridge, Sweeney Ridge, Presidio, 1995

Species	Code	Total Detections	Individual Detections	% of Individual Detections	Abundance[1]	
					Mean	SE
California slender salamander	BAAT	10	10	1.2	1.43	0.30
Domestic dog	CAFA	1	1	0.1	1.00	--
Ringneck snake	DIPU	5	5	0.6	5.00	
Opossum	DIVI	17	17	2.0	1.55	0.28
Ensatina	ENES	1	1	0.1	1.00	--
Domestic cat	FECA	2	2	0.2	1.00	--
Southern alligator lizard	GEMU	6	6	0.7	1.50	0.50
Bobcat	LYRU	2	2	0.2	1.00	--
Striped skunk	MEME	17	17	2.0	1.42	0.19
California vole	MICA	89	64	7.7	5.56	1.52
Dusky-footed woodrat	NEFU	37	37	4.5	2.06	0.40
Mouse species	PE	173	173	20.8	4.81	0.50
California mouse	PECA	3	2	0.2	1.50	0.50
Deer mouse	PEMA	626	268	32.3	12.04	1.50
Raccoon	PRLO	44	44	5.3	2.32	0.31
Western harvest mouse	REME	31	28	3.4	2.38	0.67
Western fence lizard	SCOC	57	57	6.9	2.04	0.26
Skunk species	SKNK	29	29	3.5	1.93	0.30
Snake species	SNK	4	4	0.5	2.00	--
Shrew species	SO	1	1	0.1	1.00	--
Trowbrdige shrew	SOTR	2	2	0.2	2.00	--
Vagrant shrew	SOVA	5	5	0.6	1.25	0.25
Brush rabbit	SYBA	1	1	0.1	1.00	--
Unknown species	UNKN	8	8	0.8	1.00	--
Gray fox	URCI	47	47	5.7	2.61	0.41
	Total	**3,536**	**831**	**100**		

[1] Mean abundance of individuals.

individual detections) (Table 24). Mean abundance of deer mice was greatest in grazed broad-leaved evergreen forest (mean = 3.83, SE = 1.01) and lowest in both grazed and ungrazed grasslands (no detections). Mean abundance of deer mice was also high in grazed needle-leaved evergreen forest (mean = 3.67, SE = 1.45). Woodrats were the second most abundant small mammal, accounting for 7 % of individual detections. Woodrats reached their greatest mean abundances in ungrazed coastal scrub (mean = 1.00, SE = 0.69) and grazed needle-leaved evergreen forest (mean = 1.00, SE = 1). No voles were captured during this session. Gray foxes were the most abundant of the larger mammals (27% of individual detections). Gray fox mean abundance was greatest in ungrazed coastal scrub (mean = 3.14, SE = 1.03) and lowest in grazed grassland (no detections).

Gray foxes were the most frequently encountered species on ungrazed sites (n = 25, frequency = 0.40), while deer mice were the most frequently encountered species on grazed sites (n = 19, frequency = 0.47) (Table 26). Gray foxes had the greatest frequency of occurrence in coastal scrub (frequency = 0.71) and were the only species detected on ungrazed grassland plots. Gray foxes were also found on 50% of the grazed broad-leaved evergreen plots and on 33% of the grazed needle-leaved evergreen plots. Deer mice were found on all grazed evergreen forest plots (n = 9), but were not found on grazed grasslands (n = 10). California slender salamanders were found at 47% of the ungrazed needle-leaved evergreen forest plots (n = 15), but were not encountered on any grazed plots of the same type (n = 3).

Overall trap success for pitfalls and Sherman live traps was greater on grazed plots (41%) than on ungrazed plots (13%) (Table 27). Trap success was greatest in grazed broad-leaved evergreen forest (43%) and lowest in ungrazed grassland (no captures). Deer mice showed the greatest trap success across all sites. In grazed habitats, they were the only small mammals captured. On ungrazed sites, pitfall traps also captured woodrats, Trowbridge shrews, western fence lizards, and California slender salamanders.

Pitfall-drift fence arrays were also employed in ungrazed needle-leaved evergreen forest. California slender

Table 24. Detection statistics of vertebrates sampled using systematic survey methods, Bolinas Ridge, 1995

Habitat Type/Treatment	Code	Total detections	Individual detections	Mean abundance[1]	
				Mean	SE
Ungrazed coastal scrub	DIPU	5	5	0.71	0.71
	DIVI	3	3	0.43	0.43
	NEFU	7	7	1.00	0.69
	PEMA	7	5	0.71	0.42
	PRLO	3	3	0.43	0.43
	SCOC	4	4	0.57	0.30
	SKNK	5	5	0.71	0.47
	URCI	22	22	3.14	1.03
	Total	**218**	**54**		
Ungrazed grassland	URCI	6	6	2.00	1.15
	Total	**90**	**6**		
Ungrazed needle-leaf evergreen forest	BAAT	10	10	0.67	0.23
	DIVI	3	3	0.20	0.11
	NEFU	1	1	0.07	0.07
	PE	1	1	0.07	0.07
	PEMA	13	9	0.60	0.35
	PRLO	6	6	0.40	0.21
	SKNK	1	1	0.07	0.07
	SOTR	2	2	0.13	0.13
	URCI	6	6	0.40	0.21
	Total	**308**	**39**		
Grazed broad-leaf evergreen forest	PE	2	2	0.33	0.33
	PEMA	33	23	3.83	1.01
	URCI	6	6	1.00	0.52
	Total	**117**	**31**		
Grazed grassland	MEME	1	1	0.10	0.10
	SCOC	1	1	0.10	0.10
	UNKN	3	3	0.30	0.15
	Total	**184**	**5**		
Grazed needle-leaf evergreen forest	DIVI	2	2	0.67	0.33
	NEFU	3	3	1.00	1.00
	PEMA	14	11	3.67	1.45
	URCI	1	1	0.33	0.33
	Total	**59**	**17**		

[1] Mean abundance of individuals.

Table 25. Number of species detected in sampled habitat /treatment types, Bolinas Ridge, 1995

Habitat Type	Treatment	N	Mean	SE
Grassland	Ungrazed	3	0.67	0.33
	Grazed	10	0.50	0.22
	Total	**13**	**0.54**	**0.18**
Coastal scrub	Ungrazed	7	2.71	0.36
	Total	**7**	**2.71**	**0.36**
Broad-leaved evergreen forest	Grazed	6	1.67	0.21
	Total	**6**	**1.67**	**0.21**
Needle-leaved evergreen forest	Ungrazed	15	1.60	0.35
	Grazed	3	2.33	0.33
	Total	**18**	**1.72**	**0.30**
All Habitat Types	Ungrazed	25	1.80	0.26
	Grazed	19	1.16	0.22
	Total	**44**	**1.52**	**0.18**

Table 26. Frequency of occurrence (proportion of sites with at least one detection of a species), Bolinas Ridge, 1995

	Ungrazed coastal scrub n = 7		Ungrazed grassland n = 3		Ungrazed needle-leaf evergreen forest n = 15		Grazed broad-leaf evergreen forest n= 6		Grazed grassland n = 10		Grazed needle-leaf evergreen forest n = 3	
Code	Sites with detections	Freq	Sites with detections	Freq	Sites with detections	Freq	Sites with detections	Freq	Sites with detections	Freq	Sites with detections	Freq
BAAT	--	--	--	--	7	0.47	--	--	--	--	--	--
DIPU	1	0.14	--	--	--	--	--	--	--	--	--	--
DIVI	1	0.14	--	--	3	0.20	--	--	--	--	2	0.67
MEME	--	--	--	--	--	--	--	--	1	0.10	--	--
NEFU	3	0.43	--	--	1	0.07	--	--	--	--	1	0.33
PE	--	--	--	--	1	0.07	1	0.17	--	--	--	--
PEMA	3	0.43	--	--	4	0.27	6	1.00	--	--	3	1.00
PRLO	1	0.14	--	--	3	0.20	--	--	--	--	--	--
SCOC	3	0.43	--	--	--	--	--	--	1	0.10	--	--
SKNK	2	0.29	--	--	1	0.07	--	--	--	--	--	--
SOTR	--	--	--	--	1	0.07	--	--	--	--	--	--
UNKN	--	--	--	--	--	--	--	--	3	0.30	--	--
URCI	5	0.71	2	0.67	3	0.20	3	0.50	--	--	1	0.33

Table 27. Trap success (2 x 4s, wood squares, pitfall traps, Sherman live traps) and track plate detection success, Bolinas Ridge, 1995

		Total detections						Trap success					
Habitat/Treatment Type	**Code**	**2x4**	**DF**	**PF**	**SH**	**TP**	**WS**	**2x4**	**DF**	**PF**	**SH**	**TP**	**WS**
Ungrazed coastal scrub	DIPU	--	--	--	--	--	5	--	--	--	--	--	0.36
	DIVI	--	--	--	--	3	--	--	--	--	--	0.05	--
	NEFU	--	--	1	--	6	--	--	--	0.02	--	0.15	--
	PEMA	--	--	2	5	--	--	--	--	0.04	0.11	--	--
	PRLO	--	--	--	--	3	--	--	--	--	--	0.05	--
	SCOC	--	--	3	--	1	--	--	--	0.06	--	0.02	--
	SKNK	--	--	--	--	5	--	--	--	--	--	0.09	--
	URCI	--	--	--	--	22	--	--	--	--	--	0.39	--
Total trap-nights		**48**		**52**	**47**	**57**	**14**						
Ungrazed grassland	URCI	--	--	--	--	6	--	--	--	--	--	0.27	--
Total trap-nights		**21**	**--**	**21**	**19**	**22**	**7**	--	--	--	--	--	--
Ungrazed needle-leaved evergreen	BAAT	2	5	3	--	--	--	0.03	0.20	0.05	--	--	--
	DIVI	--	--	--	--	3	--	--	--	--	--	0.05	--
	NEFU	--	--	--	--	1	--	--	--	--	--	0.02	--
	PE	--	--	--	--	1	--	--	--	--	--	0.02	--
	PEMA	--	--	1	12	--	--	--	--	0.02	0.18	--	--
	PRLO	--	--	--	--	6	--	--	--	--	--	0.10	--
	SKNK	--	1	--	--	--	--	--	0.04	--	--	--	--
	SOTR	--	--	2	--	--	--	--	--	0.03	--	--	--
	URCI	--	--	--	--	6	--	--	--	--	--	0.10	--
Total trap-nights		**69**	**25**	**64**	**68**	**63**	**19**						
Grazed grassland	MEME	--	--	--	--	1	--	--	--	--	--	0.02	--
	SCOC	--	--	--	--	1	--	--	--	--	--	0.02	--
	UNKN	--	--	--	--	3	--	--	--	--	--	0.05	--
Total trap-nights				**59**	**59**	**58**	**8**						
Grazed needle-leaved evergreen	DIVI	--	--	--	--	2	--	--	--	--	--	0.11	--
	NEFU	--	--	--	--	3	--	--	--	--	--	0.17	--
	PEMA	--	--	6	8	--	--	--	--	0.30	0.44	--	--
	URCI	--	--	--	--	1	--	--	--	--	--	0.06	--
Total trap-nights				**20**	**18**	**18**	**3**						
Grazed broad-leaved evergreen	PE	--	--	--	--	2	--	--	--	--	--	0.06	--
	PEMA	--	--	17	16	--	--	--	--	0.41	0.46	--	--
	URCI	--	--	--	--	6	--	--	--	--	--	0.17	--
Total trap-nights			**41**	**35**	**35**	**6**							

salamanders were the only species captured using this method (20% trap success).

Artificial cover boards were unsuccessful on all plots except for 5 ringneck snake captures on 1 coastal scrub plot and 2 California slender salamander captures in ungrazed needle-leaved evergreen forest.

Track plate detection success was greatest for gray foxes in coastal scrub (39%). Gray fox detection success was lowest in grazed needle-leaved evergreen forest (6%).

Presidio

We detected 6 mammal species and 3 reptile species, including 1 unidentified snake species, in the Presidio during 903 trap-nights of effort (Table 28). We recorded 8 known species, 1 unidentified skunk species, and 1 unidentified snake species. We detected an average of 3.14 species (SE = 0.35) in coastal dune scrub, and an average of 1.50 species (SE = 0.50) in cultural pine forest. We detected no small mammals on forest plots.

Western harvest mice were the only small mammal species detected on the Presidio plots (20% of individual detections). Skunks (striped skunks and skunk species uncertain) were the most abundant of the larger mammals (31% of individual detections). Raccoons accounted for 27% of individual detections, followed by opossums (7% of individual detections). Gray foxes accounted for 4% of individual detections in coastal scrub. Only raccoons and skunks were encountered in the cultural pine forest, with raccoons accounting for 60% of individual detections.

In coastal dune scrub, raccoons were the most frequently encountered species (frequency = 0.62), followed by western harvest mice (frequency = 0.57) and striped skunks (frequency = 0.52) (Table 29). Gray foxes were encountered on 14% of the plots. We detected 1 domestic cat on a single site. We encountered raccoons on both of the cultural forest sites.

Trap success for pitfalls and Sherman live traps was low over 425 trap-nights of effort (Table 30). Trap success for Western harvest mice was 6%, with more mice being captured in Sherman live traps (71% of total captures) than in pitfall traps. Southern alligator lizards and western fence were also captured in pitfall traps. Pitfall-drift fence arrays were employed on coastal dune scrub plots. Southern alligator lizards were the only species captured using this method. Trap success for this species was 13% over 32 drift-fence trap-nights.

Artificial cover boards showed no detections.

Sweeney Ridge

We detected 11 mammal species, 1 reptile species, and 1 amphibian species on Sweeney Ridge during 1,657 trap-nights of effort (Table 31). We also recorded shrews (species uncertain) and 2 unknowns. We detected 12 species in coastal scrub and 7 species in grassland. We detected an average of 4.11 species per plot in grassland (SE = 0.31) and an average of 3.85 species per plot in coastal scrub (SE = 0.22).

Deer mice were the most abundant species detected (40% of individual detections), followed by voles (12% of individual detections) and western fence lizards (9% of individual detections). Deer mice were abundant on both grassland (mean = 6.78, SE = 0.89) and coastal scrub (mean = 6.12, SE = 0.62) plots, while voles were more abundant on grassland plots (mean = 2.22, SE = 1.39). Western fence lizards were more abundant in grassland (mean = 1.89, SE = 0.65) than in coastal scrub (mean = 1.19, SE = 0.28). California mice (*Peromyscus californicus*) were detected for the first time during this inventory, but showed low abundance values (mean = 0.08, SE = 0.05). Gray foxes and bobcats were the only large, native mammals detected during this sampling session. Both species were found in coastal scrub. We did not detect opossums, raccoons, and skunks on any of the Sweeney Ridge plots. We recorded 1 domestic dog and 1 domestic cat.

Deer mice were the most frequently encountered species in coastal scrub, occurring on 25 of 26 plots (Table 32). Voles were the second most frequently encountered mammal species (frequency = 0.46), followed by woodrats (frequency = 0.31). We detected California mice on only 2 of the 26 coastal scrub sites. We found western fence lizards on 58% of the scrub plots. We recorded 1 detection of an ensatina (*Ensatina eshcholtzi*) on 1 coastal scrub plot. All larger mammals showed a low frequency of occurrence. We detected bobcats on 8% of the coastal scrub sites and gray foxes on 4% of scrub plots. We detected deer mice on all grassland plots (n = 9). We encountered voles on 33% of grassland plots and woodrats on 56% of the grassland plots. Woodrat presence on these plots was explained by the close proximity of dense patches of coastal scrub. Western fence lizards also had a high frequency of occurrence on grassland plots (frequency = 0.78). We detected brush rabbits (*Sylvilagus bachmani*) on a single grassland plot.

Trap success for pitfalls and Sherman live traps was great on Sweeney Ridge. Combined trap success was 63% in coastal scrub and 53% in grassland. In coastal scrub, trap success was greatest for deer mice (51%) (Table 33). Vole trap success was 8%, while California mouse trap success was less than 1%. Both deer mice and voles showed greater trap success in pitfall traps. Pitfall traps also accounted for the single ensatina detection. On grassland plots, trap success was greatest for deer mice (43%). Again, pitfall traps captured more deer mice than did Sherman live traps.

We did not employ artificial cover boards on Sweeney Ridge in 1995. We established pitfall-drift fence arrays on a subset of the grass-dominated plots and captured 3 species during 42 trap-nights of effort. Trap success for this method was 12%.

