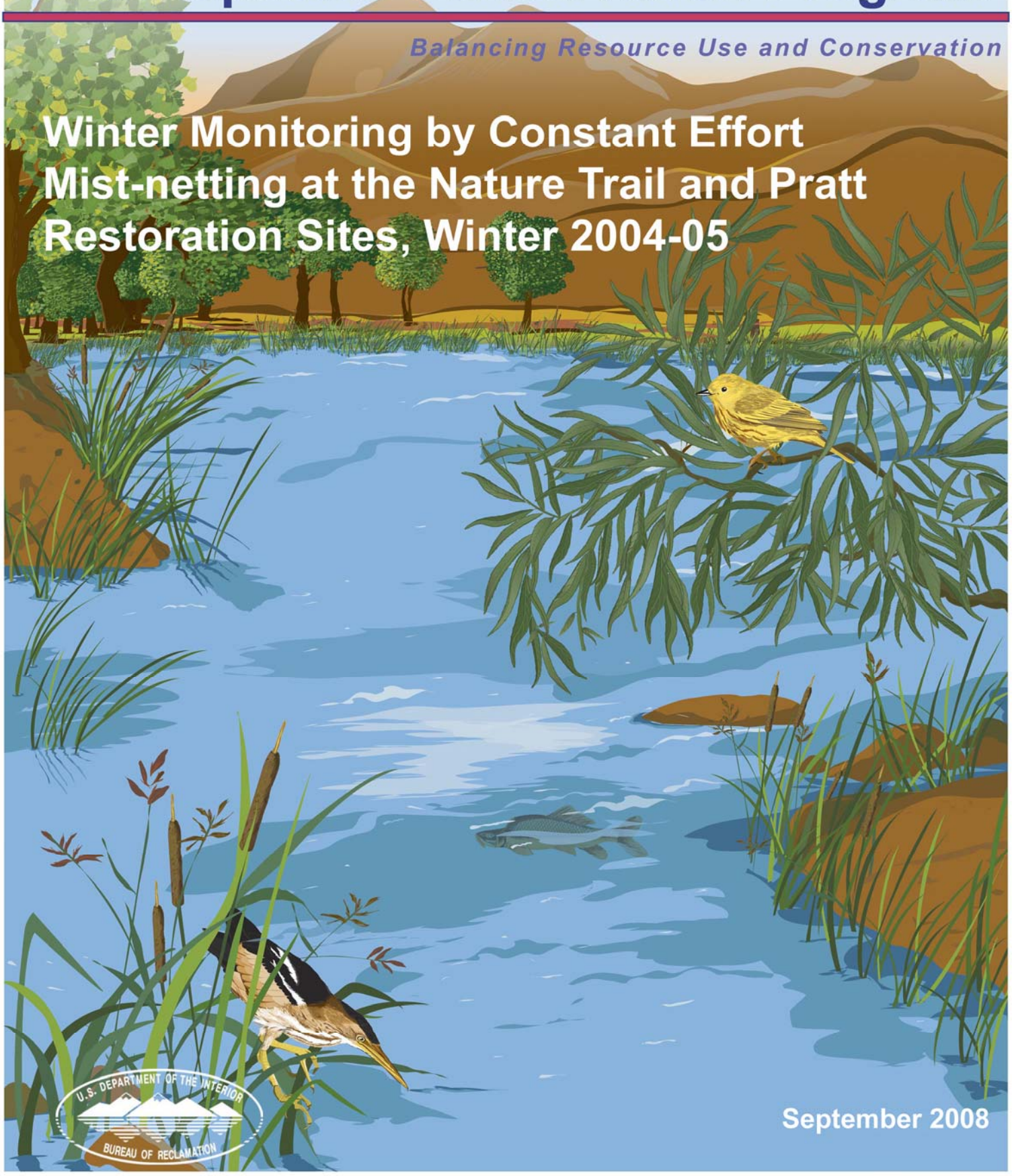
Lower Colorado River Multi-Species Conservation Program

Balancing Resource Use and Conservation

Winter Monitoring by Constant Effort Mist-netting at the Nature Trail and Pratt Restoration Sites, Winter 2004-05



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September 2008

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Lower Colorado River Multi-Species Conservation Program

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Lower Colorado River
Multi-Species Conservation Program
Bureau of Reclamation
Lower Colorado Region
Boulder City, Nevada
http://www.lcrmscp.gov

September 2008

Abstract

The Bureau of Reclamation has established two experimental restoration sites along the Lower Colorado River and from November 2004 to March 2005, these sites were monitored for winter bird use. The Cibola Nature Trail site is located on Cibola National Wildlife Refuge and the Pratt Restoration Site is located on land managed by the Bureau of Land Management outside Yuma, Arizona. Both sites were monitored using a combination of area search and mist-netting techniques. Vegetation data were taken to correlate with the avian monitoring results. This is the third year of winter avian monitoring at the two sites and capture rates and detection rates were lower than in the previous two years. Only the Abert's towhee (*Pipilo aberti*) showed a statistically significant difference in capture rate. Other measures of winter use, such as site persistence and annual return, were also lower than in the two previous years of data.

Introduction

The lower Colorado River (LCR) travels from Lees Ferry, south of Glen Canyon Dam, to the Gulf of California in Mexico. Flowing through the Mojave and Sonoran deserts, the LCR provides a large expanse of riparian vegetation in an arid environment. Riparian areas in the Southwest support a disproportionately high bird diversity and abundance, yet form less than 0.5% of the land area (Powell and Stiedl 2000). The decline of size and quality of this habitat has negatively affected the avian species that utilize it (Szaro 1980, Rosenberg *et al*. 1991, Powell and Stiedl 2000). Much of this habitat has decreased due to climate change, habitat destruction, agricultural land conversion, urban development, mining, overgrazing, and river regulation (Bureau of Reclamation 1996, Powell and Stiedl 2000). A search of the literature finds very little data concerning year-round bird use in xeroriparian areas of the Southwest, especially in restoration sites.

