RECLAMATION

Managing Water in the West

Final Report

Operation of Two Monitoring Avian Production and Survivorship (MAPS) Stations on the Lower Colorado River, 2005 Breeding Season

Lower Colorado River Multi-Species Conservation Program
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Abstract

Two Monitoring Avian Production and Survivorship (MAPS) stations were operated during the 2005 breeding season by the Bureau of Reclamation; one station at Cibola National Wildlife Refuge and the other at Havasu National Wildlife Refuge. Area searches were also conducted in conjunction with the MAPS efforts. Banding was conducted for the first time at the Havasu site, which is a site that represents "typical" habitat found along the river. Captures at the Cibola site were lower than in the previous two seasons of banding. The two sites were compared to one another for both mist net capture and area search detection data. The Havasu site is adjacent to a marsh and aquatic species were detected in the area searches but not captured in the banding efforts. Species diversity indices (transformed Shannon-Weaver) obtained using MAPS data were similar between sites. Higher diversity was recorded at the Havasu site when area search data was analyzed, likely due to the presence of waterbirds, which are not captured in MAPS efforts. Vegetation was also analyzed at both sites at each net location, and these data are summarized and compared.

Introduction

During the summer breeding season of 2005, Bureau of Reclamation (Reclamation) operated two Monitoring Avian Production and Survivorship (MAPS) stations along the Lower Colorado River (LCR). The Havasu (HAVA) station was operated near Needles, CA on the Havasu National Wildlife Refuge for the first time this year, and the Cibola Nature Trail (CIBO) station was operated for the third year at Cibola National Wildlife Refuge, Arizona. Use of the Headgate Rock (HERO) station was discontinued this year after five years of operation.

The MAPS program is a cooperative network of bird banding stations operated throughout the U.S., Canada, and Mexico. All stations are operated during the summer breeding season, with the principal purpose of documenting use of breeding habitat by birds throughout North America. The data is collected and analyzed by the Institute for Bird Populations (IBP), which also establishes a set of guidelines and protocol for all MAPS stations (DeSante *et al.* 2002). Data from all the stations are compared to one another and long term trends for many bird species are monitored on a continent-wide basis.

Riparian areas of the Southwest support a disproportionately high bird diversity and abundance; yet form less than 0.5% of all the land area (Powell and Stiedl 2000). Much of this habitat has been altered and decreased due to climate change, habitat destruction, agricultural land conversion, urban development, mining, overgrazing, and river regulation (Powell and Stiedl 2000, and US Bureau of Reclamation 1996). Species richness, relative abundance, and individual bird condition are being recorded and analyzed in restored and non-restored habitats.

Study Areas

Cibola National Wildlife Refuge is located along the LCR south of Blythe, California in Cibola, Arizona. Established in 1964 to offset wildlife and habitat losses due to channelization of the LCR, the refuge attracts more than 200 bird species (U.S. Fish and Wildlife Service 2003). The Cibola Nature Trail restoration site contains 3 distinct areas separated into a 5.5 hectare (ha) mixture of honey mesquite (*Prosopis glandulosa*) and screwbean mesquite (*P. pubescens*), 2.6 ha of Goodding willow (*Salix gooddingii*), and 1 ha of Fremont cottonwood (*Populus fremontii*). A total of 1,500 honey mesquite, 1,500 screwbean mesquite, 10,000 Goodding willow, and 2,600 Fremont cottonwoods were planted (USBR 2003).

The Havasu banding site is located on the Havasu National Wildlife Refuge at the southern end of Topock Marsh, approximately 1.5 km north of the town of Topock, AZ. The nets are located on either side of the dirt road which follows the new South Dike just off state route 95. A large portion of the area is covered in saltcedar (*Tamarix spp.*) and arrowweed (*Pulchea sercea*), with some large, mature cottonwoods forming an overstory over roughly half the site. The cottonwoods at the site are the remaining trees from an earlier planting, conducted by Bureau of Reclamation personnel in 1987, where most of the trees planted did not survive (Glen Gould, pers. comm.)

Permits

Banding was conducted under the USFWS Banding Permit #22994, with Joe Kahl as the Master Bander and, Greg Clune, Matthew Voisine, Beth Sabin and Chris Dodge as sub-permitees. At least one of the sub-permit holders was present during any banding efforts.

Methods

The MAPS stations were run once in a 10-day period, for a total of 10 periods during the months of May to August. Established protocol for MAPS station operations was used at all times (De Sante *et al.* 2002).

The Cibola site contained nine 12m nets and two 6m nets. Six 12m nets were located in the Goodding willows, three 12m nets in the Fremont cottonwoods and two 6m nets in the mesquites. These locations were chosen in order to sample the three distinct habitat types.

Ten 12m nets were used at the Havasu banding site. Three nets were located in areas with an overstory of Freemont cottonwood and seven nets were located in areas dominated by the presence of salt cedar mixed with arroweed and Freemont cottonwood. These locations were chosen in order to evenly sample the vegetation found at the site.

Nets were set up 1/2 hour before sunrise, and closed 5 hours later, or when the temperature exceeded 37.8° C. The nets were checked every 30 to 50 minutes, depending on the temperature. All data were recorded on a standardized data sheet (Desante *et al.* 2002). A metal, numbered USFWS band was placed on all captured birds, with the exception of game species and hummingbirds. Each bird was identified to species, aged, sexed, measured for wing chord, body fat and pectoral muscle mass, weighed and released. Time, date, and net location from which a bird was captured were recorded, as well as total hours of net operations. Birds were identified to species using Pyle (1997) and National Geographic (1999). Birds were aged and sexed using Pyle (1997).

