



Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Small Mammal Colonization at Habitat Creation Areas Along the Lower Colorado River: 2008



April 2010

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Multi-Species Conservation Program
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Abstract

The Bureau of Reclamation is the lead agency for the Lower Colorado River Multi-Species Conservation Program (LCR MSCP). One of the LCR MSCP goals is to create habitat for species covered under the Habitat Conservation Plan. *Sigmodon arizonae plenus* (Colorado River cotton rat) and *Sigmodon hispidus eremicus* (Yuma hispid cotton rat) are listed as covered species. Monitoring small mammals at current and future habitat creation sites will allow Reclamation to determine whether *Sigmodon* spp. are colonizing these sites. Trapping continued at four habitat creation sites in 2008. No cotton rats were found during post-development monitoring; one cotton rat was captured during pre-development monitoring in adjacent habitat at the Imperial National Wildlife Refuge site. A new cotton rat population was found very close to the Palo Verde Ecological Reserve during a different study. A grasshopper mouse (*Onychomys torridus*) was captured at the Beal Lake Riparian and Marsh Project, making it a new species found using a habitat creation area. The two sites that are being converted from agriculture into habitat were found to have higher capture rates after habitat was created; areas where cottonwood and willow trees have grown tall enough that most of the herbaceous understory has been shaded out had lower capture rates. Trapping in future years will focus on areas that continue to have a dense herbaceous understory, such as edges, or where trees are planted more sparingly and native herbaceous plants are interspersed. Trapping will continue at current phases and additional areas will be trapped as new phases are planted and new sites are added.

Introduction

The Bureau of Reclamation (Reclamation) is the lead implementing agency for the Lower Colorado River Multi-Species Conservation Program (LCR MSCP). The LCR MSCP is a 50-year cooperative Federal-State-Tribal-County-Private endeavor, which will manage the natural resources of the LCR watershed, provide regulatory relief for the use of water resources of the river, and create native habitat types along the LCR. Implementation of the LCR MSCP began in October 2005. In order to restore native habitats, the LCR MSCP will create the following cover types: 5,940 acres (2,404 ha) of cottonwood-willow (*Populus fremontii*-*Salix* spp.), 1,320 acres (534 ha) of honey mesquite (*Prosopis glandulosa*), 512 acres (207 ha) of marsh, and 360 acres (146 ha) of backwaters (Reclamation 2004).

One of the purposes of these efforts is to provide habitat for plant and animal species covered under the Habitat Conservation Plan (HCP), including *Sigmodon hispidus eremicus* (Yuma hispid cotton rat) and *Sigmodon arizonae plenus* (Colorado River cotton rat). Of the acreages of habitat to be created, 125 acres (50.6 ha) of habitat have been designated for *S. a. plenus*, and 76 acres (30.8 ha) of habitat have been designated for *S. h. eremicus*. While other covered species habitat acreages may overlap with these numbers, these amounts will be created with specific habitat characteristics for the two *Sigmodon* species. The range of these two species is assumed to not overlap; however, these two species of *Sigmodon* cannot be distinguished by morphological characteristics. Genetic work is currently being completed by the University of Nevada-Las Vegas (UNLV) in areas where *Sigmodon* spp. have been captured. Those captured in the area of Imperial National Wildlife Refuge (NWR) and south to the Yuma, Arizona area are Yuma hispid cotton rats. Those captured from Cibola NWR and farther north are Colorado River cotton rats. The historic northern-most records of the Colorado River cotton rats is an area just south of Laughlin, Nevada (Hall 1946 and Bradley 1966). Currently, this species has not been found farther north than Havasu NWR near Needles, California.

Reclamation is increasing its understanding of restoration science through an adaptive management approach; therefore, monitoring of current habitat creation/restoration sites is crucial. Preliminary trapping at the Cibola NWR Nature Trail site and the Pratt Restoration Demonstration site in 2005 found that *Sigmodon* spp. had colonized each site (Dodge 2006). In 2006, a continuation of trapping at the Pratt site, as well as the addition of four habitat creation sites plus one reference site were added. After trapping at the Pratt site in 2006 and 2007, it was determined that cotton rats no longer are using that site due to changes in the habitat. They had been found in an area with a dense understory of *Baccharis* spp., which had grown and matured causing a bare understory that no longer gave them the cover they needed. The Nature Trail site continues to have a population of cotton rats. Only one *Sigmodon* spp. was trapped in 2006, and was located on Havasu NWR (Calvert 2007). Trapping was performed at all previous habitat creation sites as well as a new reference site in 2007, and cotton rats were found at three sites. In 2008, four sites were trapped as part of the habitat creation monitoring. Because presence of *Sigmodon* spp. has been confirmed at the Cibola Nature Trail, only minimal trapping occurred as part of the UNLV study to collect genetic samples. This report is a synopsis of all small mammal trapping done by Reclamation for the year 2008.