The Bureau of Reclamation (Reclamation) has established native tree restoration demonstration sites along the LCR. These plots were created to evaluate potential restoration techniques to meet objectives set forth in the LCR Multi-Species Conservation Plan (MSCP), for which Reclamation will act as lead implementing agency. The MSCP is a cooperative Federal-State-Tribal-County-Private endeavor to restore over 8,000 acres of habitat along the LCR within 50 years. Implementation of the MSCP began in October 2005. Reclamation developed the two native habitat restoration sites discussed in this paper as small, experimental plots to create and understand habitat requirements for specific species, particularly those listed as endangered and threatened. Avian species diversity and richness numbers collected from this project will be used as indicators of what bird use may be expected in future restoration projects conducted along the LCR.

Study Areas

The Cibola Nature Trail restoration site (CIBO) in Cibola National Wildlife Refuge is located along the LCR south of Interstate 10 in Cibola, Arizona. Established in 1964 to offset wildlife and habitat losses due to channelization of the Colorado River, the refuge attracts more than 200 bird species (USFWS 2003). The restoration site contains three distinct areas: 1) a 5.5-ha mixture of honey mesquite (*Prosopis glandulusa*) and screwbean mesquite (*Prosopis pubescens*), 2) 2.6 ha of Goodding's willow (*Salix gooddingii*), and 3) 1 ha of Fremont cottonwood (*Populus fremontii*). A total of 1,500 honey mesquite, 1,500 screwbean mesquite, 10,000 Goodding's willow, and 2,600 Fremont cottonwood were planted in 1999 (USBR 2003). Exotic Johnsongrass (*Sorghum halepense*) invaded as an understory in each of the three areas, and serves as a ground cover reaching up to 2 m in height. Between the first (November) and second (January) banding periods in the 2003-2004 season, Cibola NWR staff cut the invasive Johnsongrass within 10 m of the nets. Johnsongrass has re-established itself in many areas. The site was an island of habitat surrounded by farm fields on three sides and *Tamarix* spp. on the fourth. In the fall of 2003, the *Tamarix* spp. was removed and the area will be planted with native vegetation.

The Pratt restoration site (PRAT) is located north of Interstate 8, near Yuma, Arizona, on land administered by the Bureau of Land Management. The site is north of Laguna Dam, south of Mittry Lake, and is surrounded by farm fields and *Tamarix* spp. In the fall of 2003, *Tamarix* spp. was removed and will be restored with native vegetation. A leaseholder has farmed the 4.9-ha site since 1949. In 1999, Reclamation established six planting regimes with Fremont cottonwoods, Goodding's willows, and coyote willows (*Salix exigua)* using potted plants, seeds, and poles. Potted plants and poles were planted densely, from 1 m to 3 m apart. Seeded areas were planted with cottonwood and willow seeds collected locally and broadcast by hand over wet soils. *Baccharis* spp. independently established in a potted cottonwood plot and *Tamarix* spp. established, in small numbers, in the seeded areas. The potted coyote willow has recruited new individuals independently while the cottonwoods and Goodding's willows have not (Bureau of Reclamation 2003).

Methods

Mist-netting/bird-banding occurred at the Cibola Nature Trail restoration site and the Pratt restoration site for the third consecutive season during the winter of 2004-05. In the previous two years of banding, three 4-day periods of mist-netting/bird-banding occurred between November and February at each site. In the 2004-05 season, the protocol was adapted to the system used by other organizations, including Point Reyes Bird Observatory, which have recently instituted winter banding efforts in North America. The new protocol calls for 5 banding sessions of two days each, once a month, from November to March. In 2004-05, the banding started in November and continued through to March; however, some months were missed due to long periods of inclement weather. Nine 2.6 x 12 m nets were placed in cottonwood/willow habitat and two 2.6 x 12 m nets

were placed in the mesquite habitat at the Nature Trail restoration site. Ten 2.6 x 12 m nets were placed in cottonwood/willow habitat at the Pratt restoration site. Mesh size for all nets were 30 mm.

Nets were set up at sunrise and were open for 6 hours unless conditions, such as wind or temperature, could harm the birds. The hours of operation were extended by an hour from the protocol established for the two previous seasons because higher capture rates were generally experienced later in the day and because of the lack of heat related problems during the winter. Nets were checked every 50 minutes. A metal, numbered USFWS band was placed on all captured birds, except 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 each bird was captured were recorded as well as total hours of net operations. All data were recorded on a standardized data sheet (Desante *et al.* 2002). Birds were identified using Pyle (1997) and Sibley (2000).

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.

Bird Condition Analysis

Each bird was scored for pectoral muscle mass on a scale of 0-3 (0 = concave muscle and prominent sternum, poorer health, 3 = convex muscle and sternum undetectable, better health) (Latta and Faaborg 2002, and Gosler 1991). Fat was measured on an ordinal scale according to the protocol established by IBP, for the MAPS banding program (DeSante *et* al. 2002). In cases where a bird escaped or for some other reason was not measured for wing, weight, or fat, they were excluded from the bird condition analysis for that species.

Winter Site Persistence

Winter site persistence is a measure of birds captured in one banding period which are subsequently re-captured in a later banding period of the same year. (Latta and Faaborg 2001, 2002). Persistence was determined by the percentage of birds re-captured in banding period subsequent to the first capture period for the same winter banding season. Winter site persistence is used as an index measure of habitat suitability for birds in the winter.