Bird Safety

All operations of the banding station were conducted with bird safety as the first priority. If weather conditions, number of captures, or other circumstances were deemed to be unsafe, nets were closed immediately and banding ceased for the day or until conditions improved. Injured birds were cared for and released as soon as possible. All birds were processed in a quick and timely manner in order to reduce stress caused by handling. Standard protocols for bird extraction and handling, as established by Ralph *et al.* (1993), and De Sante *et al.* (2002), were followed at all times.

Annual Return Rate

Data from recaptured birds were used to measure annual return rate. Annual return rate is a measure of birds recaptured in subsequent field seasons after the field season of their initial capture and is recorded as a percentage (Latta and Faaborg 2001, 2002).

Vegetation Monitoring

A vegetation monitoring protocol was established to collect data on total vegetation volume (TVV) in order to gain further knowledge of how bird captures from constant effort mist-net operations may be associated to vegetation characteristics of the banding sites. This information was collected once during the summer season. At each site, measurements were taken from a starting point located at the center of each net lane. Two randomly chosen transects were established from each net lane. One transect was run on either side of the lane, at a length of 20 m. Along each transect, points were taken at every 2 m for a total of 20 points taken from each net lane. At each point, a 7.5 m pole was used to measure vegetation hits at every dm section of the pole. At every 10 cm section, a hit was recorded if any vegetation fell within a 10 cm radius of the pole. For each hit, the plant species was recorded. Hits were estimated for all vegetation over 7.5 m in height. These data were used to estimate TVV for each meter of height and for the entire site. Species composition was estimated for each entire site and by height class. This protocol was based on Mills et al. (1991). TVV was calculated using the formula:

TVV= h/10p
h= the total numbered of hits recorded for all the plots measured at one site.
p= all the decameter height sections measured.

Area Searches

Area searches were conducted at both sites throughout the summer breeding season. Ten area searches were scheduled to be conducted at each site. At the CIBO site nine area searches were actually conducted and at the HAVA site, eight areas searches were conducted. Three area searches were not conducted due to inclement weather.

Each site was divided into roughly equal sections and each section was searched for a total of 20 minutes. In each section, the numbers of each species and the type of detection for each individual was recorded. Birds were detected either visually, by call, or by song. Any signs of breeding, nesting or flocking behavior were also recorded on the data form.

Results

Ten banding periods were conducted at both sites from May to August. A total of 39 different species, with 25 being species known to breed on the LCR, were captured at the CIBO site. The birds per net hour capture rate at the CIBO site for all captures of all species was 0.71 (0.89 in 2004) and for individual captures of resident species was 0.55. At the HAVA site, 27 species were captured, 21 of which were resident species. Birds per net hour capture rate at the HAVA site for all captures of all species was 0.66 and for individual captures of resident species was 0.48. All captures is a count of any capture which occurred, including re-captures and un-banded birds. Individual captures is a count of each unique banded individuals where re-captures of the same individual are not counted in the total. The following charts (Figures 1-4) demonstrate the relative percentages of individual captures of resident species at both sites.

Figure 1. Relative percentages of mist net captures, per species, at the CIBO site.

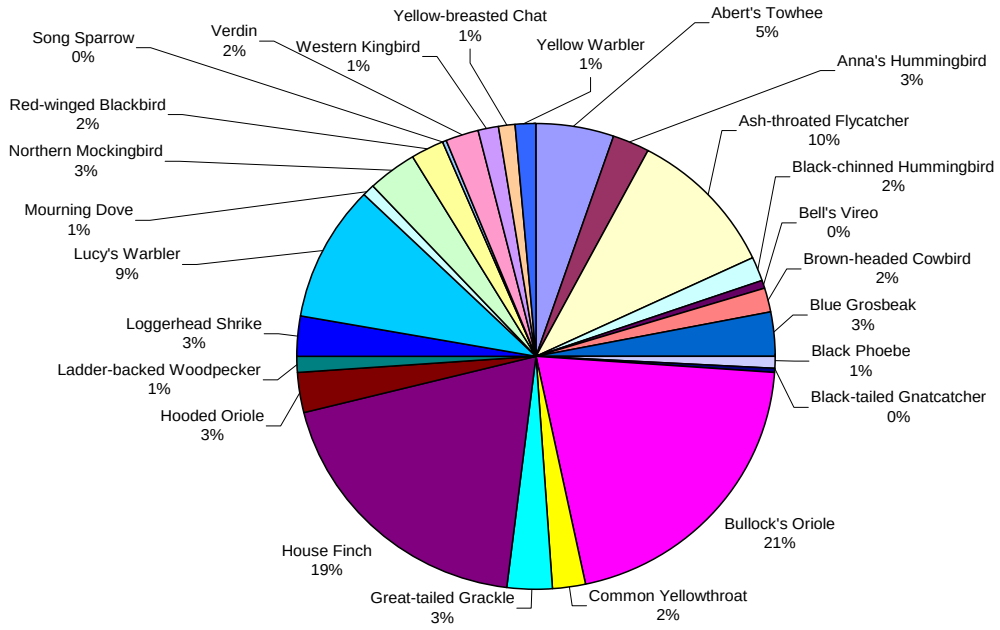


Figure 2. Three-year comparison of captures per species at the CIBO site.

