Lower Colorado River
Multi-Species Conservation Program

Balancing Resource Use and Conservation

Development of Appropriate Radio Telemetry Techniques for Gilded Flickers (*Colaptes chrysoides*) in Western Arizona

2013 Report

U.S. Department of the Interior
Bureau of Reclamation

February 2015

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Lower Colorado River
Multi-Species Conservation Program

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ACRONYMS AND ABBREVIATIONS

Bill Williams River NWR	Bill Williams River National Wildlife Refuge
BLM	Bureau of Land Management
flicker	gilded flicker (*Colaptes chrysoides*)
g	gram(s)
KHR	kernel home range
km	kilometer(s)
km^2	square kilometer(s)
Kofa NWR	Kofa National Wildlife Refuge
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
LSCV	Least Squares Cross Validation
m	meter(s)
MCP	minimum convex polygon
mm	millimeter(s)
Reclamation	Bureau of Reclamation
SD	standard deviation

Symbols

≈	approximately
°C	degrees Celsius
>	greater than
≥	greater than or equal to
<	less than
#	number
%	percent
+	plus (gain)
±	plus or minus

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EXECUTIVE SUMMARY

In 2013, the Bureau of Reclamation initiated a study to refine capture, radio tag attachment, and tracking techniques of gilded flickers (*Colaptes chrysoides*) (hereafter termed flicker) on public lands associated with historical flicker detections in western Arizona. The study was initiated at the request of Lower Colorado River Multi-Species Conservation Program (LCR MSCP) personnel in order to identify effective methods to detect flickers and inform management of created habitat at LCR MSCP conservation areas. Three capture techniques were employed to capture seven flickers (six male and one female) from February to April 2013, and of these, four males and the female were outfitted with radio transmitters. Four of the five flickers accepted the instrumentation and generated preliminary home range data using both minimum convex and kernel home range (KHR) estimates. An average of 51 location points was collected for each flicker (±15.4 standard deviation [SD], range of 35–72) from February 15 – June 29, 2013. Flickers tracked in 2013 had a mean minimum convex polygon of 2.9 square kilometers (km^2) (±1.2 SD, range of 1.9–4.5) and mean 50, 75, and 95 percent (%) KHR probabilities of 0.4, 1.0, and 2.7 km^2 (±0.3 SD, range of 0.1–0.7 for 50% KHR; ±0.7 SD, range of 0.2–2.0 for 75% KHR; and ±2.3 SD, range of 0.6–5.8 for 95% KHR). There were no long range movements from the Quartzite study area documented.

In addition, successful techniques were established to monitor flicker nest cavities during the 2013 breeding season. Nest monitoring indicated 6 of 7 monitored nests (86%) presumably fledged at least 1 chick, but the data were based only on infrequent re-checks. Results of the 2013 study indicate flickers can be captured, instrumented, and tracked successfully. Data suggest our techniques could be utilized in a full-scale home range/habitat use study for flickers.

INTRODUCTION

Gilded flickers (*Colaptes chrysoides*) (hereafter termed flicker) are native to the southwestern United States, a species of concern under the Lower Colorado River Multi-Species Conservation Program (LCR MSCP), listed as a conservation concern in 2002 by the U.S. Fish and Wildlife Service, and were listed as endangered by the State of California in 1988 (California Department of Fish and Game 1988). Though they are a listed species, aside from known nesting habitat (McAuliffe and Hendricks 1988; Zwartjes and Nordell 1998), little is known of the habitat use of flickers, particularly their use of habitats in close proximity to riparian corridors.

The LCR MSCP is a partnership of Federal and State stakeholders, created to respond to the need to balance use of lower Colorado River water resources and conservation of native species and their habitats (Bureau of Reclamation [Reclamation] 2004). Implementation of the LCR MSCP Habitat Conservation Plan (Reclamation 2004) within the LCR MSCP calls for the creation of 4,050 acres of cottonwood-willow to provide habitat for flickers within Reaches 3–7 (Davis Dam, Arizona/Nevada, to San Luis, Mexico) as defined by Reclamation (2004) (attachment 1).