Annual Return

Data from birds recaptured between years was 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 (Latta and Faaborg 2001, 2002). Annual return rate was measured as a percentage of birds recaptured from previous years, from the total of all individually captured birds.

Area Searches

Area searches were conducted at each site during each of the 5 banding periods to account for species that may not be captured during standard mist net operations. Standard area search protocol was followed (Ralph *et al*. 1993). The Nature Trail restoration site and the Pratt Agricultural restoration site were split into five sections, which were one to three hectares in size. An area larger than three hectares could not be thoroughly surveyed in twenty minutes in such dense habitat (Ralph *et al.* 1993). One twenty minute area search was conducted in each section. Temperature, cloud cover and wind speed were recorded before each area search. The start and ending time were also recorded. During the twenty minutes, the observers attempted to survey all areas within each section equally. Each individual bird heard or seen was recorded on the data form along with method of detection (visually or aurally). Birds seen flying over the area but not utilizing it were recorded in a separate category as "flyovers".

Vegetation Monitoring

In order to gain further knowledge of how bird captures from constant effort mist-net operations may be correlated to vegetation characteristics of the banding sites, a vegetation monitoring protocol was established to collect data on total vegetation volume (TVV). The protocol was based on Mills et al. (1991). This information was collected once during the winter banding 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. This gave measured sections of 0.1m tall and 0.1m radius. For each "hit", the plant species was recorded. Hits were estimated for all vegetation over 7.5 m in height. The data was then used to estimate TVV for each meter of height, and for the entire site as a whole. The data was also broken down to the percentage of each plant species making up the total number of hits for the entire site and per meter of height. This year transects were staked and flagged to allow exact location of each transect in future surveys. TVV was calculated using the formula:

$$TVV = h/10p$$

where h = the total numbered of hits recorded for all the plots measured at one site, and p = all the decameter height sections measured.

Results

Cibola Nature Trail Restoration Site

Banding operations were conducted for a total of 565.16 net hours during the winter of 2004-05. There were a total of 157 individual birds captured (0.278 per net hour) and 34 recaptures occurred (0.060 per net hour). Twenty-three species were captured (one species had two distinct subspecies captured), with 5 species accounting for 76% of all

captures: Lincoln's sparrow 32%, ruby-crowned kinglet 18%, Audobon's warbler 11%, orange-crowned warbler 8%, and white-crowned sparrows 7% (Figure 1). Individual captures were lower than in previous years (2004-05: 0.278 per net hour, 2003-04: 0.430, 2002-03: 0.434). If all captures are considered, including recaptures, the birds per net hour rate increased to 0.326. Species composition varied from the results of the previous two years, but the ruby-crowned kinglet was the only species to have its highest capture rate during the 2004-05 winter banding season (Figure 2).

Figure 1. Species composition of birds captured at the CIBO site.