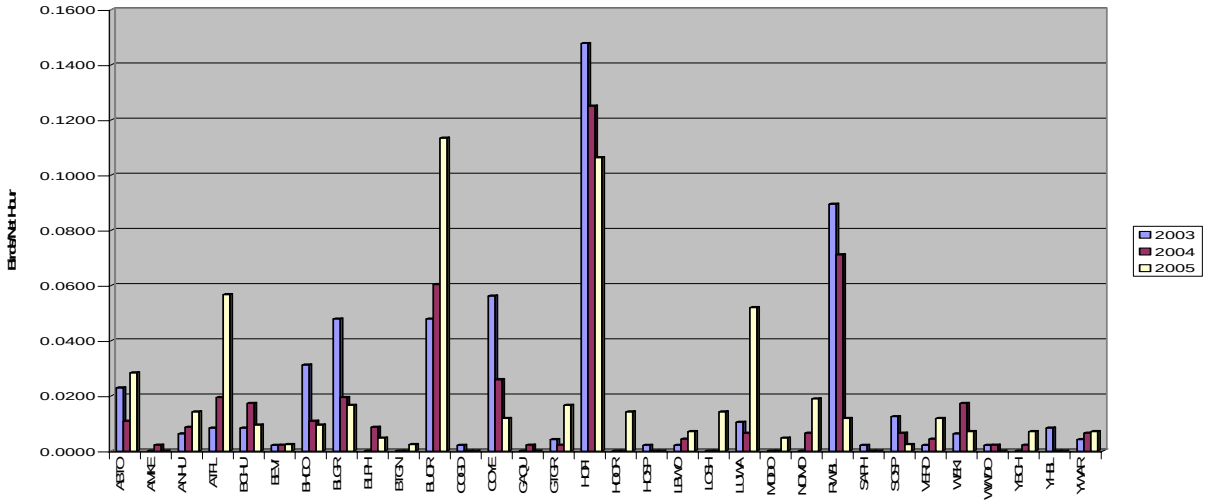


Figure 3. Relative percentages of mist net captures, per species, at the HAVA site.

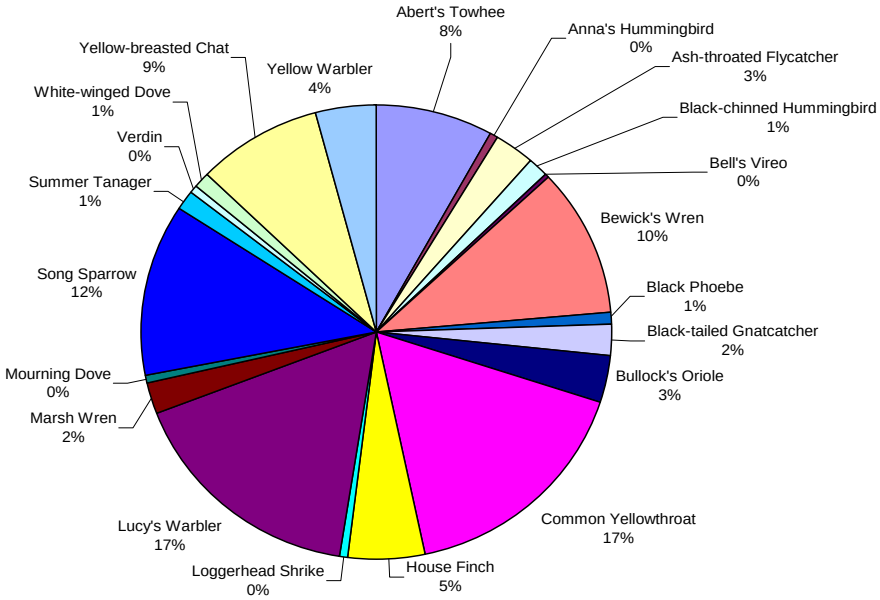
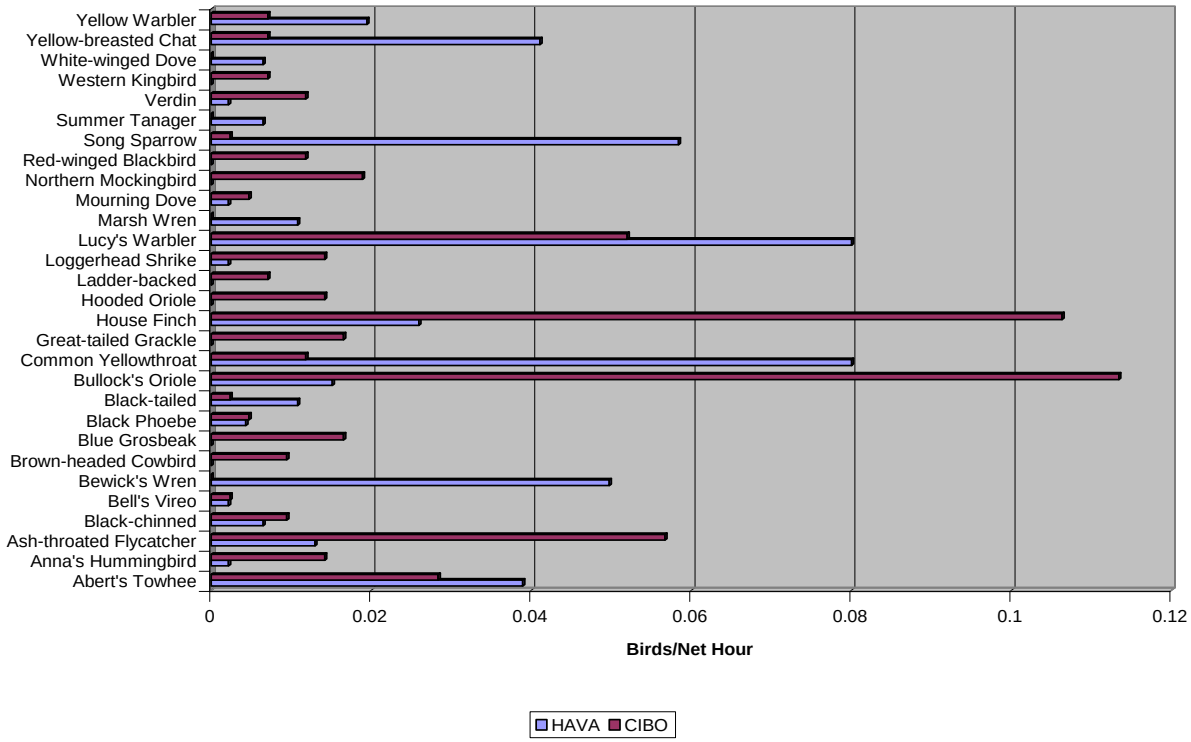