Study Areas

Beal Lake Riparian and Marsh Project

The Beal Lake site is adjacent to Beal Lake and Topock Marsh, inside Havasu NWR on the Arizona side of the Colorado River (Figure 1). It is a two-phase habitat creation project that was initiated in the spring of 2003. The 100-acre (40.5-ha) site is a joint effort between Reclamation and the Havasu NWR with the purpose of evaluating riparian restoration techniques for the improvement of habitat for terrestrial and marsh LCR MSCP covered species (Raulston 2003). The site was planted with Fremont cottonwood, Goodding's willow (*Salix gooddingii*), coyote willow (*Salix exigua*), and honey and screwbean mesquite (*Prosopis pubescens*). Currently, the site contains areas of all tree species listed above. Arrowweed (*Pluchea sericea*) has begun to fill in the open areas and edges of most of the plots in the site.

Palo Verde Ecological Preserve

Palo Verde Ecological Preserve (PVER) is located about 5 miles (8 km) north of Blythe, California, along the California side of the Colorado River (Figure 1). It will encompass up to 1,300 acres (526 ha) when completed. The acreages will be separated into nine different phases, with one phase being planted every year. In the spring of 2006, a 31-acre (12.5-ha) nursery (phase 1) was planted. Phase two was farmed for alfalfa (*Medicago sativa*) prior to conversion to native riparian habitat. In the spring of 2007 Phase 2 was planted with 80 acres (32.4 ha) of cottonwood, willow, and other riparian plants. Phase 3 was planted in the spring of 2008 and is also planted with cottonwood-willow habitat types.

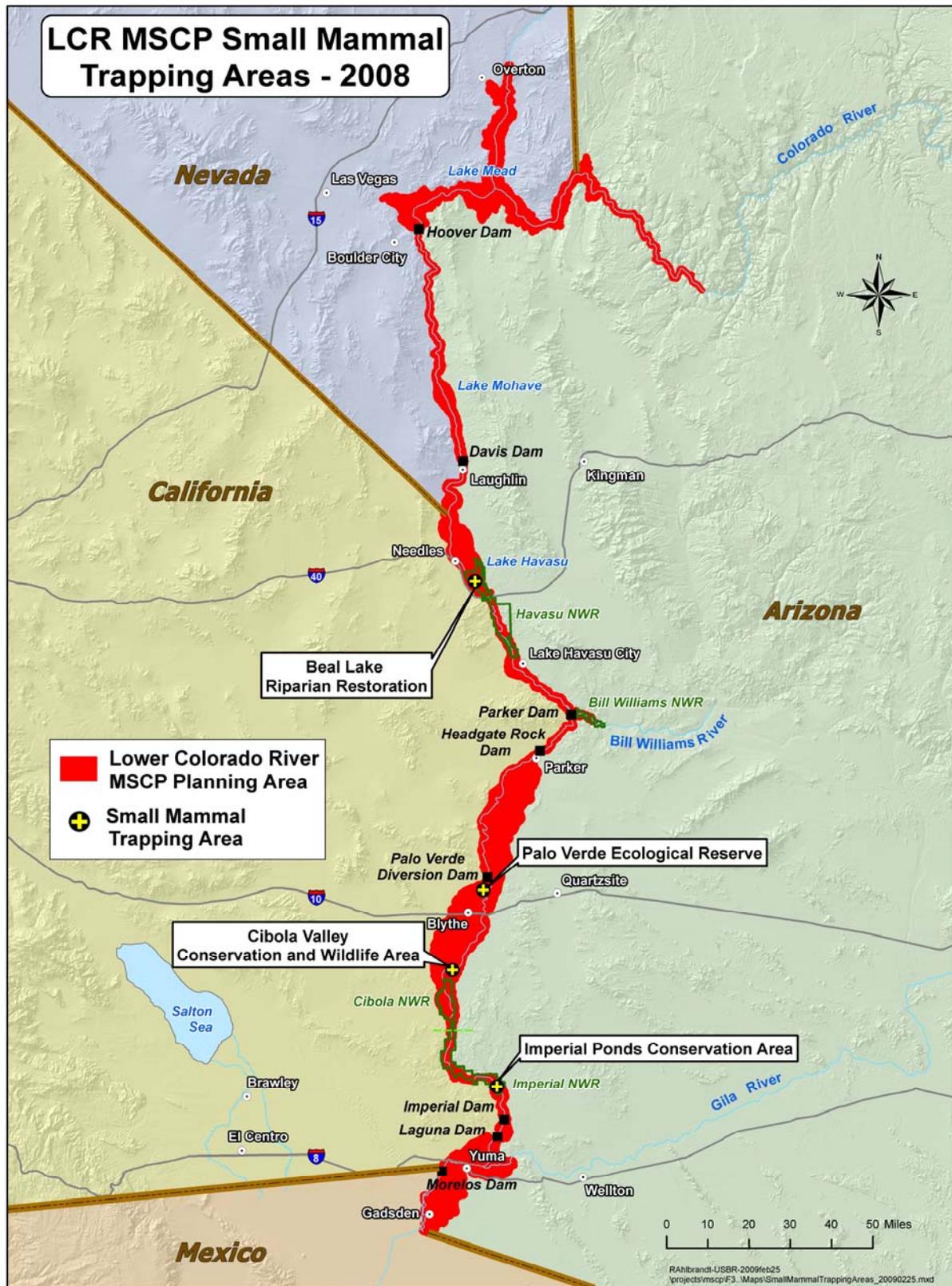
Cibola Valley Conservation and Wildlife Area