This study was initiated to be the first year (2013) of a proposed 3-year (2013–15) study to identify effective methods to detect flickers and, if effective methods are identified and selected for use, to assess movement, habitat use, and home range for this species in locations proximate to LCR MSCP priority areas in Arizona to inform management of created habitat at LCR MSCP conservation areas. The 2013 study was considered a preliminary data collection year, necessary to promote familiarity with the species, geography, and techniques necessary to develop a full-scale study plan in years two and three. The primary goals of the 2013 study were as follows:

Fiscal Year 2013 Primary Goals

1. Develop techniques for locating flickers across multiple seasons proximate to LCR MSCP priority areas in Arizona.

2. Determine the most efficient flicker capture methodologies and attachment of radio transmitters on adult flickers and observe flicker response.

3. Based on information learned in 2013, develop a multi-year proposal for 2014–15 to assess the movement, habitat use, and home range for this species in locations proximate to LCR MSCP priority areas in Arizona.

Fiscal Year 2013 Secondary Goals

1. Record and document flicker vocalizations.

2. Develop techniques for monitoring flicker nest cavities as a means to develop a standard protocol to employ in subsequent years.

Fiscal Year 2013–15 Ancillary Goal

1. Develop techniques to capture, instrument, and track fledgling and juvenile flickers.

The primary objective of this year 1 research effort was to: (1) locate a population of breeding flickers and (2) develop techniques and methodologies to quantify habitat use, seasonal movements, and breeding chronology that could be employed in subsequent years. Ultimately, this information could be used to help guide habitat creation requirements. This proposed effort is representative of conservation measure MRM1 of the LCR MSCP Habitat Conservation Plan (Reclamation 2004).

Methods

Study Area

To meet outlined year 1 pilot phase objectives, it was necessary to identify a study area(s) containing a sufficient population of flickers in a close enough proximity that would permit refinement of capture, tagging, tracking, and monitoring methodologies. General locations were surveyed February 10–21, 2013, and included: (1) Yuma Proving Grounds (U.S. Army; La Paz County, Arizona); (2) public lands managed by the Bureau of Land Management (BLM) south of Interstate 10, southwest of Quartzsite; and (3) public lands managed by the BLM east of Arizona Highway 95, near the border of the Kofa National Wildlife Refuge (Kofa NWR) (U.S. Fish and Wildlife Service, La Paz County, Arizona). Secondary surveys were conducted adjacent to the Salt River near Mesa, Arizona (June 24 and 25) and in the Bill Williams River National Wildlife Refuge (Bill Williams River NWR, Arizona (May 3 and 4). These secondary efforts were conducted in an attempt to locate flickers in closer proximity to a riparian corridor for possible future research efforts. Ultimately, the Interstate 10 location (specifically the area south and southwest of Dome Rock Mountain; figure 1) was selected, as it supported multiple pairs of flickers.