Figure 4. A comparison of birds per net hour capture rates between the HAVA and CIBO sites.



Annual Return Rate

The annual return rate was calculated for the CIBO site. No calculation was possible at the HAVA site as this was the first year of data collection at the site. Individuals from three species were re-captured from birds originally captured in previous years. Table 1 demonstrates the return rates for these species and for all individual birds captured.

Table 1. Annual return rates from the CIBO site.

Species	Annual Returns	Total Individuals	Annual Return %
Brown-headed Cowbird	1	4	25.00%
Blue Grosbeak	4	7	57.14%
Bullock's Oriole	4	48	8.33%
Total	9	274	3.28%

Area Search

Area search data was collected nine times at the CIBO site and eight times at the HAVA site. An average of 144.56 birds was detected per area search at the CIBO site and an average of 165.32 birds was detected per area search at the HAVA site. Several tests were run on the data to compare the results for species diversity and to create a similarity index comparing quantitative similarity in the data. Species diversity was calculated at each site using the Shannon-Weaver index (Krebs 1989 in Nur et. al. 1999) which uses the formula:

$$H' = \sum_{i=1}^{i=s} (p_i)(\ln p),\ i=1,2\ldots.S$$

Where S= the number of species in sample, H'= the species diversity index, and p_i= the proportion of all birds detected belonging to the *i*th species. For the HAVA site, the species diversity index was calculated to equal 3.047 and for the CIBO site it was calculated to equal 2.560. These values were then transformed into a value, N1, using the formula $N_1=e^H$. N_1 gives a value which expresses diversity in terms of species, giving a value that represents what the species richness (number of species detected) is when the data is statistically transformed to represent even detection numbers for all species (Macarthur 1965 in Nur et al.1999). This gives a more useful value to use for site comparison in the analysis. When transformed in this way, the HAVA site yields a higher index of diversity value of 21.050 and the CIBO site yields a value of 12.931.

A community similarity index was created using the Renkonen index (Nur et. al. 1999). The Renkonen index (P) is calculated using the formula:

$$P = \sum_{i=1}^{i=s} \text{minimum}(p^A{}_i, p^B{}_i)$$

Where $p^A{}_i$ is the proportion of species *i* to all species for sample A, $p^B{}_i$ is the proportion of species *i* to all species for sample B and S is the number of species in the sample. The similarity index value comparing the two sites is 0.3621.

The detections for each species, from each period, were averaged together and compared between sites. Figure 5 compares average detections per period for those species which had at least a 1 bird per period average and which were detected at least three times at one of the two sites. In Figure 6 and 7, area search species with a capture rate of less than 1% were lumped together in the "others" category.

Figure 5. Comparison of average area search detections between the CIBO and HAVA sites.

