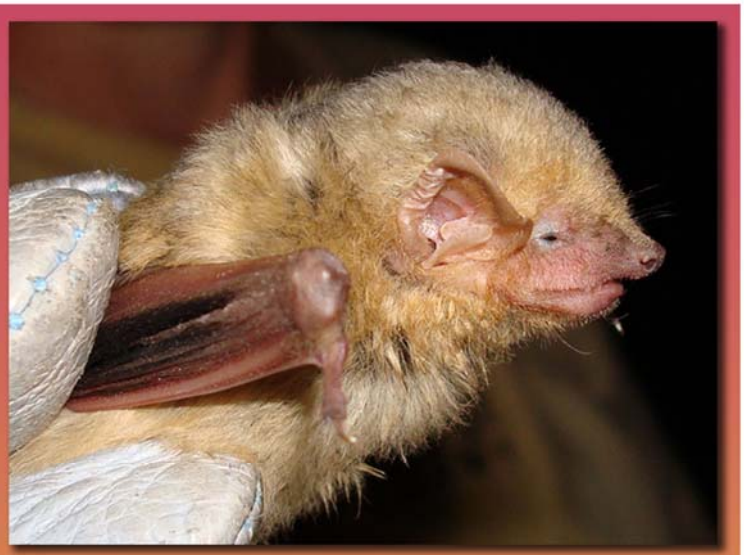
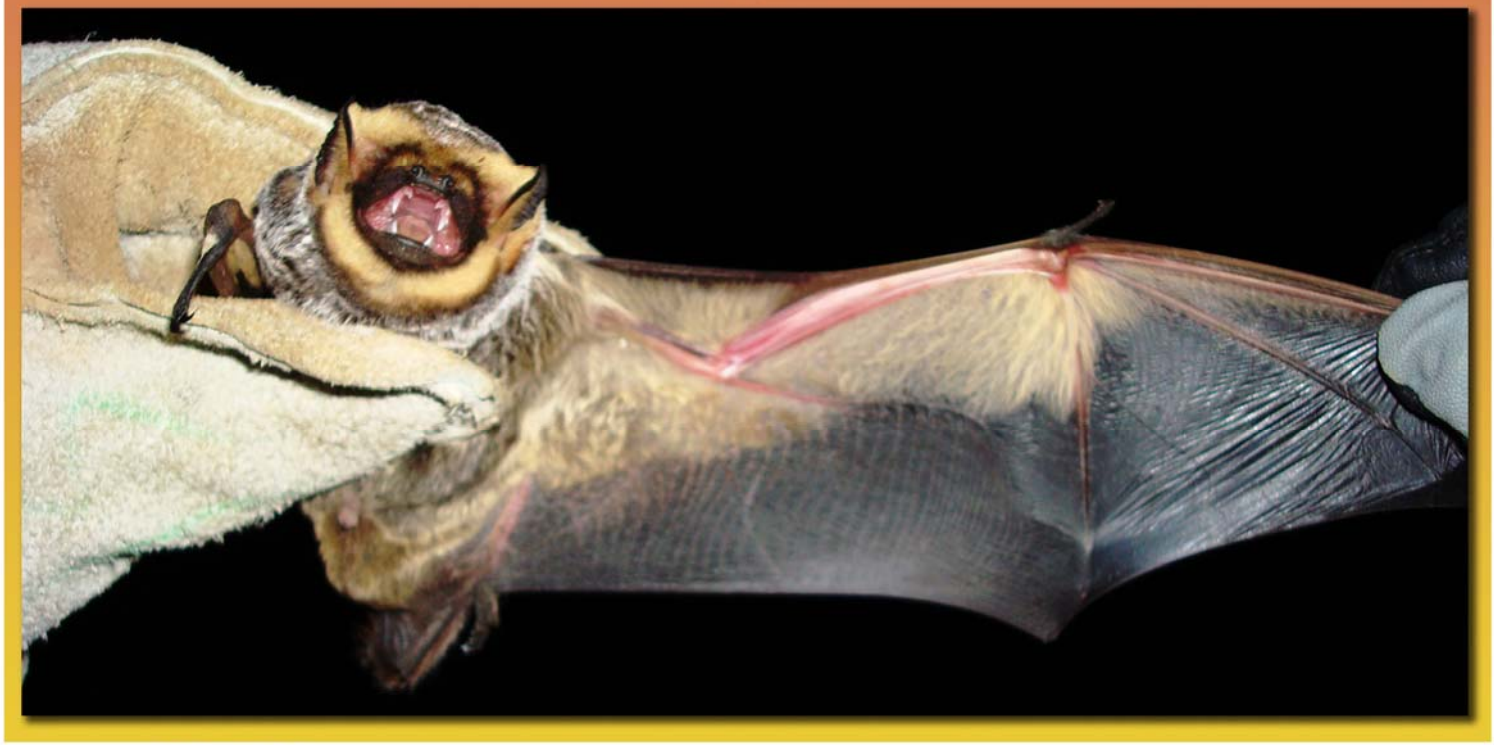
Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