Cibola Valley Conservation and Wildlife Area (CVCA) is located in Arizona adjacent to the Colorado River, about 15 miles (24 km) south of Blythe, California (Figure 1). It will encompass about 1,019 acres (412 ha) when completed. CVCA is a multi-phase plan in which the first three phases have been identified. All three phases will include Fremont cottonwood, Goodding's willow, coyote willow, and other riparian plant species. Phase 1 was planted in the spring of 2006, and contains a 22-acre (9-ha) nursery and a 64-acre (26-ha) area of cottonwood-willow habitat. Phase 3 was planted in the spring of 2007, and contains over 80 acres (32 ha) of cottonwood-willow planted in different combinations. Phase 3 also includes 11 acres (4.5 ha) of *Baccharis* spp. mixed with some cottonwood and willow. Phase 2 was planted in the spring of 2008. Most of phase 2 is planted with cottonwood-willow habitat, with one small area of honey mesquite and quailbush (*Atriplex lentiformis*). In addition to the habitat creation areas, a 194-acre (78.5-ha) area planted in alfalfa, which will be converted into habitat in the future, is also being monitored to obtain baseline data of a managed agricultural field.

Imperial Ponds Conservation Area

The Imperial Ponds Conservation Area is located on the Imperial NWR, east of the Colorado River, near River Mile 59, just north of Martinez Lake (Figure 1). The project area is within a portion of the refuge known as the Intensive Management Area, which consists of fields and marshes that are managed for waterfowl, marsh birds, native fish, riparian obligate bird species, and other wildlife (Lenon et al. 2008). The entire Intensive Management Area is restricted from public access. Currently the six ponds have been dredged, and excavated material from the ponds has been spread across some of the fields. These fields will be planted for waterfowl, and an additional 34 acres (14 ha) of cottonwood and willow habitat will be planted adjacent to the nursery as part of the Imperial Ponds Conservation Area (Lenon et al. 2008). Most of the edges of the site contain dense riparian vegetation including common reed (*Phragmites australis*), *Baccharis* spp., mesquite (*Prosopis* spp.), and some cottonwood and willow trees. These areas are where small mammal trapping took place.