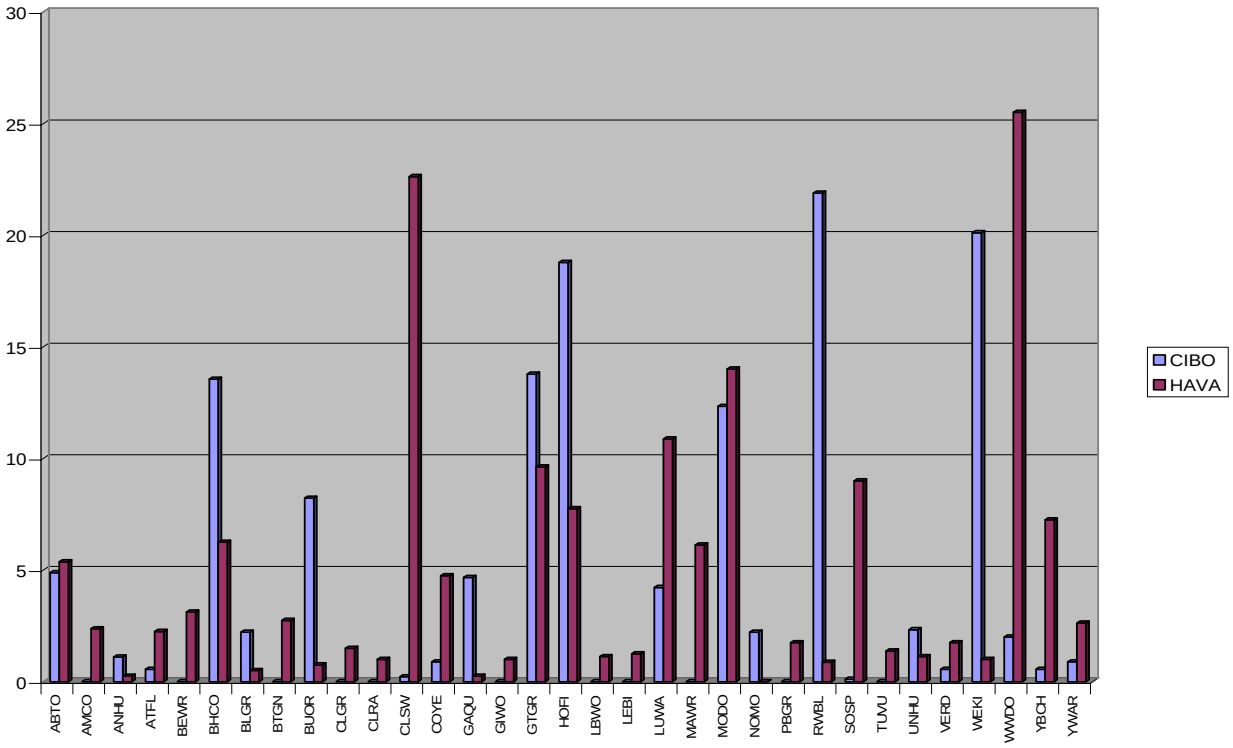


Figure 6. Relative percentages of area search detections per species at the CIBO site.

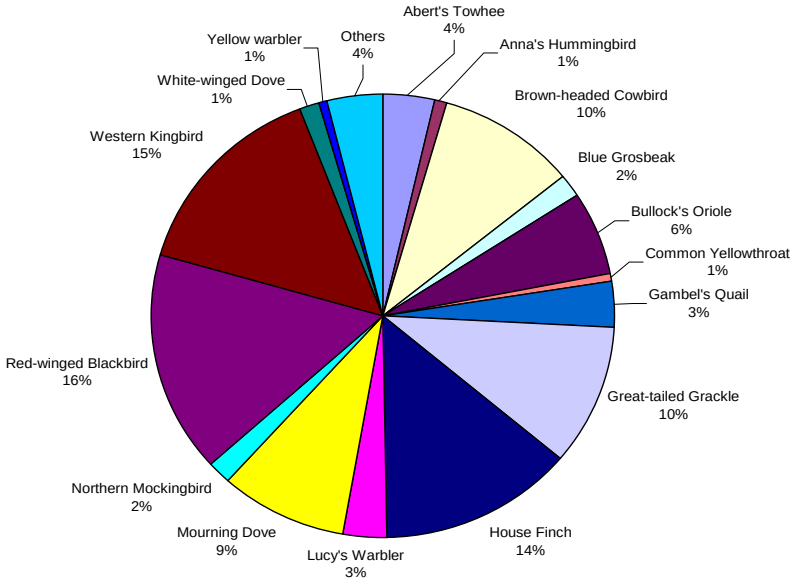
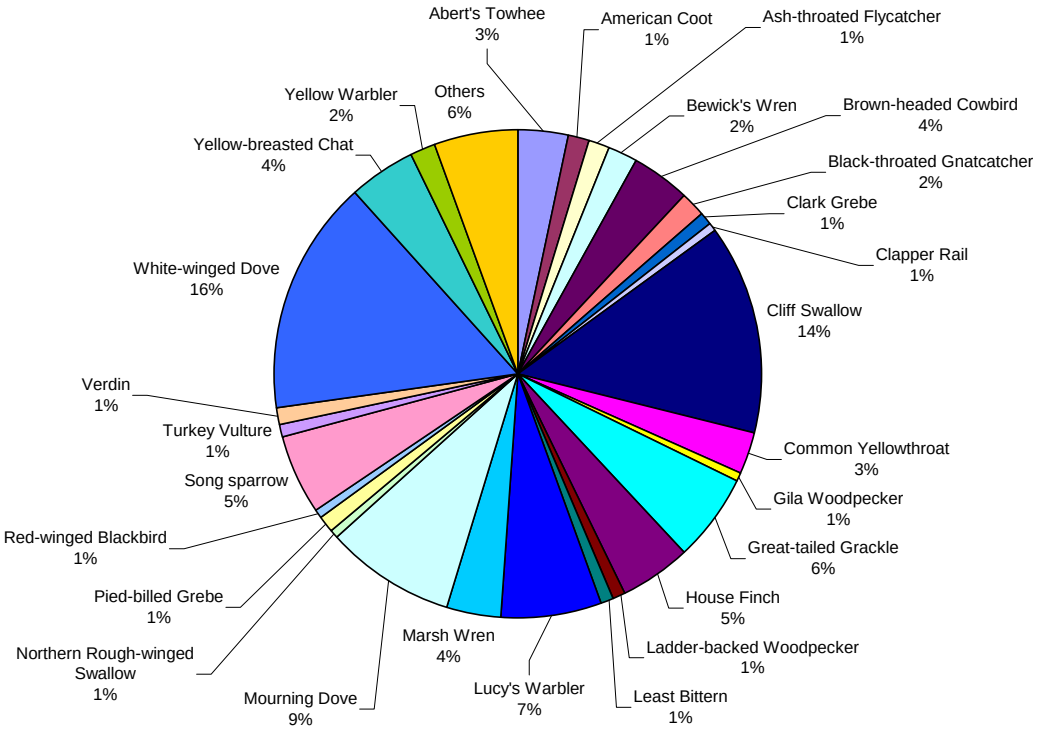


Figure 7. Relative percentages of area search detections per species at the HAVA site.



Statistical Analysis

Several statistical tests were run on the banding data from both sites; however, most statistical comparisons between the two sites were not possible as only one year of data exists for the HAVA site. The Renkonen index of community similarity was conducted to compare both sites. When both sites where compared using this method, a value of 0.359 was obtained which is very close to the value of 0.362 obtained from the area search data.