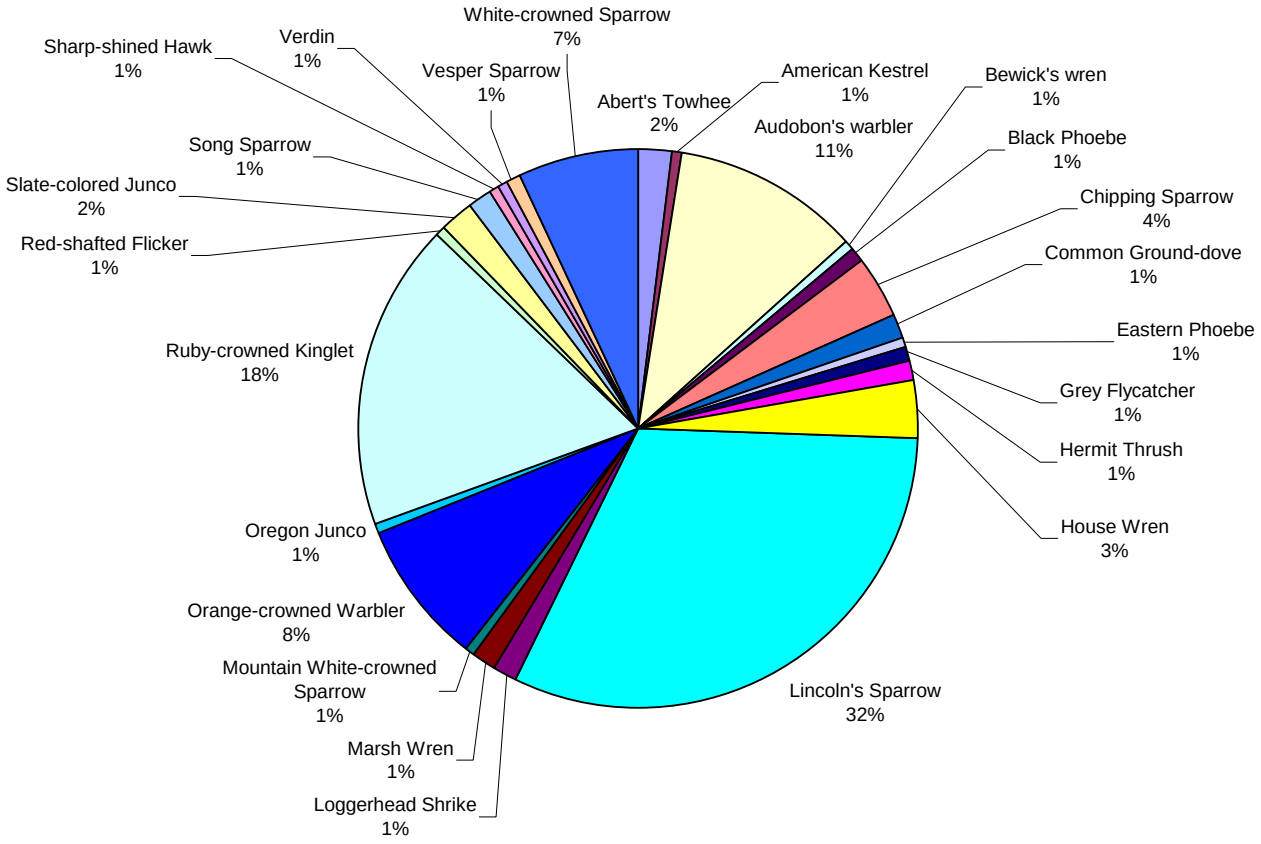
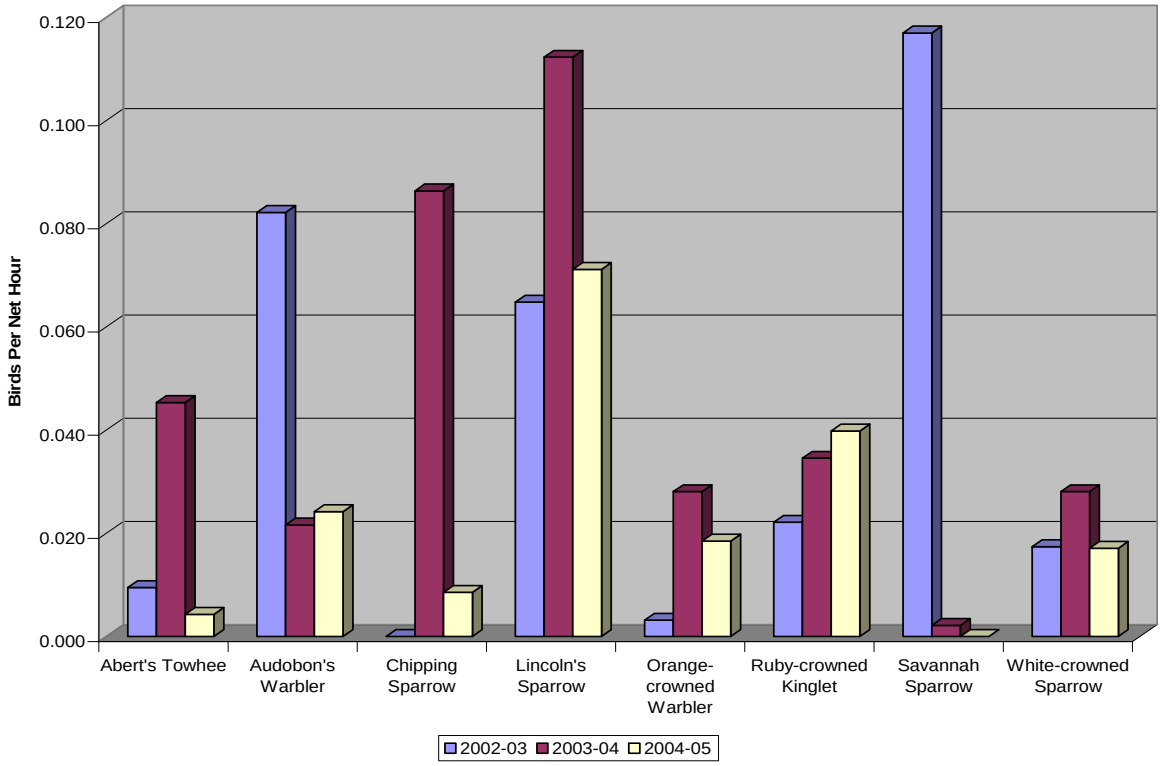


Figure 2. Three-year comparison of individual bird captures per net hour at the CIBO site.



Pratt Restoration Site

Banding was conducted for a total of 434.38 net hours at the Pratt Agricultural Site during the 2004-05 winter season. A total of 129 individuals were captured (0.297 per net hour) and on 36 occasions a recaptured bird was found in the nets (0.083 per net hour). Sixteen different species were captured but only three species individually made up more than 2% of captures: ruby-crowned kinglet (55%), orange-crowned warbler (18%), and Audubon's warbler (11%). These three species comprised 84% of all captures (Figure 3). As was the case at the CIBO site, individual captures were lower (0.297 in 2004-05, 0.398 in 2003-04, 0.573 in 2002-03). With all captures put together, the overall capture rate was 0.359 per net hour (0.483 in 2004-05, 0.662 in 2002-03).

Figure 3. Species composition of birds captured at the PRAT site.

