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INTERIM REPORT:

STATUS OF MORRO BAY KANGAROO RATS ON 3 STUDY PLOTS AT THE BAYVIEW SITE IN 1984 AND 1985

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June 10, 1986

INTRODUCTION

The only known population of Morro Bay Kangaroo Rats (*Dipodomys heermanni morroensis*) which appears to be maintaining itself at the present time is the Bayview population (refer to U.S.F.W.S., 1982, for details on the status and distribution of *D. h. morroensis*). The Bayview site covers approximately 200 acres (81 ha), but no more than 175 acres (71 ha) appear to be suitable for Morro Bay Kangaroo Rats (MBKR). The estimated population size of MBKR on the Bayview site was 170–175 individuals in 1979 and somewhere between 50 and 100 individuals in 1983 (U.S.F.W.S., 1982).

This report summarizes the results of trapping studies conducted in 1984 and 1985, on permanent study plots within the potentially occupied habitat at the Bayview site. It should be noted that nearly all of the captive breeding stock of *D. h. morroensis*, maintained at California Polytechnic State University through a U.S.F.W.S. contract grant to Dr. A. I. Roest, was drawn from the Bayview population. The removal of animals for the captive breeding project necessarily increases the error in estimating the size of the field population because the ratios of marked to unmarked individuals will be skewed in favor of unmarked animals.

METHODS

STUDY AREA

The Bayview site is located in the village of Los Osos, CA; in the NW 1/4 of Sec. 19, T30S, R11E, Morro Bay South Quadrangle; Longitude 120° 50', Latitude 35° 18'. The site is bounded by Highland Drive on the North, Broderson Avenue on the West, and Bayview Heights Drive on the East. The average slope of the landscape on the site is about 10%.

STUDY PLOTS

Two, 0.5 ha (50 m X 100 m) study plots (designated NOP and QRS) were established in 1984 and trapped repeatedly in both 1984 and 1985. One, 1 ha (50 m X 200 m) study plot (designated KKLLMM) was established in 1985 and trapped once that year. All 3 plots were located on known occupied habitat within the northern half of the Bayview site (Fig. 1).

A grid of equidistant trapping stations 25 m apart was established on each plot. Each station was identified with one or two letters (eg. N, Q, or KK) which represent lines running the long axis of the plot and a number (eg. 0+00, 0+75, or 2+00) which represent distance (m) from the base line of the plot. Each plot was referenced to a permanent landmark by means of a staff compass traverse survey. Each station was marked with a 1" X 2" X 18" stake projecting 4"–6" above the ground and a 1/2" X 2" X 4' stake projecting 2'–3' above the ground. Stations at the corners of the plots were also marked with a 1/2" X 3' piece of rebar projecting 6"–8" above the ground.

TRAPPING METHODS

Two, folding, aluminum, Sherman XLK live traps were placed within 5 m of each trapping station. A 3–5 cm diameter ball of cotton was placed in each trap and a small handful of Quaker, old–fashioned, rolled oats (bait) was divided between the interior of

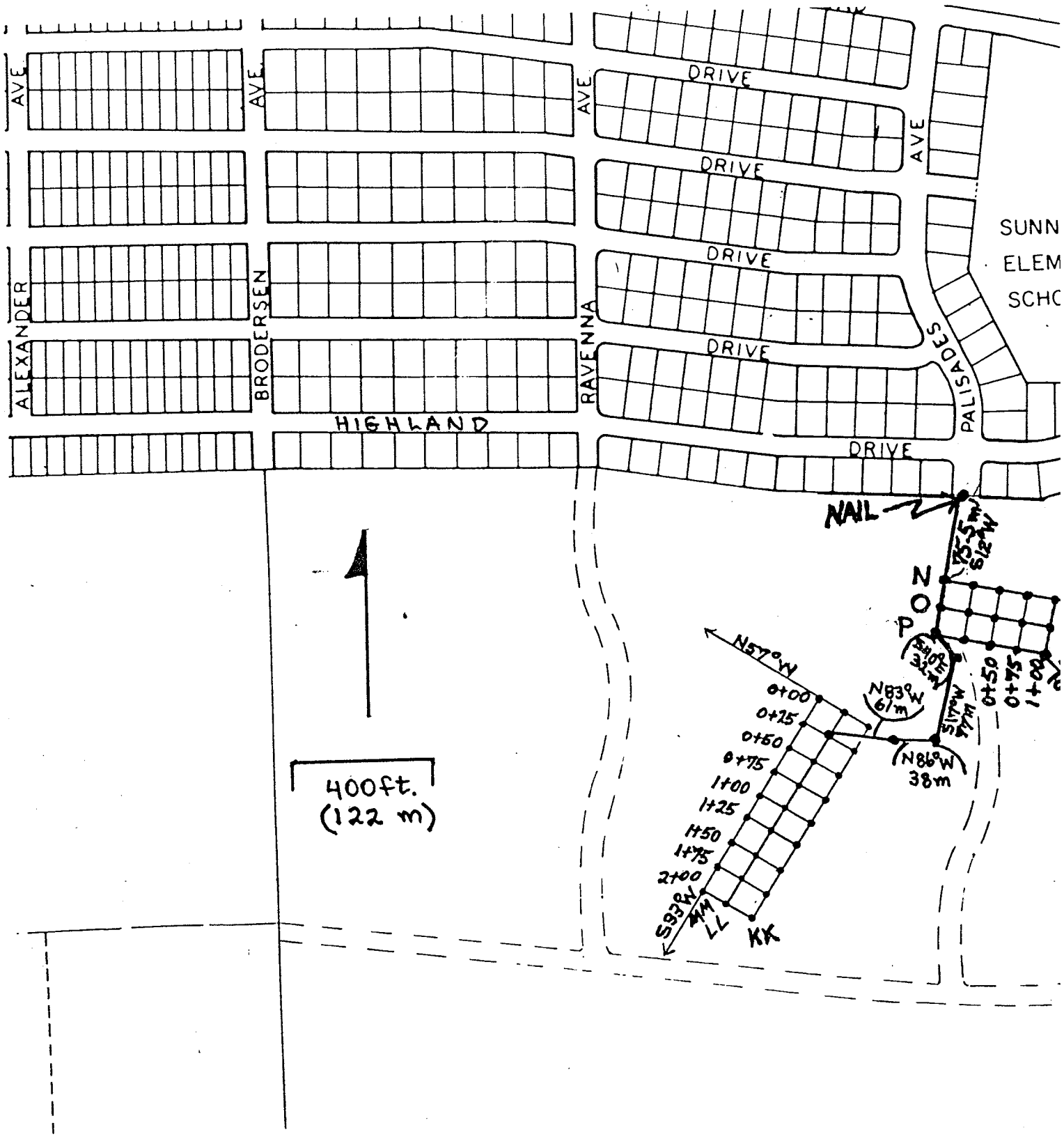
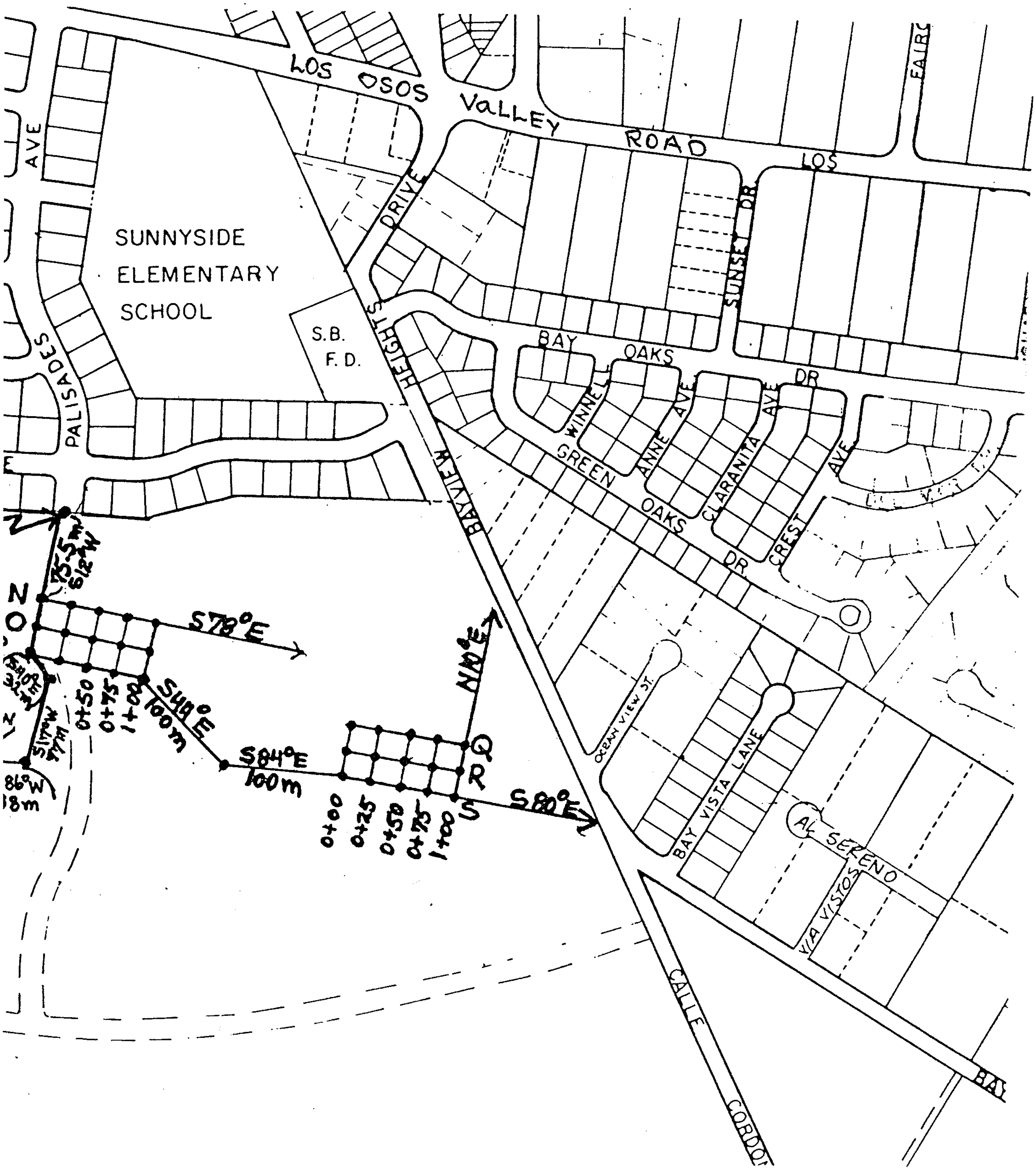


Figure 1. Location of plots NOP, QRS, and KKLLMM on the Bayview Site in the village of Los Osos, CA.