The Shannon-Weaver Index was also used to obtain species diversity index values for both sites. For the HAVA site, a value of 2.513 was obtained and at the CIBO site a value of 2.624 was obtained. When transformed to the N_1 value representing even species diversity, the HAVA site yielded an index of diversity value of 12.342 and the CIBO site yielded a value of 13.801.

Two species, the blue grosbeak (*Guiraca caerulea*) and the Bullock's oriole (*Icterus bullocki*), were analyzed for survivorship at the CIBO site using program Mark. Survivorship can be used as an index for the suitability of a site to provide adequate habitat that sustains a viable population for a species. The analysis was not conclusive, likely due to only three years of data existing for analysis, with a high range of difference in the estimates of survivorship within the 95 % confidence interval. For the blue grosbeak estimates were between 7% and 45% (n=29) and for the Bullock's oriole estimates were between 7% and 32% (n=79).

Vegetation Analysis

Data was collected on vegetation volume at both sites. Twenty-two transects were completed at the CIBO site. Twenty transects were conducted at the HAVA site, but on three of these transects, data was collected from only 8 of 10 points due to the inaccessibility of certain areas. Table 2 shows the percentage vegetation per meter, and Table 3 compares relative percentages of plant species encountered at both sites.

Table 2. A comparison of percent vegetation per meter layer between banding sites.

Meter Layer	CIBO	HAVA
0-1	40.23%	49.18%
1-2	22.00%	40.46%
2-3	23.95%	30.00%
3-4	17.91%	18.76%
4-5	13.05%	8.14%
5-6	10.09%	7.99%
6-7	6.68%	5.31%
7-8	6.55%	5.52%
8-9	5.77%	6.70%
9-10	4.95%	6.44%
10-11	2.77%	5.10%
11-12	1.73%	5.21%
TOTAL	**12.97%**	**15.73%**

Table 3. A relative percentage per plant species comparison between banding sites.

Species	CIBO	HAVA
arroweed (*Pulchea sercea)*	0.00%	12.68%
baccarus(*Baccharus glutinosa*)	13.55%	0.00%
bermuda grass(*Cynodon dactylon*)	0.47%	0.00%
Cattail (*Typha latifolia*)	0.00%	1.83%
common cocklebur *(*Xanthium strumarium*)*	0.26%	0.00%
cottonwood (*Populus fremontii*)	32.53%	23.11%
coyote willow (*Salix exigua*)	0.03%	0.00%
dead material	3.24%	14.28%
Goodding's willow (*Salix gooddingii*)	16.03%	0.00%
honey mesquite (*Prosopis glandulosa*)	5.99%	0.00%
Johnson grass (*Sorghum halapense*)	23.74%	0.00%
alkali mallow (*Malvella spp.*)	0.06%	0.00%
screwbean mesquite (*Prosopis pubescens*)	4.12%	0.00%
saltcedar (*Tamarix spp.*)	0.00%	48.10%

Discussion

This year a new MAPS station was added (HAVA), while the HERO site was discontinued after five years of operation. The HAVA site now serves as a comparison to the CIBO restoration site, as the HERO site previously did. The HAVA site has a greater component of cottonwood (23.11%), does not have a mesquite component, and has less saltcedar (32.85%) than was surveyed at the HERO site last year(.71% cottonwood, 13.25% mesquite, and 48.1% saltcedar) (Reclamation 2004). The data from the HAVA site has a higher species richness and rate of captures than in any year of data collected from the HERO site. HAVA does represent a "typical" habitat along the LCR, but one with possibly higher quality avian habitat than at the HERO site.

When HAVA is compared to CIBO, many notable differences stand out. The vegetation at HAVA is less diverse (5 species, 4 with a relative percentage greater than 10%) compared to the CIBO site (11 species, 4 with a relative percentage greater than 10%). Cottonwood was the only species recorded at both sites. At the HAVA site, the invasive exotic species saltcedar was the most dominant while it was not found in the vegetation transects conducted at the CIBO site. The HAVA site also has a higher percentage of vegetation in the first three meter layers (Table 2). The amount of vegetation in lower meter layers can be important for some bird species. The vegetation at the HAVA site is comprised almost exclusively of three species, nearly half of which is saltcedar and the CIBO site is made up of mostly native species in a more diverse mix of species. This is to be expected as the CIBO site is a planted restoration site. There are some factors at the HAVA site which may increase its suitability as bird habitat which do not appear in the vegetation data, such as the presence of permanent water and the maturity of the cottonwoods at the site. The cottonwoods at the HAVA site are higher and more mature than those found at the CIBO site, which were planted in 1999.

At the HAVA site, several species common to riparian communities of the LCR were captured at a higher rate than at the CIBO site (Figure 4). Several species, such as the yellow warbler (*Dendroica petechia*) and the summer tanager (*Piranga rubra*), are covered species under the MSCP. Others, such as the Abert's towhee (*Pipilo aberti*) and Lucy's warbler (*Vermivora luciae*), are regional species endemic to the deserts of the southwestern U.S. and northwestern Mexico and are watch list species in the Partners in Flight North American Landbird Conservation Plan (Rich et al. 2004). As such, these species can, in part, serve as indicators to how effective the sites are for native bird habitat because they are more common and easier to monitor. This allows researches to obtain sufficient amounts of data for analysis versus an endangered and threatened species, such as the southwestern willow flycatcher (*Empidonax trailii extimus*). These data would seem to indicate that, while these important species and others are utilizing the CIBO restoration site and show evidence of breeding, they are doing so at a lower abundance. In some cases with riparian obligate species, such as the yellow warbler, yellow-breasted chat (*Icteria virens*), common yellowthroat (*Geothypis trichas*), and song sparrow (*Melospiza melodia*), capture rates were considerably higher at the HAVA site. One species, the summer tanager, was only captured or observed at the HAVA site. This could indicate that the constant presence of water and the mature overstory provided by the cottonwoods at the HAVA site are important in increasing the utilization of the area by riparian obligate species.