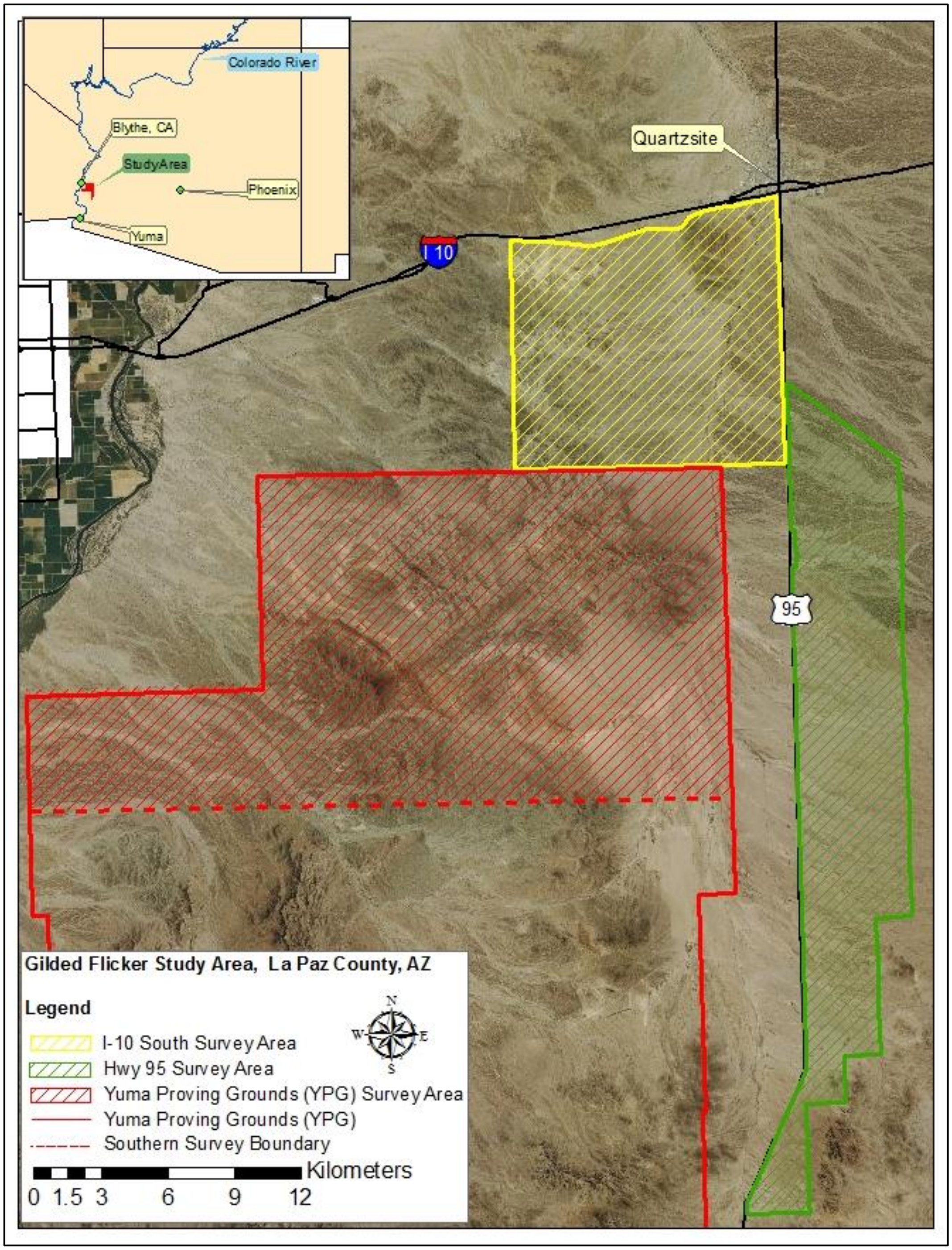

Figure 1.—General locations for surveys conducted in 2013 to identify a source of adult breeding flickers.

Capture Methods

Initial attempts to capture flickers within the study area were completed February 10–21, 2013. Call playback of various flicker calls was used to locate the birds. Flicker call recordings were provided by Macaulay Library (Cornell University Lab of Ornithology, Ithaca, New York) and Xeno-Canto (www.xeno-canto.org). Flicker "peah," "long call," and "wicka" vocalizations were played on an electronic hand-held game caller (FOXPRO, Inc., Lewistown, Pennsylvania) to elicit a call response and/or draw the bird into view. Immediately following a vocal response, biologists made visual contact and tracked the bird using a combination of binoculars and spotting scopes until positive visual species identification was obtained (due to the occurrence of northern flickers [*Colaptes auratus*], a species with very similar vocalizations, migrating through the area at this time of year).

Attempts were made to locate roosting cavities of flickers to provide a focused area for capture attempts with physical and/or passive techniques. Once an area was determined to be inhabited by flickers, birds were observed during crepuscular hours to identify roosting cavities.

Three methods were employed to capture adult flickers: mist netting, forced flush from roosting cavity, and utilizing a hoop net to capture flickers exiting the roosting cavity. Different capture techniques were attempted to determine which technique was most efficient and minimally harmful/stressful.

Mist Netting

Following the methodology of Halterman (2009) and Sechrist et al. (2012), target mist netting was used to capture some flickers. We used standard 60-millimeter (mm) mesh mist nets in 6, 9, or 12-meter (m) lengths (Avinet, Inc., Dryden, New York) and 2.6 m high. Typically two nets of the same length were sewn together and stacked (e.g., two 6-m nets were sewn together, one on top of the other, to form an 8-shelf net that was 6 m long and 5.2 m high). Nets were either set in a location near a known territory (figure 2), or if the roost/nest location was known, the nets were erected to partially surround the cactus on the side of the cavity (figure 3). In most cases, nets were erected before daylight to take advantage of low light conditions that made the nets less visible. Digital callers were placed on both sides of the net, and biologists remained concealed under camouflaged netting proximate to the nets. Vocalizations were then played strategically via remote controls based on the birds' location to try and get the birds to fly between callers and entangle in the net. If a flicker landed in close proximity, between the net and a biologist, then the biologist would attempt to flush the bird into the net.