LOS OSOS VALLEY ROAD
LOS
SUNNYSIDE ELEMENTARY SCHOOL
S.B. F.D.
AVE
PALISADES
DRIVE
HEIGHTS
SUNSET DR.
BAY OAKS DR
WINNELL
ANNE AVE
CLARANITA AVE
CREST AVE
GREEN OAKS DR.
BAYVIEW
OCEAN VIEW ST.
BAY VISTA LANE
AL SERENO
VIA VISTOS
CALLE CORDO
N
O
S78°E
S49°E 100m
S84°E 100m
N10°E
Q
R
S
S80°E
0+00
0+25
0+50
0+75
1+00

age

the trap and the ground in front of the trap. All loose debris and cotton was removed from traps between trapping sessions, but the traps were not brushed out or washed.

Traps were set during daylight on one day and then checked and rebaited in the early morning hours for 2—4 subsequent days. Animals were never left in traps later than 11:00 AM.

FIELD DATA

The following data were recorded for each small mammal trapped during the study:

1. Date of capture
2. General weather: wind, cloud cover, moisture, and temperature
3. The station and plot where the animal was captured.
4. Identification to species using external characteristics
5. Sex of the individual
6. Age class and signs of molting
7. General reproductive condition
8. Body weight to the nearest 0.5 g for animals weighing less than 50 g (to the nearest 1.0 g for animals weighing over 50 g)

The following additional data were recorded for each MBKR captured during the study:

9. Tail length
10. Hind foot length
11. Ear length
12. Dorsal coloration
13. Presence and extent of hip stripe
14. Presence of unique or unusual features

All data were recorded in pencil in weatherproof field books at the time of capture.

INDIVIDUAL MARKING AND RELEASE

Every small mammal was marked with a numbered, stainless steel fingerling tag which was clamped on one of its ears. Thus each individual was identified with a unique number followed by an L or R indicating the ear holding the tag. With the exception of animals taken to the captive breeding facility, all individuals were released at their site of capture as soon as all data had been gathered. MBKR's that were taken to the captive breeding facility were held in a cool place for an hour or so until they could be transported to the breeding facility.

TRAPPING INTENSITY AND EASE OF CAPTURE

Trapping intensity during any trapping session is expressed as number of trap nights (TN) which is equal to the sum of the number of traps set each night minus the number of tripped traps, the number of stolen traps, and the number of other (diurnal) animals captured.

Ease of capture is expressed as the ratio of the trapping intensity (TN) to the number of individuals captured. As an example, if a trapping session with 88 TN produced 3 MBKR captures, then the ease of capture for MBKR's during that session would be 29.3. The ease of capture for MBKR's during another trapping session with 88 TN and only 1 MBKR capture would be 88.

POPULATION ESTIMATION TECHNIQUES

Capture/recapture data were used to calculate population estimates using the Schnabel Method and the Schumacher–Eschmeyer Method (Davis and Winstead 1980). Capture data were used to calculate population estimates using a method described by Roest (1982). The data collected during each monthly trapping session were treated as independent samples from a closed population. Thus, the first time an individual was captured on any given month it was counted as a newly captured individual, regardless of whether or not it was captured on previous months. Unfortunately, insufficient numbers of captures and/or recaptures prevented calculating Schnabel population estimates for several of the trapping sessions. However, since the Roest method relies upon captures only, population estimates could be made for all trapping sessions. Agreement between the two methods was assessed by comparing population estimates derived from the Schnabel, capture/recapture method to population estimates derived from the Roest, capture method using regression and correlation statistics.

DENSITY ESTIMATION TECHNIQUES

The area trapped was obtained by assuming that each trapping station "trapped" a 25 m X 25 m (625 m^2) area. Thus, each of the two 1/2 ha plots (NOP AND QRS), containing 15 trapping stations each, were considered to trap an area of 15 X 625 m^2 = 9375 m^2 = .9375 ha. The 1 ha plot (KKLLMM), containing 27 trapping stations, was considered to trap an area of 27 X 625 m^2 = 16,875 m^2 = 1.6875 ha.

Density was expressed as either (1) the population estimate derived from the Schnabel method divided by the area trapped or (2) the total number of individuals captured during a trapping session divided by the area trapped. The latter expression of density is an adaptation of a line census method described by Roest (1982).

DISTRIBUTION OF SMALL MAMMALS ON THE STUDY PLOTS

Several small mammal species occurred on each of the study plots, but the distribution of their captures over the plot was far from uniform. The patchy occurrence of different species over the three study plots could indicate differences in microhabitat preferences and/or competitive relationships among the different species. Analysis of these relationships is confounded by several unavoidable factors. Removal of a substantial number of MBKR's from the study site for use in the captive breeding program resulted in incomplete trapping records on these individuals during the 1984 and 1985 field seasons. Furthermore, the number of recaptures on other individuals was too low to define home range boundaries with any degree of accuracy. As a compromise, I decided to sort all the trapping data for each species by trapping station and then express the distribution of each species as (1) the yearly number of captures at each station and (2) the yearly number of different individuals captured at each station.

RESULTS

TRAPPING INTENSITY, SPECIES OCCURRENCE, AND EASE OF CAPTURE

PLOT NOP

A total of 547 trap nights were exerted on plot NOP from March through October, 1984 (Table 1). One female *Dipodomys heermanni morroensis* (Morro Bay kangaroo rat), 4 *Perognathus californicus* (California pocket mouse), 2 *Peromyscus boylii* (brush mouse), 1 *Peromyscus californicus* (California mouse), and 1 *Peromyscus maniculatus* (deer mouse), were captured during the 1984 field season (Table 2). Pocket mice required only 15 – 30 trap nights to capture one individual (TN / individual) whereas the other 4 species required 30 – 60 TN / individual.

A total of 222 trap nights were exerted on plot NOP from April through June, 1985 (Table 3). Seven *Perognathus californicus* and 1 *Peromyscus maniculatus* were captured during the 1985 field season (Table 4). Pocket mice were generally easier to capture (11 – 49 TN / individual) than deer mice (28 – 88 TN / individual). The apparent absence of Morro Bay kangaroo rats, California mice, and brush mice from plot NOP in 1985, probably represents a local change in the distribution of these species in the area; however, results from 1986 will undoubtedly clarify the changes that occurred in 1985.

PLOT QRS

A total of 562 trap nights were exerted on plot QRS from March through October, 1984 (Table 5). Five Morro Bay kangaroo rats (all females) and 1 California pocket mouse were captured during the 1984 field season (Table 6). Morro Bay kangaroo rats were considerably easier to capture in March, April, and May (12 – 20 TN / individual) than during June, July, and August (59 – 118 TN / individual). No Morro Bay kangaroo rats were captured in September and October. The only California pocket mouse captured was caught in March and never seen again.

A total of 264 trap nights were exerted on plot QRS from April through June, 1985 (Table 3). Eight Morro Bay kangaroo rats (5 females and 3 males) and 2 California pocket mice were captured during the 1985 field season (Table 7). Morro Bay kangaroo rats were easier to capture (13 – 30 TN / individual) than were California pocket mice (30 – 87 TN / individual).

PLOT KKLLMM

A total of 158 trap nights were exerted on plot KKLLMM in August, 1985 (Table 3). Eight Morro Bay kangaroo rats (4 females and 4 males) and 9 California pocket mice were captured during the 1985 field season (Table 8). Both Morro Bay kangaroo rats and California pocket mice were markedly easier to capture on plot KKLLMM than on either of the two other Bayview plots, 8 and 6 TN / individual, respectively.

Table 1. Trapping dates, number of trap nights (TN) exerted per trapping session, and the relative ease of capturing individuals of each small mammal species (expressed as the number of trap nights required to capture one individual) on plot NOP in 1984. Species abbreviations are as follows: Dh. mor. = *Dipodomys heermanni morroensis*, Pg. cal. = *Perognathus californicus*, Pm. boy. = *Peromyscus boylii*, Pm. cal. = *Peromyscus californicus*, and Pm. man. = *Peromyscus maniculatus*.

PLOT	DATE	#T.N.	#TN/Dh.mor.	#TN/Pg.cal.	#TN/Pm.boy.	#TN/Pm.cal.	#TN/Pm.man.
NOP	23/MAR/84						
	24/MAR/84						
Σ		60	60.00			30.00	
NOP	27/APR/84						
	28/APR/84						
Σ		60	60.00	15.00	60.00	60.00	
NOP	25/MAY/84						
	26/MAY/84						
Σ		59			59.00		
NOP	19/JUN/84						
	20/JUN/84						
	21/JUN/84						
Σ		87		29.00			
NOP	10/JUL/84						
	11/JUL/84						
	12/JUL/84						
	13/JUL/84						
Σ		112		18.67			
NOP	2/AUG/84						
	3/AUG/84						
Σ		56					
NOP	4/SEP/84						
	5/SEP/84						
Σ		57					
NOP	17/OCT/84						
	18/OCT/84						
Σ		56				56.00	56.00

Table 2. Detailed trapping data collected from all animals captured on plot NOP in 1984. The L or R following the number of the stainless steel ear tag indicates whether the left or right ear was used to carry the tag. STA (trapping station) indicates where each individual was captured on the plot. Letters of the trapping stations indicate unique lines running the length of the plot and numbers indicate the distance (m) from the origin of the line. Species abbreviations are as follows: Dh. mor. = *Dipodomys heermanni morroensis*, Pg. cal. = *Perognathus californicus*, Pm. boy. = *Peromyscus boylii*, Pm. cal. = *Peromyscus californicus*, and Pm. man. = *Peromyscus maniculatus*. Age abbreviations are: A = full-sized animals with bright, adult pelage, SUBA = animals weighing less than full adults with nearly adult pelage, J = animals with more or less uniform, dull pelage. BR. CND. (breeding condition) of males is designated as TD = testes scrotal or TND = testes abdominal. Breeding condition of females is designated as follows: NL = no external signs of present, past, or forthcoming reproductive activity as evidenced by examination of mammae and vulva, PLAC = minor development of mammae perhaps indicating either very early gestation or a post-weaning condition, PREG = distended abdomen and heavy body weight which were indicative of late gestation, LAC = enlarged mammae surrounded by a concentric zone of bare skin, VPLG = conspicuous, light-colored mass of tissue at the vaginal opening which may indicate early stages of gestation, or BLVG = blood present at the vaginal opening which may indicate recent parturition. In addition to general notes, body measurements (mm) of some individuals are given as tail (base to end of last vertebra) / hind foot (end of heel to end of longest toe pad) / ear (unstretched from notch to tip). The dorsal coloration of Morro Bay kangaroo rats is designated as Dark or Light and the degree of incompleteness of their hip stripe is designated as % incomplete.