Figure 1. 2008 Small mammal trapping locations



Methods

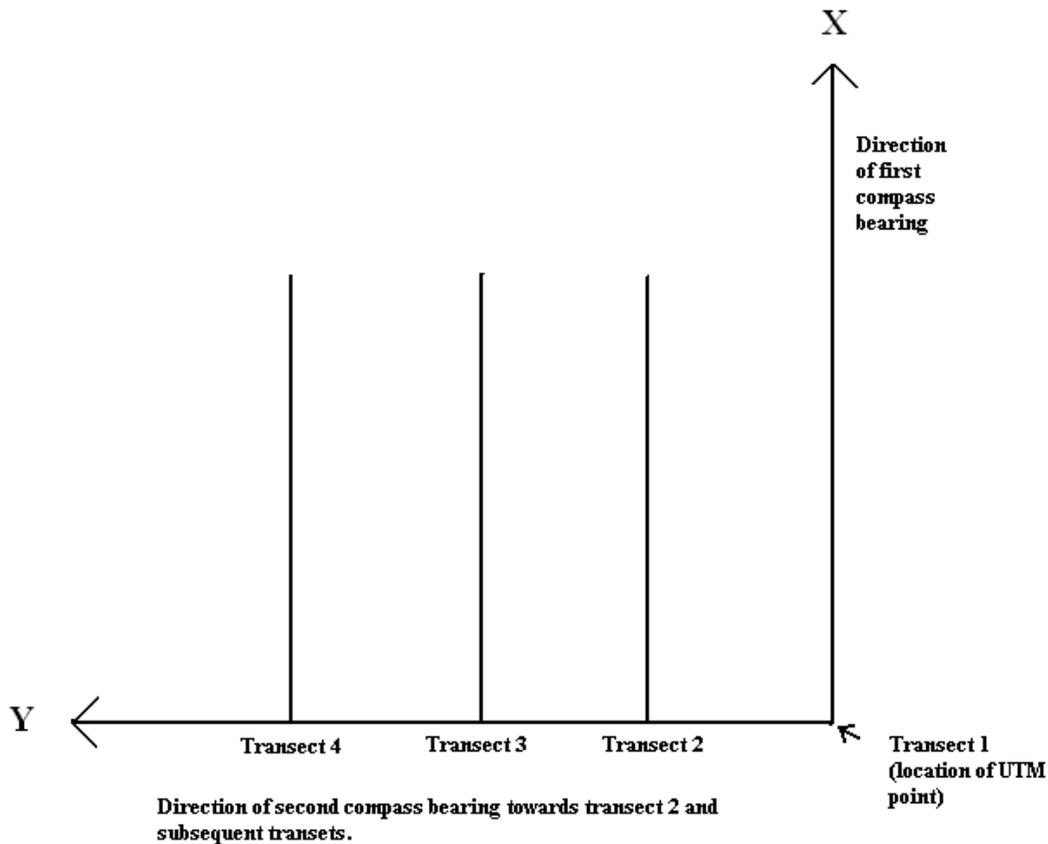
An ocular examination was made of the habitat types at each site and traps were first placed in areas with the highest density of vegetation at ground level. High vegetation density at ground level has been shown to be positively correlated with higher capture numbers of *Sigmodon* along the LCR and elsewhere (Andersen and Nelson 1999). Once the densest habitats had been sampled, other less densely vegetated habitats were sampled.

These surveys are focused on finding *Sigmodon* spp. All other captures are incidental to our main focus. To obtain data on densities of small mammal populations in these sites, a more standardized trap array would be needed.

Traps were baited with a mixture of oats, peanut butter, and vanilla. A small handful of cotton was also added to each trap to provide insulating cover for any animal trapped over night. Sherman live traps were used, which are triggered by the animal stepping on a pressure plate that then closes a trap door behind the animal. Traps were set out in transects of 15 traps per transect whenever possible. Transects were then set out in a grid to cover as great an area as possible. Traps in each transect were 33 ft (10 m) apart, and each transect was 50 ft (15 m) apart.

A UTM reading (NAD 83) was taken with a GPS unit at the location of the first trap of the first transect in the grid. At this point, a compass bearing (X) was taken in the direction of the first transect. A second bearing (Y) was also taken from this point perpendicular to the X bearing. In the Y direction, each subsequent transect in the grid was started at this bearing (see Figure 2). This enabled replication of the grid and determination of approximate locations for noteworthy captures for future efforts. Each transect was labeled by a letter, and each trap was numbered. For example, the first trap of the first transect of a grid was labeled A-1 on the data sheet. Aerial maps of each site were also used, with trapping areas marked for future reference.

Figure 2. Diagram of a transect grid



Trapping was focused on areas of each site where cotton rat colonization was most likely. The 15-trap transect grid method does not always work when focusing on these areas. When the grid method was not used, transects were placed in a manner that the entire focus area was saturated with traps. Distance between traps varied, but the average was 25 ft (7.6 m). This enabled fewer traps to be used while increasing the capture rate. Because the focus of this effort is to find cotton rats, areas where they were unlikely to occur were not trapped. This still allowed ample captures of non-target species, which are more general in their habitat preferences. This method was recommended by researchers at UNLV with whom we have a cooperative agreement to study population genetics of the two cotton rat species. Also, for areas where planting has not yet occurred and bare ground and agriculture are the pre-treatment conditions, trapping will occur in adjacent areas when possible cotton rat habitat is present to discover whether there are nearby populations that would be likely to colonize sites.