2007 Preliminary Results for the Capture of Bats at Riparian Habitat Creation Sites along the Lower Colorado River





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August 2009

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Multi-Species Conservation Program
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Abstract

A bat mist-netting/trapping survey was added to ongoing acoustic surveys at habitat creation sites along the lower Colorado River. Netting and trapping was added to obtain voucher acoustic calls of bat species, as well as to determine whether any uncommon species are being missed by acoustic surveys. Three sites were surveyed in July and October, and an additional site was surveyed in September. All of these sites have been planted with Fremont cottonwood (*Populus fremontii*), Goodding's willow (*Salix gooddingii*), and coyote willow (*Salix exigua*). Three of the sites also have honey mesquite (*Prosopis glandulosa*) and screwbean mesquite (*Prosopis pubescens*) planted. Mist-nets and harp traps were used to capture bats within these sites. It was found that when nets were stacked on top of each other using tall poles and a pulley system, captures increased with the ability to sample higher up in the canopy. A total of 95 individual bats of 9, possibly 10, species were captured between the four sites. Of particular importance were the captures of two Lower Colorado River Multi-Species Conservation Program (LCR MSCP) covered species. These were the western yellow bat (*Lasiurus xanthinus*), and the California leaf-nosed bat (*Macrotus californicus*). One of the yellow bats was captured at a site for which no acoustic data had been found, confirming the importance of using both acoustic and capture techniques to survey an area. Also captured was a hoary bat (*Lasiurus cinereus*), which has been named an indicator species because it is a tree-roosting bat of the same genus as two LCR MSCP covered species. Finding the best areas of a site to net also allowed for a better understanding of how bats use these sites. Bats tend to avoid cluttered areas and use edges, open areas, and corridors. One possible method to add bat use to the future design of these sites may be to create wider spaces between planting areas to create artificial corridors. These would allow bats to use more area of the site as well as make it easier to net bats at these sites.

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 effort to 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. To restore native habitats, the LCR MSCP will create the following cover types: 1) 5,940 acres (2,404 ha) of cottonwood-willow, 2) 1,320 acres (534 ha) of honey mesquite, 3) 512 acres (207 ha) of marsh, and 4) 360 acres (146 ha) of backwaters (LCR MSCP 2004).

The LCR MSCP uses a variety of methods to monitor covered species on these habitat creation areas. In the fall of 2006 a post-development bat survey using acoustic bat detectors was started by the Bureau of Reclamation's Denver Technical Service Center (Broderick 2008). During these acoustic surveys in July and October 2007, a preliminary netting and trapping survey began at three of the locations for which acoustic data has been collected. In September, a fourth site was surveyed for which only exploratory acoustic work had been done. Riparian habitat creation sites along the LCR have only minimally been surveyed for bats in the past (Brown 2006). This new survey is an attempt to increase effort, and thus increase the capture of bats to discover whether LCR MSCP covered species are utilizing habitat creation sites.