TAG #	STA	DATE 1	SPECIES	AGE	SEX	BR. CND.	NOTES	WT(g)
1023L	O 100	24/Mar/84	Dh. mor.	A	F	NL	Inj. R. Eye Dark, Inc. H. S. (50%)	57.0
1023L	O 025	27/Apr/84	Dh. mor.	A	F	NL	Eye Healed, Dark, Inc. H. S. (50%)	61.0
1129L	P 075	27/Apr/84	Pg. cal.	A	F	NL		18.0
1132L	N 100	27/Apr/84	Pg. cal.	A	M	TD		30.0
1133L	P 100	27/Apr/84	Pg. cal.	A	M	TD	Blood-Urine	24.0
1132L	P 100	28/Apr/84	Pg. cal.	A	M	TD		31.0
1129L	P 100	20/Jun/84	Pg. cal.	A	F	LAC		23.0
1129L	P 100	21/Jun/84	Pg. cal.	A	F	LAC		23.5
1132L	N 100	21/Jun/84	Pg. cal.	A	M	TD		26.0
1359R	P 100	10/Jul/84	Pg. cal.	A	M	TD		24.0
1132L	N 100	11/Jul/84	Pg. cal.	A	M	TD	ShrtTail	24.5
1359R	P 100	11/Jul/84	Pg. cal.	A	M	TD		24.0
1132L	N 100	12/Jul/84	Pg. cal.	A	M	TD	ShrtTail	24.5
1359R	P 100	12/Jul/84	Pg. cal.	A	M	TD		23.0
1132L	N 100	13/Jul/84	Pg. cal.	A	M	TD	Escaped	
1130R	N 100	27/Apr/84	Pm. boy.	A	F	NL	Ck. ID, Pm. cal.	23.0
1176L	P 075	26/May/84	Pm. boy.	A	F	NL	Ck. ID, Pm. cal.; gray back, W-tip	25.0
1122R	O 050	23/Mar/84	Pm. cal.	J	M	TND		30.5
1122R	O 050	24/Mar/84	Pm. cal.	SUBA	M	TND	Molting on head	29.0
1122R	N 100	28/Apr/84	Pm. cal.	A	M	TD		30.0
1122R	N 100	18/Oct/84	Pm. cal.	A	M	TND	117/24/23	28.5
1284L	P 050	17/Oct/84	Pm. man.	A	F	NL		15.0

Table 3. Trapping dates, number of trap nights (TN) exerted per trapping session, and the relative ease of capturing individuals of each small mammal species (expressed as the number of trap nights required to capture one individual) on plots NOP, QRS, and KKLLMM in 1985. Refer to Table 1 for an explanation of species abbreviations used in this table.

PLOT	DATE	#T.N.	#TN/Dh.mor.	#TN/Pg.cal.	#TN/Pm.man.
NOP	4/APR/85				
	5/APR/85				
	6/APR/85				
Σ		85		10.62	28.33
NOP	24/APR/85				
	25/APR/85				
	26/APR/85				
Σ		88		11.00	88.00
NOP	5/JUN/85				
	6/JUN/85				
Σ		49		49.00	
QRS	4/APR/85				
	5/APR/85				
	6/APR/85				
Σ		88	29.33	29.33	
QRS	24/APR/85				
	25/APR/85				
	26/APR/85				
Σ		87	17.40	87.00	
QRS	5/JUN/85				
	6/JUN/85				
	7/JUN/85				
Σ		89	12.71		
KKLLMM	20/AUG/85				
	21/AUG/85				
	22/AUG/85				
Σ		158	7.52	6.08	

Table 4. Detailed trapping data collected from all animals captured on plot NOP in 1985. Refer to Table 2 for an explanation of the abbreviations used in this table.

TAG #	STA	DATE 1	SPECIES	AGE	SEX	BR. CND.	NOTES	WT(g)
1544R	P 075	04/Apr/85	Pg. cal.	SUBA	F	NL		18.5
1545L	O 050	04/Apr/85	Pg. cal.	SUBA	F	NL		17.5
1546R	O 075	04/Apr/85	Pg. cal.	A	F	NL		18.0
1548L	O 050	04/Apr/85	Pg. cal.	A	M	TD	Anus swollen	25.5
1545L	O 050	05/Apr/85	Pg. cal.	SUBA	F	NL		18.0
1548L	O 050	05/Apr/85	Pg. cal.	A	M	TD		26.5
1544R	P 075	06/Apr/85	Pg. cal.	SUBA	F	NL		20.5
1545L	O 050	06/Apr/85	Pg. cal.	SUBA	F	NL	*=1414R*	18.5
0114L	P 100	24/Apr/85	Pg. cal.	A	F	NL	*NEW ANIMAL*	23.0
0117L	N 075	24/Apr/85	Pg. cal.	A	M	TD	*NEW ANIMAL*	24.0
1548L	O 075	24/Apr/85	Pg. cal.	A	M	TD		26.5
0114L	P 100	25/Apr/85	Pg. cal.	A	F	NL		23.0
0117L	N 075	25/Apr/85	Pg. cal.	A	M	TD		24.0
1548L	O 075	25/Apr/85	Pg. cal.	A	M	TD	metalic powder on paws	27.0
1553L	O 075	25/Apr/85	Pg. cal.	A	M	TD		30.0
1548L	O 050	26/Apr/85	Pg. cal.	A	M	TD	gray dust on paws	27.0
0114L	P 100	05/Jun/85	Pg. cal.	A	F	LAC		25.5
1549L	N 025	04/Apr/85	Pm. man.	A	M	TD		19.0
1549L	N 025	05/Apr/85	Pm. man.	A	M	TD		18.5
1549L	N 025	06/Apr/85	Pm. man.	A	M	TND		17.0
1549L	N 025	25/Apr/85	Pm. man.	A	M	TD		18.5

Table 5. Trapping dates, number of trap nights (TN) exerted per trapping session, and the relative ease of capturing individuals of each small mammal species (expressed as the number of trap nights required to capture one individual) on plot QRS in 1984. Refer to Table 1 for an explanation of species abbreviations used in this table.

PLOT	DATE	#T.N.	#TN/Dh.mor.	#TN/Pg.cal.
QRS	23/MAR/84			
	24/MAR/84			
Σ		59	19.67	29.50
QRS	27/APR/84			
	28/APR/84			
Σ		60	12.00	
QRS	25/MAY/84			
	26/MAY/84			
Σ		60	12.00	
QRS	19/JUN/84			
	20/JUN/84			
	21/JUN/84			
Σ		89	89.00	
QRS	10/JUL/84			
	11/JUL/84			
	12/JUL/84			
	13/JUL/84			
Σ		118	118.00	
QRS	2/AUG/84			
	3/AUG/84			
Σ		59	59.00	
QRS	4/SEP/84			
	5/SEP/84			
Σ		60		
QRS	17/OCT/84			
	18/OCT/84			
Σ		57		

Table 6. Detailed trapping data collected from all animals captured on plot QRS in 1984. Refer to Table 2 for an explanation of the abbreviations used in this table.

TAG #	STA	DATE 1	SPECIES	AGE	SEX	BR. CND.	NOTES	WT(g)
0501R	S 025	23/Mar/84	Dh. mor.	A	F	NL	175/38/16	58.0
1123R	R 100	23/Mar/84	Dh. mor.	A	F	NL	Inj. L. Sh. Dark, inc. H. S(35-50%)	46.0
1123R	Q 075	24/Mar/84	Dh. mor.	A	F	NL	Wnd. Healed	44.0
0501R	R 025	27/Apr/84	Dh. mor.	A	F	LAC		66.0
1123R	Q 100	27/Apr/84	Dh. mor.	A	F	PLAC	160/37/14	49.5
1128L	S 000	27/Apr/84	Dh. mor.	A	F	NL	Dark, Inc. H. S. (65%)	64.0
0501R	Q 050	28/Apr/84	Dh. mor.	A	F	LAC		66.0
1123R	Q 100	28/Apr/84	Dh. mor.	A	F	NL		46.0
1128L	S 000	25/May/84	Dh. mor.	A	F	NL		60.0
1170L	R 025	25/May/84	Dh. mor.	J	F	NL	Gray, Inc. H. S. (50%)	32.5
0501R	R 025	26/May/84	Dh. mor.	A	F	LAC	Dark, Inc. H. S. (33%)	58.0
1123R	Q 100	26/May/84	Dh. mor.	A	F	NL	Dark, Inc. H. S. (50%)	50.0
1170L	R 025	26/May/84	Dh. mor.	J	F	NL	Dark, Inc. H. S. (66%)	32.0
1123R	R 050	19/Jun/84	Dh. mor.	A	F	VPLG	CAP. BREED 165/36/16 VagPlug	51.0
0501R	S 025	13/Jul/84	Dh. mor.	A	F	NL	CAP. BRD. STOCK	68.0
1391L	R 025	02/Aug/84	Dh. mor.	SUBA	F	NL	CAP. BRD. Dark, Inc. H. S. (33%)	54.0
1124R	Q 075	23/Mar/84	Pg. cal.	A	M	TND		24.0
1124R	Q 075	24/Mar/84	Pg. cal.	A	M	TD		25.0

Table 7. Detailed trapping data collected from all animals captured on plot QRS in 1985. Refer to Table 2 for an explanation of the abbreviations used in this table.