Traps were set out in the afternoon and collected the following morning after sunrise. Captured animals were transferred into a clear plastic bag and identified to species. Animals were identified using a key to local small mammal species provided by UNLV, a key included in the Mammals of California field guide (Jameson and Peeters 2004), the Kays and Wilson field guide (2002), and assistance from UNLV researchers. Measurements were taken if needed for

identification. A standardized data sheet was used to list all animals captured, where in the grid they were captured, the location of the grid, and what ground cover/macrobhabitat was found in the trapping area. All animals were released back into the trapping area once identification was made. Traps in which an animal had been captured were washed in a bleach water solution and then rinsed in plain water and set out to dry after each trapping day.

Results

A list of scientific and common names for all species captured during this project can be found in Appendix 1.

Beal Lake Riparian and Marsh Project

In 2006, 1,415 traps were set with a total of 55 small mammals captured. In 2007, 575 traps were set with a total of 81 small mammals captured. A total of 600 traps were set in 2008 with 32 total captures (Table 1). No cotton rats were captured in 2007 or 2008. Arrowweed was the dominant cover where most captures occurred. One new species, the southern grasshopper mouse (*Onychomys torridus*) was captured in 2008, bringing the total species captured at Beal Lake to nine. The cactus mouse (*Peromyscus eremicus*) was the most commonly captured species.

Table 1. Summary of all captures at Beal Lake

Species	2006	2007	2008	Totals
<i>Sigmodon arizonae</i>	1	0	0	1
<i>Peromyscus eremicus</i>	8	42	17	67
<i>Peromyscus maniculatus</i>	13	9	6	28
<i>Chaetodipus penicillatus</i>	17	17	6	40
<i>Dipodomys merriami</i>	15	6	2	23
<i>Mus musculus</i>	0	4	0	4
<i>Neotoma albigula</i>	0	2	0	2
<i>Sylvilagus audubonii</i>	0	1	0	1
<i>Onychomys torridus</i>	0	0	1	1
unknown species	1	0	0	1
Totals	55	81	32	168

Palo Verde Ecological Preserve

In 2006, Phase 2 was trapped (195 trap nights) while it was still being farmed for alfalfa, and there were no captures. In the spring of 2007, Phase 2 was trapped again (255 trap nights) when it was a barren field prior to tree planting, and two deer mice (*Peromyscus maniculatus*) were captured. In the fall of 2007, Phase 2 was trapped (120 trap nights), as well as two additional areas. The edge of a drainage ditch along the west side of Phase 2 was trapped (59 trap nights),

and the nursery was also trapped (60 trap nights). In 2008, 370 traps were set in phase 2 and 40 traps were set in phase 3. A summary of captures for each year can be found in Table 2. A total of four species have been captured at PVER with the house mouse (*Mus musculus*) being the most captured. The herbaceous understory of the trapping areas was a mixture of alfalfa, Bermudagrass, and other grass species. No cotton rats were captured within the boundary of PVER; however, as part of the UNLV study, traps were set adjacent to PVER along a low bench of land that is partially inundated on the river (Figure 3). Out of 90 traps set, 14 Colorado River cotton rats were captured in the fall of 2008. The habitat in this area is dominated by an unknown shrub interspersed with a dense understory of grasses, with dallisgrass (*Paspalum dilatatum*) being the most prominent. The areas surrounding the shrubby area are a mixture of bulrush (*Scirpus* spp.) and cattail (*Typha* spp.) that are inundated on a regular basis.

Table 2. Summary of all captures at PVER

Species	2007	2008	Totals
<i>Mus musculus</i>	27	60	87
<i>Peromyscus maniculatus</i>	2	6	8
<i>Peromyscus eremicus</i>	8	1	9
<i>Chaetodipus penicillatus</i>	6	5	11
Totals	43	72	115