Figure 2.—General mist netting array (black speakers represent digital callers).

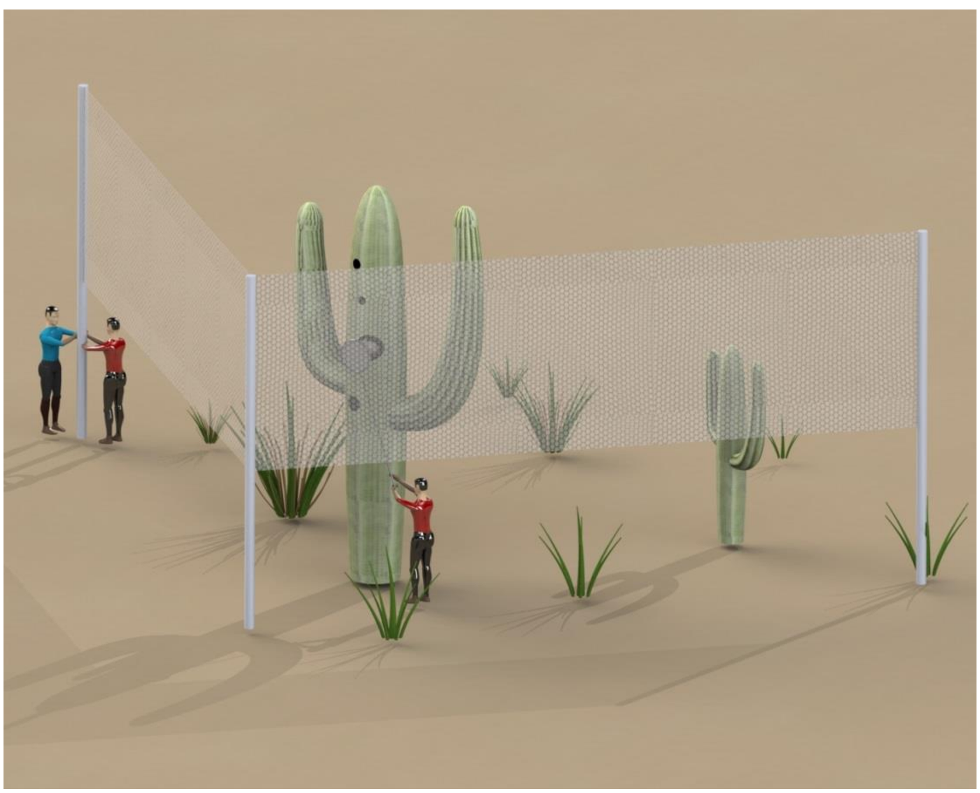

Figure 3.—Mist nets set around roost.

Forced Flush

Once roosting cavities were located, techniques to capture flickers within the cavity were attempted. We observed that walking to and then standing below roosting cavities before sunrise did not usually result in flickers flushing. Therefore, capturing flickers from a known roosting/nesting location involved returning to the location during dark conditions (preferably early morning). To physically remove flickers within the cavity, a soft towel rolled into the shape of the cavity hole and attached to a paint pole was used to block the cavity entrance, a ladder was utilized to reach cavity height, and the bird was gently coerced (using a small stick) to exit the cavity into a mesh sock net (figure 4).