TAG #	STA	DATE 1	SPECIES	AGE	SEX	BR. CND.	NOTES	WT(g)
1540L	R 025	04/Apr/85	Dh. mor.	SUBA	M	TD	CAP. BRD. 140/39/14; INC. HS. DARK	43.0
1542L	S 025	04/Apr/85	Dh. mor.	A	F	PLAC	CAP. BRD. 167/36/14; INC. HS. LIGH	65.0
1412R	S 050	06/Apr/85	Dh. mor.	SUBA	F	NL	139/39/14; INC(40%)H. S. DARK	37.0
0115L	S 050	24/Apr/85	Dh. mor.	A	F	NL	GROGY. 160/41/15; INC. H. S. LIGHT	66.0
0115L	S 050	25/Apr/85	Dh. mor.	A	F	NL	BURROW 3M S. S050; ACTIVE	65.0
1552L	S 000	25/Apr/85	Dh. mor.	SUBA	F	NL	150/42/16; INC. H. S. DARK, CstSpt	56.0
0115L	S 025	26/Apr/85	Dh. mor.	A	F	NL	BLOOD-NOSE	63.0
1552L	Q 000	26/Apr/85	Dh. mor.	SUBA	F	NL		56.0
0115L	S 000	05/Jun/85	Dh. mor.	A	F	PREG	?BR. COND? ESC., 60+g.	
1594L	R 025	05/Jun/85	Dh. mor.	A	M	TD	180/40/15; INC(50%)H. S. LIGHTER	73.0
1595L	R 025	05/Jun/85	Dh. mor.	J	F	NL	117/38/14. INC. (40%)H. S. DARK	28.0
0115L	S 000	06/Jun/85	Dh. mor.	A	F	PLAC		69.0
1415L	S 050	06/Jun/85	Dh. mor.	SUBA	M	TND	110/39/12; INC. (30%)H. S. DARK	30.5
1595L	R 025	06/Jun/85	Dh. mor.	SUBA	F	NL		27.5
0115L	S 000	07/Jun/85	Dh. mor.	A	F	PLAC		69.0
1538L	Q 000	04/Apr/85	Pg. cal.	A	M	TD		22.5
1543L	R 075	04/Apr/85	Pg. cal.	A	M	TND	FUNGUS-TAIL	22.5
1538L	Q 000	05/Apr/85	Pg. cal.	A	M	TD		23.5
1543L	Q 050	24/Apr/85	Pg. cal.	A	M	TD		21.0

Table 8. Detailed trapping data collected from all animals captured on plot KKLLMM in 1985. Refer to Table 2 for an explanation of the abbreviations used in this table.

TAG #	STA	DATE 1	SPECIES	AGE	SEX	BR. CND.	NOTES	WT(g)
1456L	LL200	20/Aug/85	Dh. mor.	A	F	NL	MOLTING, ESC., 50+g	
1468L	KK100	20/Aug/85	Dh. mor.	A	M	TD	MOLTING	61.0
1582L	LL150	20/Aug/85	Dh. mor.	A	M	TD	SHAKING	59.0
1691L	KK175	20/Aug/85	Dh. mor.	SUBA	F	NL	142/39/12; INC(50%)H.S.DARK	42.0
1695L	KK100	20/Aug/85	Dh. mor.	A	F	NL	162/38/14, INC(40%)H.S.DARK	50.0
1417L	LL050	21/Aug/85	Dh. mor.	A	M	TD	WET RUMP	63.0
1468L	KK125	21/Aug/85	Dh. mor.	A	M	TD	MOLTING	60.0
1582L	LL175	21/Aug/85	Dh. mor.	A	M	TD	FLEAS	65.0
1691L	KK175	21/Aug/85	Dh. mor.	SUBA	F	NL	FLEAS	43.0
1695L	KK100	21/Aug/85	Dh. mor.	SUBA	F	NL	MOLTING	51.0
1465L	LL175	22/Aug/85	Dh. mor.	SUBA	F	NL	MOLTING	49.5
1468L	KK100	22/Aug/85	Dh. mor.	A	M	TD	MOLTING->LITE COLOR	61.0
1582L	LL175	22/Aug/85	Dh. mor.	A	M	TD		63.0
1691L	KK200	22/Aug/85	Dh. mor.	SUBA	F	NL	FLEAS	43.0
1695L	KK100	22/Aug/85	Dh. mor.	A	F	NL	MOLTING	51.0
1840L	KK025	22/Aug/85	Dh. mor.	A	M	TD	162/41/13; INC(60%)H.S.DARK	51.0
1478L	LL075	20/Aug/85	Pg. cal.	A	F	NL		20.0
1689L	KK200	20/Aug/85	Pg. cal.	A	F	NL		20.0
1692L	KK150	20/Aug/85	Pg. cal.	SUBA	F	NL	Short Rump Bristles	17.5
1696L	KK025	20/Aug/85	Pg. cal.	A	F	PLAC		24.0
1478L	LL075	21/Aug/85	Pg. cal.	A	F	NL		19.5
1689L	KK200	21/Aug/85	Pg. cal.	A	F	NL		20.0
1692L	KK150	21/Aug/85	Pg. cal.	A	F	NL		17.0
1694L	LL100	21/Aug/85	Pg. cal.	A	M	TD		21.5
1696L	KK025	21/Aug/85	Pg. cal.	A	F	NL		23.5
1698L	LL175	21/Aug/85	Pg. cal.	A	M	TND		23.5
1700L	KK125	21/Aug/85	Pg. cal.	A	M	TD		27.5
1836L	KK075	21/Aug/85	Pg. cal.	A	M	TD		23.0
1837L	KK000	21/Aug/85	Pg. cal.	A	F	NL		19.5
1478L	KK075	22/Aug/85	Pg. cal.	A	F	NL		19.0
1689L	KK200	22/Aug/85	Pg. cal.	A	F	NL		20.0
1692L	KK150	22/Aug/85	Pg. cal.	A	F	NL		18.0
1837L	KK000	22/Aug/85	Pg. cal.	A	F	NL		19.5

POPULATION ESTIMATION

Dipodomys heermanni morroensis

The single Morro Bay kangaroo rat caught on plot NOP in 1984 was insufficient to estimate population size using the Schnabel and Schumacher / Eschmeyer techniques.

The population size of Morro Bay kangaroo rats on plot QRS in 1984 ranged from 2 animals in April to 6 animals in June (Table 9). Although a few rats were caught later in the season, their numbers were insufficient for conventional population estimation techniques. The estimated numbers of Morro Bay kangaroo rats on plot QRS in 1985 ranged from 2 animals in late April to 5 animals in June. The relatively large standard errors on all of the estimates produced unusual 95% confidence intervals which, in one case, ranged from minus 10 animals to plus 22 animals.

The largest population estimate of Morro Bay kangaroo rats ranged from 8 to 9 animals on plot KKLLMM in August, 1985 (Table 9). The 95% confidence intervals for both of these estimates are included within a range of 1 to 15 animals. This figure is inflated when compared to the other 2 plots because it is a population estimate for a 1 ha plot compared to the estimates (above) for plots NOP and QRS which are both 1/2 ha plots.

Perognathus californicus

The population size of pocket mice on plot NOP ranged from 2 to 3 animals in 1984 and was 4 animals in 1985, on those months when sufficient numbers were captured (Table 9). Like Morro Bay kangaroo rats, the standard errors for population estimates of pocket mice also were high which produced unusual 95% confidence intervals containing negative numbers.

Although pocket mice did occur on plot QRS, there were too few captured in either year to conduct conventional population estimates. Without looking further, it might appear that some sort of inhibitory or mutually exclusive relationship exists between Morro Bay kangaroo rats and pocket mice such that when there are few Morro Bay kangaroo rats there are more pocket mice (e.g. plot NOP in both 1984 and 1985) and/or conversely when there are few pocket mice there are more Morro Bay kangaroo rats (e.g. plot QRS in both years). While there may be some negative relationship between Morro Bay kangaroo rats and other small mammal species, it is not as simple as suggested above.

Plot KKLLMM, which is twice as large as plots NOP and QRS, supported the largest population of pocket mice (13 animals) as well as the largest population of Morro Bay kangaroo rats (8–9 animals) at Bayview in 1985 (Table 9). The presence of both these species in good numbers suggests that any hypothesis concerning inhibitory relationships between Morro Bay kangaroo rats and pocket mouse cannot be supported.

Peromyscus maniculatus

One deer mouse was captured once on plot NOP in 1984 and a different individual was captured 4 times on plot NOP in 1985. The 1985 recapture data permitted calculation of a population estimate of 1 animal.

Table 9. Estimated population size of those species present on each of the 3 plots for which more than 1 individual was captured during a trapping session. Schnabel population estimates, standard errors of the the Schnabel estimates (S.E. N̂), and corresponding Schumacher / Eschmeyer population estimates (N̂ SCH/ESC) are given in the last 3 columns, respectively. Refer to Table 1 for an explanation of species abbreviations used in this table.