There are a variety of reasons why bat surveys should include both acoustic and capture techniques. Not all species are successfully surveyed using only one of the two methods (O'Farrell and Gannon 1999). Species such as Townsend's big-eared bats (*Corynorhinus townsendii)*, and California leaf-nosed bats (*Macrotus californicus)* are known to echolocate at low intensities which are often missed using acoustic detectors. If there is a species identification question using acoustic data, then captures may confirm the presence of a species. Capturing bats allows for acoustic voucher calls to be made when releasing bats near a bat detector. The design of future habitat creation sites may also be aided by capturing bats. The location of mist-nets and traps at current sites may allow a better understanding of how bats use riparian areas. Acoustic data shows that most bats avoid cluttered areas and forage along edges of riparian forests, in corridors, and openings in forest canopies which create "flyways" for bats. Capture techniques may allow for more refined specifications on how to create corridors and flyways in future sites. This will allow for bats to use a larger area of these sites, as well as allowing biologists to more easily find locations to capture bats during future surveys.

Study Areas

Beal Lake Riparian and Marsh Project

Beal Lake is an approximately 200-acre (81-ha) site located in Arizona on Havasu National Wildlife Refuge (NWR) near Needles, California. Netting was conducted in three locations in the project area. The first location was on a small dike that divides the ditch connecting Beal

Lake with Topock Marsh. The second location was within the riparian re-vegetation area, on the edges of fields G, B, H, and C. The third area was across a road dividing fields O and P. Vegetation at the site is predominately Fremont cottonwood (*Populus fremontii*) and Goodding's willow (*Salix gooddingii*), with patches of screwbean mesquite (*Prosopis pubescens*) nearby.

Cibola NWR Nature Trail

The Cibola NWR Nature Trail (Nature Trail) is a 34-acre (13.8-ha) site located south of Cibola, Arizona. Netting took place in areas of the Nature Trail where tall cottonwood trees lined the trail. Goodding's willow, screwbean mesquite, and honey mesquite (*Prosopis glandulosa*) are additional tree species found within the site. Also included as part of the netting area adjacent to the Nature Trail is a 17-acre (7-ha) area where there is a planting demonstration of a technique to plant large numbers of cottonwood and willow in a short amount of time. This will be hereafter known as the mass planting area.

Pratt Restoration Demonstration Site

The Pratt site is a 12-acre (4.9-ha) site located north of Yuma, Arizona, between Laguna Dam and Mittry Lake. Netting was conducted on two consecutive nights at two areas of the site. The first area consisted of a corridor formed in the interior of the site along a small access road with a completely enclosed canopy of cottonwoods and willows. The second area was along a dirt road on the south boundary of the site. One side of the road contained a dense stand of *Baccharis* spp. interspersed with small cottonwoods. On the other side of the road, there are a few established Goodding's willows mixed with *Tamarix* spp. and some mesquite. The rest of the Pratt site, as a whole, is comprised of cottonwood, Goodding's willow, and coyote willow (*Salix exigua*).

'Ahakhav Tribal Preserve

The 'Ahakhav Tribal Preserve was not part of the post-development acoustic monitoring in 2007. The preserve is 150 acres (61 ha) and is located south of Parker, Arizona, on Colorado River Indian Tribe (CRIT) land. This site contains fields of cottonwood, willow, and mesquite planted as part of an agreement between CRIT and the Bureau of Reclamation. The area that was used for netting was planted in 2001 and has the largest trees of the site. Cottonwood, Goodding's willow, and coyote willow were planted in the area.

Methods

Capture techniques used for this survey included mist-nets and harp traps. The number and size of mist-nets varied between sites depending on habitat in the site. Generally, the optimum number of nets and traps used at each site corresponded to what could be handled by the number of personnel available. Both 6-m (19.7-ft) and 12-m (39.4-ft) wide Avinet Inc. nets were 2.6 m (8.5 ft) tall and made from 50-denier polyester with a 38-mm (1.5-in) mesh size. One 30.5 m (100 ft) wide by 6 m (20 ft) tall mist net was used when a joint effort between Reclamation and

