TRANSLOCATION OF THE ENDANGERED SAN BERNARDINO KANGAROO RAT

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ABSTRACT: *Dipodomys merriami parvus* was listed as endangered by the U. S. Fish and Wildlife Service (USFWS) in September 1998 following its emergency listing of January 1998. A Biological Opinion issued by USFWS on a sand and gravel mining within Cajon Wash, an area of critical habitat, included translocation as a minimization measure. Preliminary to translocation, a salvage trapping effort was initiated in May 1998 to remove animals from a 32.5-ha site scheduled for mining operations. Fifteen *D. m. parvus* (11 males and 4 females) were captured and released on a re-vegetated reclamation site that contained a complement of native rodents including three resident *D. m. parvus*. All translocated animals were reproductively active. Translocation success was assessed in August 1998. Thirty-three percent of the original resident *D. m. parvus* and 40% of the translocated individuals were still present on the site. In contrast, among resident animals of other species, 57.1% of *Dipodomys simulans* and 15.4% of *Peromyscus maniculatus* remained on the site. Three juvenile *D. m. parvus*, apparently offspring from released animals, were captured in the release area. All adult *D. m. parvus* captured in August showed signs of reproductive activity, including evidence of a second litter in progress. Continued monitoring will verify the apparent short-term success of the translocation and suggest refinements for future efforts.

Key words: California, endangered species, *Dipodomys merriam parvus*, translocation.

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Federal listing of several species of rodents in southern California has resulted in the formation of preserves or other forms of habitat protection. Although these actions are important, ancillary actions are critical to the long-term maintenance and survival of the listed species. A monitoring program is essential to follow trends in key habitat features and population levels to provide the basis for making essential management decisions (O'Farrell and Stoddard 1993). The smaller and more isolated the management unit, the more difficult the maintenance of a healthy population.

Dipodomys merriami parvus was listed as endangered in September 1998 (USFWS 1998) following its emergency listing in January 1998 due to the estimated loss of 96% of the historic range, severe fragmentation of remaining populations, and habitat degradation within the extant localities. Of the 7 remaining known occupied sites, 4 are less than 8 ha. Approximately 35% of the remaining occupied habitat occurs within the Lytle and Cajon wash complex. These drainages are being extensively mined for sand and gravel. The mining company, CALMAT, has an active program of site reclamation in the form of reconstructed benches above and at the periphery of the active drainage (Mitrovich et al. 1999). After reconstruction, the benches were re-vegetated with species associated with alluvial fan sage scrub. A Biological Opinion (1-6-94-F- 51R1; 24 April 1998) issued by the USFWS provided the option of salvage-trapping animals from areas to be mined and translocation of those animals to reclaimed areas.

In spring 1998, the first parcel designated for new mining activity was identified. The purpose of this paper is to describe the salvage and translocation procedure, and provide a short-term assessment of the success of the translocation.

MATERIALS AND METHODS

I took a 3-part approach: 1) determine and describe existing conditions on a prepared reclamation site; 2) conduct salvage trapping and translocation of select species to the reclamation site; and 3) monitor the success of the translocation.

The reclamation site consisted of a reconstructed bench on the east side of Lytle Creek Wash, south of the confluence of this drainage with Cajon Wash, San Bernardino County, California. The site was examined visually for diagnostic surface sign (i.e., burrows, scat, runways, tracks, dust baths), following the methodology developed for the federally-endangered *Dipodomys stephensi* by O'Farrell and Uptain (1989). Sixteen permanent trap lines were established over the area to determine composition of rodent species. Trap lines were oriented east to west about 15 m apart and a single mesh live trap was placed at approximately 10-m intervals along each line for a total of 128 traps. Trapping was conducted for 3 consecutive nights during 23-25 May 1998. Traps were opened each afternoon and baited with a mixture of wild birdseed, crimped oats, and peanut butter. Traps were checked and closed at sunrise. All animals captured were identified to species and sex, toe-

clipped for future identification, assessed for reproductive condition and relative age, weighed, and released at the point of capture.

Salvage trapping was conducted on a 32.5-ha site in Cajon Wash approximately 4 km north of the reclamation site. The entire site was examined visually, as at the reclamation site. The area was heavily overgrown with dense shrubs and tree-like shrubs (e.g., *Ceanothus cuneatus, Rhamnus ilicifolia, Rhus integrifolia*) with only small patches of more open vegetation. No areas containing robust, dense patches of tree-like shrubs and *Toxicodendron diversilobum* were sampled. Traps were placed in roughly parallel lines approximately 15 m apart within the open patches. One mesh live-trap was placed at approximately 10-m intervals along each trap line for a total of 370 traps. Trapping was conducted for 5 consecutive nights during 26-30 May 1998 following the same protocol used on the reclamation site.