Figure 3. Area adjacent to PVER where cotton rats were captured in 2008



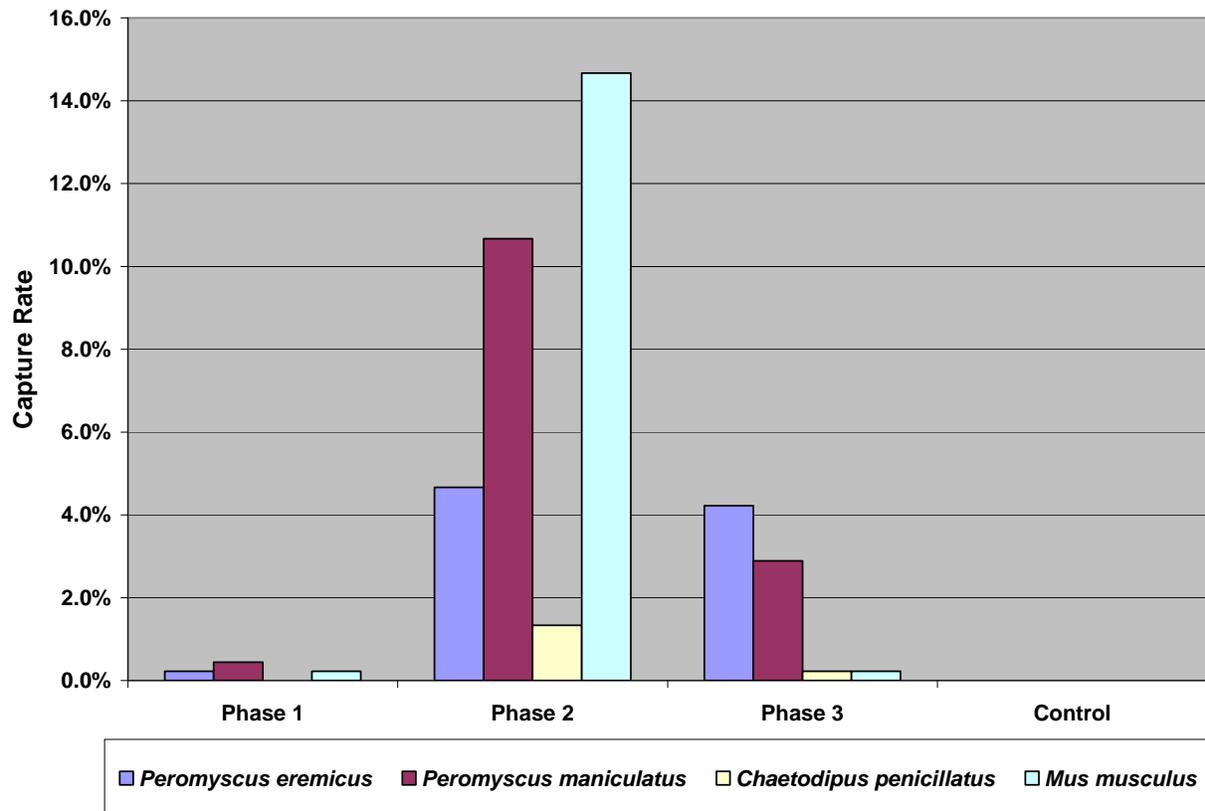
Cibola Valley Conservation and Wildlife Area

In 2006, trapping was conducted in the spring (484 trap nights) prior to planting on Phase 1, and then again after the first growing season in the fall (255 trap nights). Five deer mice were captured prior to planting, and only one was captured in the fall. The control alfalfa area was also trapped in 2006 (195 trap nights) with no captures. In the spring of 2007, there were no captures in Phase 1 (300 trap nights), three captures in the control area (300 trap nights), and one capture in Phase 3 pre-planting (150 trap nights). One of the control area captures was a Merriam's kangaroo rat (*Dipodomys merriami*); all other captures were deer mice. In the fall of 2007, there were 31 captures in Phase 1 (195 trap nights), no captures in the control area (45 trap nights), and four captures in Phase 3 (225 trap nights). In 2008, 450 traps were set in Phase 1, 150 traps in Phase 2, 450 traps in Phase 3, and 105 traps in the control field, with a total of 85 captures (Table 3). Phase 2, which was the last phase planted, had the highest capture rates for all four species captured in 2008 (Figure 4). A total of five species have been captured at CVCA. No cotton rats have been captured at CVCA. A total of 645 traps have been set at the control agriculture field since 2006, with a total of three captures.