Arizona Game and Fish Department (AGFD) was conducted at the Pratt site. Two types of high net setups were used at one of the sites. These high nets are constructed by stacking regular nets (2.6 m tall) on top of each other using poles in which a pulley system has been made to reach the higher stacked nets. One of these setups uses three nets stacked on top of each other, known herein as a "triple". This pole set-up was made by Bat Management and Conservation Inc. Depending on the width of the corridor, either 6-m, or 12-m wide nets were used in this system. The other high net set-up used four stacked nets, known as a "quad". This setup was constructed by AGFD personnel. Harp traps were also used to capture bats. The Faunatech, Austbat harp trap is 1.8 m (6 ft) wide and has 4.2 m^2 (45 ft^2) of capture area. It is used when a corridor narrows in an area where bats would be "funneled" into a tighter area. An additional smaller harp trap made by AGFD personnel was used during one survey.

Nets and traps were set up at a site where bats were most likely to be using an area as a flyway. Usually this involved natural corridors within a site, or roadways and trails that divided areas of habitat creating artificial corridors. The size of the net or trap used was determined by the width of the corridor, maximizing the area where bats could be captured. In some areas where it appeared that one single net may be easily avoidable by a bat, nets were placed together in a manner that would basically "confuse" the bat. The first method was to set the nets parallel to each other in the hopes that a bat would avoid the first net by flying up and over, and then being captured in the second net when they would drop back down into their normal flight pattern. The other method was to set nets up in a V-formation, where a bat might be funneled into the capture area by avoiding one net, and being captured in the other. These techniques have been used successfully by Bat Conservation International (personal observation). The triple or quad high nets were used in corridors to capture bats that fly higher and where single nets are easily avoidable. Nets were generally set up near dusk and stayed open until near midnight, depending on the activity of the bats. During netting, an Anabat SD-1 bat detector (Titley Electronics) was connected to an HP iPAQ hx2495b pocket PC to obtain voucher calls of captured bats when released, as well as to discover whether bat activity in the area was changing over the course of the evening. This acoustic data was also used later on to determine whether any MSCP covered species were in the area of the nets, but not captured.

Results

Beal Lake Riparian and Marsh Project

Netting in July was performed near the new moon phase at Beal on the 16th from 8:00 p.m. to 12:00 a.m. for a total of 4 hours of netting. Four nets and one harp trap were set up at the site. One 12-m net was set up on top of a small dike. In the riparian area, one harp trap was set up along a small corridor in which vegetation had grown into the corridor, making it narrower. Two 6-m nets were placed across the same corridor in parallel with each other. An additional 12-m net was set up on the other side of an access road, across the same corridor as the previous nets. A total of four Yuma myotis (*Myotis yumanensis*) were captured (Table 1). Three were captured in the net on top of the dike; the other was captured in the harp trap. One was a female juvenile, and the other three were non-reproductive males.

Netting in October was performed on the 9th from 6:50 p.m. to 10:30 p.m. for a total of 3 hours and 40 minutes. Three 12-m nets were set up using the triple high pole setup across a road that was bordered by cottonwood trees on both sides. A single non-reproductive male pallid bat (*Antrozous pallidus*) was captured (Table 1).

Table 1. Summary of all captures at Beal

Species	July	October	Totals
Myotis yumanensis	4	0	4
Antrozous pallidus	0	1	1
Totals	4	1	5

Cibola NWR Nature Trail

Netting in July was performed at the Nature Trail on the 17th from 8:00 p.m. to 12:00 a.m. for a total of 4 hours of netting. Six mist nets and one harp trap were set up in various areas of the site. One 6-m net was set up at the beginning of the west trail where large cottonwoods stand on each side of the trail. The other 6-m net was set up across a side trail that is lined with large cottonwoods and some Goodding's willow which are located in the northeast area of the site. Two 12-m nets were set up in a V-formation across a bend in the west trail which is lined with tall cottonwoods. One side of the trail contains an area of tall cottonwoods and the other is an area of mesquite trees. An additional 12-m net was placed on the west edge of the site where poles were already set up for a bird mist-netting project. A harp trap was set up in the mass planting area where a narrow corridor is located between two areas of mass planted trees. A total of four bats of three species were captured (Table 2). One juvenile female Yuma myotis was captured in the 6-m net at the beginning of the west trail. Two juvenile male big brown bats (*Eptesicus fuscus*) were captured in the V-formation set-up. One California leaf-nosed bat (*Macrotus californicus*) was captured in the 6-m net set up across the side trail. The leaf-nosed bat escaped before sex, age, or reproductive status could be determined.