PLOT	SPECIES	DATE	#CAUGHT	#NEW MRKD.	#RECAP(m̂)	N̂(SCHNABEL)	S.E.-N̂	N̂ SCH/ESC
NOP	Pg. cal.	27/ 4/84	3	3	0			
		28/ 4/84	1	0	1	3.00	3.97	3.00
NOP	Pg. cal.	20/ 6/84	1	1	0			
		21/ 6/84	2	1	1	2.00	2.65	2.00
NOP	Pg. cal.	10/ 7/84	1	1	0			
		11/ 7/84	2	1	1	2.00	2.65	
		12/ 7/84	2	0	2	2.00	1.37	
		13/ 7/84	1	0	1	2.00	1.15	2.00
NOP	Pg. cal.	4/ 4/85	4	4	0			
		5/ 4/85	2	0	2	4.00	3.53	
		6/ 4/85	2	0	2	4.00	2.29	4.00
NOP	Pg. cal.	24/ 4/85	3	3	0			
		25/ 4/85	4	1	3	4.00	2.74	
		26/ 4/85	1	0	1	4.00	2.29	4.00
NOP	Pm. man.	4/ 4/85	1	1	0			
		5/ 4/85	1	0	1	1.00	1.32	
		6/ 4/85	1	0	1	1.00	.88	1.00
QRS	Dh. mor.	23/ 3/84	2	2	0			
		24/ 3/84	1	0	1	2.00	2.65	2.00
QRS	Dh. mor.	27/ 4/84	3	3	0			
		28/ 4/84	2	0	2	3.00	2.65	3.00
QRS	Dh. mor.	25/ 5/84	2	2	0			
		26/ 5/84	3	2	1	6.00	7.94	6.00
QRS	Dh. mor.	4/ 4/85	2	2	0			
		6/ 4/85	1	1	0			
QRS	Dh. mor.	24/ 4/85	1	1	0			
		25/ 4/85	2	1	1	2.00	2.65	
		26/ 4/85	2	0	2	2.00	1.37	2.00
QRS	Dh. mor.	5/ 6/85	3	3	0			
		6/ 6/85	3	1	2	4.50	3.97	
		7/ 6/85	1	0	1	4.33	2.97	4.30
KKLLMM	Pg. cal.	20/ 8/85	7	7	0	.00	.00	
		21/ 8/85	11	5	6	12.83	5.76	
		22/ 8/85	8	1	7	13.31	3.85	13.42
KKLLMM	Dh. mor.	20/ 8/85	8	8	0	.00	.00	
		21/ 8/85	6	0	6	8.00	3.59	
		22/ 8/85	7	1	6	8.67	2.62	8.67

It is particularly interesting to note that deer mice were not captured on plot QRS in 1984 or 1985 nor were they captured on plot KKLLMM in 1985. Although this pattern suggests (weakly) that deer mice and Morro Bay kangaroo rats might be mutually incompatible, it does not disprove the hypothesis that the habitat on plots QRS and KKLLMM is simply unsuitable for deer mice.

Peromyscus californicus and Peromyscus boylii

One California mouse and 2 brush mice were captured on plot NOP in 1984, but neither species was caught on other plots in 1984 and/or 1985. The occurrence of these 2 species of *Peromyscus* on the plot with the fewest Morro Bay kangaroo rats (1 in 1984 only) and the absence of these 2 species from those plots having greater numbers of Morro Bay kangaroo rats (QRS and KKLLMM) follows the same pattern as that observed in deer mice. However, unlike deer mice which appear to have a broad range of habitat preference, California mice and brush mice typically occur in tall, dense brush and tree—covered sites in the coastal region of San Luis Obispo County. Since these habitat types occur on and adjacent to plot NOP it is not surprising to find these two larger species of *Peromyscus* on the plot.

DENSITY ESTIMATION

Like population estimates, estimates of density are limited because of insufficient numbers of animals during some of the trapping sessions. The modified method of density estimation developed by Roest (1982) is useful under these circumstances because it enables one to estimate density even when only a single animal is captured. The disadvantage of this latter method is that there is no obvious way to determine confidence intervals around the estimates. Furthermore, when a large number of animals are recaptured during consecutive days of a trapping session, the Roest method, which is not designed to handle data from consecutive trapping days, gives inflated values for density. Since the density estimates obtained from the Schnabel method are based upon different data than those obtained from the Roest method, I decided to compare the degree of disparity between the two methods before including both in the results. The densities of Morro Bay kangaroo rats obtained from the two methods agreed fairly well (Fig. 2). Although the degree of variability between the two methods tended to increase with larger values of density, the correlation coefficient ($r = .87$) was significant ($p<.01$, $df=7$). Both methods will be presented below and densities values will be designated with either an "S" (Schnabel) or an "R" (Roest) to indicate the basis of the calculation.

POOLED DATA FOR 1984 AND 1985 FROM ALL 3 BAYVIEW PLOTS

Before considedring differences in the densities of small mammals on the three Bayview plots, it is instructive to look at the general patterns which emerge from the pooled data. Average densities (number of individuals / ha) $\pm$ 1 standard deviation along with the sample size is given for estimates derived from both estimation methods when possible.

Dipodomys heermanni morroensis: Average densities for Morro Bay kangaroo rats at Bayview were 3.97 $\pm$3.48, n=12 (R) and 3.92 $\pm$ 1.57, n=9 (S).

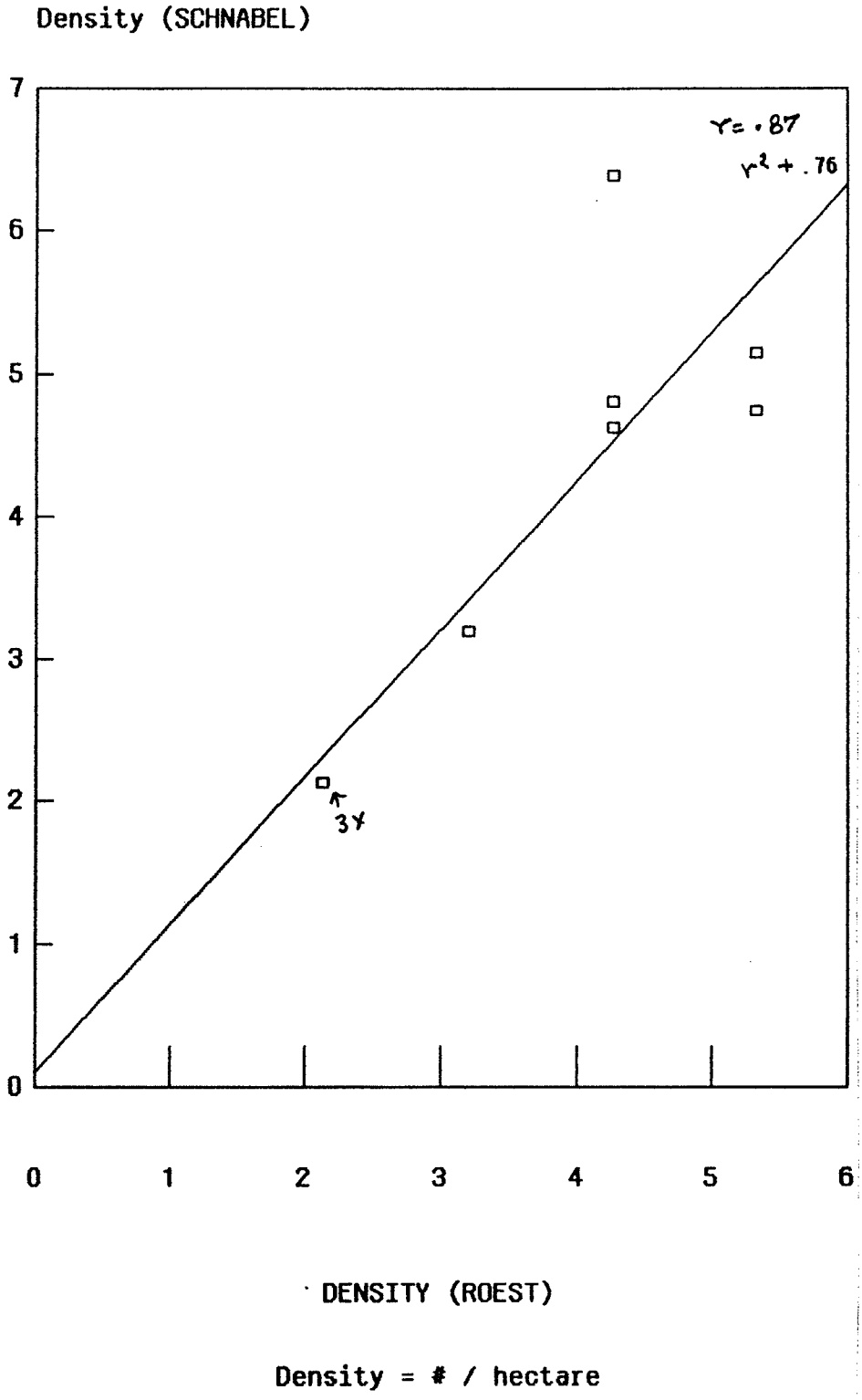


Figure 2. Linear regression comparison of population density estimates for Morro Bay Kangaroo Rats on plots NOP, QRS, and KKLLMM at the Bayview site in 1984 and 1985 using the Schnabel method and an adaptation of a method described by Roest (1982). The correlation coefficient, + .87, is significant ($p<.01$, $df = 7$).

Perognathus californicus: Average densities for pocket mice at Bayview were 5.38 ± 4.47, n=10 (R) and 4.03 ± 2.07, n=11 (S).

Peromyscus boylii: Average density for brush mice at Bayview was 1.07 ± 0, n=2 (R).

Peromyscus californicus: Average density of California mice at Bayview was 1.42 ± 0.62, n=3 (R).

Peromyscus maniculatus: Average densities of deer mice at Bayview were 1.78 ± 1.23, n=3 (R) and 1.07 ± 0, n=2 (S).

PLOT NOP

The average density of pocket mice on plot NOP in 1984 was 2.7 (S) / 4.6 (R) individuals / ha (Table 10). California mice ranked second with an average density of 1.8 (R) individuals / ha. Morro Bay kangaroo rats, brush mice, and deer mice all ranked third with densities of 1.1 (R) individuals / ha, respectively.

The average density of pocket mice on plot NOP increased to 4.3 (S) / 6.0 (R) individuals / ha in 1985 (Table 11). The average density of deer mice on plot NOP remained about the same at 1.1 (S) / 2.1 (R) individuals / ha in 1985. Morro Bay kangaroo rats, brush mice, and California mice were not trapped on plot NOP in 1985.

PLOT QRS

The average density of Morro Bay kangaroo rats on plot QRS in 1984 was 2.9 (R) / 3.9 (S) individuals / ha (Table 12). Pocket mice ranked second with a density of 2.1 (R) individuals / ha.

The average density of Morro Bay kangaroo rats on plot QRS increased to 3.4 (S) / 5.3 (R) individuals / ha in 1985 (Table 11). The average density of pocket mice on plot QRS remained about the same at 2.13 (R) in 1985.