Because of their low abundance, *Chaetodipus fallax fallax* and *Reithrodontomys megalotis* were also translocated to the reclamation site. Other species were not translocated because either suitable habitat did not occur or well-established populations already existed on the reclamation site. Captured animals to be translocated were placed in holding cages (Emmerson and O'Farrell 1993), and held under constant temperature (24°C). Individuals of other species were removed from the site to improve the ability to trap the maximum number of target species. Animals captured during the first 4 nights were released at sunset on the fifth night (30 May). On the last night, traps were checked before sunrise and the few animals captured were released immediately on the reclamation site.

A short-term assessment of the success of the translocation effort was conducted 3 months following the release of salvage-trapped animals during 21-23 August 1998 using the above protocol.

RESULTS AND DISCUSSION

Pre-existing Conditions

The reclamation site chosen for release of salvage-trapped animals contained a reconstructed alluvial fan sage scrub species assemblage but did not have the diversity found in surrounding, undisturbed habitat. *Lepidospartum squamatum* and *Eriogonum fasciculatum* comprised the densest shrub elements. The soils over much of the upper bench were fine and gravelly, similar to those occupied by *D. m. parvus* elsewhere. The lower slopes dropping into the adjacent drainage were composed of silts and were dominated by extremely dense, robust Lotus scoparius and *Melilotus officinalis*.

The small mammal assemblage was consistent with naturally occurring alluvial fan sage scrub habitat (Table 1). The presence of low numbers of *D. m. parvus* indicated suitability of habitat within the reclamation site. The 3 captures occurred within the extreme northern portion of the reclamation site. The lack of widespread surface sign on other portions of the reclamation site suggested a slow rate of colonization of *D. m. parvus* from less disturbed habitat to the north of this re-created bench. Based on a visual examination of habitat quality and the presence of a very few existing *D. m. parvus* individuals, I decided that the habitat could support additional, salvaged animals.

Salvage Trapping

No visual sign of occupation by *D. m. parvus* was apparent on the salvage site except for the peripheral wash habitat. The species richness and composition of animals trapped on the salvage site (Table 1) was indicative of mature alluvial fan sage scrub grading into dense chaparral. The presence of *Neotoma lepida* and *Peromyscus californicus* resulted from dense shrubs and *Microtus californicus* from dense grass cover. Both shrub and grassland habitat features appeared to limit suitability for *D.m. parvus.* Large numbers of *P. maniculatus* and *D. simulans* were further evidence of well-developed shrubland. Nine of the 15 *D. m. parvus* captured were taken from the wash habitat at the periphery of the salvage site. That so few individuals were captured reinforced the visual assessment that the main salvage site was marginal habitat.

Cumulative capture rates remained steep for *D. simulans, P. maniculatus*, andI over the course of trapping. No *D. m. parvus* were captured on the fifth day but captures were too few to adequately evaluate efficacy of trapping. In general, a 5-day period to trap out a 32.5-ha site is not adequate. I encountered generally high rates of removal for most species. In salvage and translocation efforts, each species in the assemblage can be expected to demonstrate differential trap response (Calhoun 1964, Gentry et al. 1971). As animals are removed, more traps become available for species that may be reticent to immediately enter traps. I found that some species (e.g., *M. californicus*) did not appear in traps for several nights. Other species (e.g., *P. l. brevinasus*) may have been present but not trappable within the time available.

It is noteworthy that the majority of captures occurred on the second night for *P. californicus*, the third night for *C. fallax*, and the fifth night for *R. megalotis*. I found a tendency for a greater proportion of juveniles to be captured as the trap out progressed (*D. simulans* - 2.9, 10.5, 5.7, 11.4, and 38.9% for nights 1-5, respectively; *P. maniculatus* - 14.9, 18.6, 29.1, 48.1, and 32.5% for nights 1-5, respectively). I also found that adults comprised the majority of first animals captured. As adults were removed, the proportion of juveniles increased. Similar age differentials in trappability have been docu-

Table 1. Summary of sex ratio, age structure, and reproductive condition for small mammals captured on the CALMAT salvage and reclamation site, May and August 1998. M = Male; F = Female; SCR = Scrotal; EST = Estrus; PREG = Pregnant; LACT = Lactating.