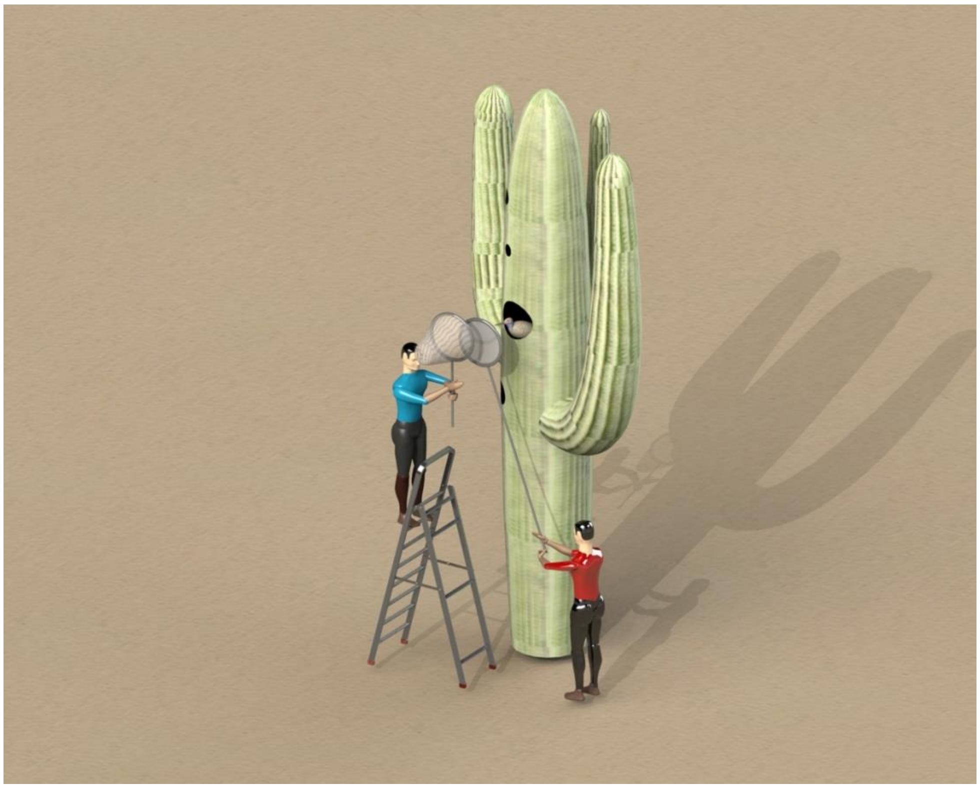

Figure 4.—Force flushing a flicker from a cavity.

Hoop Nets

Hoop nets were used to capture flickers as they exited their nest or roost location. A modified soft-mesh butterfly-type net attached to a telescoping paint pole was used to directly cover the cavity opening (figure 5). Hoop net frames were constructed of #12 gauge galvanized wire bent into a hoop and affixed into a paint roller handle to allow for easy attachment to an extendable painter’s pole. One-meter lengths of 60-mm mesh mist nets were sewn into a cone shape and the opening affixed with zip ties to the galvanized wire frame. The net was either erected in the early a.m. before light or during daylight hours immediately after a bird had entered a cavity (during breeding season).

Figure 5.—A modified hoop net, attached to a telescoping painter's pole, being used to remove a flicker from its saguaro cavity. Of the flicker capture techniques, this method proved to be the most efficient.

Positively identified roosting/nesting cavity location (Global Positioning System coordinates), cavity height (m), orientation (cardinal direction) and, when accessible, cavity opening width and height (mm) and inner cavity depth and width (mm), were measured. A picture of the saguaro and cavity were taken to help identify the cavity for future monitoring efforts.

Tagging and Tracking

Captured flickers were immediately transferred to a lightweight cotton immobilization bag for ease of handling and to minimize stress, banded with a Federal metal band (left tarsus) and Darvic plastic color combinations (right tarsus; to aid in visual identification (figure 6), measured (bill length, width, and depth; tarsus length; tail length; and wing chord [mm]), and weighed in grams (g). Blood (20–30 microliters) was sampled using a micro-hematocrit tube and transferred to a PermaCode card (Avian Biotech International, Tallahassee, Florida), and feathers lost during processing were saved for possible future DNA

Figure 6.—Federal (metallic) and Darvic (red and yellow) bands attached to an adult flicker.

analyses. Backpack radio transmitters (Model A1080 and A1060, Advanced Telemetry Systems, Isanti, Minnesota) were fixed to adult flickers (n = 5; 4 males, 1 female) using elastic chord (< 1-mm diameter; figures 7, 8, and 9) with a modified Rappole and Tipton (1991) leg-loop harness (Sechrist and Best 2012). Transmitter weights of 3.9 and 2.8 g were selected for captured birds so as not to exceed the 3-percent (%) tag to body weight ratio (U.S. Geological Survey's Bird Banding Laboratory permit requirements; Gustafson et al. 1997). The 3.9- and 2.8-g transmitters have a manufacturer specified battery life of 441 and 198 days (at 30 pulses per minute), respectively. Reference birds (n = 2 males), used to differentiate effects of capturing and handling from radio transmitter outfitted birds, were handled and processed in the same fashion as all other captured flickers, but they were not fitted with a radio transmitter.