PLOT KKLLMM

The average density of pocket mice on plot KKLLMM in 1985 was 7.8 (S) / 15.4 (R) individuals / ha. Morro Bay kangaroo rats had an average density of 4.9 (S) / 12.4 (R) individuals / ha on plot KKLLMM in 1985. Since the high densities obtained from the Roest method are a result of high recapture rates in both species, the values obtained from the Schnabel method are considered to be more realistic estimates of density.

DISTRIBUTION OF SMALL MAMMALS ON THE STUDY PLOTS

PLOT NOP

The diversity of species captured on plot NOP in 1984, reached a maximum of 5 species and each species seemed to occupy more or less exclusive trap stations (Fig. 3.) The one instance in which two different species were captured at the same trap station involved a pocket mouse and a brush mouse. No other small mammal species were captured at stations where a single Morro Bay kangaroo rat was captured; however this also was true of the single deer mouse.

Table 10. Monthly density estimates (number of individuals / hectare) of all small mammal species captured on plot NOP in 1984. Estimates under those columns indicated by (ROEST) are based upon an adaptation of a density estimation method described by Roest (1982); whereas estimates under columns indicated by (SCHNABEL) are based upon standard Schnabel population estimation methods. Refer to Table 1 for an explanation of species abbreviations used in this table.

		AREA	Dh. mor.	Pg.cal.	Pg.cal.	Pm. boy.	Pm. cal.	Pm. man.
		TRAPPED	(#/ha)	(#/ha)	(#/ha)	(#/ha)	(#/ha)	(#/ha)
PLOT	DATE	(ha)	(ROEST)	(ROEST)	(SCHNABEL)	(ROEST)	(ROEST)	(ROEST)
NOP	23/MAR/84							
	24/MAR/84							
		.9375	1.07				2.13	
NOP	27/APR/84							
	28/APR/84				3.20			
		.9375	1.07	4.27		1.07	1.07	
NOP	25/MAY/84							
	26/MAY/84							
		.9375				1.07		
NOP	19/JUN/84							
	20/JUN/84							
	21/JUN/84				2.13			
		.9375		3.20				
NOP	10/JUL/84							
	11/JUL/84				2.13			
	12/JUL/84				2.13			
	13/JUL/84				2.13			
		.9375		6.40				
NOP	2/AUG/84							
	3/AUG/84							
		.9375						
NOP	4/SEP/84							
	5/SEP/84							
		.9375						
NOP	17/OCT/84							
	18/OCT/84							
		.9375					1.07	1.07

Table 11. Monthly density estimates (number of individuals / hectare) of all small mammal species captured on plots NOP, QRS, and KKLLMM in 1985. Estimates under those columns indicated by (ROEST) are based upon an adaptation of a density estimation method described by Roest (1982); whereas estimates under columns indicated by (SCHNABEL) are based upon standard Schnabel population estimation methods. Refer to Table 1 for an explanation of species abbreviations used in this table.

PLOT	DATE	AREA TRAPPED (ha)	Dh. mor. (#/ha) (ROEST)	Dh. mor. (#/ha) (SCHNABEL)	Pg.cal. (#/ha) (ROEST)	Pg.cal. (#/ha) (SCHNABEL)	Pm. man. (#/ha) (ROEST)	Pm. man. (#/ha) (SCHNABEL)
NOP	4/APR/85							
	5/APR/85					4.27		1.07
	6/APR/85					4.27		1.07
		.9375			8.53		3.20	
NOP	24/APR/85							
	25/APR/85					4.27		
	26/APR/85					4.27		
		.9375			8.53		1.07	
NOP	5/JUN/85							
	6/JUN/85							
		.9375			1.07			
QRS	4/APR/85							
	5/APR/85							
	6/APR/85							
		.9375	3.20		3.20			
QRS	24/APR/85							
	25/APR/85			2.13				
	26/APR/85			2.13				
		.9375	5.33		1.07			
QRS	5/JUN/85							
	6/JUN/85			4.80				
	7/JUN/85			4.62				
		.9375	7.47					
KKLLMM	20/AUG/85							
	21/AUG/85			4.74		7.60		
	22/AUG/85			5.14		7.89		
		1.6875	12.44		15.41			

Table 12. Monthly density estimates (number of individuals / hectare) of all small mammal species captured on plot QRS in 1984. Estimates under those columns indicated by (ROEST) are based upon an adaptation of a density estimation method described by Roest (1982); whereas estimates under columns indicated by (SCHNABEL) are based upon standard Schnabel population estimation methods. Refer to Table 1 for an explanation of species abbreviations used in this table.

PLOT	DATE	AREA TRAPPED (ha)	Dh. mor. (#/ha) (ROEST)	Dh. mor. (#/ha) (SCHNABEL)	Pg. cal. (#/ha) (ROEST)	Pg. cal. (#/ha) (SCHNABEL)
QRS	23/MAR/84					
	24/MAR/84			2.13		
		.9375	3.20		2.13	
QRS	27/APR/84					
	28/APR/84			3.20		
		.9375	5.33			
QRS	25/MAY/84					
	26/MAY/84			6.40		
		.9375	5.33			
QRS	19/JUN/84					
	20/JUN/84					
	21/JUN/84					
		.9375	1.07			
QRS	10/JUL/84					
	11/JUL/84					
	12/JUL/84					
	13/JUL/84					
		.9375	1.07			
QRS	2/AUG/84					
	3/AUG/84					
		.9375	1.07			
QRS	4/SEP/84					
	5/SEP/84					
		.9375				
QRS	17/OCT/84					
	18/OCT/84					
		.9375				

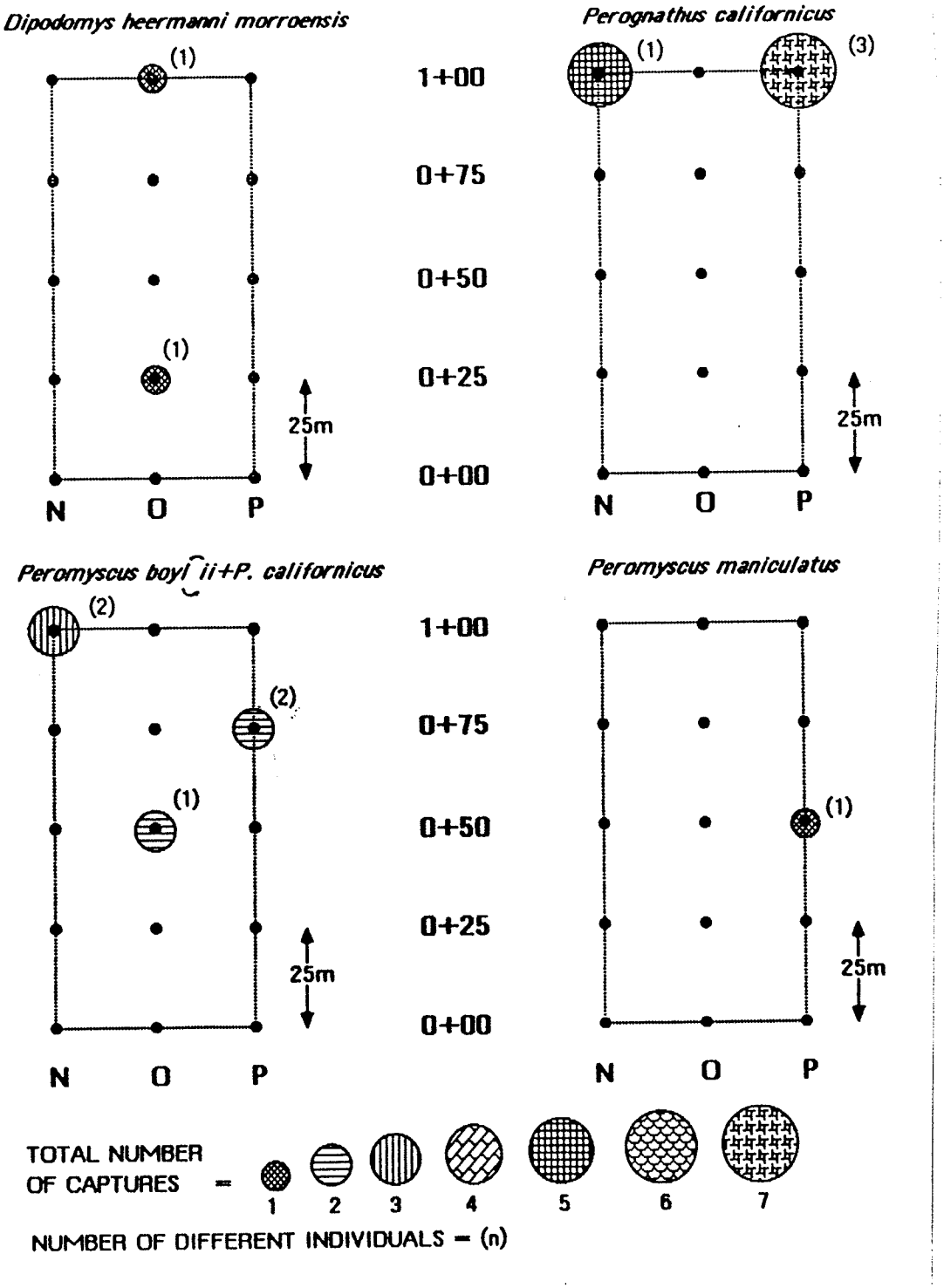


Figure 3. Distribution of small mammal captures on plot NOP (0.5 hectare) at the Bayview site in 1984.

Species diversity dropped substantially on plot NOP in 1985. Only 2 species were trapped on the plot and they occupied completely exclusive trap stations (Fig. 4). Pocket mice occupied the same half of the plot as they did in 1984, but they were trapped at more sites in 1985 than in 1984. A single deer mouse was repeatedly captured at one station which was in the half of the plot not used by pocket mice. Morro Bay kangaroo rats, brush mice, and California mice, species which had been present in 1984, were absent from plot NOP in 1985.

PLOT QRS

Plot QRS was dominated by Morro Bay kangaroo rats in 1984. Eight of the 15 trap stations were used by Morro Bay kangaroo rats; whereas only one of the 15 stations was used by a pocket mouse (Fig. 5). Although the pocket mouse was not caught at a station which received a high incidence of kangaroo rat use, one kangaroo rat was caught once at the same station during the period of the study.