Table 28. Detection statistics of vertebrates sampled using systematic survey methods, Presidio, 1995

Code	Total detections	Individual detections	% of individual detections	Mean Abundance[1]			
				Coastal scrub		Cultural forest	
				Mean	SE	Mean	SE
DIVI	9	9	0.07	0.43	0.20	--	--
FECA	1	1	0.01	0.05	0.05	--	--
GEMU	6	6	0.05	0.29	0.16	--	--
MEME	16	16	0.12	0.76	0.19	--	--
PRLO	35	35	0.27	1.19	0.27	5.0	1.0
REME	30	27	0.20	1.29	0.44	--	--
SCOC	4	4	0.03	0.19	0.15	--	--
SKNK	23	23	0.17	1.05	0.30	0.5	0.5
SNK	4	4	0.03	0.19	0.13	--	--
UNKN	2	2	0.02	0.10	0.07	--	--
URCI	5	5	0.04	0.24	0.15	--	--
Total	**903**	**132**					

[1] Mean abundance of individuals.

Table 29. Frequency of occurrence (proportion of sites with at least one detection of a species), Presidio, 1995

Code	Coastal scrub n = 21		Cultural forest (Monterey pine) n = 2	
	Sites with detections	Frequency	Sites with detections	Frequency
DIVI	5	0.24	--	--
FECA	1	0.05	--	--
GEMU	4	0.19	--	--
MEME	11	0.52	--	--
PRLO	13	0.62	2	1.00
REME	12	0.57	--	--
SCOC	2	0.10	--	--
SKNK	11	0.52	1	0.50
SNK	2	0.10	--	--
UNKN	2	0.10	--	--
URCI	3	0.14	--	--

Table 30. Trap success (2 x 4s, wood squares, pitfall traps, Sherman live traps) and track plate detection success, Presidio, 1995

		Total detections					Trap success					
Habitat type	**Code**	**2x4**	**DFA**	**PF**	**SH**	**TP**	**2x4**	**DFA**	**PF**	**PF+SH**	**SH**	**TP**
Coastal scrub	DIVI	--	--	--	--	9	--	--	--	--	--	0.04
	FECA	--	--	--	--	1	--	--	--	--	--	0.00
	GEMU	--	4	2	--	--	--	0.13	0.01	0.01	--	--
	MEME	--	--	--	--	16	--	--	--	--	--	0.08
	PRLO	--	--	--	--	25	--	--	--	--	--	0.12
	REME	--	--	7	17	6	--	--	0.04	0.06	0.09	0.03
	SCOC	--	--	4	--	--	--	--	0.02	0.01	--	--
	SKNK	--	--	--	--	22	--	--	--	--	--	0.10
	SNK	--	--	--	--	4	--	--	--	--	--	0.02
	UNKN	--	--	--	--	2	--	--	--	--	--	0.01
	URCI	--	--	--	--	5	--	--	--	--	--	0.02
Total trap-nights		**191**	**32**	**195**	**194**	**211**				**389**		
Cultural forest	PRLO	--	--	1	1	8	--	--	--	--	--	0.44
	SKNK	--	--	--	--	1	--	--	--	--	--	0.06
Total trap-nights		**18**	**8**	**18**	**18**	**18**				**36**		

Table 31. Detection statistics of vertebrates sampled using systematic survey methods, Sweeney Ridge, 1995

				Mean abundance [1]			
				Grassland		Coastal Scrub	
Code	**Total detections**	**Individual detections**	**% of individual detections**	**Mean**	**SE**	**Mean**	**SE**
CAFA	1	1	0.00	0.11	0.11	--	--
ENES	1	1	0.00	--	--	0.04	0.04
FECA	1	1	0.00	--	--	0.04	0.04
LYRU	2	2	0.00	--	--	0.08	0.05
MICA	89	64	0.12	2.22	1.39	1.69	0.62
NEFU	26	26	0.05	1.78	0.78	0.38	0.14
PE	170	170	0.31	5.67	1.08	4.54	0.57
PECA	3	2	0.00	--	--	0.08	0.05
PEMA	559	220	0.40	6.78	0.89	6.12	0.62
REME	1	1	0.00	--	--	0.04	0.04
SCOC	48	48	0.09	1.89	0.65	1.19	0.28
SO	1	1	0.00	--	--	0.04	0.04
SOVA	5	5	0.01	0.33	0.24	0.08	0.05
SYBA	1	1	0.00	0.11	0.11	--	--
UNK	1	1	0.00	--	--	0.04	0.04
UNKN	2	2	0.00	--	--	0.08	0.05
URCI	1	1	0.00	--	--	0.04	0.04
Total	**1,657**	**547**					

[1] Mean abundance of individuals.

Table 32. Frequency of occurrence (proportion of sites with at least one detection of a species), Sweeney Ridge, 1995

Code	Coastal scrub n = 26		Grassland n = 9	
	Sites with detections	Frequency	Sites with detections	Frequency
CAFA	--	--	1	0.11
ENES	1	0.04	--	--
FECA	1	0.04	--	--
LYRU	2	0.08	--	--
MICA	12	0.46	3	0.33
NEFU	8	0.31	5	0.56
PE	25	0.96	9	1.00
PECA	2	0.08	--	--
PEMA	24	0.92	9	1.00
REME	1	0.04	--	--
SCOC	15	0.58	7	0.78
SO	1	0.04	--	--
SOVA	2	0.08	2	0.22
SYBA	--	--	1	0.11
UNK	1	0.04	--	--
UNKN	2	0.08	--	--
URCI	1	0.04	--	--

Table 33. Trap success (drift fence arrays, pitfall traps, Sherman live traps) and track plate detection success, Sweeney Ridge, 1995

Habitat type	Code	Total detections				Trap success				
		DFA	PF	SH	TP	DFA	PF	SH	PF+SH	TP
Coastal scrub	ENES	--	1	--	--	--	0.00	--	0.0	--
	FECA	--	--	--	1	--	--	--	--	0.00
	LYRU	--	--	--	2	--	--	--	--	0.01
	MICA	--	54	9	5	--	0.11	0.03	0.08	0.02
	NEFU	--	--	--	10	--	--	--	--	0.03
	PE	--	--	--	118	--	--	--	--	0.36
	PECA	--	1	2	--	--	0.00	0.01	0.00	--
	PEMA	--	296	128	--	--	0.58	0.40	0.51	--
	REME	--	--	1	--	--	--	0.00	0.00	--
	SCOC	--	29	--	2	--	0.06	--	0.03	0.01
	SO	--	1	--	--	--	0.00	--	0.00	--
	SOVA	--	2	--	--	--	0.00	--	0.00	--
	UNK	--	--	--	1	--	--	--	--	0.00
	UNKN	--	--	1	1	--	--	0.00	0.00	0.00
	URCI	--	--	--	1	--	--	--	--	0.00
	Total trap-nights		**509**	**321**	**328**				**830**	
Grassland	CAFA	--	--	--	1	--	--	--	--	0.01
	MICA	3	11	3	4	0.07	0.06	0.02	0.04	0.03
	NEFU	--	--	--	16	--	--	--	--	0.11
	PE	--	--	--	52	--	--	--	--	0.36
	PEMA	--	88	47	--	--	0.49	0.36	0.43	--
	SCOC	1	15	--	1	0.02	0.08	--	0.05	0.01
	SOVA	1	2	--	--	0.02	0.01	--	0.01	--
	SYBA	--	--	--	1	--	--	--	--	0.01
	Total trap-nights	**42**	**181**	**132**	**144**				**313**	

Sampling Year 1996

We sampled 37 coastal scrub and 18 grassland plots on Sweeney Ridge in 1996 (Figures 11, 11a, 11b). Sampling occurred between July and September. In addition, we established and sampled 15 plots in dense coastal scrub within the San Francisco Watershed (Figures 11, 11c). We removed center stakes and sampling devices from these plots at the end of the sampling period. We also established 10 plots in second-growth redwood forest on the Phleger Estate (Figures 11, 11d).

We recorded 22 species during 3,368 trap-nights of effort (Table 34). We recorded 17 species on Sweeney Ridge, 8 species on the Phleger Estate, and 7 species in the San Francisco Watershed. Across all sampling sites, deer mice were the most abundant species detected (45.0% of individual detections). Voles (14.3% of individual detections) and vagrant shrews (8.1% of individual detections) were the second and third most abundant small mammal species, respectively. Overall carnivore abundance was low, with bobcats showing the greatest overall abundance (0.5% of individual detections).

Sweeney Ridge

We recorded 14 mammal species and 3 reptile species on Sweeney Ridge during 2,634 trap-nights of effort (Table 35). We detected 16 species in coastal scrub and 10 species in grassland. We also recorded snakes (species uncertain) and 1 unknown. The mean number of species detected per plot was greater in coastal scrub (mean = 4.00, SE = 0.19) than in grassland (mean = 3.06, SE = 0.42).

Again, deer mice were the most abundant species detected (48.1% of individual detections). Mean abundance of deer mice was greater in coastal scrub (mean = 6.27, SE = 0.47) than in grassland (mean = 2.72, SE = 0.67). Voles were the second most abundant species detected (14.6% of individual detections) and were found on both grassland and coastal scrub plots. California mouse detection rates were low (0.3% of individual detections) and were recorded only on coastal scrub plots. We detected woodrats on both grassland (mean = 0.39, SE = 0.22) and coastal scrub plots (mean = 0.32, SE = 0.10). Abundance values for larger mammals were low. Across all plots, bobcats, gray foxes, coyotes, and raccoons each accounted for less than 1% of individual detections. We did not detect skunks or opossums on any plots.

We encountered deer mice on all coastal scrub sites (Table 36). We detected voles on 62% of scrub plots and vagrant shrews on 41% of scrub plots. Western fence lizards were the most frequently encountered reptiles in coastal scrub (frequency = 0.38). Frequency of occurrence of large mammals was low. Coyote, gray fox, and raccoon detections each occurred at a single plot. Deer mice also showed the greatest frequency of occurrence on grassland plots (frequency = 0.83). We detected voles and western fence lizards on 33% of the plots. Bobcat detections occurred on 2 grassland sites. We detected coyotes and gray foxes on single grassland plots.

Trap success for pitfall traps and Sherman live traps was great (Table 37). Trap success was greater in coastal scrub (68%) than in grassland (32%). In coastal scrub, trap success was greatest for deer mice (48% of total detections). We captured 61% of deer mice in pitfall traps. Voles showed a combined trap success of 11%. Pitfall traps accounted for 76% of vole captures. Similarly, we captured 82% of vagrant shrews in pitfall traps. Vagrant shrews displayed an overall trap success of 4% in coastal scrub. In grassland, trap success was again greatest for deer mice (24%), while voles showed a trap success of 6% in the same habitat type. In grassland, pitfall traps accounted for 55% of deer mice captures and 59% of vole captures.

Track plate success was low for large mammals. In both grassland and coastal scrub habitats, deer mice (species uncertain) and woodrats showed the greatest track plate detection successes.

We detected 1 rubber boa beneath an artificial cover board.

San Francisco Watershed

We recorded 6 mammal species, 1 reptile species, and 1 unidentified shrew species in the San Francisco Watershed during 507 trap-nights of effort (Table 38). We did not detect California mice or large mammals on these plots. These sites supported a mean of 3.20 species (SE = 0.28).

Deer mice were the most abundant species detected (39.4% of individual detections). Voles and vagrant shrews were equally abundant (15.9% of individual detections). Deer mice were also the most frequently encountered species, occurring on 87% of the sites sampled (Table 39). Voles (frequency = 0.47) and vagrant shrews (frequency = 0.40) occurred on fewer than 50% of the sites.

Combined trap success was greatest for deer mice (31%) (Table 40), with more captures occurring in Sherman live traps than in pitfall traps. Trap success was greater for voles (12%) than for vagrant shrews (8%). While vole captures were divided almost equally between pitfall traps and Sherman live traps, 86% of vagrant shrews were caught in pitfall traps.

We recorded only deer mice and 1 woodrat on track plates during the sampling session.

We did not record any artificial cover board detections.

Phleger Estate

We detected 8 mammal species during 227 trap-nights of effort (Table 41). We recorded no reptiles or amphibians. We detected an average of 1.70 species (SE = 0.30) across all plots.

Piñon mice (*Peromyscus truei*) were the most abundant species detected (15.0% of individual detections). Woodrats (12.5% of individual detections) and western gray squirrels (*Sciurus griseus*) (4.2% of individual detections) were the only other small mammal species detected. Raccoons were the most abundant larger mammal species (16.7% of individual detections). Piñon mice occurred on 40% of the plots (Table 42). Bobcats, gray foxes, and raccoons occurred on 20% of the sites, while opossums and domestic cats occurred on 10% of plots.

Sherman live trap success for piñon mice was 14% (Table 43). Pitfall traps were not used during this survey.

Overall track plate success was 22%. Raccoons and mice (species uncertain) each had track plate detection success values of 5%.

We detected no reptile or amphibian species using artificial cover boards.

Similarly, the time-area searches yielded no detections.

Table 34. Detection statistics of vertebrates sampled using systematic survey methods, Sweeney Ridge, San Francisco Watershed, and Phleger Estate, 1996

Code	Total detections	Individual detections	% of individual detections	Mean abundance[1]	
				Mean	SE
CAFA	2	2	0.3	1.00	--
CALA	1	1	0.1	1.00	--
CHBO	1	1	0.1	1.00	--
DIVI	1	1	0.1	1.00	--
FECA	1	1	0.1	1.00	--
GECO	2	2	0.3	1.00	--
HOSA	1	1	0.1	1.00	--
LYRU	4	4	0.5	1.00	--
MICA	171	106	14.3	2.94	0.34
NEFU	23	23	3.1	1.64	0.20
NEGI	1	1	0.1	1.00	--
PE	114	114	15.4	2.11	0.14
PECA	1	1	0.1	1.00	--
PEMA	661	333	45.0	5.12	0.37
PETR	10	6	0.8	1.50	0.50
PRLO	6	6	0.8	1.50	0.29
REME	8	7	0.9	0.88	0.13
SCGR	1	1	0.1	1.00	--
SCOC	39	39	5.3	1.56	0.17
SMML	1	1	0.1	1.00	--
SNK	5	5	0.7	1.25	0.25
SO	12	12	1.6	2.40	1.17
SOTR	1	1	0.1	1.00	--
SOVA	60	60	8.1	2.86	0.46
SYBA	5	5	0.7	1.00	--
THEL	1	1	0.1	1.00	--
UNKN	3	3	0.4	1.00	--
URCI	3	3	0.4	1.00	--
Total trap-nights	**3,368**	**740**	**100**		

[1] Mean abundance of individuals.