Flickers were released in close proximity (< 100 m) to their capture location. Following release, the birds were visually tracked by a minimum of two biologists, for at least a 30-minute period, as well as a portion of the next tracking day, to watch for responses to both handling stress and transmitter fit.

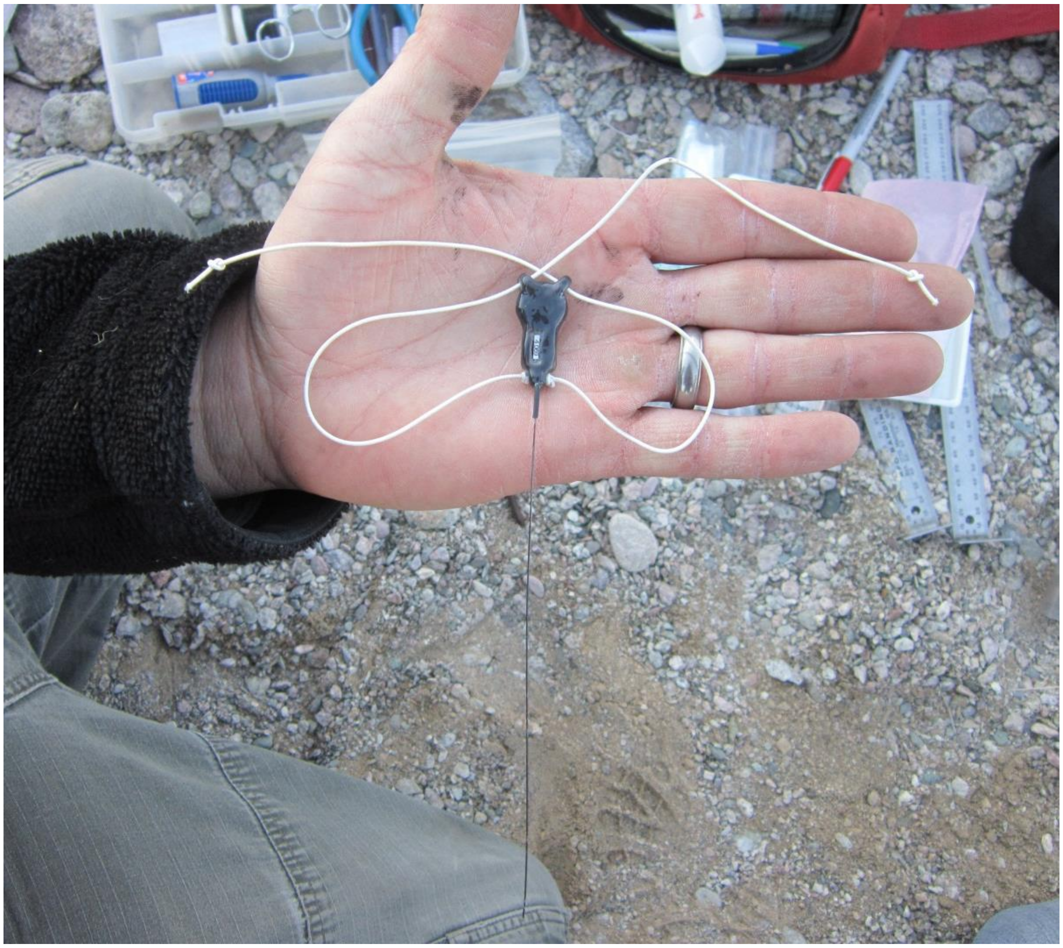

Figure 7.—Backpack radio transmitter (Model A1080, Advanced Telemetry Systems, Isanti, Minnesota) and leg-loop harness (< 1 mm elastic chord) used to track movements of flickers.

Instrumented birds were also visited, at a minimum, once daily for 2 days, and any sign of abnormal flight resulted in immediate targeting for recapture and transmitter removal. For the sake of this study, abnormal flight was defined as labored or awkward wing-beats or lack of flight all together.

Birds were tracked within morning (0500–1100), mid-day (1200–1600), and evening (1700–2100) time blocks to monitor flicker response to the radio transmitter, determine an appropriate tracking technique, observe behaviors that could impact methodologies employed in subsequent study years, and to ascertain the level of data collection necessary for developing suitable home range estimates. All instrumented flickers were recaptured at least once between February and April 2013 to visually inspect for wounds or other adverse effects of the transmitter, elastic chord, or bands, and weighed to see if the additional transmitter weight restricted flicker growth.