A general comparison of the transformed species diversity index values (N_1) utilizing banding data shows a slight difference between banding sites, with CIBO having a value (13.801) 1.459 higher than that at HAVA(12.342). The area search data showed a greater difference in diversity with the HAVA site (21.050) having a value 8.22 higher than that obtained at the CIBO site (12.931). This is to be expected as aquatic species were found during area searches at HAVA, but absent at CIBO. This indicates that overall diversity is higher at the HAVA site but when aquatic species are excluded, as the banding data does, the diversity between the two sites is fairly equal.

Species diversity measures both the richness and quantity of birds found at the sites but the Renkonen index measures the actual quantitative similarity between the sites. The Renkonen index is based on a percentage scale, with a value of 1 indicating complete similarity and a value of 0 indicating complete dissimilarity. The values of 0.359 obtained from banding data and 0.362 from area search data indicate that, while species diversity between the sites is similar, it is due to fairly even diversity of different species and not the same species. The comparisons of the banding and area search data shown in figures 4 and 5 bear this out. While overall captures and detection rates are not widely different, the actual rates for many individual species are.

The HAVA site had substantially higher capture rates, although several species were captured at much higher rates at the CIBO site. Two species, the house finch (*Carpodacus mexicanus*) and the Bullock's oriole, dominated the overall captures, comprising 21% and 19% of the total individual captures, respectively, and were the only species to comprise more than 10% of the total individual captures (Figure 1). Their capture rates were the only two to surpass 0.1 per net hour and were captured at least twice the rate of any other species (Figure 4). Overall the captures at the HAVA site were more evenly distributed between several species than at the CIBO site.

The CIBO site had several changes in bird captures from the previous two years of banding. There was an increased presence of Lucy's warbler, ash-throated flycatcher (*Myiarchus cinerascens*), and Bullock's oriole (figure 2). In the case of the Lucy's warbler, the increase was especially pronounced, with the capture rate for 2005 eight times higher than in 2004 and five times higher than in 2003. Possible explanations for the increase of these species include the mild, wet weather during the spring of the year or the maturing of the mesquite habitat at the site. Nothing definitive could be connected to a one year increase in these species but this should be monitored in future years.

The area search data produced results which are especially useful in providing data on species not captured in the mist nets. Species such as the cliff swallow (*Petrochelidon pyrrhonota*), mourning dove (*Zenaida macroura*), white-winged dove (*Zenaida asiatica*), and great-tailed grackle (*Quiscalus mexicanus*), were detected more often during area searches at the HAVA site than during banding. At the CIBO site, species such as, western kingbird (*Tyrannus verticalis*), great-tailed grackle, mourning dove, and red-winged blackbird (*Agelaius phoeniceus*) were more commonly detected during area search efforts. These species are hard to capture during banding either due to their avoidance of nets or their use of habitats which keep them from the nets (such as habitats above the height of the nets, or open aquatic habitats). The area search data is much more reflective for these species' actual use of the areas. For other species, such as Lucy's

warbler, which are somewhat secretive and do not vocalize later in the breeding season, the banding data may better represent their actual numbers.

No analysis was made of bird condition indices, such as fat levels and pectoral muscle mass. In previous years, these data were analyzed and used as a general indicator of health for birds captured. This data has proven to be ineffective for this use as a great amount of variation occurs in both these measures, which can be unrelated to bird health. Other methods such as, community similarity indices, and survivorship analysis, will be used to determine habitat suitability.

This year, with the initiation of the HAVA site, there is now a greater number of captures to compare to the restoration site. The HERO site did not provide enough capture numbers for individual species to allow significant comparison between the two sites. As more data is collected in future seasons, it should be possible to gain greater insight into how the CIBO restoration site compares in bird productivity to a more typical area along the LCR and provide improvements in future design of re-vegetation sites.

Appendix A

Standard AOU (American Ornithological Union) Codes used for North American Bird Species found along the LCR