		Sex Ratio/Age Structure				Reproductive Condition			
		Adult		Juvenile		Male	Female		
Species	**Total**	**M**	**F**	**M**	**F**	**SCR**	**EST**	**PREG**	**LACT**
				May (Reclamation Site)					
Dipodomys merriami	3	2	1	0	0	1	0	1	0
Dipodomys simulans	14	7	7	0	0	2	2	3	2
Peromyscus maniculatus	39	13	14	7	5	10	0	4	5
Reithrodontomys megalotis	2	0	2	0	0	0	0	1	0
				May (Salvage Site)					
Chaetodipus fallax	8	6	2	0	0	5	0	1	1
Dipodomys merriami	15	9	3	2	1	8	1	2	1
Dipodomys simulans	187	107	70	4	6	54	16	21	13
Microtus californicus	3	1	2	0	0	1	0	0	0
Neotoma lepida	34	17	14	0	3	12	0	0	12
Peromyscus californicus	5	4	1	0	0	1	0	0	0
Peromyscus maniculatus	203	132	71	34	41	62	0	15	28
Reithrodontomys megalotis	10	5	5	0	0	5	0	3	0
				August (Reclamation Site)					
Chaetodipus fallax	1	0	1	0	0	0	0	0	0
Dipodomys merriami	10	4	3	1	2	4	0	2	0
Dipodomys simulans	23	13	10	0	0	9	2	5	1
Peromyscus maniculatus	37	18	15	1	3	14	0	0	1
Reithrodontomys megalotis	2	1	1	0	0	1	0	0	0

mented elsewhere (Carley and Knowlton 1968, Gentry et al. 1968). Because of the presence of patches of dense habitat that were not trapped, as well as adjacent, potentially suitable habitat, immigration would be expected as animals were removed.

Short-term Translocation Success

The number of individuals of small mammals on the reclamation site increased during the 3 months following translocation (Table 1). The three main species, *D. m. parvus, D. simulans*, and *P. maniculatus*, increased in numbers both by reproductive recruitment and the addition of translocated individuals. Seven of the 10 *D. m. parvus* trapped in August were animals handled in May. Six of the 10 were individuals translocated from the salvage site, representing 33.3% persistence of May residents and 40% persistence of translocated individuals. In contrast, 57.1% of *D. simulans* and 15.4% of *P. maniculatus* that were resident in May persisted through to August. Neither former resident nor translocated western harvest mice were recaptured. *Chaetodipus fallax* had been added to the assemblage but none of the translocated individuals was captured in August. The single adult captured probably represented an immigrant from surrounding habitat.

The majority of individuals of all species were reproductively active in May on both the reclamation and salvage sites (Table 1). Most adult males were reproductively active. Of particular importance, 2 pregnant *D. m. parvus* and 1 juvenile female in estrus were translocated to the reclamation site.

In August on the reclamation site, 1 adult *D. m. parvus* was post-lactating and the remaining 2 adults were in early pregnancy. Half of the adult males were still reproductively active. Apparently adults were producing a second litter and young-of-the-year adults a first litter in August. Three juveniles were captured at the southern extreme of the reclamation site. Salvage-trapped individuals were released in the southern and middle portion of the site that was furthest removed from the location of resident individuals trapped in May at the extreme northern portion. Thus, it is reasonable to conclude that the juveniles were offspring of translocated individuals.

Short-term success in the present translocation (40% persistence) exceeded previous efforts with kangaroo rats. Several factors may account for this success. The habitat on the reclamation bench contained suitable but unoccupied habitat and was surrounded by non-suitable habitat. There was a well-developed infrastructure of existing rodent burrows and protective aerial cover of shrubs. Animals were released immediately after sunset, which allowed an entire night for them to become familiar with the release site and find shelter for the following day. Short-term persistence and the level of reproductive activity suggest the potential for long-term success.

Because no long-term monitoring has been conducted on any of the translocation efforts attempted to date, I have little basis for evaluating potential long-term success of the present effort. At present, there is no provision for multiple-year monitoring of this translocation. Placing animals on reclaimed habitat necessitates monitoring of that habitat to follow trends in quality and animal response to changing trends. With such information, appropriate management decisions can be made, thus increasing the chances for long-term survival of these populations.

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