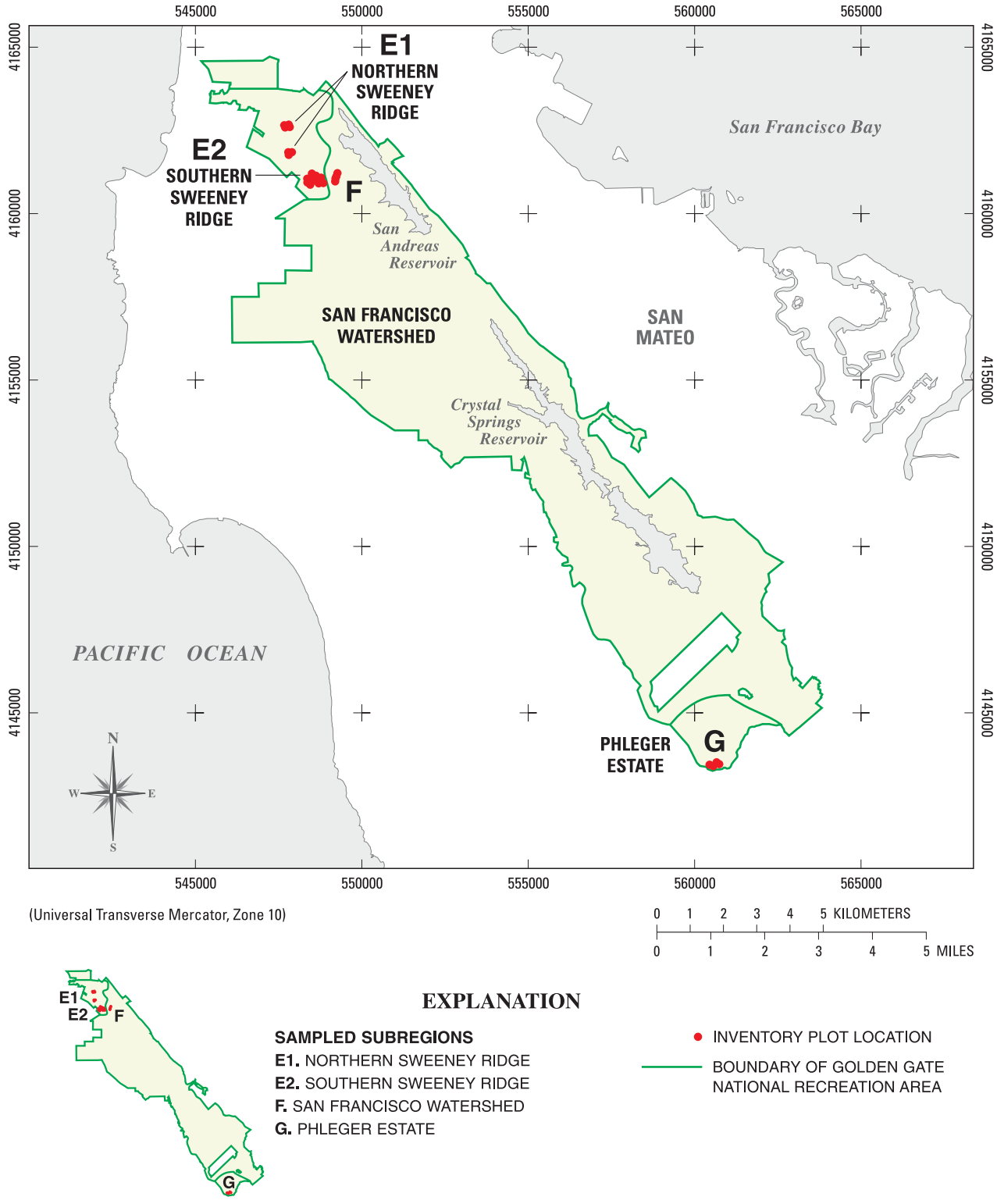
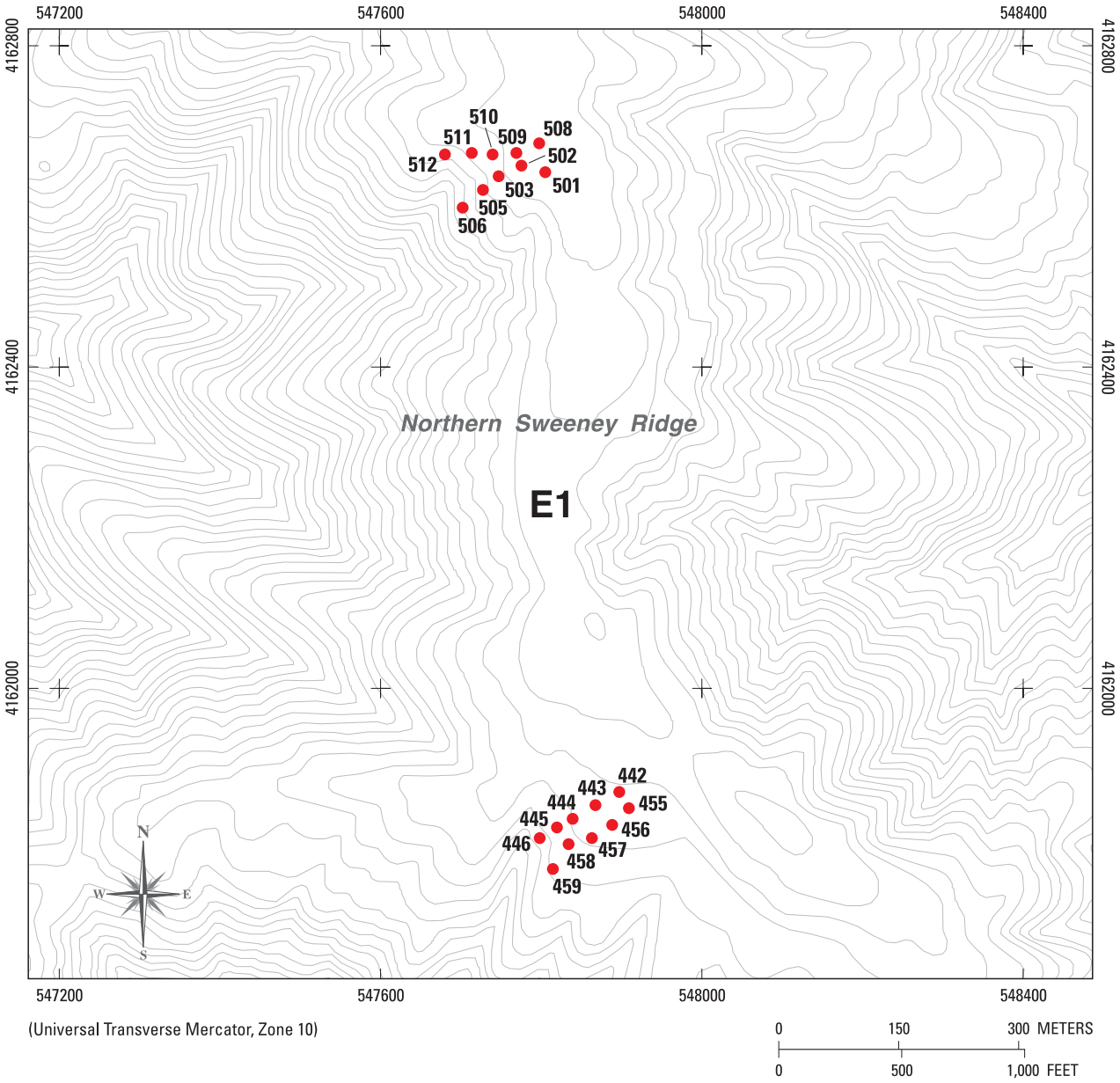


Figure 11. Vertebrate inventory plots, 1996.



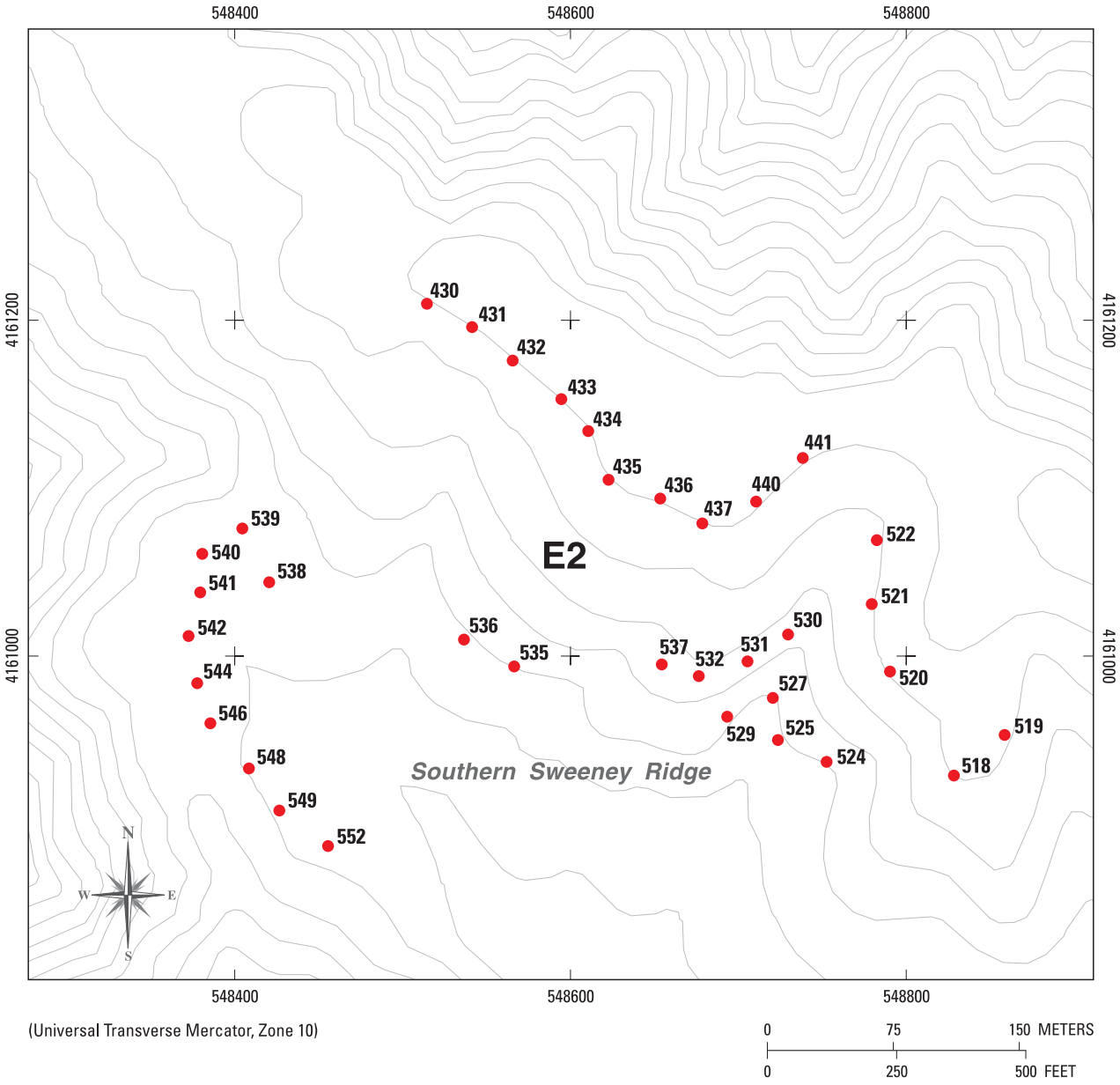
EXPLANATION

SAMPLED SUBREGION

E1. NORTHERN SWEENEY RIDGE

459 ● INVENTORY PLOT LOCATION AND IDENTIFICATION NUMBER (Refer to Appendix D.)

Figure 11a. Vertebrate inventory plots: detail of northern Sweeney Ridge plots, 1996.



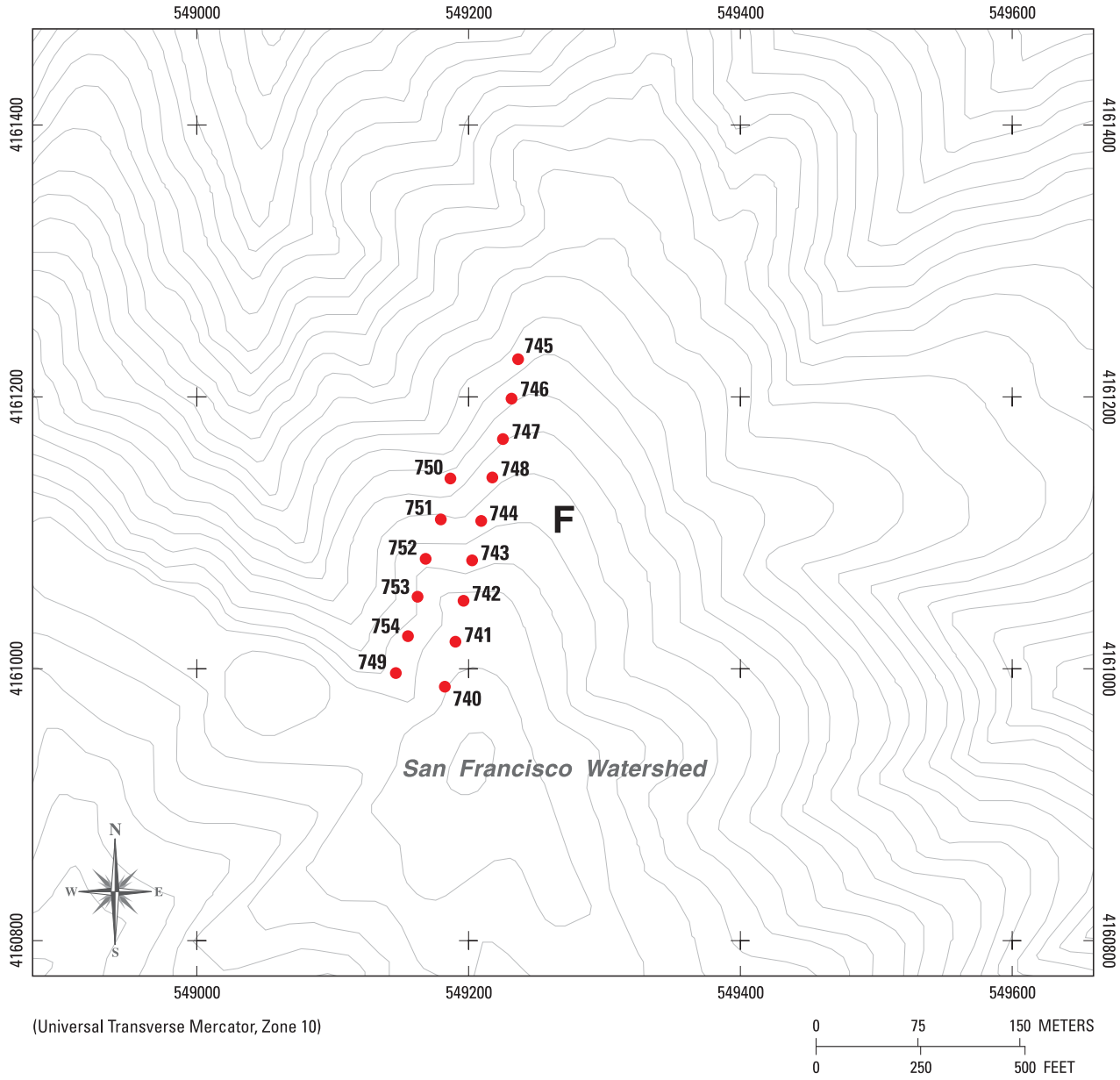
EXPLANATION

SAMPLED SUBREGION

E2. SOUTHERN SWEENEY RIDGE

552 ● INVENTORY PLOT LOCATION AND IDENTIFICATION NUMBER (Refer to Appendix D.)

Figure 11b. Vertebrate inventory plots: detail of southern Sweeney Ridge plots, 1996.

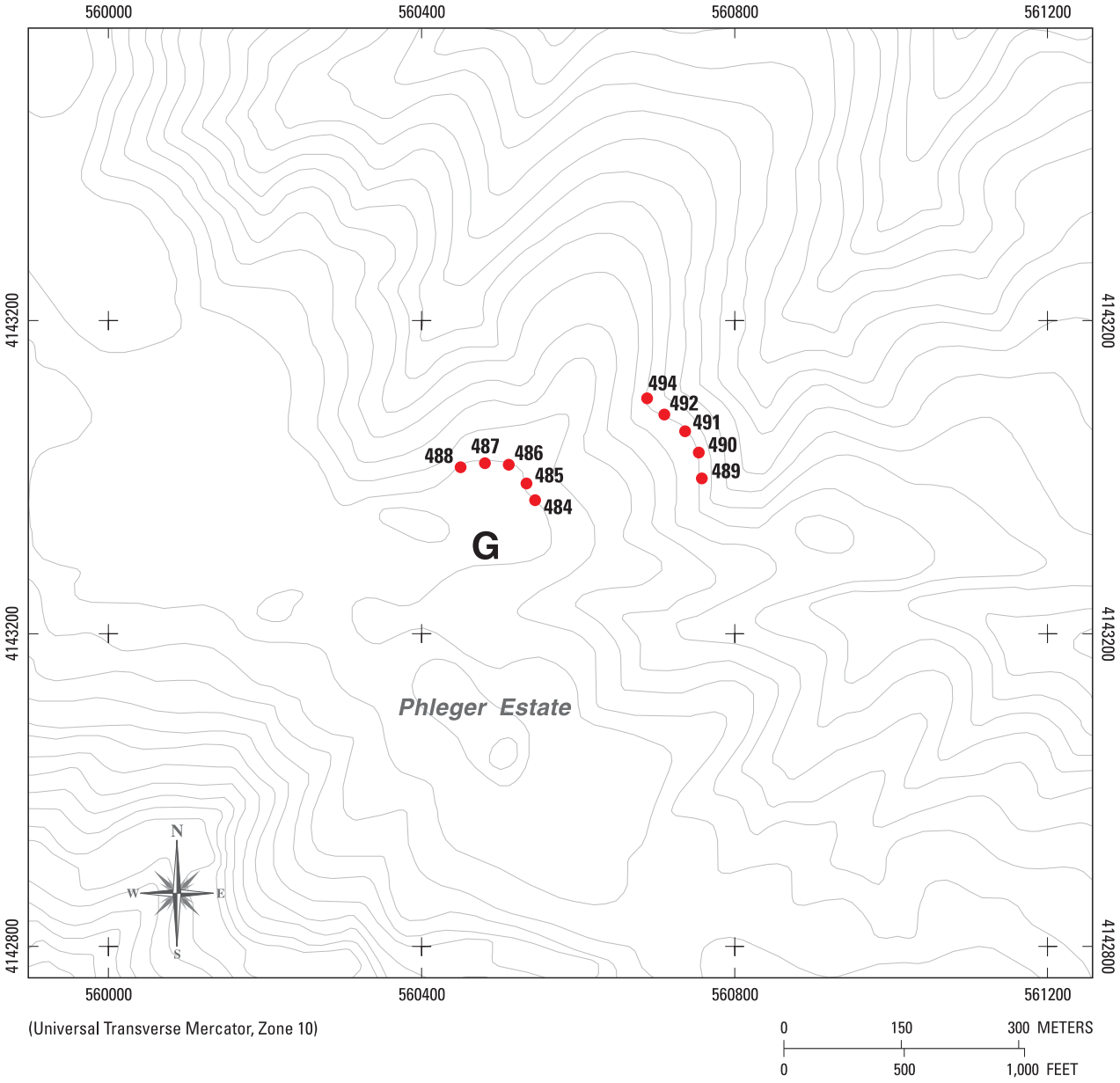


EXPLANATION

SAMPLED SUBREGION
F. SAN FRANCISCO WATERSHED

740 ● INVENTORY PLOT LOCATION AND IDENTIFICATION NUMBER (Refer to Appendix D.)