Code	Common Name	Scientific Name
NOHA	northern harrier	Circus cyaneus
SSHA	Sharp-shinned hawk	Accipiter striatus
AMKE	American kestrel	Falco parverius
GAQU	Gambel's quail	Callipepela gambelii
WWDO	white-winged dove	Zenaida asiatica
MODO	mourning dove	Zenaida macroura
COGD	common ground-dove	Columbina passerine
YBCU	yellow-billed cuckoo	Coccyzus americanus
GRRO	greater roadrunner	Geococcyx californianus
LENI	lesser nighthawk	Chordeiles acutipennis
WTSW	white-throated swift	Aeronautes saxatalis
BCHU	black-chinned hummingbird	Archilocus alexandri
ANHU	Anna's hummingbird	Calypte anna
COHU	Costa's hummingbird	Calypte costae
RUHU	rufous hummingbird	Selaphorus rufus
LBWO	ladder-backed woodpecker	Picoides scolaris
RSFL	red-shafted flicker	Colaptes auratus cafer
YSFL	yellow-shafted flicker	Colaptes auratus auratus
WWPE	western wood pee-wee	Contopus sordidulus
WIFL	willow flycatcher	Empidonax trailii
LEFL	least flycatcher	Empidonax minimus
HAFL	Hammond's flycatcher	Empidonax hammondii
GRFL	gray flycatcher	Empidonax wrightii
DUFL	dusky flycatcher	Empidonax oberholseri
WEFL	western flycatcher	Empidonax difficilis /occidentalis
PSFL	Pacific-slope flycatcher	Empidonax difficilis
COFL	Cordilleran flycatcher	Empidonax occidentalis
EAPH	Eastern phoebe	Sayornis phoebe
BLPH	black phoebe	Sayornis nigricans
SAPH	Say's phoebe	Sayornis saya
VEFL	vermillion flycatcher	Pyrocephalus rubinus
ATFL	ash-throated flycatcher	Myiarchus cinerascens
BCFL	brown-crested flycatcher	Myiarchus tyrannulus
CAKI	Cassin's kingbird	Tyrannus vociferans
WEKI	western kingbird	Tyrannus verticalis
LOSH	loggerhead shrike	Lanius ludovicianus
BEVI	Bell's vireo	Vireo belli
PLVI	plumbeous vireo	Vireo plumbeus
CAVI	Cassin's vireo	Vireo cassinii
WAVI	warbling vireo	Vireo gilvus
CORA	common raven	Corvus corax
HOLA	horned lark	Eremophila alpestris
TRES	tree swallow	Tachycineta bicolor
VGSW	violet-green swallow	Tachycineta thalassina
NRWS	northern rough-winged swallow	Stelgidopteryx serripennis
CLSW	cliff swallow	Petrochelidon pyrrhonota

Code	Common Name	Scientific Name
BARS	barn swallow	Hirundo rustica
VERD	verdin	Auriparus flaviceps
RBNH	red-breasted nuthatch	Sitta Canadensis
CACW	cactus wren	Campylorhynchus brunneicapillus
BEWR	Bewick's wren	Thryomanes bewickii
HOWR	house wren	Troglodytes aedon
MAWR	marsh wren	Cistothorus palustris
RCKI	ruby-crowned kinglet	Regulus calendula
BGGN	blue-grey gnatcatcher	Polioptila caerulea
BTGN	black-tailed gnatcatcher	Polioptila melanura
SWTH	Swainson's thrush	Catharus ustulatus
HETH	hermit thrush	Catharus guttatus
AMRO	American robin	Turdus migratorius
NOMO	northern mockingbird	Mimus polyglottos
CRTH	crissal thrasher	Toxostoma crissale
PHAI	phainopepla	Phainopepla nitens
OCWA	orange-crowned warbler	Vermivora celata
NAWA	Nashville warbler	Vermivora ruficapilla
LUWA	Lucy's warbler	Vermivora luciae
YWAR	yellow warbler	Dendroica petechia
AUWA	yellow-rumped (Audubon's) warbler	Dendroica coronata auduboni
MYWA	yellow-rumped (Myrtle's) warbler	Dendroica coronata coronata
BTYW	black-throated gray warbler	Dendroica nigrescens
TOWA	Towsend's warbler	Dendroica townsendi
HEWA	hermit warbler	Dendroica occidentalis
AMRE	American redstart	Setophaga ruticilla
NOWA	northern waterthrush	Seiurus noveboracensis
KEWA	Kentucky warbler	Oporornis formosus
MGWA	Macgillivray's warbler	Oporornis tolmiei
COYE	common yellowthroat	Geothypis trichas
WIWA	Wilson's warbler	Wilsonia pusilla
YBCH	yellow-breasted chat	Icteria virens
SUTA	summer tanager	Piranga rubra
WETA	western tanager	Piranga ludoviciana
GTTO	green-tailed towhee	Pipilo chlorurus
SPTO	spotted towhee	Pipilo maculatus
ABTO	Abert's towhee	Pipilo aberti
CHSP	chipping sparrow	Spizella passerine
BRSP	Brewer's sparrow	Spizella breweri
VESP	vesper sparrow	Pooecetes gramineus
LASP	lark sparrow	Chondestes grammacus
BTSP	black-throated sparrow	Amphispiza bilenata
SAVS	savannah sparrow	Passerculus sandwichensis
GRSP	grasshopper sparrow	Ammodramus savannarum
FOSP	fox sparrow	Passerela iliaca
SOSP	song sparrow	Melospiza melodia
LISP	Lincoln's sparrow	Melospiza lincolnii
WTSP	white-throated sparrow	Zonotrichia albicollis
WCSP	white-crowned sparrow	Zonotrichia leucophrys
GWCS	Gambel's white-crowned sparrow	Zonotrichia l. gambelii
MWCS	mountain white-crowned sparrow	Zonotrichia l. oriantha
DEJU	dark-eyed junco	Junco hyemalis
SCJU	slate-colored junco	Junco hyemalis hyemalis
BHGR	black-headed grosbeak	Phueciticus melanocephalus
BLGR	blue grosbeak	Guiraca caerulea

Code	Common Name	Scientific Name
LAZB	lazuli bunting	Passerina amoena
INBU	indigo bunting	Passerina cyanea
RWBL	red-winged blackbird	Agelaius phoeniceus
WEME	western meadowlark	Sturnella neglecta
YHBL	yellow-headed blackbird	Xanthocephalus xanthocephalus
GTGR	great-tailed grackle	Quiscalus mexicanus
BHCO	brown-headed cowbird	Molothrus ater
HOOR	hooded oriole	Icterus cucullatus
BAOR	Baltimore oriole	Icterus galbula
BUOR	Bullock's oriole	Icterus bullockii
SCOR	Scott's oriole	Icterus parisorum
HOFI	house finch	Carpodacus mexicanus
LEGO	lesser goldfinch	Carduelis psaltria
HOSP	house sparrow	Passer domesticus

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