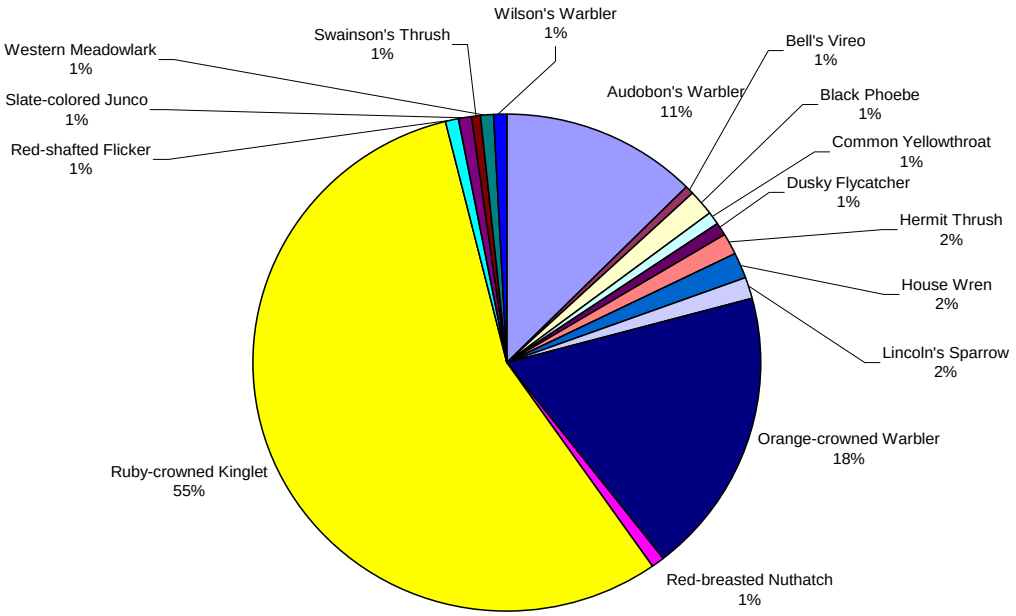
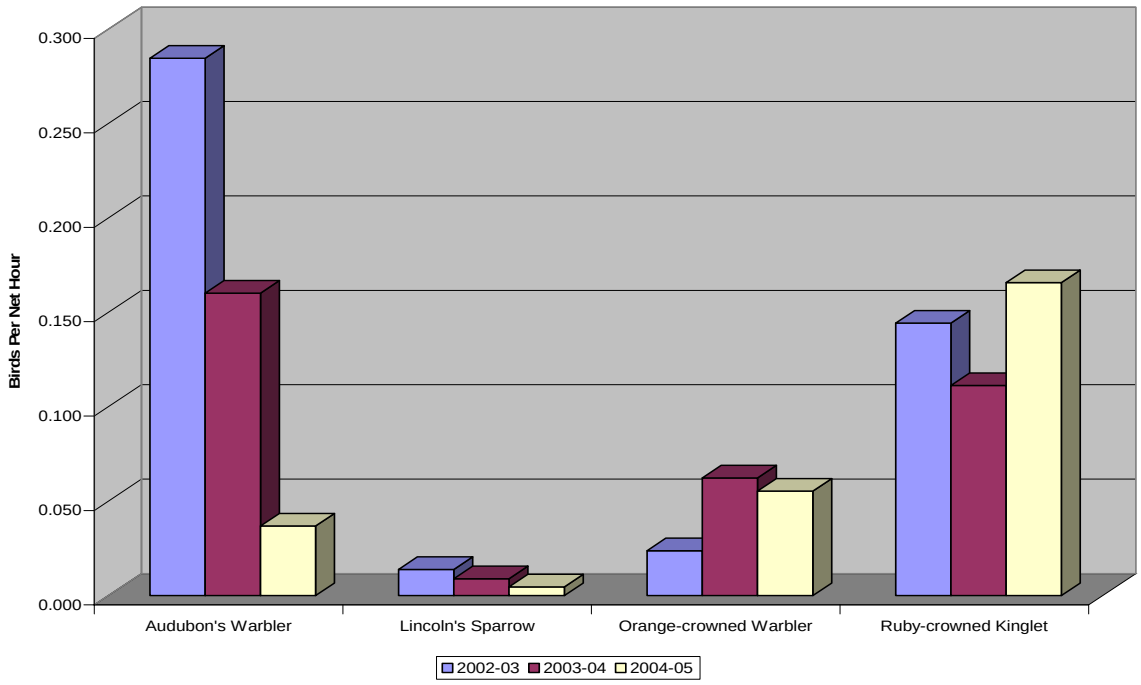


Figure 4. Three-year comparison of individual bird captures per net hour at the PRAT site.



Statistical Analysis
Several statistical tests were performed on the data collected from the three years of winter banding effort. An analysis of variance (ANOVA) test was performed for significant differences in capture rates of commonly captured species between years. At the CIBO site, the test was performed for savannah sparrow, yellow-rumped warbler (Audobon's race), white-crowned sparrow, chipping sparrow, Abert's towhee, ruby-crowned kinglet, and Lincoln's sparrow. The Abert's towhee was the only species to demonstrate significant difference ($p = 0.032$) in captures between years. At the PRAT site, three species were tested for significant difference in capture rates between years: Audobon's warbler, orange-crowned warbler, and ruby-crowned kinglet. None of the species demonstrated significant difference.

An ANOVA analysis was also conducted on each banding site for significant difference in capture rates between years. No significant difference was found. Finally, a t-test was performed between the two sites to test for significant difference between species diversity at the sites. The two-tailed t-test yielded a significant difference ($p = 0.009$) in species diversity between the two sites over the three years of banding.

Annual Return
Annual return rates were calculated for all species that had at least one individual return for both sites. Five species had annual returns at the CIBO site (Table 1) and three species had annual returns at the PRAT site (Table 2).

Table 1. Annual return rates at the CIBO site winter 2004-05.

Species	Ann. Return	Captures	AR %
House Wren	1	5	20.00%
Lincoln's Sparrow	2	50	4.00%
Marsh Wren	1	2	50.00%
Orange-crowned Warbler	1	13	7.69%
Ruby-crowned Kinglet	1	28	3.57%

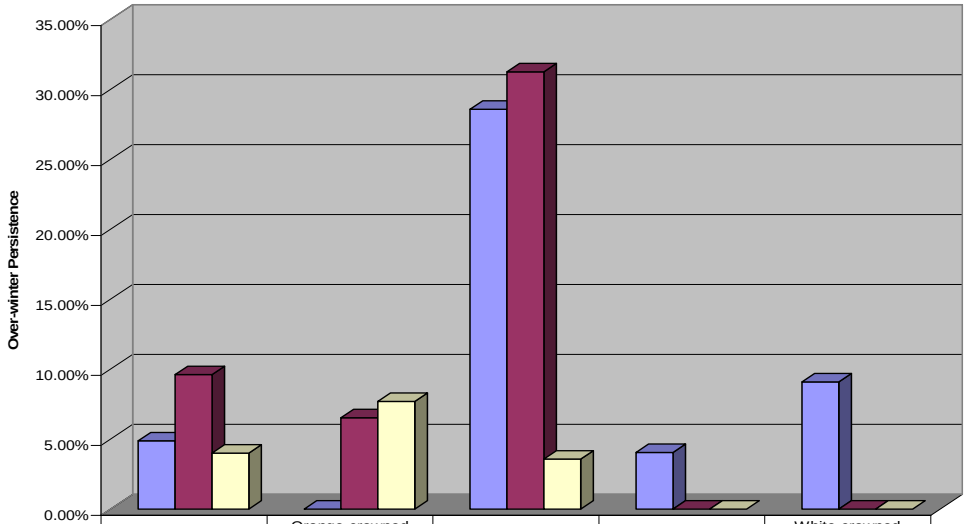
Table 2. Annual return rates at the Pratt site winter 2004-05.