Figure 11c. Vertebrate inventory plots: detail of San Francisco Watershed plots, 1996.



EXPLANATION

SAMPLED SUBREGION
G. PHLEGER ESTATE

484 ● INVENTORY PLOT LOCATION AND IDENTIFICATION NUMBER (Refer to Appendix D.)

Figure 11d. Vertebrate inventory plots: detail of Phleger Estate plots, 1996.

Table 35. Detection statistics of vertebrates sampled using systematic survey methods, Sweeney Ridge, 1996

Code	Total detections	Individual detections	% of individual detections	Mean abundance[1]			
				Coastal scrub		Grassland	
				Mean	SE	Mean	SE
CAFA	2	2	0.3	0.03	0.03	0.06	0.06
CALA	1	1	0.2	0.03	0.03	--	--
CHBO	1	1	0.2	0.03	0.03	--	--
GECO	2	2	0.3	0.03	0.03	0.06	0.06
HOSA	1	1	0.2			0.06	0.06
LYRU	2	2	0.3			0.11	0.08
MICA	139	85	14.6	1.81	0.37	1.00	0.40
NEFU	19	19	3.2	0.32	0.10	0.39	0.22
PE	84	84	14.3	1.70	0.23	1.17	0.28
PECA	1	1	0.3	0.03	0.03	--	--
PEMA	576	281	48.1	6.27	0.47	2.72	0.67
PRLO	2	2	0.3	0.03	0.03	0.06	0.06
REME	6	5	0.9	0.05	0.04	0.17	0.09
SCOC	32	32	5.5	0.62	0.15	0.50	0.23
SNK	5	5	0.9	0.05	0.05	0.17	0.09
SO	11	11	1.9	0.30	0.20	--	--
SOTR	1	1	0.2	0.03	0.03	--	--
SOVA	39	39	6.7	1.05	0.29	--	--
SYBA	5	5	0.9	0.11	0.05	0.06	0.06
THEL	1	1	0.2	0.03	0.03	--	--
UNKN	3	3	0.5	0.03	0.03	0.11	0.08
URCI	1	1	0.2	0.03	0.03	--	--
Total trap-nights	**2,634**	**584**					

[1] Mean abundance of individuals.

Table 36. Frequency of occurrence (proportion of sites with at least one detection of a species), Sweeney Ridge, 1996

Code	Coastal scrub n = 37		Grassland n = 18	
	Sites with detections	Frequency	Sites with detections	Frequency
CAFA	1	0.03	1	0.06
CALA	1	0.03	--	--
CHBO	1	0.03	--	--
GECO	1	0.03	1	0.06
HOSA	--	--	1	0.06
LYRU	--	--	2	0.11
MICA	23	0.62	6	0.33
NEFU	9	0.24	3	0.17
PE	29	0.78	10	0.56
PECA	1	0.03	--	--
PEMA	37	1.00	15	0.83
PRLO	1	0.03	1	0.06
REME	2	0.05	3	0.17
SCOC	14	0.38	6	0.33
SNK	1	0.03	3	0.17
SO	4	0.11	--	--
SOTR	1	0.03	--	--
SOVA	15	0.41	--	--

Table 36. Frequency of occurrence (proportion of sites with at least one detection of a species), Sweeney Ridge, 1996—Continued

	Coastal scrub		Grassland	
	n = 37		n = 18	
Code	Sites with detections	Frequency	Sites with detections	Frequency
SYBA	4	0.11	1	0.06
THEL	1	0.03	--	--
UNKN	1	0.03	2	0.11
URCI	1	0.03	--	--

Table 37. Trap success (pitfall traps, Sherman live traps, wood squares) and track plate detection success, Sweeney Ridge, 1996

		Total detections				Trap success				
Habitat type	Code	PF	SH	TP	WS	PF	SH	PF+SH	TP	WS
Coastal scrub	CAFA	--	--	1	--	--	--	--	0.00	--
	CALA	--	--	1	--	--	--	--	0.00	--
	CHBO	--	--	--	1	--	--	--	--	0.00
	GECO	1	--	--	--	0.00	--	0.00	--	--
	MICA	85	25	2	--	0.15	0.07	0.11	0.01	--
	NEFU	--	--	12	--	--	--	--	0.03	--
	PE	--	--	63	--	--	--	--	0.16	--
	PECA	--	1	--	--	--	0.00	0.00	--	--
	PEMA	283	180	--	--	0.50	0.47	0.48	--	--
	PRLO	--	--	1	--	--	--	--	0.00	--
	REME	3	--	--	--	0.01	--	0.00	--	--
	SCOC	22	--	1	--	0.04	--	0.02	0.00	--
	SNK	--	--	2	--	--	--	--	0.01	--
	SO	11	--	--	--	0.02	--	0.01	--	--
	SOTR	1	--	--	--	0.00	--	0.00	--	--
	SOVA	32	7	--	--	0.06	0.02	0.04	--	--
	SYBA	--	--	4	--	--	--	--	0.01	--
	THEL	1	--	--	--	0.00	--	0.00	--	--
	UNKN	--	--	1	--	--	--	--	0.00	--
	URCI	--	--	1	--	--	--	--	0.00	--
	Total trap-nights	**582**	**384**	**384**	**380**			**966**		
Grassland	CAFA	--	--	1	--	--	--	--	0.01	--
	GECO	1	--	--	--	0.00	--	0.00	--	--
	HOSA	--	--	1	--	--	--	--	0.01	--
	LYRU	--	--	2	--	--	--	--	0.01	--
	MICA	16	11	--	--	0.06	0.05	0.06	--	--
	NEFU	--	--	7	--	--	--	--	0.03	--
	PE	--	--	21	--	--	--	--	0.10	--
	PEMA	61	51		1	0.24	0.23	0.24		0.01
	PRLO	--	--	1	--	--	--	--	0.01	--
	REME	1	2	--	--	0.00	0.01	0.01	--	--
	SCOC	9	--	--	--	0.04	--	0.02	--	--
	SNK	--	--	3	--	--	--	--	0.01	--
	SYBA	--	--	1	--	--	--	--	0.01	--
	UNKN	--	--	2	--	--	--	--	0.01	--
	Total trap-nights	**255**	**220**	**210**	**219**			**475**		

Table 38. Detection statistics of vertebrates sampled using systematic survey methods, San Francisco Watershed, 1996

Code	Total detections	Individual detections	% of individual detections	Mean abundance [1] Coastal scrub Mean	Mean abundance [1] Coastal scrub SE
MICA	32	21	15.9	1.40	0.53
NEFU	1	1	0.8	0.07	0.07
NEGI	1	1	0.8	0.07	0.07
PE	26	26	19.7	1.73	0.30
PEMA	85	52	39.4	3.47	0.53
REME	2	2	1.5	0.13	0.09
SCOC	7	7	5.3	0.47	0.22
SO	1	1	0.8	0.07	0.07
SOVA	21	21	15.9	1.40	0.59
Total trap-nights	**507**	**132**			

[1] Mean abundance of individuals.

Table 39. Frequency of occurrence (proportion of sites with at least one detection of a species), San Francisco Watershed, 1996

Code	Coastal Scrub n = 15 Sites with detections	Coastal Scrub n = 15 Frequency
MICA	7	0.47
NEFU	1	0.07
NEGI	1	0.07
PE	12	0.80
PEMA	13	0.87
REME	2	0.13
SCOC	5	0.33
SO	1	0.07
SOVA	6	0.40

Table 40. Trap success (pitfall traps, Sherman live traps, wood squares) and track plate detection success, San Francisco Watershed, 1996

Habitat type	Code	Total detections PF	Total detections SH	Total detections TP	Total detections WS	Trap success PF	Trap success SH	Trap success PF+SH	Trap success TP	Trap success WS
Coastal scrub	MICA	17	15	--	--	0.11	0.12	0.12	--	--
	NEFU	--	--	1	--	--	--	--	0.01	--
	NEGI	--	1	--	--	--	0.01	0.00	--	--
	PE	--	--	26	--	--	--	--	0.22	--
	PEMA	36	49	--	--	0.24	0.40	0.31	--	--
	REME	1	1	--	--	0.01	0.01	0.01	--	--
	SCOC	7	--	--	--	0.05	--	0.03	--	--
	SO	1	--	--	--	0.01	--	0.00	--	--
	SOVA	18	3	--	--	0.12	0.02	0.08	--	--
	Total trap-nights	**150**	**122**	**117**	**118**			**272**		

Table 41. Detection statistics of vertebrates sampled using systematic survey methods, Phleger Estate, 1996

Code	Total detections	Individual detections	% of individual detections	Needle-leaved evergreen (redwood) n = 10 Mean abundance Mean	SE
DIVI	1	1	4.2	0.10	0.10
FECA	1	1	4.2	0.10	0.10
LYRU	2	2	8.3	0.20	0.13
NEFU	3	3	12.5	0.30	0.30
PE	4	4	16.7	0.40	0.22
PETR	10	6	15.0	0.60	0.31
PRLO	4	4	16.7	0.40	0.27
SCGR	1	1	4.2	0.10	0.10
SMML	1	1	4.2	1.00	0.10
URCI	2	2	8.3	0.20	0.13
Total	**227**	**24**			

Table 42. Frequency of occurrence (proportion of sites with at least one detection of a species), Phleger Estate, 1996

Code	Needle-leaved evergreen (redwood) forest n = 10 Sites with detections	Frequency
DIVI	1	0.10
FECA	1	0.10
LYRU	2	0.20
NEFU	1	0.10
PE	3	0.30
PETR	4	0.40
PRLO	2	0.20
SCGR	1	0.10
SMML	1	0.10
URCI	2	0.20

Table 43. Trap success (Sherman live traps, wood squares) and track plate detection success, Phleger Estate, 1996

Habitat Type	Code	Trap			Trap Success		
		SH	TP	WS	SH	TP	WS
Needle-leaved evergreen forest (redwood)	DIVI	--	1	--	--	0.01	--
	FECA	--	1	--	--	0.01	--
	LYRU	--	2	--	--	0.03	--
	NEFU	1	1	1	0.01	0.01	0.01
	PE	--	4	--	--	0.05	--
	PETR	10	--	--	0.14	--	--
	PRLO	--	4	--	--	0.05	--
	SCGR	--	1	--	--	0.01	--
	SMML	--	1	--	--	0.01	--
	URCI	--	2	--	--	0.03	--
	Total trap-nights	**74**	**78**	**75**			

Sampling Year 1997

In 1997, we conducted vertebrate sampling in the Marin Headlands (Figure 12). We randomly selected 25 coastal scrub and 51 grassland plots from sites originally sampled between 1990 and 1992. We recorded 17 species during 1,952 trap-nights of effort (Table 44). We detected 14 species on coastal scrub plots and 12 species on grassland plots. We also recorded unidentified skunk and snake species. Grassland plots showed a mean of 3.08 species (SE = 0.20), while coastal scrub plots demonstrated a mean of 3.72 species (SE = 0.32).

Overall, deer mice (25.0% of individual detections) and voles (23.9% of individual detections) showed the greatest abundances. Deer mouse mean abundance was greater in grassland (mean = 1.78, SE = 0.23) than in coastal scrub (mean = 1.52, SE = 0.26), while vole mean abundance was greater in coastal scrub (mean = 2.56, SE = 0.48) than in grassland (mean = 1.16, SE = 0.26). Skunks (striped skunk and unidentified skunk) were the most abundant of the larger mammals (3.9% of individuals detected). Striped skunk mean abundance was greater on grassland plots (mean = 0.14, SE = 0.07) than on coastal scrub plots (no detections). Skunks (species uncertain) also showed a greater mean abundance on grassland plots (mean = 0.22, SE = 0.11) than on coastal scrub plots (mean = 0.08, SE = 0.06). We recorded only 1 gray fox detection. We detected coyotes for the first time in the Marin Headlands and long-tailed weasels (*Mustela frenata*) for the first time during this pilot inventory.

Deer mice were the most frequently encountered species in both grassland (frequency = 0.71) and coastal scrub (frequency = 0.80) (Table 45). Voles were encountered on 68% of the coastal scrub plots and on 43% of the grassland plots. Brush rabbits had the greatest frequency of occurrence of larger mammals in coastal scrub (frequency = 0.28). Raccoons were recorded on 16% of the scrub plots, while skunks (species uncertain) and opossums were detected on 8% of those plots. Coyotes, bobcats, long-tailed weasels, and gray foxes all showed low frequencies of occurrence (frequency = 0.04). Brush rabbits were also the most frequently encountered larger mammals on grassland plots (frequency = 0.16). Striped skunks and unidentified skunk species exhibited the second highest frequency of occurrence of larger mammals on grassland plots (frequency = 0.10), followed by raccoons (frequency = 0.08).

Combined trap success for pitfalls and Sherman live traps was greater in coastal scrub (43% of total captures) than in grassland (34% of total captures) (Table 46). On coastal scrub plots, trap success was greatest for voles (23% of total captures). Pitfall traps accounted for 70% of meadow vole captures. On grassland plots, trap success was greatest for deer mice (20% of total captures). Sherman live traps accounted for 74% of deer mice captures. Track plate detection success was greatest for deer mice in coastal scrub (17% of total detections). Among larger mammals, brush rabbits showed the greatest detection success (4% of total detections). In grassland, deer mice also had the greatest detection success (16% of total detections). Skunks (3% of total detections) and brush rabbits (2% of total detections) showed the greatest detection successes among larger mammals.

We used artificial cover boards on 3 of 76 plots; the remaining boards were missing and were not replaced. We recorded no detections for this method.

Table 44. Detection statistics of vertebrates sampled using systematic survey methods, Marin Headlands, 1997

Code	Total detections	Individual detections	% of individual detections	Mean abundance[1]			
				Coastal scrub		Grassland	
				Mean	SE	Mean	SE
CALA	1	1	0.2	0.04	0.04	--	--
DIVI	5	5	1.0	0.20	0.14	--	--
LECA	2	2	0.4	--	--	0.04	0.03
LYRU	3	3	0.6	0.04	0.04	0.04	0.03
MEME	7	7	1.4	--	--	0.14	0.07
MICA	203	123	23.9	2.56	0.48	1.16	0.26
MUFR	1	1	0.2	0.04	0.04	--	--
NEFU	33	33	6.4	0.88	0.31	0.22	0.08
ODHE	6	6	1.2	0.20	0.16	0.02	0.02
PE	107	107	20.8	1.56	0.25	1.33	0.19
PEMA	241	129	25.0	1.52	0.26	1.78	0.23
PIME	2	2	0.4	--	--	0.04	0.03
PRLO	10	10	1.9	0.16	0.07	0.12	0.07
SCOC	34	34	6.6	0.32	0.15	0.51	0.14
SKNK	13	13	2.5	0.08	0.06	0.22	0.11
SNK	6	6	1.2	0.04	0.04	0.10	0.06