Netting in October was performed on the 10th from 6:45 p.m. to 11:00 p.m. for a total of 4 hours and 15 minutes of netting. One 12-m net was set up in the same location as in July where the bird mist-netting poles were set up. Another 12-m net was set up at the beginning of the west trail, and an additional three 6-m nets were set up using the triple high pole set-up across a portion of the trail. A total of 15 bats of three species were captured (Table 2). California leaf-nosed bats accounted for 13 of the captures. There were five males and five females, and three were released without being sexed. Eight of them were in the 12-m net at the beginning of the trail, three were in the 12-m bird net, and two were from the triple high set-up. Both of the high net captures were in the second of the three nets. A single scrotal male pallid bat was captured in the 12-m net at the beginning of the trail, and one male hoary bat (*Lasiurus cinereus*) was captured in the second net of the triple high set-up.

Table 2. A summary of all captures at Cibola

Species	July	October	Totals
Macrotus californicus	1	13	14
Lasiurus cinereus	0	1	1
Antrozous pallidus	0	1	1
Eptesicus fuscus	2	0	2
Myotis yumanensis	1	0	1
Totals	4	15	19

Pratt Restoration Demonstration Site

Netting in July occurred on the 18th and 19th from 8:10 p.m. to 12:00 a.m. the first night, and from 8:00 p.m. to 12:00 a.m. the second night for a total of just under 8 hours. On the first night, all nets and traps were set up in a corridor within the habitat. A harp trap was set up at the beginning of the corridor, followed by two 12-m nets placed in a V-formation. A little farther down two 6-m nets were placed in parallel with each other. Toward the end of the corridor, a 6-m and a 12-m net were also set up in parallel. At the end of the corridor, a smaller harp trap was set up. On the second night of netting, the same set up in the corridor was placed without the 6-m and 12-m V-formation or the small harp trap on the far end of the corridor. Instead, a 30.5 m x 6 m) net was placed along a road on the southern edge of the site along with two 6-m nets which were placed on each end of the long net in a Z-formation.

A total of 42 bats of five species were captured between the two nights (Table 3).Three pallid bats (*Antrozous pallidus*) were captured the first night. A lactating female was captured in the V-formation, and the other two juvenile females were captured in the harp trap. Also, a non-reproductive male leaf-nosed bat was captured in the 6-m parallel set, and a juvenile female western yellow bat (*Lasiurus xanthinus*) was captured in the harp trap on the first night.

On the second night of netting, 33 big brown bats were captured. Twenty-nine were captured in the long net, and four were captured in one of the 6-m nets that created a Z-formation with the long net. Three of them were post-lactating females, and the rest were juveniles (16 males and 14 females). Two juvenile Yuma myotis (1 male and 1 female) and one non-reproductive male California leaf-nosed bat were also captured in the long net. Two female juvenile pallid bats were captured in the 6-m parallel set in the corridor.

Netting in October occurred on the 11th from 6:30 p.m. to 11:00 p.m. for a total of 4 hours and 30 minutes of netting. The harp trap was placed in the same location as in July. The triple high set-up with 12-m nets was used instead of the 12-m V-formation. Two 6-m nets were set in parallel in the same general area as they were in July. A total of three adult female California leaf-nosed bats were captured (Table 3). One was captured in the lowest net of the triple set-up, and the other two were caught in each of the two 6-m nets set in parallel.