Species	Ann. Return	Captures	AR %
House Wren	1	2	50.00%
Orange-crowned Warbler	4	24	16.67%
Ruby-crowned Kinglet	4	72	5.56%

Over-winter Site Persistence

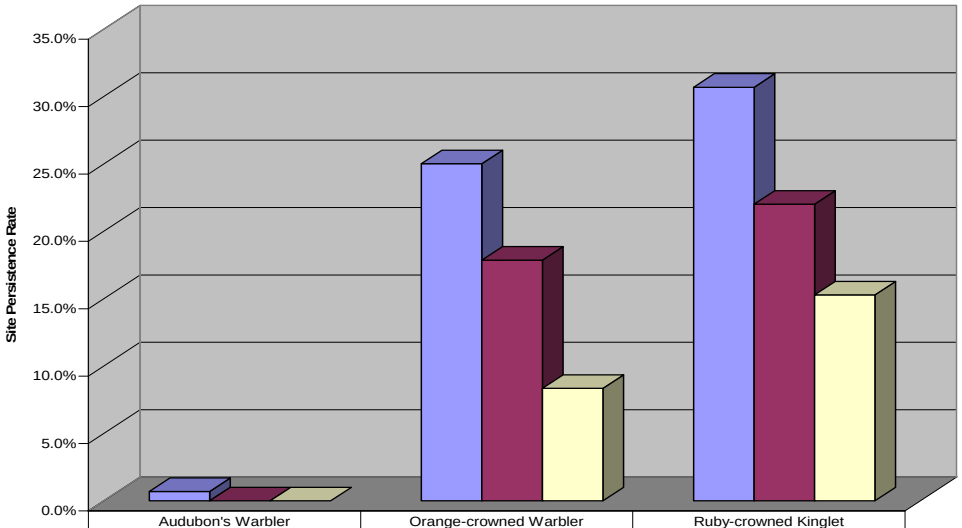
Over-winter site persistence was calculated as a percentage of birds recaptured in at least one other period than that of its original capture from all the individual birds captured during the winter season. Below are two graphs (Figure 5 CIBO, and Figure 6 for PRAT) presenting the winter site persistence rate for each year over the three years of banding.

Figure 5. A comparison of the winter site persistence rate over the three years of banding at the CIBO site.



	Lincoln's Sparrow	Orange-crowned Warbler	Ruby-crowned Kinglet	Savannah Sparrow	White-crowned Sparrow
2002-03	4.88%	0.00%	28.57%	4.05%	9.09%
2003-04	9.62%	6.53%	31.25%	0.00%	0.00%
2004-05	4.00%	7.69%	3.57%	0.00%	0.00%

Figure 6. A comparison of the winter site persistence rate over the three years of banding at the PRAT site.



	Audubon's Warbler	Orange-crowned Warbler	Ruby-crowned Kinglet
2002-03	0.7%	25.0%	30.7%
2003-04	0.00%	17.86%	22.00%
2004-05	0.00%	8.33%	15.28%

Bird Condition Analysis

Average values for condition measurements were calculated per species. Tables 3 and 4 show the average condition values for those species that had a minimum of at least 10 individual captures, from each study site.

Table 3. Bird condition index measures for commonly captured species at the CIBO site.

Species	Indiv. Captures	Fat	Wing Chord	Weight	Pectoral
Audobon's warbler	17	1.24	74.88	11.40	2.25
Lincoln's sparrow	50	0.94	60.15	15.33	2.37
Orange-crowned warbler	13	0.71	58.65	8.61	2.38
Ruby-crowned kinglet	28	1.56	58.17	6.06	2.51
White-crowned sparrow	11	0.82	75.36	24.34	1.93

Table 4. Bird condition index measures for commonly captured species at the PRAT site.

Species	Captures	Fat	Wing Chord	Weight	Pectoral
Audobon's warbler	16	1.25	72.88	11.42	2.21
Orange-crowned warbler	24	1.23	60.38	7.16	2.17
Ruby-crowned kinglet	72	2.27	55.57	5.35	2.24

Area Search

Area searches were to be completed once each banding period for a total of five area searches for each site over the banding season. Unfortunately, complications caused by weather allowed for only three area searches to be completed at the PRAT site (for periods 3-5) and four to be completed at the CIBO site (periods 2-5) (figures 7 and 8). At the CIBO site an average of 65 birds were detected per period, but more than half (59%) of the total detections came in the second period (the first to be surveyed).

Climate Data

October to March precipitation was highest in 2004-05 and lowest in 2003-04 for the CIBO site and the PRAT site over the three years of the study (Table 5).

Table 5. Precipitation data (in inches) for the period from October to March for the three years of the operation of winter banding at the PRAT and CIBO sites (Azmet 2005).

Site	2002-03	2003-04	2004-05
Parker, AZ	3.26	1.27	7.64
Yuma, AZ	1.3	0.76	3.77

Figure 7. Comparison of overall capture/detection percentages per species between banding and area search data for the CIBO site.