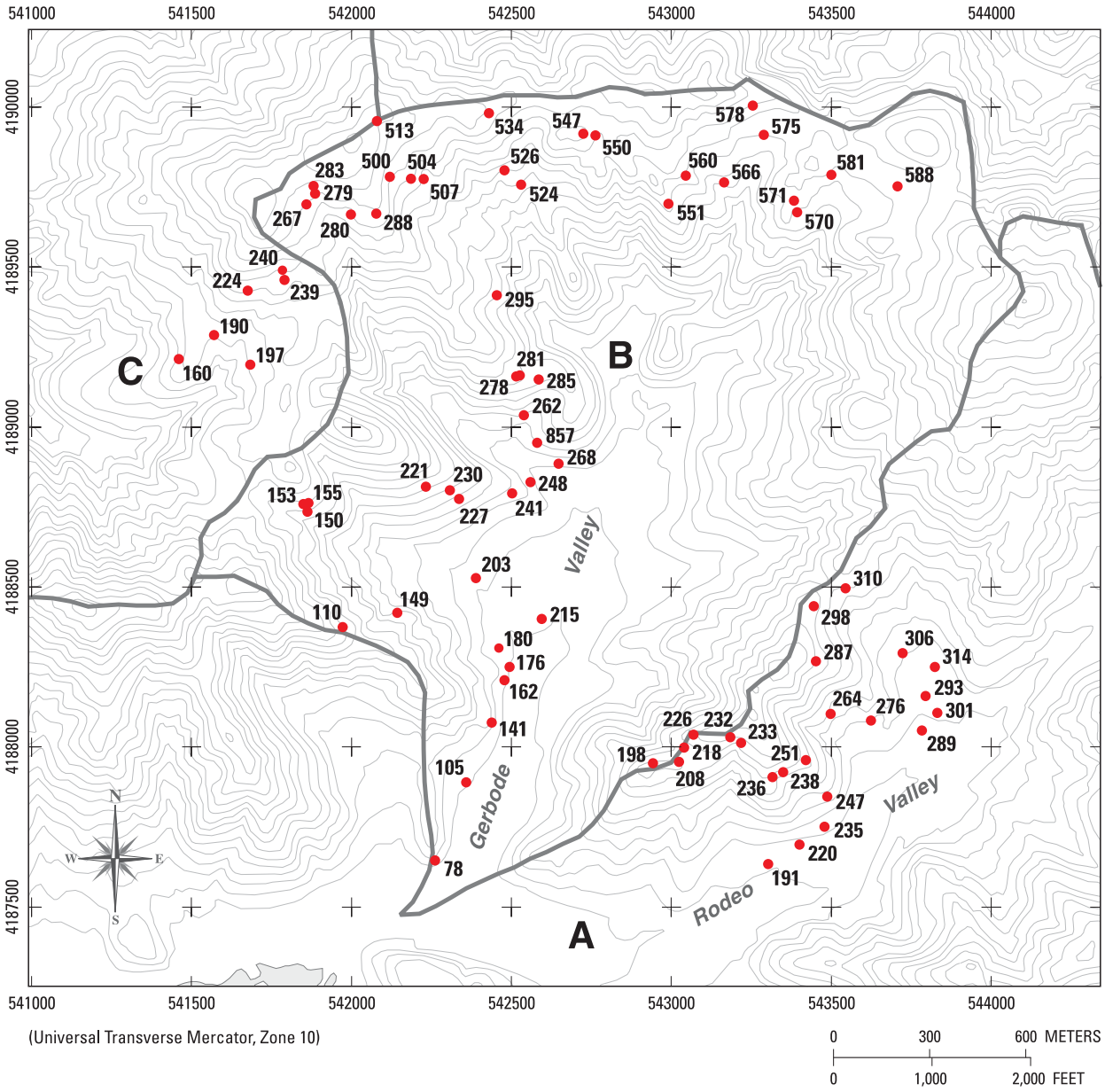
Table 44. Detection statistics of vertebrates sampled using systematic survey methods, Marin Headlands, 1997—Continued

Code	Total detections	Individual detections	% of individual detections	Mean abundance[1]			
				Coastal scrub		Grassland	
				Mean	SE	Mean	SE
SOVA	4	4	0.8	0.12	0.09	0.02	0.02
SYBA	18	18	3.5	0.32	0.11	0.20	0.07
THBO	1	1	0.2	0.04	0.04	--	--
UNKN	9	9	1.7	--	--	0.18	0.05
URCI	1	1	0.2	0.04	0.04	--	--
Total	**1,952**	**515**	**100**				

[1] Mean abundance of individuals.

Table 45. Frequency of occurrence (proportion of sites with at least one detection of a species), Marin Headlands, 1997

Code	Coastal scrub n = 25		Grassland n = 51	
	Sites with detections	Frequency	Sites with detections	Frequency
CALA	1	0.04	--	--
DIVI	2	0.08	--	--
LECA	--	--	2	0.04
LYRU	1	0.04	2	0.04
MEME	--	--	5	0.10
MICA	17	0.68	22	0.43
MUFR	1	0.04	--	--
NEFU	8	0.32	8	0.16
ODHE	2	0.08	1	0.02
PE	18	0.72	35	0.69
PEMA	20	0.80	36	0.71
PIME	--	--	2	0.04
PRLO	4	0.16	4	0.08
SCOC	5	0.20	14	0.27
SKNK	2	0.08	5	0.10
SNK	1	0.04	3	0.06
SOVA	2	0.08	1	0.02
SYBA	7	0.28	8	0.16
THBO	1	0.04	--	--
UNKN	--	--	9	0.18
URCI	1	0.04	--	--



EXPLANATION

SAMPLED SUBREGIONS

A. RODEO VALLEY

B. GERBODE VALLEY

C. TENNESSEE VALLEY

78 INVENTORY PLOT LOCATION AND IDENTIFICATION NUMBER (Refer to Appendix D.)

Figure 12. Vertebrate inventory plots: Marin Headlands, 1997.

Table 46. Trap success (big Sherman trap [1], pitfall traps, Sherman live traps, wood squares) and track plate detection success, Marin Headlands, 1997

Habitat Type	Code	Total detections					Trap success					
		BS	PF	SH	TP	WS	BS	PF	SH	PF+SH	TP	WS
Coastal scrub	CALA	--	--	--	1	--	--	--	--	--	0.00	--
	DIVI	--	--	--	5	--	--	--	--	--	0.02	--
	LYRU	--	--	--	1	--	--	--	--	--	0.00	--
	MICA	--	70	30	3	--	--	0.30	0.15	0.23	0.01	--
	MUFR	--	--	--	1	--	--	--	--	--	0.00	--
	NEFU	1	--	2	19	--	1.00	--	0.01	0.01	0.08	--
	ODHE	--	--	--	5	--	--	--	--	--	0.02	--
	PE	--	--	--	39	--	--	--	--	--	0.17	--
	PEMA	--	19	53	--	--	--	0.08	0.26	0.16	--	--
	PRLO	--	--	--	4	--	--	--	--	--	0.02	--
	SCOC	--	7	1	--	--	--	0.03	0.01	0.02	--	--
	SKNK	--	--	--	2	--	--	--	--	--	0.01	--
	SNK	--	--	--	1	--	--	--	--	--	0.00	--
	SOVA	--	3	--	--	--	--	0.01	--	0.01	--	--
	SYBA	--	--	--	8	--	--	--	--	--	0.04	--
	THBO	--	1	--	--	--	--	0.00	--	0.00	--	--
	URCI	--	--	--	1	--	--	--	--	--	0.00	--
	Total trap-nights	**1**	**230**	**205**	**225**	**2**				**436**		
Grassland	LECA	--	--	--	2	--	--	--	--	--	0.01	--
	LYRU	--	--	--	2	--	--	--	--	--	0.01	--
	MEME	--	--	--	7	--	--	--	--	--	0.02	--
	MICA	--	68	31	1	--	--	0.15	0.08	0.11	0.00	--
	NEFU	--	--	--	11	--	--	--	--	--	0.03	--
	ODHE	--	--	--	1	--	--	--	--	--	0.00	--
	PE	--	--	--	68	--	--	--	--	--	0.16	--
	PEMA	--	44	125	--	--	--	0.10	0.31	0.20	--	--
	PIME	--	2	--	--	--	--	0.01	--	0.00	--	--
	PRLO	--	--	--	6	--	--	--	--	--	0.01	--
	SCOC	--	19	--	7	--	--	0.04	--	0.02	0.02	--
	SKNK	--	--	--	11	--	--	--	--	--	0.03	--
	SNK	--	--	--	5	--	--	--	--	--	0.01	--
	SOVA	--	1	--	--	--	--	0.00	--	0.00	--	--
	SYBA	--	--	--	10	--	--	--	--	--	0.02	--
	UNKN	--	--	--	9	--	--	--	--	--	0.02	--
	Total trap-nights		**449**	**410**	**429**	**1**				**839**		

[1] Loner Sherman live-trap.

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Appendixes A–D

Appendix A. Vertebrate sampling data sheets, Golden Gate National Recreation Area, 1990–1997

Trap Data Sheet

Summer

Site # ___________________________ Location______________________

	Prin Obs		Species Code				Sex	Length				Age	Comments Below	Date Entered
Date		Trap			Wt	Tag#	M/F	Body	Tail	Hind foot	Ear	J,S,A		
		TP												
		WS												
		SH												
		PF												
		TP												
		WS												
		SH												
		PF												
		TP												
		WS												
		SH												
		PF												
		TP												
		WS												
		SH												
		PF												

Comments (date):

For Office Use ___________________

Data entry completed:

Date Initials

WILDLIFE OBSERVATION FORM
GOLDEN GATE NATIONAL RECREATION AREA, CALIFORNIA

DATE	OBS	SPECIES	LOCATION	BEHAVIOR	HABITAT	COMMENTS

Appendix B. Recorded plant species, Golden Gate National Recreation Area, 1990–1997

Code	Family	Genus/species	Lifeform	Native/Exotic
acar	Ranunculaceae	Actaea rubra ssp. arguta	Herb-perennial	N
acca	Rosaceae	Aceana pinnatifida var. californica	Herb-perennial	N
acma	Aceraceae	Acer macrophyllum	Tree	N
acmi	Asteraceae	Achillea millefolium	Herb-perennial	N
adfa	Rosaceae	Adenostoma fasciculatum	Shrub	N
adjo	Pteridaceae	Adiantum jordanii	Fern	N
aeca	Hippocastanaceae	Aesculus californica	Shrub/Tree	N
agex	Poaceae	Agrostis exerata	Grass-perennial	N
agha	Poaceae	Agrostis hallii	Grass-perennial	N
agpa	Poaceae	Agrostis pallens	Grass-perennial	N
agsp	Poaceae	Agrostis species uncertain	Grass-perennial	N
aica	Poaceae	Aira caryophyllea	Grass-annual	E
aipr	Poaceae	Aira praecox (some uncertainty, will be checked)	Grass-annual	E
anar	Primulaceae	Anagalis arvensis	Herb-annual	E
anma	Asteraceae	Anaphalis margaritacea	Herb-perennial	N
aqfo	Ranunculaceae	Aquilegia formosa	Herb-perennial	N
arca	Asteraceae	Artemesia californica	Shrub	N
ardo	Asteraceae	Artemesia douglasiana	Herb-perennial	N
asch	Asteraceae	Aster chilensis	Herb-perennial	N
assp	Asteraceae	Aster species uncertain	Herb	
atfi	Dryopteridaceae	Athyrium filix-femina	Fern	N
atpa	Chenopodiaceae	Atriplex patula	Herb-annual	N
avba	Poaceae	Avena barbata	Grass-annual	E
bapi	Asteraceae	Baccharis pilularis	Shrub	N
bepi	Berberidaceae	Berberis pinnata	Shrub	N
bg		Bare ground--soil exposed		
brca	Poaceae	Bromus carinatus	Grass-perennial	N
brdi	Poaceae	Bromus diandrus	Grass-annual	E
brds	Poaceae	Brachypodium distachyon	Grass-annual	E
brel	Liliaceae	Brodiaea elegans	Herb-perennial	N
brho	Poaceae	Bromus hordeaceous	Grass-annual	E
brla	Poaceae	Bromus laevipes	Grass-perennial	N
brma	Poaceae	Briza maxima	Grass-annual	E
brmi	Poaceae	Briza minor	Grass-annual	E
brru	Poaceae	Bromus madritensis ssp. rubens	Grass-annual	E
brsp	Poaceae	Bromus species uncertain	Grass	
brte(?)	Poaceae	Bromus tectorum--some uncertainty	Grass-annual	E
brvu(?)	Poaceae	Bromus vulgaris--some uncertainty	Grass-perennial	N
cabr	Cyperaceae	Carex brevicaulis	Sedge-perennial	N
cade	Cyperaceae	Carex densa	Sedge-perennial	N
cafr	Scrophulariaceae	Castilleja subinclusa ssp. franciscana	Herb-perennial	N
cale	Cyperaceae	Carex leptopoda	Sedge-perennial	N
canu	Poaceae	Calamagrostis nutkaensis	Grass-perennial	N
caob	Cyperaceae	Carex obnupta	Sedge-perennial	N
caoc	Convolvulaceae	Calystegia occidentalis	Herb-perennial	N

Code	Family	Genus/species	Lifeform	Native/Exotic
caov	Onagraceae	Camissonia ovata	Herb-perennial	N
capy	Asteraceae	Carduus pycnocephalus	Herb-annual	E
cari		One occurrence, code unknown		
case		code unknown--probable mistype		
casp	Cyperaceae	Carex species uncertain	Sedge-perennial	N
casu	Cyperaceae	Carex subbracteata	Sedge-perennial	N
catu	Cyperaceae	Carex tumulicola	Sedge-perennial	N
cawr	Scrophulariaceae	Castilleja wightii	Herb-perennial	N
cegl	Caryophyllaceae	Cerastium glomeratum	Herb-annual	E
ceso	Asteraceae	Centaurea solstitialis	Herb-annual	E
ceth	Rhamnaceae	Ceanothus thyrsiflorus	Shrub	N
cevi	Caryophyllaceae	Cerastium glomeratum (C. viscosum misapplied)	Herb-annual	E
chle	Asteraceae	Chrysanthemum leucanthemum (Leucanthemum vulgare)	Herb-perennial	E
chpo	Liliaceae	Chlorogalum pomeridianum	Herb-perennial	N
ciqu	Asteraceae	Circium quercetorum	Herb-perennial	N
civu	Asteraceae	Circium vulgare	Herb-bien	E
clam	Onagraceae	Clarkia amoena	Herb-annual	N
clpe	Portulacaceae	Claytonia perfoliata	Herb-annual	N
coar	Convolvulaceae	Convolvulus arvensis	Herb-annual	E
coco	Betulaceae	Corylus cornuta	Shrub	N
coma	Apiaceae	Conium maculatum	Herb-bien	E
copa	Rosaceae	Cotoneaster pannosa	Shrub	E
crcr		code unknown--one occurrence		
crmo	Rosaceae	Crategus monogyna	Shrub	E
cuma	Cupressaceae	Cupressus macrocarpa	Tree	N
cyec	Poaceae	Cynosurus echinatus	Grass-annual	E
cygr	Boraginaceae	Cynoclossum grande	Herb-perennial	N
cymo		code unknown--one occurrence		
cysc	Fabaceae	Cytisus scoparius	Shrub	E
daca	Poaceae	Danthonia californica	Grass-perennial	N
dagl	Poaceae	Dactylis glomerata	Grass-perennial	E
dapi	Poaceae	Danthonia pilosa	Grass-perennial	E
dapu	Apiaceae	Daucus pusillus	Herb-annual	N
deca	Poaceae	Deschampsia cespitosa	Grass-perennial	N
dein	Brassicaceae	Dentaria integrifolia (Cardamine californica)	Herb-perennial	N
dica	Liliaceae	Dichelostemmma capitatum	Herb-perennial	N
dido	Convolvulaceae	Dichondra donelliana	Herb-perennial	N
diho	Liliaceae	Disporum hookeri	Herb-perennial	N
disp	Poaceae	Distichlis spicata	Grass-perennial	N
drar	Dryopteridaceae	Dryopteris arguta	Fern	N
elca	Poaceae	Elymus californica	Grass-perennial	N
elgl	Poaceae	Elymus glaucus	Grass-perennial	N
elma	Cyperaceae	Eleocharis macrostachya	Sedge-perennial	N
epsp	Onagraceae	Epilobium species uncertain	Herb-annual	
eqar	Equisetaceae	Equisetum arvense	Perennial	N
erar	Apiaceae	Eryngium armatum	Herb-bien	N

Code	Family	Genus/species	Lifeform	Native/Exotic
erbo	Geraniaceae	Erodium botrys	Herb-annual	E
erca	Hydrophyllaceae	Eriodictyon californicum	Shrub	N
ergl	Asteraceae	Erigeron glaucus	Herb-perennial	N
erla	Polygonaceae	Eriogonum latifolium	Herb-annual	N
ermi	Asteraceae	Erichtites minima	Herb-annual	E
ernu	Polygonaceae	Eriogonum nudum	Herb-perennial	N
ersp		Erodium sp?		
erst	Asteraceae	Eriophyllum staechadifolium	Shrub	N
esca	Papaveraceae	Eschscholzia californica	Herb-annual	N
euoc	Asteraceae	Euthamia occidentalis	Herb-perennial	N
fear	Poaceae	Festuca arundinaceae	Grass-perennial	E
feca	Poaceae	Festuca californica	Grass-perennial	N
feid	Poaceae	Festuca idahoensis	Grass-perennial	N
feru	Poaceae	Festuca rubra	Grass-perennial	N
fesp	Poaceae	Festuca species not identified	Grass	
figa	Asteraceae	Filago gallica	Herb-annual	E
forb		unknown forb		
fovu	Apiaceae	Foeniculum vulgare	Herb-perennial	E
frch	Rosaceae	Fragaria chiloensis	Herb-perennial	N
frgr	Frankeniaceae	Frankenia salina (F. grandifolia)	Subshrub	N
frve	Rosaceae	Fragaria vesca	Herb-perennial	N
g1	Poaceae	Grass species uncertain		
g2	Poaceae	Unidentifiable brome	Herb-perennial	
gaap	Rubiaceae	Galium aparine	Herb-annual	E
gaca	Rubiaceae	Galium californicum	Herb-perennial	N
gadi	Rubiaceae	Galium divaricatum	Herb-annual	E
gasp	Rubiaceae	Galium species uncertain		
gatr	Rubiaceae	Galium trifidium	Herb-perennial	N
gave	Poaceae	Gastridium ventricosum	Grass-annual	E
gedi	Geraniaceae	Geranium dissectum	Herb-annual	E
gemo	Geraniaceae	Geranium molle	Herb-annual	E
gnpu	Asteraceae	Gnaphalium purpureum	Herb-bien	N
gnra	Asteraceae	Gnaphalium ramosissimum	Herb-bien	N
gnsp	Asteraceae	Gnaphalium species uncertain		
grs1	Poaceae	Grass species uncertain		
grs2	Poaceae	Grass species uncertain		
grsp	Poaceae	Grass species uncertain		
hear	Rosaceae	Heteromeles arbutifolia	Shrub	N
hebo	Asteraceae	Heterotheca sessiliflora ssp. bolanderi	Herb-perennial	N
heco		code unknown--probable mistype		
hela	Apiaceae	Heracleum lanatum	Herb-perennial	N
hepu	Asteraceae	Helenium puberulum	Herb-annual	N
hial	Asteraceae	Hieracium albiflorum	Herb-perennial	N
hiin	Brassicaceae	Hirschfeldia incana	Herb-bien	E
hobr	Poaceae	Hordeum brachyantherum	Grass-perennial	N
hoca	Rosaceae	Horkelia californica	Herb-perennial	N
hodi	Rosaceae	Holodiscus discolor	Shrub	N