Species diversity on plot QRS remained at 2 species in 1985. Morro Bay kangaroo rats still dominated the plot, however their pattern of captures was restricted to fewer stations (5 out of 15) than in 1984. The pattern of space use by the few pocket mice on the plot showed a weak overlap with Morro Bay kangaroo rats, but pocket mice were not captured at stations which were used repeatedly by Morro Bay kangaroo rats.

PLOT KKLLMM

Like plot QRS, only 2 species were captured on plot KKLLMM: Morro Bay kangaroo rats and pocket mice (Fig. 6). Although Morro Bay kangaroo rats were moderately abundant on plot KKLLMM, pocket mice were even more abundant. The two species were trapped over much of the study plot (13 of 27 stations for Morro Bay kangaroo rats and 15 of 27 stations for pocket mice). The fact that individuals of both species were captured at 5 different stations on the plot suggests that these two species are somewhat compatible in the habitat encompassed by the plot.

The general patterns that emerge from the examination of species distributions by trap sites are: (1) when Morro Bay kangaroo rats occur at moderate or high densities on a plot, pocket mice are likely to be the only other small mammal species to occur at moderate densities on the same plot; (2) when Morro Bay kangaroo rats occur at low densities on a plot, pocket mice as well as deer mice, brush mice, and California mice also may occur at low densities on the same plot; (3) there appears to be a low to moderate degree of compatibility between Morro Bay kangaroo rats and pocket mice. It is not possible to evaluate the degree of compatibility between Morro Bay kangaroo rats and the other 3 species of small mammals (above) because there were too few observations of such species assembleges in the same study plot.

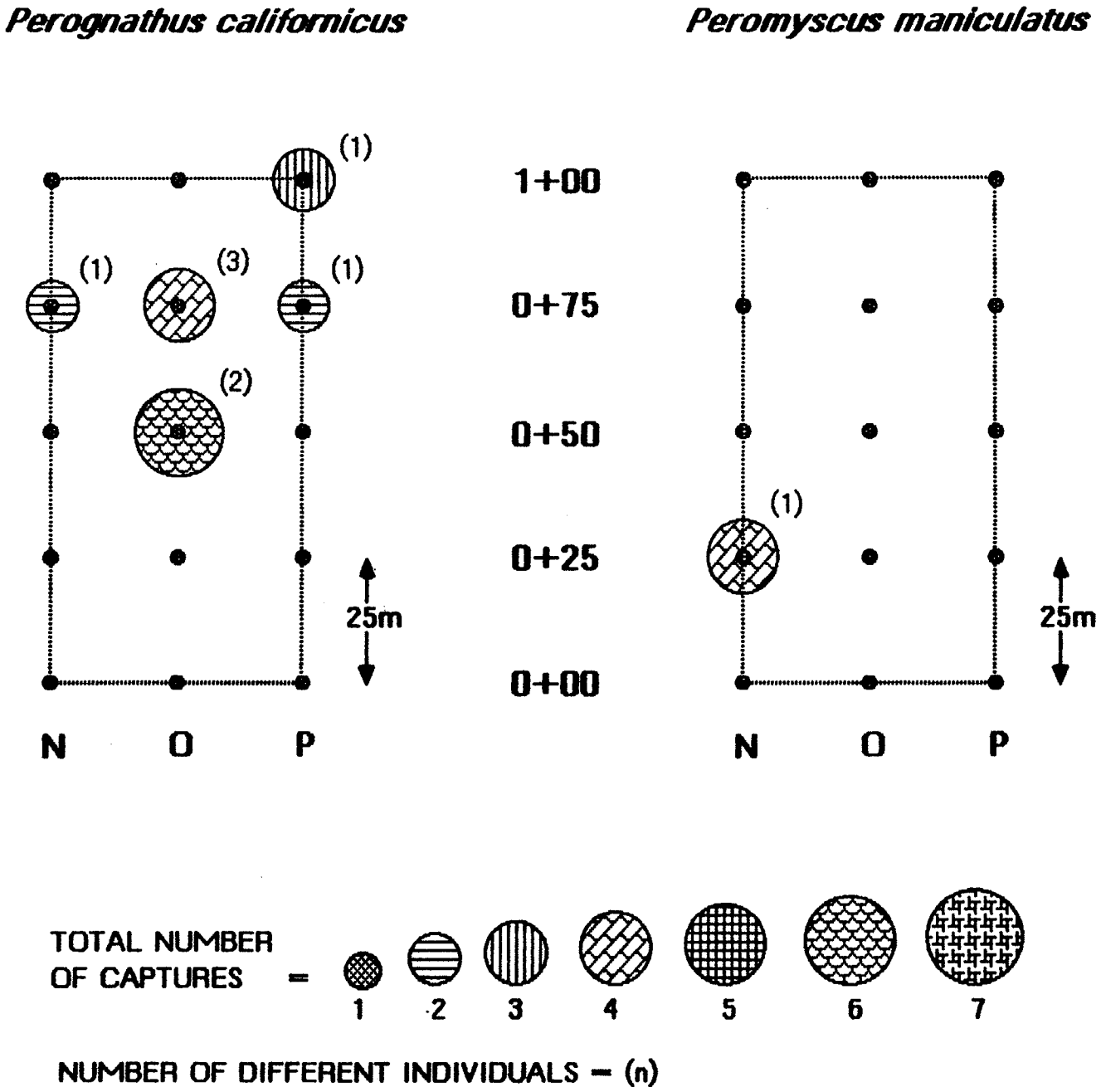


Figure 4. Distribution of small mammal captures on plot NOP (0.5 hectare) at the Bayview site in 1985.

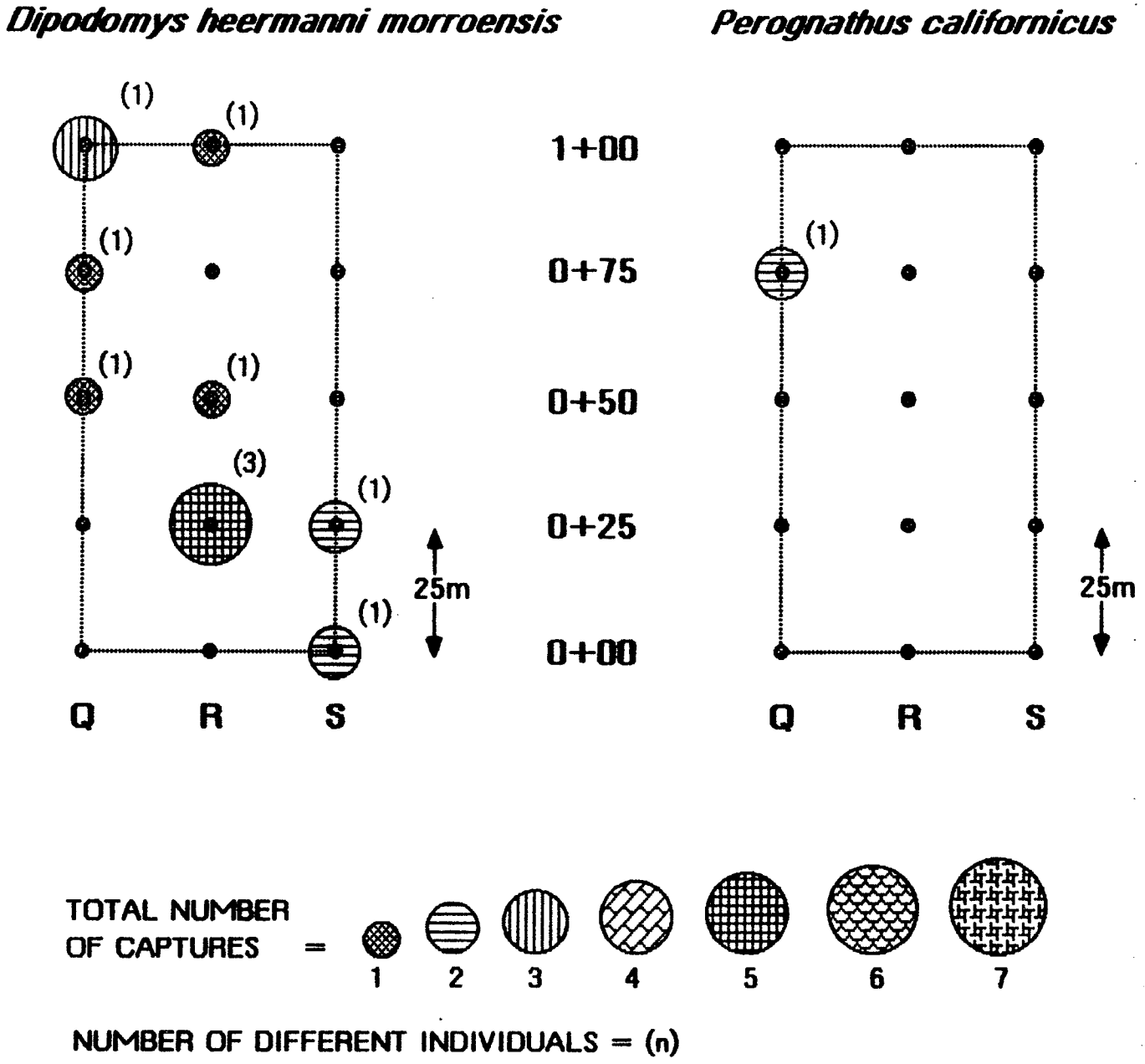


Figure 5. Distribution of small mammal captures on plot QRS (0.5 hectare) at the Bayview site in 1984.