Table 3. Summary of all captures at CVCA

Species	2006	2007	2008	Totals
<i>Mus musculus</i>	0	27	24	51
<i>Peromyscus maniculatus</i>	6	9	31	46
<i>Peromyscus eremicus</i>	0	1	27	28
<i>Chaetodipus penicillatus</i>	0	1	3	4
<i>Dipodomys merriami</i>	0	1	0	1
Totals	6	39	85	130

Figure 4. A comparison of capture rates between trapping areas at CVCA for 2008



Imperial Ponds Conservation Area

In 2006, 75 total traps were set at the cottonwood-willow nursery and at an area across the road from the nursery, with a total of five small mammals captured. In 2007, a total of 297 traps (149 in March and 148 in October) were set around the perimeter of most of the conservation area, and 60 rodents were captured. No cotton rats were captured in 2006, but six were captured in 2007 across the road from the nursery in a dense stand of vegetation dominated by common reed. One additional juvenile cotton rat was captured in the spring across the road from bare fields in a sparse mixture of common reed, arrowweed, and *Baccharis* spp. In 2008, 59 traps were set in the area where cotton rats had been captured in 2007. A total of 44 rodents were captured including one cotton rat (Table 4). A total of seven species have been captured at Imperial Ponds.

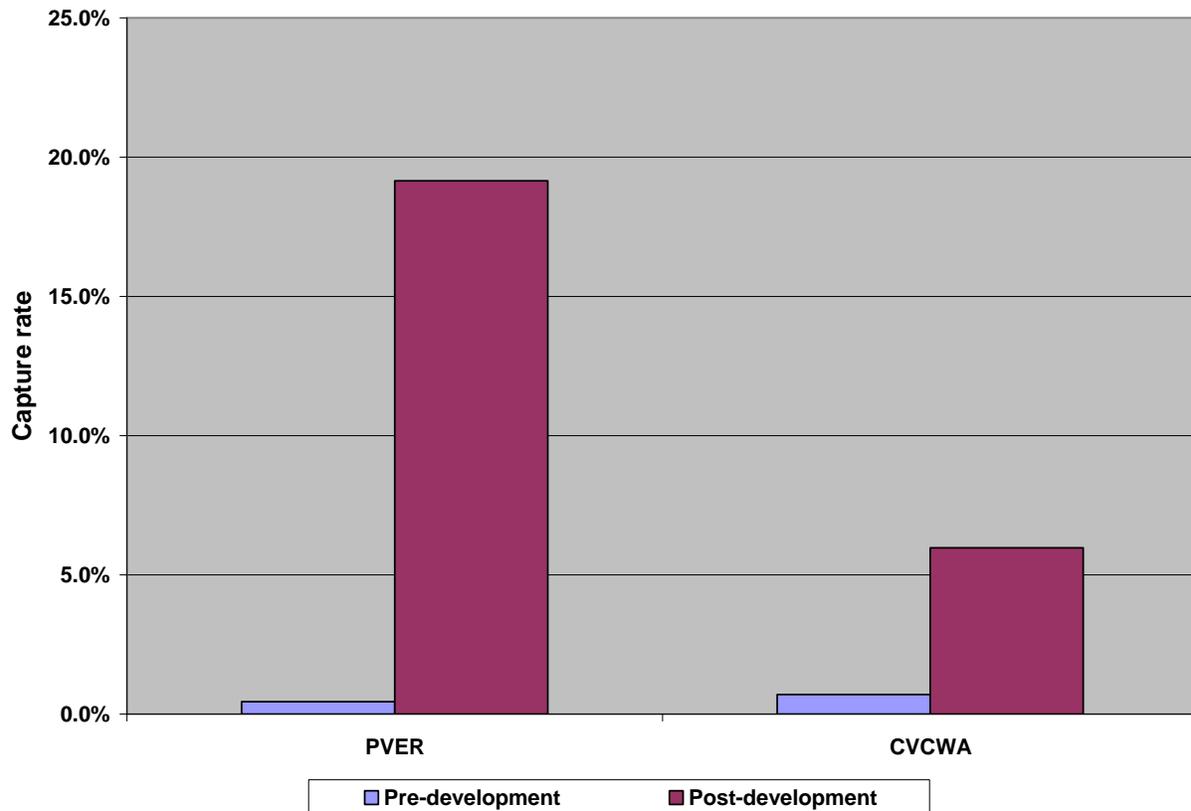
Table 4. Summary of all captures at Imperial Ponds

Species	2006	2007	2008	Totals
<i>Sigmodon hispidus</i>	0	6	1	7
<i>Peromyscus eremicus</i>	4	34	37	75
<i>Peromyscus maniculatus</i>	0	1	0	1
<i>Chaetodipus penicillatus</i>	0	16	4	20
<i>Neotoma albigula</i>	0	2	0	2
<i>Reithrodontomys megalotis</i>	1	1	0	2
<i>Mus musculus</i>	0	0	2	2
Totals	5	60	44	109

Between-Site Comparison

The PVER and CVCA are both sites that had been agricultural fields prior to habitat creation. Capture rates have been much higher after conversion into habitat (Figure 5). The Beal Lake site had originally been an area dominated by *Tamarix* spp., and no pre-development monitoring had been conducted at the site. All monitoring at Imperial Ponds has been pre-development in natural habitats adjacent to future habitat creation development. Both the Beal Lake and Imperial Ponds sites have higher species richness than PVER and CVCA. The most captured species at CVCA and PVER was the exotic house mouse. The native cactus mouse was the most commonly captured species at Beal Lake and Imperial Ponds.