Code	Family	Genus/species	Lifeform	Native/Exotic
hola	Poaceae	Holcus lanatus	Grass-perennial	E
hole	Poaceae	Hordeum murinum ssp. leporinum	Grass-annual	E
hyra	Asteraceae	Hypochaeris radicata	Herb-perennial	E
irdo	Iridaceae	Iris douglasiana	Herb-perennial	N
jaca	Asteraceae	Jaumea carnosa	Herb-perennial	N
jubo	Juncaceae	Juncus bolanderi	Rush-perennial	N
jubu	Juncaceae	Juncus bufonius	Rush-perennial	N
juef	Juncaceae	Juncus effusus	Rush-perennial	N
jupa	Juncaceae	Juncus patens	Rush-perennial	N
koma	Poaceae	Koeleria macrantha	Grass-perennial	N
lasa	Asteraceae	Lactuca saligna	Herb-annual	E
lasp	Fabaceae	Lathrys species uncertain		
libe	Linaceae	Linum bienne	Herb-perennial	E
lide	Fagaceae	Lithocarpus densiflorus	Tree	N
lisp	Liliaceae	Species uncertain, just coming in	Herb-perennial	
litt		plant litter		
loco	Fabaceae	Lotus corniculatus	Herb-perennial	E
lofo	Fabaceae	Lotus formosissimus	Herb-perennial	N
log		Downed Tree		
lohi	Caprifoliaceae	Lonicera hispidula	Shrub	N
lohu	Fabaceae	Lotus humistratus	Herb-annual	N
loin	Caprifoliaceae	Lonicera involucrata	Shrub	N
lomi	Fabaceae	Lotus micranthus	Herb-annual	N
lomu	Poaceae	Lolium multiflorum	Grass-annual	E
lope	Poaceae	Lolium perenne	Grass-perennial	E
losc	Fabaceae	Lotus scoparius	Herb-perennial	N
losp	Fabaceae	Lotus species uncertain	Herb-annual	N
luar	Fabaceae	Lupinus arboreus	Shrub	N
lubi	Fabaceae	Lupinus bicolor	Herb-annual	N
lubi (va)	Fabaceae	Lupinus bicolor or varicolor, not sure	Herb-annual	N
luco	Juncaceae	Luzula comosa	Rush-perennial	N
lusp	Fabaceae	Lupinus species uncertain (herbaceous)	Herb-annual	N
mafa	Cucurbitaceae	Marah fabaceus	Herb-perennial	N
mama	Asteraceae	Matricaria matricarioides (Chamomilla suaveolens)	Herb-annual	E
masa	Asteraceae	Madia sativa	Herb-annual	N
masy	Rosaceae	Malus sylvestris	Tree	E
meca	Poaceae	Melica californica	Grass-perennial	N
mech	Aizoaceae	Mesembryanthemum chilensis (Carpobrotus chilensis)	Shrub	E
mepu	Lamiaceae	Mentha pulegium	Herb-perennial	E
mesp	Poaceae	Melica species uncertain	Grass-perennial	N
mesu	Poaceae	Melica subulata	Grass-perennial	N
meto	Poaceae	Melica torreyana	Grass-perennial	N
miau	Scrophulariaceae	Mimulus aurantiacus	Shrub	N
migu	Scrophulariaceae	Mimulus guttatus	Herb-annual	N
movi	Lamiaceae	Monardella villosa	Herb-perennial	N

Code	Family	Genus/species	Lifeform	Native/Exotic
myla	Boraginaceae	Myosotis latifolia	Herb-perennial	N
nale	Poaceae	Nasella lepida	Grass-perennial	N
napu	Poaceae	Nasella pulchra	Grass-perennial	N
nasp	Poaceae	Nasella species uncertain	Grass-perennial	N
nasq	Polemoniaceae	Navarretia squarrosa	Herb-annual	N
noda		no data entered for point		
orsp	Scrophulariaceae	Orthocarpus(triphysaria) species uncertain	Herb-annual	
osch	Apiaceae	Osmorhiza chilensis	Herb-perennial	N
oxpe	Oxalidaceae	Oxalis pes-caprae	Herb-perennial	E
petr	Pteridaceae	Pentagramma triangularis	Fern	N
phaq	Poaceae	Phalaris aquatica	Grass-perennial	E
piec	Asteraceae	Picris echioides	Herb-annual	E
pimu	Pinaceae	Pinus muricata	Tree	N
pira	Pinaceae	Pinus radiata	Tree	N
pise	Poaceae	Piptochaetium setosum	Grass-perennial	E
plco	Plantaginaceae	Plantago coronopus	Herb-annual	E
pler	Plantaginaceae	Plantago erecta	Herb-annual	N
plla	Plantaginaceae	Plantago lanceolata	Herb-perennial	E
poan	Rosaceae	Potentilla anserina	Herb-annual	N
pogl	Rosaceae	Potentilla glandulosa	Herb-annual	N
pola	Polygonaceae	Polygonum lapathifolium	Herb-annual	N
pomo	Poaceae	Polypogon monspeliensis	Grass-annual	E
pomu	Dryopteridaceae	Polystichum munitum	Fern	N
popu	Polygonaceae	Polygonum punctatum	Herb-annual	N
prsp	Rosaceae	Prunus species uncertain--	Shrub	
psme	Pinaceae	Pseudotsuga menziesii	Tree	N
ptaq	Dennstaedtiaceae	Pteridium aquilinum	Fern	N
quag	Fagaceae	Quercus agrifolia	Tree	N
quch	Fagaceae	Quercus chrysolepsis	Tree	N
qusp	Fagaceae	Quercus species uncertain--low growing	Shrub	N
quwi	Fagaceae	Quercus wizlizenii	Tree	N
raca	Ranunculaceae	Ranunculus californicus	Herb-perennial	N
rasa	Brassicaceae	Raphanus sativus	Herb-annual	E
rhca	Rhamnaceae	Rhamnus californica	Shrub	N
rica	Grossulariaceae	Ribes californicum	Shrub	N
ro		Rocky outcrop		
road		Road or trail		
roca	Rosaceae	Rosa californica	Shrub	N
rock		Exposed rock		
ruac	Polygonaceae	Rumex acetosella	Herb-perennial	E
ruco	Polygonaceae	Rumex conglomeratus	Herb-perennial	E
rucr	Polygonaceae	Rumex crispus	Herb-perennial	E
rupa	Rosaceae	Rubus parviflorus	Shrub	N
ruur	Rosaceae	Rubus ursinus	Herb-perennial	N
sabi	Apiaceae	Sanicula bipinnatifida	Herb-bien	N
sacr	Apiaceae	Sanicula crassicaulis	Herb-bien	N
sado	Lamiaceae	Satureja douglasii	Herb-perennial	N
sala	Salicaceae	Salix lasiolepsis	Shrub/Tree	N

Code	Family	Genus/species	Lifeform	Native/Exotic
sals	Salicaceae	Salix lucida ssp. lasiandra	Shrub/Tree	N
sara	Caprifoliaceae	Sambucus racemosa	Shrub	N
savi	Chenopodiaceae	Salicornia virginica	Herb-perennial	N
scam	Cyperaceae	Scirpus americanus	Sedge-perennial	N
scca	Cyperaceae	Scirpus californicus	Sedge-perennial	N
sevu	Asteraceae	Senecio vulgaris	Herb-annual	E
shar	Rubiaceae	Sherardia arvensis	Herb-annual	E
sibe	Iridaceae	Sisyrinchium bellum	Herb-perennial	N
siga	Caryophyllaceae	Silene gallica	Herb-annual	E
siju	Poaceae	Sitanion jubatum (Elymus multisetus)	Grass-perennial	N
sima	Malvaceae	Sidalcea malvaeflora	Herb-perennial	N
siml	Asteraceae	Silybum marianum	Herb-annual	E
smra	Liliaceae	Smilacina racemosa	Herb-perennial	N
smsp	Liliaceae	Smilacina species uncertain	Herb-perennial	N
smst	Liliaceae	Smilacina stellata	Herb-perennial	N
soas	Asteraceae	Sonchus asper	Herb-annual	E
sono	Solanaceae	Solanum nodiflorum (S. americanum)	Herb-annual	N
sool	Asteraceae	Sonchus oleraceus	Herb-annual	E
sosp	Asteraceae	Sonchus species uncertain	Herb-annual	E
soxa	Solanaceae	Solanum xanti	Herb-perennial	N
staj	Lamiaceae	Stachys ajugoides	Herb-annual	N
stbu	Lamiaceae	Stachys bullata	Herb-annual	N
stch	Lamiaceae	Stachys chamissonis	Herb-annual	N
stme	Caryophyllaceae	Stellaria media	Herb-annual	E
syal	Caprifoliaceae	Symphoricarpos albus	Shrub	N
symo	Caprifoliaceae	Symphoricarpos mollis	Shrub	N
toar	Apiaceae	Torilis arvensis	Herb-annual	E
todi	Anacardiaceae	Toxicodendron diversilobum	Shrub	N
tono	Apiaceae	Torilis nodosa	Herb-annual	E
tosp	Apiaceae	Torilis species uncertain	Herb-annual	E
trca	Fabaceae	Trifolium campestre	Herb-annual	E
trdu	Fabaceae	Trifolium dubium--could be campestre (sample v. dry)	Herb-annual	E
trla	Liliaceae	Triteleia laxa	Herb-perennial	N
trla2	Primulaceae	Trientalis latifolia	Herb-perennial	N
trmi	Fabaceae	Trifolium microcephalum	Herb-annual	N
trre	Fabaceae	Trifolium repens	Herb-perennial	E
trsp	Fabaceae	Trifolium species uncertain	Herb-annual	
tyla	Typaceae	Typha latifolia	Herb-perennial	N
umca	Lauraceae	Umbellularia californica	Tree	N
unkn		Unknown species--dead forb	Unknown	
urdi	Urticaceae	Urtica dioica	Herb-perennial	N
vaov	Ericaceae	Vaccinium ovatum	Shrub	N
viam	Fabaceae	Vicia americana	Herb-perennial	N
vigi	Fabaceae	Vicia gigantea	Herb-perennial	N
visa	Fabaceae	Vicia sativa	Herb-annual	E
visp	Fabaceae	Vicia species uncertain		
vubr	Poaceae	Vulpia bromoides	Grass-annual	E

Code	Family	Genus/species	Lifeform	Native/Exotic
vumy	Poaceae	Vulpia myuros	Grass-annual	E
vusp	Poaceae	Vulpia species uncertain	Grass-annual	
watr		Open lagoon		
wyan	Asteraceae	Wyethia angustifolia	Herb-perennial	N

Appendix C. Vegetation survey data sheets, Golden Gate National Recreation Area, 1990–1997

VEGETATION SURVEY DATA SHEET: **GRASSLAND** Plot Number_____ Date_____

Point Sampling Data Data Collector_____

Trans #	Point	Grass Type (check one)		Species Code	Height of Tallest Grass Touching the Pole	
		Annual	Perennial	Enter the species code(s) for Plant(s) touching the pole	< 12”	> 12”
	1m					
	2m					
	3m					
	4m					
	5m					
	6m					
	7m					
	8m					
	9m					
	10m					
	11m					
	12m					
	13m					
	14m					
	15m					
	16m					
	17m					
	18m					
	19m					
	20m					
	21m					
	22m					
	23m					
	24m					
	25m					

Comments: Data Entry Person _____

_____ Date _____

_____

VEGETATION SURVEY DATA SHEET: **COASTAL SCRUB** Plot Number Date:

Transect # (1–4) Data Collector:

Species Code Enter the species code			Foliar Cover Interval Record the distance along the tape occupied by each plant		Scrub Size (Check one)			
Scrub	Grass	Other			Seedling	Young	Mature[1]	Decadent[2]

[1] > 25% live foliage
[2] < 25% live foliage

Species present on plot, but not touching transects:

_____

_____

Data Entry Person:
Date:

Appendix D. Study plot UTM coordinates and habitat group designations, Golden Gate National Recreation Area, 1990–1997

PLOT	EMES	NMES	GPS	LIFEFORM	GRAZED	DISTRICT	HANTA [1]
1	539273	4188499	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
3	539416	4188503	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
5	539489	4188593	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
6	542329	4191233	NO	GRASSLAND	NO	MARIN HEADLANDS	
9	539356	4188961	NO	GRASSLAND	NO	MARIN HEADLANDS	
10	541990	4190950	NO	BL EVERGREEN	NO	MARIN HEADLANDS	
11	542210	4191140	NO	BL EVERGREEN	NO	MARIN HEADLANDS	
13	541961	4190922	NO	BL EVERGREEN	NO	MARIN HEADLANDS	
14	541961	4190980	NO	BL EVERGREEN	NO	MARIN HEADLANDS	
15	539584	4188924	YES	GRASSLAND	NO	MARIN HEADLANDS	
16	539562	4189023	YES	GRASSLAND	NO	MARIN HEADLANDS	
17	541929	4190949	NO	BL EVERGREEN	NO	MARIN HEADLANDS	
18	541834	4190914	NO	BL EVERGREEN	NO	MARIN HEADLANDS	
19	541807	4190948	NO	BL EVERGREEN	NO	MARIN HEADLANDS	
20	539685	4189065	YES	GRASSLAND	NO	MARIN HEADLANDS	
21	539275	4189484	YES	GRASSLAND	NO	MARIN HEADLANDS	
22	541806	4190915	NO	BL EVERGREEN	NO	MARIN HEADLANDS	
23	541807	4190886	NO	BL EVERGREEN	NO	MARIN HEADLANDS	
24	541776	4190916	NO	BL EVERGREEN	NO	MARIN HEADLANDS	
28	539325	4189721	YES	GRASSLAND	NO	MARIN HEADLANDS	YES
30	539339	4189730	YES	GRASSLAND	NO	MARIN HEADLANDS	YES
31	539284	4189830	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	YES
33	540006	4189121	YES	GRASSLAND	NO	MARIN HEADLANDS	
34	539969	4189213	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
35	539304	4189933	NO	GRASSLAND	NO	MARIN HEADLANDS	
36	539428	4189892	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	YES
37	540409	4188963	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
40	539332	4190042	YES	GRASSLAND	NO	MARIN HEADLANDS	YES
41	540425	4189029	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
48	539671	4189831	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
49	540423	4189093	YES	GRASSLAND	NO	MARIN HEADLANDS	
50	542109	4191219	YES	GRASSLAND	NO	MARIN HEADLANDS	
51	540325	4189189	YES	GRASSLAND	NO	MARIN HEADLANDS	
53	539200	4190317	YES	GRASSLAND	NO	MARIN HEADLANDS	
58	539489	4190174	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
59	540697	4189002	YES	GRASSLAND	NO	MARIN HEADLANDS	
61	540046	4189745	NO	GRASSLAND	NO	MARIN HEADLANDS	
62	540634	4189012	YES	GRASSLAND	NO	MARIN HEADLANDS	
64	539775	4190050	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
66	539913	4189958	YES	GRASSLAND	NO	MARIN HEADLANDS	
67	539998	4189840	YES	GRASSLAND	NO	MARIN HEADLANDS	
74	542953	4187241	NO	COASTAL SCRUB	NO	MARIN HEADLANDS	
75	542533	4187352	YES	GRASSLAND	NO	MARIN HEADLANDS	

[1] Sampled for hantavirus.