Table 3. A summary of all captures at Pratt

Species	July	October	Totals
Lasiurus xanthinus	1	0	1
Macrotus californicus	5	3	8
Eptesicus fuscus	33	0	33
Antrozous pallidus	5	0	5
Myotis yumanensis	1	0	1
Totals	45	3	48

‘Ahakhav Tribal Preserve

Netting was performed on September 10, 2007 from 7:00 p.m. to 11:30 p.m., and on September 12, 2007 from 7:10 p.m. to 11:30 p.m. for a total of just under 9 hours of netting. On the first night, one harp trap was set up near an opening in the habitat where trees had created a narrow corridor between two areas. Two 6-m nets were also set up across a lined irrigation canal that contained water. One additional 6-m net was set up across a small corridor that separated two open areas. Also, two high net setups were used along two wide corridors lined with tall cottonwood trees on two sides of a road. One setup was a quad stack with 12-m nets, while the other was a triple stack with 6-m nets. On the second night, only one triple stack 12-m net setup was used.

A total of 26 bats of 7, possibly 8 species, were captured between the two nights (Table 4). On the first night, one post-lactating female California myotis (*Myotis californicus*) and one non-reproductive female cave myotis (*Myotis velifer*) were captured in the quad set-up. One non-reproductive male Mexican free-tailed bat (*Tadarida brasiliensis*), and one post-lactating female California leaf-nosed bat were captured in the triple set-up. Three Yuma myotis were captured, including one juvenile female caught in the harp trap, and two non-reproductive (1 male and 1 female) adults captured in the triple set-up. Three pallid bats were also captured including one scrotal male captured in one of the 6-m nets set over the irrigation ditch; a second scrotal male was captured in the quad set-up, and a third non-reproductive female wascaught in the triple setup. Four western yellow bats were captured including two captured in the quad setup and two captured in the triple setup. Two of the four escaped without identification of sex or reproductive status. The other two were both juveniles (1 male and 1 female).

On the second night of netting, one scrotal male pallid bat, one non-reproductive female Yuma myotis, and five cave myotis were captured. Three of the cave myotis were non-reproductive females, and the other two were adult males, one being scrotal. Five *Myotis* spp. were also captured that could not be identified to species. Of these unidentified *Myotis* spp., three were non-reproductive females, and two were scrotal males.

Table 4. A summary of all captures at ‘Ahakhav

Species	Sept. 10	Sept. 12	Totals
Lasiurus xanthinus	4	0	4
Macrotus californicus	1	0	1
Antrozous pallidus	3	1	4
Tadarida brasiliensis	1	0	1
Myotis yumanensis	3	1	4
Myotis californicus	1	0	1
Myotis velifer	1	5	6
Myotis spp.	0	5	5
Totals	14	12	26

Summary of Results

A total of nine nights of netting were conducted at four sites in 2007. A total of 95 bats of 9, possibly 10, species were captured (Table 5). Of those, the western yellow bat and California leaf-nosed bat are covered under the LCR MSCP. The hoary bat has been designated as an indicator species because it is a tree-roosting species. The cave myotis is known to primarily forage in riparian areas (Brown 2006). The other four species are considered generalist species.

Table 5: Summary of the number of all species captured at each location

Species	Beal	Cibola	Pratt	‘Ahakhav	Totals
Macrotus californicus	0	14	5	1	20
Lasiurus xanthinus	0	0	1	4	5
Lasiurus cinereus	0	1	0	0	1
Antrozous pallidus	1	1	5	4	11
Eptesicus fuscus	0	2	33	0	35
Myotis yumanensis	4	1	1	4	10
Myotis californicus	0	0	0	1	1
Myotis velifer	0	0	0	6	6
Myotis spp.	0	0	0	5	5
Tadarida brasiliensis	0	0	0	1	1
Totals	5	19	45	26	95

Discussion

The most important findings of this preliminary survey were the presence of western yellow bats (MSCP covered species) at two of the sites, and California leaf-nosed bats (MSCP evaluation species) at three of the sites. Western yellow bats have yet to be found acoustically at Pratt,

showing the importance of supplementing the quarterly acoustic surveys with mist-netting/trapping. At the ‘Ahakhav Tribal Preserve, only exploratory acoustic data had been collected; however, the acoustic data did show that yellow bats used the site. Previously at the Cibola Nature Trail, California leaf-nosed bats had been captured by Brown (2006), but captures at Pratt and the Tribal Preserve are new records. Mist-netting/trapping of bats had never occurred at the Beal site, the Pratt site, or the Tribal Preserve before this survey. From the 2007 preliminary data, it appears that the use of stacked nets (triple or quad) increases capture rates due to sampling higher in the canopy and the greater net area that a bat has to avoid.