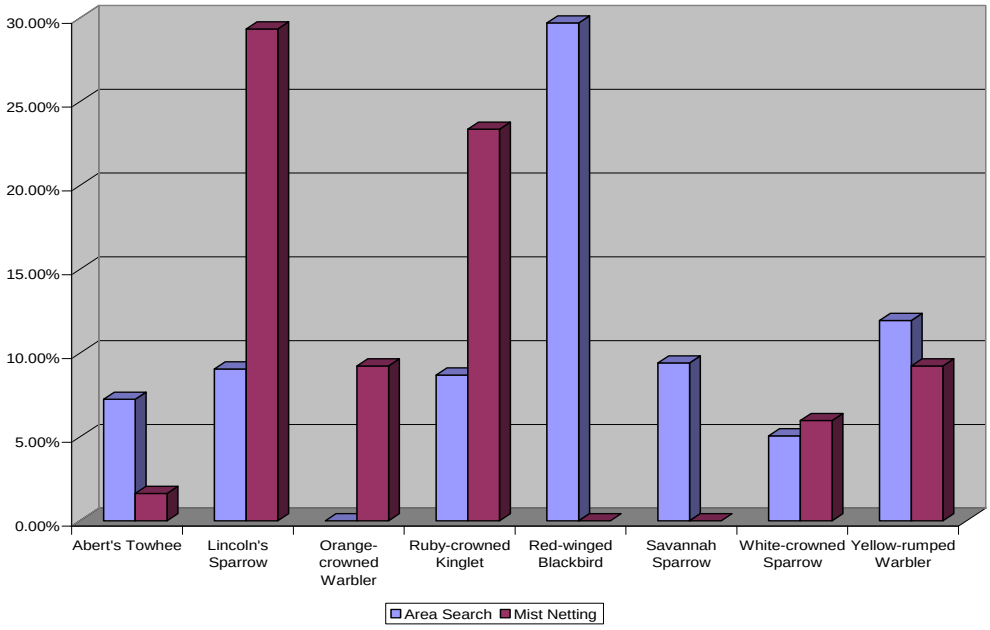
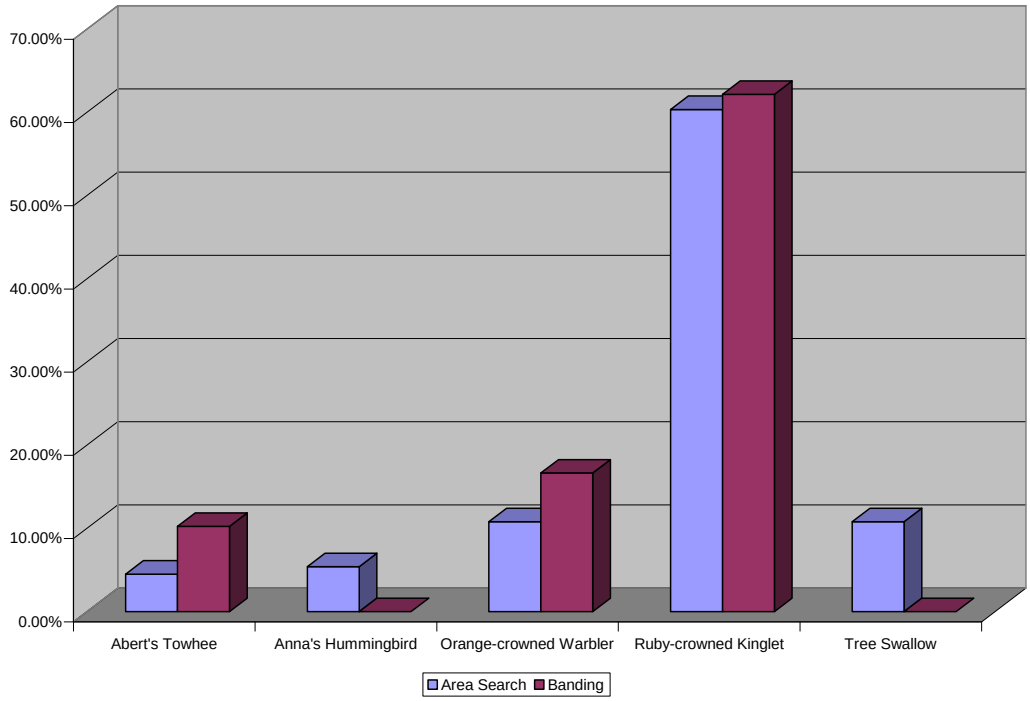


Figure 8. Comparison of overall capture/detection percentages per species between banding and area search data for the PRAT site.



Vegetation Analysis

As was done the previous year, total vegetation analysis was carried out at both sites for all 12 nets. In 2004-05, permanent markers were set to delineate the positions of the originally randomly determined transects. This allows the calculation of the same transect from year to year in the future. This was instituted during 2004-05, and therefore transect locations were not exact to those of the previous year. Table 6 compares results for all species encountered at both sites.

Table 6. A comparison of total vegetation volume at the PRAT and CIBO sites. Species that had a percentage of 5% or greater are highlighted in gray.

Species	PRAT	CIBO
Alfalfa	0.46%	0.00%
Baccharis	11.63%	8.84%
Bermudagrass	2.01%	0.00%
Conyza c.	0.79%	0.00%
Cottonwood	52.96%	42.63%
Coyote willow	2.73%	0.85%
Dandelion spp.	0.05%	0.00%
Dead material	1.85%	26.78%
Goodding's willow	23.14%	14.74%
Honey mesquite	0.02%	1.97%
Quailbush	0.00%	0.03%
Saltcedar	4.36%	0.00%
Screwbean mesquite	0.00%	4.17%

Table 7. A comparison of percentage of vegetation within each meter level from the PRAT and CIBO sites.