PLOT	EMES	NMES	GPS	LIFEFORM	GRAZED	DISTRICT	HANTA[1]
76	539660	4190227	YES	GRASSLAND	NO	MARIN HEADLANDS	
77	540016	4189873	YES	GRASSLAND	NO	MARIN HEADLANDS	
78	542263	4187646	YES	GRASSLAND	NO	MARIN HEADLANDS	
79	540173	4189766	YES	GRASSLAND	NO	MARIN HEADLANDS	
81	540884	4189105	YES	GRASSLAND	NO	MARIN HEADLANDS	
82	540946	4189052	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
83	540812	4189112	YES	GRASSLAND	NO	MARIN HEADLANDS	
84	541597	4187150	NO	COASTAL MARSH	NO	MARIN HEADLANDS	
85	541468	4187099	NO	COASTAL MARSH	NO	MARIN HEADLANDS	
86	539990	4190011	YES	GRASSLAND	NO	MARIN HEADLANDS	
87	541319	4187050	NO	COASTAL MARSH	NO	MARIN HEADLANDS	
89	539960	4190114	YES	GRASSLAND	NO	MARIN HEADLANDS	
90	542263	4187746	YES	GRASSLAND	NO	MARIN HEADLANDS	
91	541196	4186987	NO	COASTAL MARSH	NO	MARIN HEADLANDS	
92	541085	4186965	N O	COASTAL MARSH	NO	MARIN HEADLANDS	
93	540245	4189890	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
95	540987	4186942	NO	COASTAL MARSH	NO	MARIN HEADLANDS	
96	540433	4189810	YES	GRASSLAND	NO	MARIN HEADLANDS	
97	540940	4187197	NO	COASTAL MARSH	NO	MARIN HEADLANDS	
98	541078	4187208	NO	COASTAL MARSH	NO	MARIN HEADLANDS	
99	541181	4189033	NO	COASTAL SCRUB	NO	MARIN HEADLANDS	
100	541572	4187292	NO	COASTAL MARSH	NO	MARIN HEADLANDS	
101	541716	4187360	YES	RIPARIAN	NO	MARIN HEADLANDS	
102	540297	4189930	YES	GRASSLAND	NO	MARIN HEADLANDS	
103	542166	4187475	NO	RIPARIAN	NO	MARIN HEADLANDS	
104	540257	4189974	YES	GRASSLAND	NO	MARIN HEADLANDS	
105	542360	4187890	YES	GRASSLAND	NO	MARIN HEADLANDS	
107	542556	4187390	NO	RIPARIAN	NO	MARIN HEADLANDS	
109	541275	4189018	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
110	541973	4188376	YES	GRASSLAND	NO	MARIN HEADLANDS	
111	542879	4187427	YES	GRASSLAND	NO	MARIN HEADLANDS	
112	543165	4187453	NO	RIPARIAN	NO	MARIN HEADLANDS	
113	540193	4190126	YES	GRASSLAND	NO	MARIN HEADLANDS	
114	543232	4187503	NO	RIPARIAN	NO	MARIN HEADLANDS	
116	540245	4190130	YES	GRASSLAND	NO	MARIN HEADLANDS	
117	543511	4187578	NO	RIPARIAN	NO	MARIN HEADLANDS	
118	540242	4190151	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
119	543697	4187871	NO	RIPARIAN	NO	MARIN HEADLANDS	
121	541960	4190949	NO	BL EVERGREEN	NO	MARIN HEADLANDS	
123	540269	4190140	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
124	540486	4189967	YES	GRASSLAND	NO	MARIN HEADLANDS	
126	541400	4189047	NO	COASTAL SCRUB	NO	MARIN HEADLANDS	
135	542203	4191335	NO	GRASSLAND	NO	MARIN HEADLANDS	
136	543158	4187377	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
137	540026	4190503	YES	GRASSLAND	NO	MARIN HEADLANDS	
141	542439	4188077	YES	GRASSLAND	NO	MARIN HEADLANDS	
143	540351	4190183	YES	GRASSLAND	NO	MARIN HEADLANDS	

[1] Sampled for hantavirus.

PLOT	EMES	NMES	GPS	LIFEFORM	GRAZED	DISTRICT	HANTA[1]
144	542691	4187846	NO	COASTAL SCRUB	NO	MARIN HEADLANDS	
146	542841	4187688	YES	GRASSLAND	NO	MARIN HEADLANDS	
147	542860	4187684	YES	GRASSLAND	NO	MARIN HEADLANDS	
148	540493	4190084	YES	GRASSLAND	NO	MARIN HEADLANDS	
149	542145	4188421	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
150	541864	4188737	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
151	540219	4190353	YES	GRASSLAND	NO	MARIN HEADLANDS	YES
152	540570	4190053	YES	GRASSLAND	NO	MARIN HEADLANDS	
153	541851	4188761	YES	GRASSLAND	NO	MARIN HEADLANDS	
155	541866	4188763	YES	GRASSLAND	NO	MARIN HEADLANDS	
157	543407	4187257	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
158	540355	4190250	YES	GRASSLAND	NO	MARIN HEADLANDS	
159	540059	4190596	YES	GRASSLAND	NO	MARIN HEADLANDS	
160	541462	4189214	YES	GRASSLAND	NO	MARIN HEADLANDS	
161	540599	4190071	YES	GRASSLAND	NO	MARIN HEADLANDS	
162	542480	4188210	YES	GRASSLAND	NO	MARIN HEADLANDS	
163	542008	4188668	YES	GRASSLAND	NO	MARIN HEADLANDS	
164	542551	4188143	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
165	540739	4189974	YES	GRASSLAND	NO	MARIN HEADLANDS	
166	540008	4190670	YES	GRASSLAND	NO	MARIN HEADLANDS	
167	540611	4190082	YES	GRASSLAND	NO	MARIN HEADLANDS	
170	542982	4187716	YES	GRASSLAND	NO	MARIN HEADLANDS	
171	540347	4190332	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
173	540044	4190660	YES	GRASSLAND	NO	MARIN HEADLANDS	
174	542725	4187953	YES	GRASSLAND	NO	MARIN HEADLANDS	
176	542496	4188251	YES	GRASSLAND	NO	MARIN HEADLANDS	
178	543709	4187105	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	YES
179	540211	4190515	YES	GRASSLAND	NO	MARIN HEADLANDS	
180	542462	4188310	YES	GRASSLAND	NO	MARIN HEADLANDS	
181	541986	4188804	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
184	543069	4187708	YES	GRASSLAND	NO	MARIN HEADLANDS	
189	540090	4190722	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	YES
190	541571	4189289	YES	GRASSLAND	NO	MARIN HEADLANDS	
191	543307	4187635	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
192	543033	4187797	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
193	540887	4189992	YES	GRASSLAND	NO	MARIN HEADLANDS	
196	540055	4190797	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	YES
197	541685	4189196	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
198	542947	4187950	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
199	540640	4190213	YES	GRASSLAND	NO	MARIN HEADLANDS	
201	540143	4190708	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	YES
202	540721	4190138	YES	GRASSLAND	NO	MARIN HEADLANDS	
203	542390	4188529	YES	GRASSLAND	NO	MARIN HEADLANDS	
208	543027	4187956	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
209	542741	4188088	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
211	540656	4190272	NO	GRASSLAND	NO	MARIN HEADLANDS	
213	542680	4188279	YES	GRASSLAND	NO	MARIN HEADLANDS	

[1] Sampled for hantavirus.

PLOT	EMES	NMES	GPS	LIFEFORM	GRAZED	DISTRICT	HANTA[1]
214	540808	4190133	YES	GRASSLAND	NO	MARIN HEADLANDS	
215	542596	4188402	YES	GRASSLAND	NO	MARIN HEADLANDS	
218	543043	4188001	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
220	543402	4187696	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
221	542234	4188814	YES	GRASSLAND	NO	MARIN HEADLANDS	
222	543255	4187770	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
224	541676	4189428	YES	GRASSLAND	NO	MARIN HEADLANDS	
226	543072	4188040	YES	GRASSLAND	NO	MARIN HEADLANDS	
227	542338	4188776	YES	GRASSLAND	NO	MARIN HEADLANDS	
229	542836	4188181	YES	GRASSLAND	NO	MARIN HEADLANDS	
230	542309	4188803	YES	GRASSLAND	NO	MARIN HEADLANDS	
231	542785	4188244	YES	GRASSLAND	NO	MARIN HEADLANDS	
232	543188	4188032	YES	GRASSLAND	NO	MARIN HEADLANDS	
233	543222	4188013	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
235	543480	4187751	YES	GRASSLAND	NO	MARIN HEADLANDS	
236	543319	4187908	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
238	543352	4187922	YES	GRASSLAND	NO	MARIN HEADLANDS	
239	541792	4189461	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
240	541785	4189492	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
241	542504	4188794	YES	GRASSLAND	NO	MARIN HEADLANDS	
245	542861	4188442	YES	GRASSLAND	NO	MARIN HEADLANDS	
247	543492	4187846	YES	GRASSLAND	NO	MARIN HEADLANDS	
248	542561	4188829	YES	GRASSLAND	NO	MARIN HEADLANDS	
251	543425	4187960	YES	GRASSLAND	NO	MARIN HEADLANDS	
252	542942	4188334	YES	GRASSLAND	NO	MARIN HEADLANDS	
253	542612	4188813	NO	GRASSLAND	NO	MARIN HEADLANDS	
257	542902	4188586	YES	GRASSLAND	NO	MARIN HEADLANDS	
262	542540	4189039	YES	GRASSLAND	NO	MARIN HEADLANDS	
263	542751	4188781	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
264	543499	4188105	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
267	541861	4189697	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
268	542648	4188887	YES	GRASSLAND	NO	MARIN HEADLANDS	
270	542189	4189401	NO	COASTAL SCRUB	NO	MARIN HEADLANDS	
276	543625	4188083	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
278	542517	4189160	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
279	541887	4189731	YES	GRASSLAND	NO	MARIN HEADLANDS	
280	542000	4189665	YES	GRASSLAND	NO	MARIN HEADLANDS	
281	542528	4189162	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
283	541882	4189755	YES	GRASSLAND	NO	MARIN HEADLANDS	
285	542586	4189150	YES	GRASSLAND	NO	MARIN HEADLANDS	
287	543457	4188271	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
288	542078	4189668	YES	GRASSLAND	NO	MARIN HEADLANDS	
289	543788	4188054	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
293	543797	4188161	YES	GRASSLAND	NO	MARIN HEADLANDS	
295	542456	4189414	YES	GRASSLAND	NO	MARIN HEADLANDS	
298	543447	4188442	YES	GRASSLAND	NO	MARIN HEADLANDS	
299	541330	4187248	NO	COASTAL MARSH	NO	MARIN HEADLANDS	

[1] Sampled for hantavirus.

PLOT	EMES	NMES	GPS	LIFEFORM	GRAZED	DISTRICT	HANTA[1]
301	543833	4188108	YES	GRASSLAND	NO	MARIN HEADLANDS	
306	543725	4188294	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
308	543306	4188705	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
310	543546	4188499	YES	GRASSLAND	NO	MARIN HEADLANDS	
314	543826	4188253	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
316	543361	4188761	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
331	543494	4188826	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
333	542128	4191455	YES	GRASSLAND	NO	MARIN HEADLANDS	
338	542529	4191029	NO	GRASSLAND	NO	MARIN HEADLANDS	
346	543676	4188967	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
349	541892	4191437	NO	GRASSLAND	NO	MARIN HEADLANDS	
358	543523	4189321	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
363	541833	4191364	NO	GRASSLAND	NO	MARIN HEADLANDS	
401	545781	4183281	YES	COASTAL SCRUB	NO	PRESIDIO	
402	545896	4183400	NO	COASTAL SCRUB	NO	PRESIDIO	
403	545881	4183382	NO	COASTAL SCRUB	NO	PRESIDIO	
404	545877	4183352	NO	COASTAL SCRUB	NO	PRESIDIO	
405	545875	4183323	NO	COASTAL SCRUB	NO	PRESIDIO	
406	545883	4183299	NO	COASTAL SCRUB	NO	PRESIDIO	
407	545896	4183271	NO	NL EVERGREEN	NO	PLOT VANDALIZED	
408	545908	4183244	NO	NL EVERGREEN	NO	PLOT VANDALIZED	
409	545918	4183217	NO	NL EVERGREEN	NO	PRESIDIO	
410	545920	4183192	NO	NL EVERGREEN	NO	PRESIDIO	
411	545787	4183269	NO	COASTAL SCRUB	NO	PRESIDIO	
412	545788	4183299	NO	COASTAL SCRUB	NO	PRESIDIO	
414	545775	4183325	NO	COASTAL SCRUB	NO	PRESIDIO	
415	545761	4183353	NO	COASTAL SCRUB	NO	PRESIDIO	
416	545755	4183384	NO	COASTAL SCRUB	NO	PRESIDIO	
417	545754	4183413	NO	COASTAL SCRUB	NO	PRESIDIO	
418	545763	4183438	YES	COASTAL SCRUB	NO	PRESIDIO	
421	545767	4183465	YES	COASTAL SCRUB	NO	PRESIDIO	
422	545800	4183468	NO	COASTAL SCRUB	NO	PRESIDIO	
423	545718	4183526	YES	COASTAL SCRUB	NO	PRESIDIO	
425	545670	4183301	NO	COASTAL SCRUB	NO	PRESIDIO	
426	545666	4183326	NO	COASTAL SCRUB	NO	PRESIDIO	
427	545664	4183347	NO	COASTAL SCRUB	NO	PRESIDIO	
428	545657	4183373	NO	COASTAL SCRUB	NO	PRESIDIO	
429	545660	4183396	NO	COASTAL SCRUB	NO	PRESIDIO	
430	548515	4161210	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
431	548542	4161196	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
432	548566	4161176	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
433	548595	4161153	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
434	548611	4161134	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
435	548623	4161105	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
436	548654	4161094	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
437	548679	4161079	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
439	542631	4190926	NO	GRASSLAND	NO	MARIN HEADLANDS	

[1] Sampled for hantavirus.

PLOT	EMES	NMES	GPS	LIFEFORM	GRAZED	DISTRICT	HANTA[1]
440	548711	4161092	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
441	548739	4161118	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
442	547898	4161871	YES	GRASSLAND	NO	SWEENEY RIDGE	
443	547868	4161855	NO	GRASSLAND	NO	SWEENEY RIDGE	
444	547840	4161838	YES	GRASSLAND	NO	SWEENEY RIDGE	
445	547820	4161827	NO	GRASSLAND	NO	SWEENEY RIDGE	
446	547799	4161814	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
455	547910	4161851	YES	GRASSLAND	NO	SWEENEY RIDGE	
456	547889	4161830	YES	GRASSLAND	NO	SWEENEY RIDGE	
457	547864	4161814	YES	GRASSLAND	NO	SWEENEY RIDGE	
458	547835	4161806	YES	GRASSLAND	NO	SWEENEY RIDGE	
459	547815	4161775	YES	GRASSLAND	NO	SWEENEY RIDGE	
484	560546	4143371	NO	NL EVERGREEN	NO	PHLEGER	
485	560535	4143392	NO	NL EVERGREEN	NO	PHLEGER	
486	560512	4143416	NO	NL EVERGREEN	NO	PHLEGER	
487	560482	4143418	NO	NL EVERGREEN	NO	PHLEGER	
488	560451	4143413	NO	NL EVERGREEN	NO	PHLEGER	
489	560759	4143399	NO	NL EVERGREEN	NO	PHLEGER	
490	560755	4143432	NO	NL EVERGREEN	NO	PHLEGER	
491	560738	4143459	NO	NL EVERGREEN	NO	PHLEGER	
492	560711	4143480	NO	NL EVERGREEN	NO	PHLEGER	
494	560689	4143501	NO	NL EVERGREEN	NO	PHLEGER	
500	542121	4189783	YES	GRASSLAND	NO	MARIN HEADLANDS	
501	547806	4162643	YES	COASTAL SCRUB	NO	SWEENEY RIDGE	
502	547776	4162651	YES	COASTAL SCRUB	NO	SWEENEY RIDGE	
503	547748	4162638	YES	COASTAL SCRUB	NO	SWEENEY RIDGE	
504	542187	4189776	YES	GRASSLAND	NO	MARIN HEADLANDS	
505	547728	4162621	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
506	547703	4162599	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
507	542226	4189776	YES	GRASSLAND	NO	MARIN HEADLANDS	
508	547798	4162679	YES	COASTAL SCRUB	NO	SWEENEY RIDGE	
509	547770	4162667	YES	COASTAL SCRUB	NO	SWEENEY RIDGE	
510	547740	4162665	YES	COASTAL SCRUB	NO	SWEENEY RIDGE	
511	547714	4162667	YES	COASTAL SCRUB	NO	SWEENEY RIDGE	
512	547681	4162665	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
513	542079	4189955	YES	GRASSLAND	NO	MARIN HEADLANDS	
518	548829	4160929	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
519	548859	4160953	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
520	548791	4160991	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
521	548780	4161031	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
522	548783	4161069	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
524	542533	4189759	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
525	548724	4160950	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
526	542480	4189802	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
527	548721	4160975	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
528	543911	4188414	YES	GRASSLAND	NO	MARIN HEADLANDS	
529	548694	4160964	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	

[1] Sampled for hantavirus.