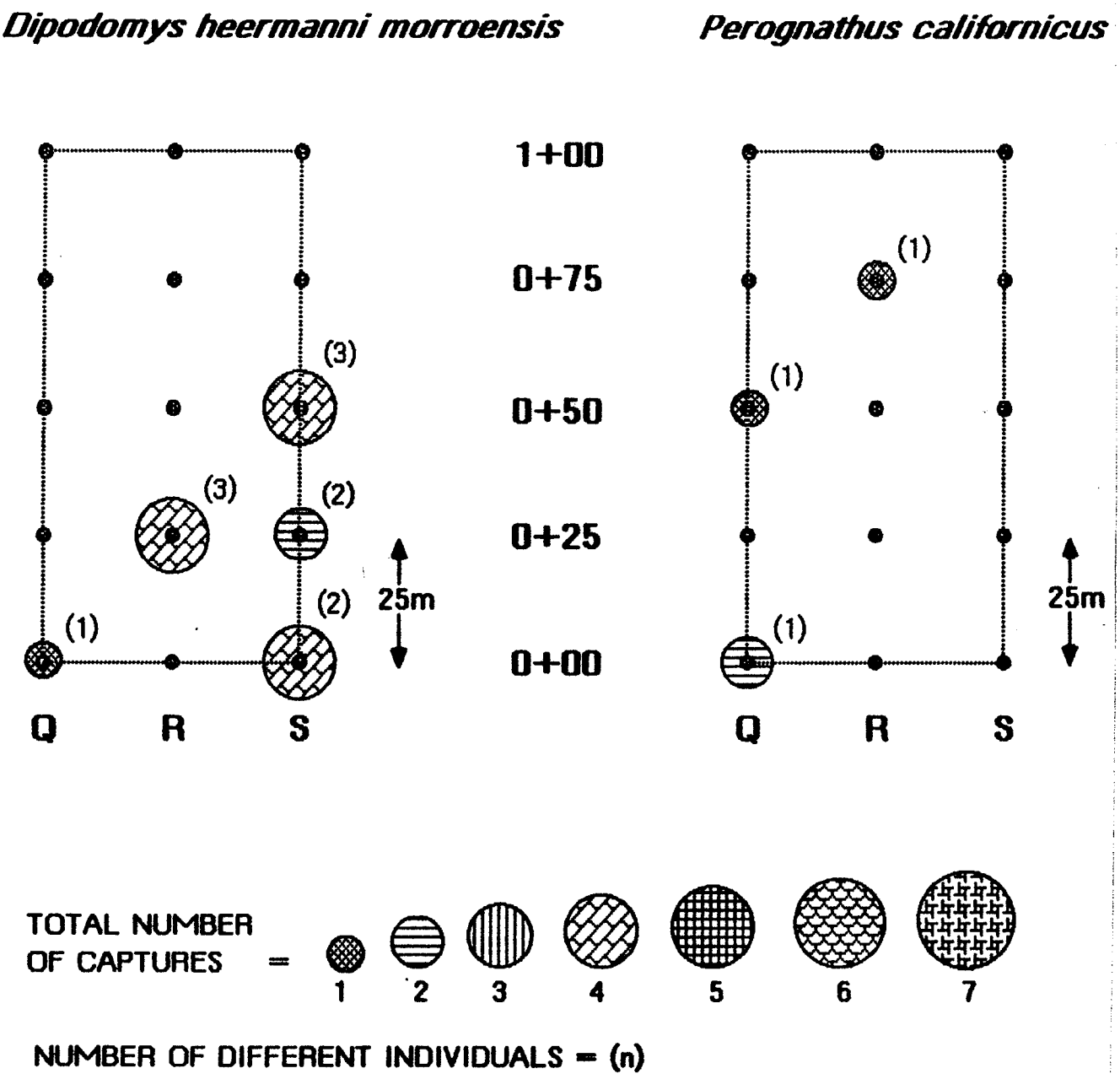


Figure 6. Distribution of small mammal captures on plot QRS (0.5 hectare) at the Bayview site in 1985.

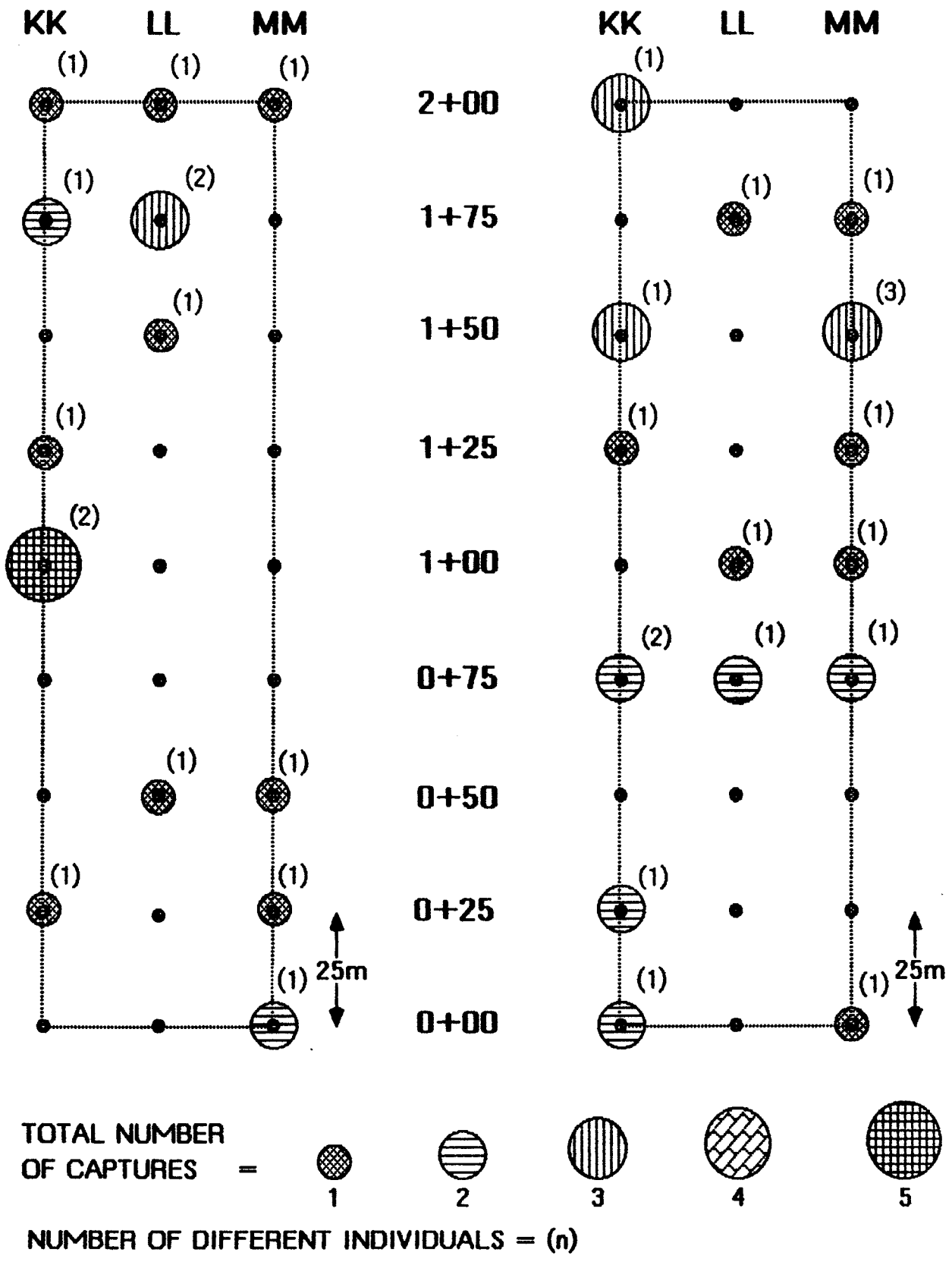


Figure 7. Distribution of small mammal captures on plot KKLLMM (1.0 hectare) at the Bayview site in 1985.

DISCUSSION

Previous studies of small mammals at the Bayview site in 1978/79 (Toyoshima 1983) found 4 species living in association with Morro Bay kangaroo rats — deer mouse (*Peromyscus maniculatus*), western harvest mouse (*Reithrodontomys megalotis*), California pocket mouse (*Perognathus californicus*), and California vole (*Microtus californicus*). Western harvest mice and California voles were not captured during the present study; however deer mice and California pocket mice were present on most of the study plots. The appearance of brush mice (*Peromyscus boylii*) and California mice (*Peromyscus californicus*) during the present study may indicate that the shrub canopy and the herbaceous understory at the Bayview site has become less suitable for Morro Bay kangaroo rats.

The relative ease of capturing Morro Bay kangaroo rats on the Bayview site in previous studies was: 29.9 TN/rat in 1971, (Congdon and Roest 1975); 30 TN/rat in 1977, (Roest 1977); and 15.2 TN/rat in 1978/79, (Toyoshima 1983). Relative ease of capturing Morro Bay kangaroo rats during each month of the present study varied from infinity at some times to as few as 7.52 TN/rat on plot KKLLMM in 1985. By pooling results from all plots and only considering the number of different Morro Bay kangaroo rats captured during the 2 years of the present study, the relative ease of capture can be more accurately compared to previous studies. In 1984, 6 individuals were captured over 1,109 trap nights which gives an overall ease of capture = 185 TN/rat. In 1985, 16 individuals were captured over 644 trap nights which gives an overall ease of capture = 40 TN/rat. It should be noted that half the animals captured in 1985 were trapped during 1, 3—night session on a new plot (KKLLMM) established during the summer of 1985. Even though there was considerable variation in the ease of capturing Morro Bay kangaroo rats on different plots and on different years, it is clear from the pooled results that they were substantially more difficult to trap in 1984 and 1985 than in previous studies.

Average density estimates from previous studies were calculated from total population estimates and estimated occupied range values presented by Roest (June 26, 1984, poster presented to the 64 th Annual Meeting of the American Society of Mammalogists at Humboldt State University, Arcata, CA). Using these figures, the following estimated average densities of Morro Bay kangaroo rats over the past 28 years are: 1957 — 14.1 rats/ha. (Stewart 1958); 1971 — 6.6 rats/ha. (Congdon and Roest 1975); 1977 — 14.1 rats/ha. (Roest 1977); 1978/79 — 3.4—13.3 rats/ha. (Toyoshima 1983); and 1984 — 2.5—6.3 rats/ha. (Roest loc. cit.). The average density obtained during the present study was 3.9 rats/ha. which is much less that estimates from 1957, 1971, and 1977; but within the ranges given for estimates from 1978/79 and 1984. Since there are only about 20 ha. which appear to support Morro Bay kangaroo rats at the Bayview site, the estimated population (based upon present density estimates) is about 80 animals.

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