Meter Level	CIBO	PRAT
0-1	37.25%	22.25%
1-2	13.42%	25.21%
2-3	18.71%	26.46%
3-4	16.88%	22.17%
4-5	12.46%	21.54%
5-6	9.46%	16.13%
6-7	8.92%	15.42%
7-8	8.04%	12.92%
8-9	6.25%	7.63%
9-10	4.79%	3.00%
10-11	3.08%	1.04%
11-12	2.67%	0.04%

Discussion

The levels of individual captures and the overall capture rate were lower in the winter of 2004-05 than in the previous two winter seasons. Rainfall amounts recorded from areas near both sites were at or near record levels (Table 5), and temperatures were somewhat cooler than average. These abnormal weather conditions may have had an effect on the number of birds captured. Nonetheless, the only statistically significant differences in capture rates over the 3-year banding period occurred for the Abert's towhee at the CIBO site ($p = 0.032$). With the change in precipitation rates experienced in the whole region during the banding season, it is difficult to compare the 2004-05 results with results from previous years. As more data is collected, 2004-05 may be an anomaly in the long-term trend data for winter bird use at the two restoration sites.

Bird captures by species were variable as compared to captures from previous years. Most species showed roughly the same or lower capture rates as compared to rates from previous years, with only the ruby-crowned kinglet having the highest capture rates during the 2004-05 season (figures 2 and 4). Winter site persistence rates also showed some changes with rates slightly declining overall, but the ruby-crowned kinglet showed a precipitous decline to 3.57% from 31.25% the previous year. With the change in protocol from three 4-day banding periods to five 2-day banding periods, it is difficult to draw any conclusions but does indicate that use patterns of the ruby-crowned kinglet may have changed in 2004-05 as compared to patterns from the previous two years. A possible reason for this change may be the increased precipitation and the commensurate increase in vegetation growth throughout the LCR region. This may have allowed birds to use other habitats and decreased the need to congregate on the restoration sites, which in previous years, due to regular irrigation, were wetter than the surrounding area.

There was no spike in capture numbers for one particular species as was experienced at the CIBO site with savannah sparrow and chipping sparrow in the first and second seasons of banding, respectively (figures 3 and 4). Interestingly, area search detections for savannah sparrow were relatively high (9.42%), but none were captured at the CIBO site (Figure 7). The cause for this is unknown but may indicate that savannah sparrow numbers could have been under-represented in the banding data. Other discrepancies between the banding data and area search data occur with species that are known to be difficult to capture in mist nets, such as red-winged blackbird and tree swallow. Area search data would likely more accurately represent the relative abundance of these species and others, such as raptors, which are rarely captured in the mist nets.

More birds captured from previous years were re-captured during the 2004-05 winter season, especially at the CIBO site where only one bird was considered an annual return in the previous year (Bureau of Reclamation 2004). More annual return birds were re-captured at the PRAT site as well. While annual return rates do not appear to be high for most species with at least 10 individuals captured, some examples do stand out (tables 1 and 2). Orange-crowned warblers at the PRAT site demonstrated a 16.67% annual return rate from 24 captured individuals, which could indicate substantial return to the area by this species. Because color banding and re-sight methods cannot be used at the sites due

to the time commitment required, annual return rates are lower than in places where these methods are used. Relying solely on banding re-captures for annual return calculations is limited in that it is impossible to know how many annual return birds are truly using an area, but it does provide an index of annual returns. Preliminary data indicate that the number of annual returns is increasing and, given with the fact that overall bird use was lower in 2004-05, may indicate that some birds make substantial use of the area on a yearly basis.

The vegetation data collected in 2004-05 are similar to data taken in the previous two years. The data demonstrate the basic differences in the two sites: Cibola has higher vegetation volume in the first meter layer and in the last three vegetation layers (layers 9-12) (Table 6). The differences in vegetation density and structure may be an important cause of differences in species captured. Vegetation density, stand density, stand structure, and water availability may determine species diversity and richness at each site.

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

Code	Common Name	Scientific Name
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
GRRO	greater roadrunner	Geococcyx californianus
LENI	lesser nighthawk	Chordeiles acutipennis
BCHU	black-chinned hummingbird	Archilocus alexandri
ANHU	Anna's hummingbird	Calypta anna
COHU	Costa's hummingbird	Calypte costae
LBBO	ladder-backed woodpecker	Picoides scolaris
NOFL	northern flicker	Colaptes 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	grey flycatcher	Empidonax wrightii
DUFL	dusky flycatcher	Empidonax oberholseri
WEFL	western flycatcher	Empidonax difficilis/occidentalis
PSFL	Pacific-slope flycatcher	Empidonax difficilis
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
WAVI	warbling vireo	Vireo gilvus
VERD	verdin	Auriparus flaviceps
RBNH	red-breasted nuthatch	Sitta canadensis
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-throated 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 (Audobon's) warbler	Dendroica coronata audoboni
MYWA	yellow-rumped (Myrtle's) warbler	Dendroica coronata coronata

Code	Common Name	Scientific Name
BTYW	black-throated gray warbler	Dendroica nigrescens
TOWA	Townsend'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
BTSP	black-throated sparrow	Amphispiza bilenata
SAVS	savannah sparrow	Passerculus sandwichensis
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
BHGR	black-headed grosbeak	Phueciticus melanocephalus
BLGR	blue grosbeak	Passerina caerulea
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	I. bullocki
SCOR	Scott's oriole	Icterus parisorum
HOFI	house finch	Carpodacus mexicanus
LEGO	lesser goldfinch	Carduelis psaltria
HOSP	house sparrow	Passer domesticus