PLOT	EMES	NMES	GPS	LIFEFORM	GRAZED	DISTRICT	HANTA[1]
530	548730	4161013	YES	COASTAL SCRUB	NO	SWEENEY RIDGE	
531	548706	4160997	YES	COASTAL SCRUB	NO	SWEENEY RIDGE	
532	548677	4160988	YES	COASTAL SCRUB	NO	SWEENEY RIDGE	
533	548602	4160983	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
534	542432	4189979	YES	GRASSLAND	NO	MARIN HEADLANDS	
535	548567	4160994	NO	GRASSLAND	NO	SWEENEY RIDGE	
536	548537	4161010	NO	GRASSLAND	NO	SWEENEY RIDGE	
537	548655	4160995	YES	COASTAL SCRUB	NO	SWEENEY RIDGE	
538	548421	4161044	YES	COASTAL SCRUB	NO	SWEENEY RIDGE	
539	548405	4161076	YES	GRASSLAND	NO	SWEENEY RIDGE	
540	548381	4161061	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
541	548380	4161038	YES	COASTAL SCRUB	NO	SWEENEY RIDGE	
542	548373	4161012	YES	GRASSLAND	NO	SWEENEY RIDGE	
544	548378	4160984	YES	GRASSLAND	NO	SWEENEY RIDGE	
546	548386	4160960	YES	GRASSLAND	NO	SWEENEY RIDGE	
547	542726	4189916	YES	GRASSLAND	NO	MARIN HEADLANDS	
548	548409	4160933	YES	GRASSLAND	NO	SWEENEY RIDGE	
549	548427	4160908	YES	GRASSLAND	NO	SWEENEY RIDGE	
550	542765	4189911	YES	GRASSLAND	NO	MARIN HEADLANDS	
551	542992	4189699	YES	GRASSLAND	NO	MARIN HEADLANDS	
552	548456	4160887	NO	GRASSLAND	NO	SWEENEY RIDGE	
555	544129	4188683	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
560	543047	4189786	YES	GRASSLAND	NO	MARIN HEADLANDS	
561	544185	4188689	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
562	544234	4188641	YES	GRASSLAND	NO	MARIN HEADLANDS	
566	543165	4189764	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
567	544070	4188886	YES	GRASSLAND	NO	MARIN HEADLANDS	
569	544006	4188954	YES	GRASSLAND	NO	MARIN HEADLANDS	
570	543393	4189673	YES	GRASSLAND	NO	MARIN HEADLANDS	
571	543386	4189708	YES	GRASSLAND	NO	MARIN HEADLANDS	
572	544093	4189028	YES	GRASSLAND	NO	MARIN HEADLANDS	
575	543289	4189913	NO	GRASSLAND	NO	MARIN HEADLANDS	
576	544112	4189153	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
578	543255	4190003	YES	GRASSLAND	NO	MARIN HEADLANDS	
579	544131	4189152	YES	GRASSLAND	NO	MARIN HEADLANDS	
581	543501	4189789	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
588	543709	4189753	NO	COASTAL SCRUB	NO	MARIN HEADLANDS	
591	544371	4189200	YES	GRASSLAND	NO	MARIN HEADLANDS	
592	544798	4188802	YES	GRASSLAND	NO	MARIN HEADLANDS	
594	544797	4188813	YES	GRASSLAND	NO	MARIN HEADLANDS	
596	544721	4188961	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
597	544648	4189049	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
598	544782	4188899	YES	GRASSLAND	NO	MARIN HEADLANDS	
599	544804	4188921	YES	GRASSLAND	NO	MARIN HEADLANDS	
600	545011	4188762	YES	GRASSLAND	NO	MARIN HEADLANDS	
737	542427	4191138	NO	GRASSLAND	NO	MARIN HEADLANDS	
740	549183	4160987	NO	COASTAL SCRUB	NO	SF WATERSHED	

[1] Sampled for hantavirus.

PLOT	EMES	NMES	GPS	LIFEFORM	GRAZED	DISTRICT	HANTA[1]
741	549191	4161020	NO	COASTAL SCRUB	NO	SF WATERSHED	
742	549197	4161050	NO	COASTAL SCRUB	NO	SF WATERSHED	
743	549203	4161080	NO	COASTAL SCRUB	NO	SF WATERSHED	
744	549210	4161109	NO	COASTAL SCRUB	NO	SF WATERSHED	
745	549237	4161228	NO	COASTAL SCRUB	NO	SF WATERSHED	
746	549232	4161199	NO	COASTAL SCRUB	NO	SF WATERSHED	
747	549226	4161169	NO	COASTAL SCRUB	NO	SF WATERSHED	
748	549218	4161141	NO	COASTAL SCRUB	NO	SF WATERSHED	
749	549147	4160997	NO	COASTAL SCRUB	NO	SF WATERSHED	
750	549187	4161140	NO	COASTAL SCRUB	NO	SF WATERSHED	
751	549180	4161110	NO	COASTAL SCRUB	NO	SF WATERSHED	
752	549169	4161081	NO	COASTAL SCRUB	NO	SF WATERSHED	
753	549163	4161053	NO	COASTAL SCRUB	NO	SF WATERSHED	
754	549156	4161024	NO	COASTAL SCRUB	NO	SF WATERSHED	
801	524091	4205392	NO	BL EVERGREEN	YES	OLEMA-GRAZED	
802	524074	4205382	NO	BL EVERGREEN	YES	OLEMA-GRAZED	
803	524037	4205374	NO	BL EVERGREEN	YES	OLEMA-GRAZED	
804	523996	4205358	NO	BL EVERGREEN	YES	OLEMA-GRAZED	
805	523959	4205341	NO	BL EVERGREEN	YES	OLEMA-GRAZED	
806	523959	4205280	NO	GRASSLAND	YES	OLEMA-GRAZED	
807	540835	4190081	YES	COASTAL SCRUB	NO	MARIN HEADLANDS	
808	523996	4205214	NO	GRASSLAND	YES	OLEMA-GRAZED	
809	524012	4205173	NO	GRASSLAND	YES	OLEMA-GRAZED	
810	524000	4205128	NO	GRASSLAND	YES	OLEMA-GRAZED	
811	524508	4205096	NO	NL EVERGREEN	YES	OLEMA-GRAZED	
812	524514	4205069	NO	NL EVERGREEN	YES	OLEMA-GRAZED	
813	524521	4205039	NO	BL EVERGREEN	YES	OLEMA-GRAZED	
814	524502	4205022	NO	NL EVERGREEN	YES	OLEMA-GRAZED	
815	524486	4204998	NO	NL EVERGREEN	YES	OLEMA-GRAZED	
817	524509	4204953	NO	GRASSLAND	YES	OLEMA-GRAZED	
818	524489	4204957	NO	GRASSLAND	YES	OLEMA-GRAZED	
820	524532	4204947	NO	GRASSLAND	YES	OLEMA-GRAZED	
821	524556	4204944	NO	GRASSLAND	YES	OLEMA-GRAZED	
822	524572	4204935	NO	GRASSLAND	YES	OLEMA-GRAZED	
823	520910	4209090	NO	GRASSLAND	YES	OLEMA-GRAZED	
824	520907	4209063	YES	GRASSLAND	YES	OLEMA-GRAZED	
825	520906	4209035	YES	GRASSLAND	YES	OLEMA-GRAZED	
826	520933	4209025	YES	GRASSLAND	YES	OLEMA-GRAZED	
827	520959	4209022	YES	GRASSLAND	YES	OLEMA-GRAZED	
828	520917	4209151	NO	NL EVERGREEN	YES	OLEMA-GRAZED	
829	520924	4209175	YES	BL EVERGREEN	YES	OLEMA-GRAZED	
830	520946	4209183	NO	NL EVERGREEN	YES	OLEMA-GRAZED	
832	520962	4209194	NO	BL EVERGREEN	YES	OLEMA-GRAZED	
833	520963	4209210	NO	BL EVERGREEN	YES	OLEMA-GRAZED	
834	520841	4209074	NO	GRASSLAND	YES	OLEMA-GRAZED	
835	520842	4209048	YES	GRASSLAND	YES	OLEMA-GRAZED	
836	520860	4209018	YES	GRASSLAND	YES	OLEMA-GRAZED	

[1] Sampled for hantavirus.

PLOT	EMES	NMES	GPS	LIFEFORM	GRAZED	DISTRICT	HANTA[1]
837	520884	4209002	YES	GRASSLAND	YES	OLEMA-GRAZED	
838	520910	4209000	YES	BL EVERGREEN	YES	OLEMA-GRAZED	
839	520848	4209134	NO	BL EVERGREEN	YES	OLEMA-GRAZED	
840	520864	4209149	NO	BL EVERGREEN	YES	OLEMA-GRAZED	
841	520882	4209162	NO	BL EVERGREEN	YES	OLEMA-GRAZED	
842	520900	4209174	NO	BL EVERGREEN	YES	OLEMA-GRAZED	
843	520919	4209188	NO	BL EVERGREEN	YES	OLEMA-GRAZED	
850	523983	4205255	NO	GRASSLAND	YES	OLEMA-GRAZED	
857	542581	4188952	NO	GRASSLAND	NO	MARIN HEADLANDS	
900	529115	4197161	NO	GRASSLAND	NO	OLEMA-UNGRAZED	
901	530009	4196111	NO	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
902	530206	4196118	NO	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
903	529921	4196145	NO	GRASSLAND	NO	OLEMA-UNGRAZED	
904	530066	4196231	NO	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
905	529927	4196367	NO	GRASSLAND	NO	OLEMA-UNGRAZED	
906	530071	4196335	NO	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
907	530261	4196449	NO	GRASSLAND	NO	OLEMA-UNGRAZED	
908	529418	4196963	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
909	529530	4197106	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
910	528958	4197141	NO	GRASSLAND	NO	OLEMA-UNGRAZED	
911	529427	4196993	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
912	529413	4196986	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
913	529341	4196836	NO	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
914	529445	4197013	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
916	529463	4197028	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
917	529292	4196940	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
918	529315	4196958	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
919	543511	4187509	NO	COASTAL SCRUB	NO	MARIN HEADLANDS	
920	529225	4197117	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
921	529846	4197017	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
922	529484	4197039	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
923	529446	4196916	YES	GRASSLAND	NO	OLEMA-UNGRAZED	
924	529473	4196906	YES	GRASSLAND	NO	OLEMA-UNGRAZED	
925	529493	4196881	YES	GRASSLAND	NO	OLEMA-UNGRAZED	
926	529511	4196850	YES	GRASSLAND	NO	OLEMA-UNGRAZED	
927	529523	4196825	YES	GRASSLAND	NO	OLEMA-UNGRAZED	
928	529532	4196990	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
929	529557	4197008	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
930	529575	4197033	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
931	529587	4197057	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
932	529592	4197084	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
933	529531	4196937	YES	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
934	529544	4196909	YES	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
935	529559	4196885	YES	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
936	529588	4196871	YES	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
937	529616	4196869	YES	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
938	529329	4196982	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	

[1] Sampled for hantavirus.

PLOT	EMES	NMES	GPS	LIFEFORM	GRAZED	DISTRICT	HANTA[1]
939	529336	4197011	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
940	529345	4197035	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
941	529290	4196890	YES	GRASSLAND	NO	OLEMA-UNGRAZED	
942	529317	4196873	YES	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
943	529333	4196874	YES	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
944	529358	4196856	NO	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
945	529379	4196840	NO	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
946	529623	4196988	NO	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
947	529640	4196966	NO	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
948	529673	4196950	NO	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
949	529702	4196935	NO	COASTAL SCRUB	NO	OLEMA-UNGRAZED	
950	529728	4196920	NO	GRASSLAND	NO	OLEMA-UNGRAZED	
951	529630	4197043	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
952	529627	4197077	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
953	529636	4197112	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
954	529668	4197144	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
955	529702	4197180	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	
956	529093	4197137	NO	GRASSLAND	NO	OLEMA-UNGRAZED	YES
957	529039	4197146	YES	GRASSLAND	NO	OLEMA-UNGRAZED	YES
958	529018	4197168	YES	GRASSLAND	NO	OLEMA-UNGRAZED	YES
959	528996	4197187	YES	GRASSLAND	NO	OLEMA-UNGRAZED	YES
960	529176	4197198	NO	GRASSLAND	NO	OLEMA-UNGRAZED	YES
961	529152	4197209	NO	GRASSLAND	NO	OLEMA-UNGRAZED	YES
962	529128	4197230	NO	GRASSLAND	NO	OLEMA-UNGRAZED	YES
963	529090	4197233	NO	GRASSLAND	NO	OLEMA-UNGRAZED	YES
964	529058	4197246	NO	GRASSLAND	NO	OLEMA-UNGRAZED	YES
965	529152	4197177	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	YES
966	529192	4197166	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	YES
967	529232	4197241	YES	NL EVERGREEN	NO	OLEMA-UNGRAZED	YES
968	529240	4197214	NO	BL EVERGREEN	NO	OLEMA-UNGRAZED	YES
969	529246	4197249	NO	BL EVERGREEN	NO	OLEMA-UNGRAZED	YES
970	529214	4197222	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	YES
971	529214	4197254	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	YES
972	529208	4197292	NO	BL EVERGREEN	NO	OLEMA-UNGRAZED	YES
973	529222	4197316	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	YES
974	529248	4197308	NO	NL EVERGREEN	NO	OLEMA-UNGRAZED	YES
524b	548753	4160937	NO	COASTAL SCRUB	NO	SWEENEY RIDGE	
993			Location Unknown	GRASSLAND	NO	MARIN HEADLANDS	

[1] Sampled for hantavirus.

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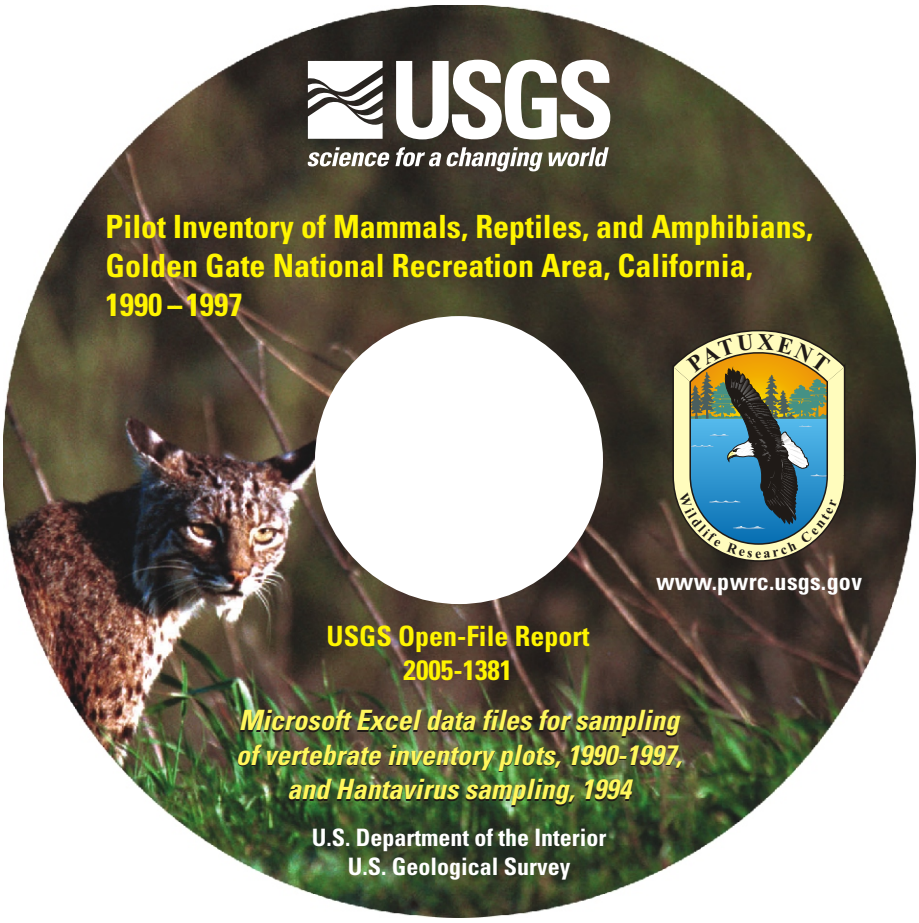

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