The unidentified myotis captured at the ‘Ahakhav Tribal Preserve may have been one of three different species. Arizona myotis (*Myotis occultus*) was the species that best fit with measurements taken of these bats; however, it has not been reported on the LCR since 1945 (Brown 2006). A wing punch kit for DNA collection was not available during the survey. The cave myotis and the Yuma myotis are the other two species that these unidentified bats may have been. The forearm measurements were slightly large for Yuma myotis, and slightly small for cave myotis. An attempt to record these bats acoustically was performed when the bats were released, and three were recorded with their calls beginning at 40 kHz. This is the frequency at which Arizona myotis and cave myotis echolocate, while Yuma myotis echolocate starting at 50 kHz. All bats captured appeared to be adults and both of the males were scrotal. If these bats are not Arizona myotis, then they are probably small cave myotis.

Of the 33 big brown bats captured at Pratt, only 3 were adults, and they were all females. In higher elevation habitats such as mountain ranges, male and females are known to separate at different elevations, with males staying at higher elevations than females (Kurta and Baker 1990). It is unknown whether big brown bats separate by sex in lower areas such as the LCR floodplain. Big brown bats are known to forage within 1-2 km of roosts, which indicates that a maternity colony is probably nearby (Kurta and Baker 1990). Males usually roost alone in the summer, which may be one of the reasons why no adult males were captured.

The October netting surveys proved to have mixed results. The Beal site only had one capture, and the Pratt site only had three captures. While temperatures at the start of netting were mild, within an hour or two of sunset the temperature dropped rapidly and activity also dropped. O’Farrell and Bradley (1970) found that bat activity over a desert spring decreased as temperatures decreased both on a given night as well as by season. This aligns with what we found in October. The Cibola site showed high use by California leaf-nosed bats, which are active year round. The hoary bat was an uncommon capture which was probably a migrant due to the time of year and lack of acoustic data for this species during the July acoustic survey. Using both our netting data as well as data taken from quarterly acoustic surveys taken during the same week, we plan on no longer netting in October. We will focus our effort on months where bat activity does not decrease so rapidly after sunset. In 2008 we plan to net at these same four sites, plus an additional site at Havasu NWR between the months of April and September. We intend to net at three of these sites five different times during this time period. Depending on the success of netting at Beal and the new site, the more productive site will be chosen to be monitored more frequently than the other.

Location of nets and traps is also important for successful capture of bats. Most netting surveys take place over or near water sources where nets can be positioned to capture bats as they dip down to drink. In most riparian re-vegetation sites along the LCR, there are very few open water sources, except for irrigation ditches, which can be difficult to set a net over. Most bat species avoid foraging in cluttered areas of forests (Lacki et. al 2007). The best location to set nets and traps at these sites seems to be where corridors or flyways occur within a large stand of trees. These corridors can either be roads between fields, or a break in the planting scheme between two areas of trees. These corridors may have to have a minimum width to create a large enough flyway for bats to use the area. The narrowest corridor that was surveyed was at the Pratt site, which was around 5 m (16 ft) across. This corridor not only enables enough of a flyway to create a corridor, but it also was narrow enough that the canopy of the trees had begun to partially cover the top of the corridor. This makes the corridor similar to a tunnel which may aid capturing bats by keeping them from flying up and out of the corridor and avoiding nets.

While these corridors aid biologists in determining where to attempt to capture bats, it is also assumed that these are the areas where bats are using the habitat the most, given that bats tend to avoid cluttered areas. Netting in these areas allows for a better understanding of bat use of riparian restoration areas, which may be useful in the future design of these sites. It may be as simple as creating a few 6-12 m (20-40 ft) breaks in cottonwood-willow planting areas to create corridors that would allow bats greater use of the site. This would also enable a more rapid determination on where to not only set nets, but also where to monitor acoustically at these sites. Netting bats at these sites gives the LCR MCSP more information than just presence or absence of covered species, including age, reproductive status, and sex ratios.

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