Figure 5. Comparison between capture rates before and after habitat creation



Discussion

This was the fourth year of small mammal trapping for Reclamation at habitat creation sites as part of the LCR MSCP (Dodge 2006, Calvert 2007 and 2009). Trapping effort has increased each year since the preliminary trapping of 2005. As effort has increased, so has the number of captures, capture rate, and for most sites, the number of species. Reclamation's focus during these surveys has been on the presence or absence of *Sigmodon* spp.; all other species abundance, excluding *Sigmodon* spp., may not be correctly represented in these surveys. Traps were not set equally among habitat types, and the number of traps varied with the size of available habitat in which *Sigmodon* spp. might be found. Because of this, true comparisons between sites cannot be made in regards to total small mammal assemblages.

One *Sigmodon* spp. was captured at Beal Lake in 2006. Most of the trapping in 2007 and 2008 at Beal Lake occurred either in the general area, or in similar habitat (dense arrowweed) to where the capture was made. Additional trapping outside of Beal Lake has not proved successful in discovering any other cotton rats at Havasu NWR. One new species, the grasshopper mouse, was captured in 2008. It is primarily an insectivore, and not as likely to be trapped using the typical oats and peanut butter bait. The high species richness at Beal Lake compared to other sites is

probably due to its location and age. Beal Lake was planted three years before the first phases at CVCA and PVER and is surrounded by natural habitat as opposed to agriculture.

The PVER and CVCA are very similar both in planting design and in being agricultural conversions. More trapping has occurred at CVCA because more phases have been planted. Because trapping prior to habitat conversion has resulted in few captures, it is recommended that no additional trapping occur in agricultural fields prior to planting. Also, as the mass-planted cottonwood and willow trees have grown and shaded out the herbaceous understory, captures have decreased. The capture rates in these dense stands of riparian trees are similar to capture rates in other older habitat creation areas that Reclamation has trapped. Future trapping at these two sites will focus on areas where there is still a dense herbaceous understory. In cottonwood and willow plantings, this typically means that traps will be placed on edges of these stands where a strip of grassy vegetation occurs. The number of traps will be determined by the amount of habitat available and may not equal 500 traps per year. Future habitat creation at the PVER site includes planting some areas with native herbaceous plants with minimal planting of mesquite trees, which will allow enough sunlight for successful establishment of a native herbaceous understory (Iglitz and Raulston in press). Trapping in these phases will focus on areas where the native plants successfully grow into a dense understory.

The Imperial Ponds site was only trapped minimally in 2008 because the presence of cotton rats has already been determined. Only minimal trapping will be conducted, primarily for obtaining additional genetic samples, until habitat creation occurs (estimated to take place in 2010). The Cibola NWR Nature Trail was only trapped for the UNLV study in 2008. Because presence of cotton rats is confirmed, trapping may not occur at this site in 2009; however, additional riparian habitat will be created nearby as part of the Cibola NWR Unit #1 Conservation Area, which will likely be trapped in the fall of 2009 after the first growing season. No other additional sites will be added, although new phases of already established sites will be added to the total monitoring for each site.

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Appendix 1. Scientific and common names of all species captured during project

Scientific Name	Common Name
<i>Sigmodon hispidus eremicus</i>	Yuma hispid cotton rat
<i>Sigmodon arizonae plenus</i>	Colorado River cotton rat
<i>Peromyscus eremicus</i>	Cactus mouse
<i>Peromyscus maniculatus</i>	Deer mouse
<i>Chaetodipus penicillatus</i>	Desert pocket mouse
<i>Dipodomys merriami</i>	Merriam's kangaroo rat
<i>Neotoma albigula</i>	White-throated woodrat
<i>Reithrodontomys megalotis</i>	Western harvest mouse
<i>Sylvilagus audubonii</i>	Desert cottontail
<i>Mus musculus</i>	House mouse
<i>Onychomys torridus</i>	Southern grasshopper mouse