Figure 8.—Dorsal view of backpack radio transmitter (Model A1080, Advanced Telemetry Systems, Isanti, Minnesota) outfitted on a flicker).

Automatic scanning receivers (Model R2100 and R410, Advanced Telemetry Systems, Isanti, Minnesota) were coupled with three-element Yagi antennas to receive signals from instrumented flickers (figure 10). Once a signal was detected, gradual movements in a back and forth semicircular pattern toward the target were completed until audible signal strength suggested the instrumented bird was < 100 m in proximity. Instrumented birds deemed to be within 100 m were tracked with slower, directed movements, paired with consistent visual observation using binoculars until visual confirmation of the bird's precise location was achieved (or, in some instances, a signal direction change coupled with plumage verification from a flushed flicker was used to confirm location). Once positively identified, instrumented flickers were observed, and notes pertaining to habitat type used, foraging, proximity to other flickers or male/female pairing, and calls were recorded. After the instrumented flicker was observed leaving the area, and transmitter signal strength suggested the bird was no longer in close proximity (≈ 50 m, or out of visual range), a Global Positioning System location was obtained. To minimize anthropogenic influence on bird behavior, we attempted to limit the amount of time between recorded points to $\geq$ 15 minutes.

Figure 9.—Backpack radio transmitter (Model A1080, Advanced Telemetry Systems, Isanti, MN) (with antenna visible) on a flicker.

Nest Monitoring

Monitoring of nest cavities was initiated in early April, after all instrumented birds were presumed to have initiated mating. Nest cavities were monitored every 2 weeks, from April – June, 2013. Visual inspection of the cavity was completed by attaching a mini camcorder with infrared lights (1080P HD Mini Camcorder, FoxOffer, Ltd., Shenzhen, China) to the end of a telescoping painter's pole and recording a short (< 20 seconds) video of the nest contents (figures 11 and 12). Video contents were reviewed on a computer, and presence/absence of eggs, number of eggs, and number of hatchlings was noted.

Figure 10.—Reclamation biologist using a scanning receiver (model R410, Advanced Telemetry Systems, Isanti, Minnesota) and three-element Yagi antenna to track a flicker southwest of Quartzsite, Arizona.

Home Range Estimate

Telemetry data were analyzed to provide estimates of home range and seasonal maximum distance traveled by flickers within the study area. We calculated home ranges using BIOTAS 2.0 software (Ecological Software Solutions, LCC, Hegymagas, Hungary). The 100% minimum convex polygon (MCP) (Mohr 1947; Stickel 1954; Jennrich and Turner 1969) and fixed kernel home range (KHR) estimators (Worton 1989) were used to estimate home range size. The KHR output for each individual provided calculations of flicker home ranges for 50, 75, and 95% probability polygons, with smoothing determined by either ad hoc or least-squares cross-validation (Silverman 1986).

In kernel estimation, each point in a given distribution is evaluated. Each evaluation point is in turn evaluated based on the points that surround it. A point that is surrounded by many other points will have a high density value. To determine which surrounding points will contribute to the estimation of the density at the evaluation point, a smoothing factor is used to describe the search radius about the evaluation point. The distance from each point to the evaluation point is then calculated based on these distances; a cumulative value is assigned to the evaluation point. Next, another evaluation point is selected. This procedure

Figure 11.—Mini camcorder (1080P HD Mini Camcorder, FoxOffer, Ltd., Shenzhen, China) used to monitor cavity nest chronology of flickers).

continues until all the points in the distribution have been evaluated. Points are all scored and assigned density values. A grid of a specified size is then overlaid on the distribution. Starting again with each evaluation point, the pixels within the search radius are populated with (assigned) their respective density values. Each subsequent point is evaluated in the distribution. Finally, a surface is created that contains pixel values of the kernel density estimate of the distribution. The surface is then contoured at specified volumes to give percentage home ranges. Importantly, a 95% home range is contoured at 95% of the volume of the density surface – not at 95% of the area of the home range (Laver 2005). However, within the context of a dataset, the practical application of a KHR is that, for example, a 95% output represents an area with a 95% probability that the animal is inside that area (Sechrist, personal observation).

The MCP estimates of home range were based on the ability of the Biotas 2.0 program to completely enclose all location points for each individual flicker by connecting the outermost locations and, thus, creating a convex-shaped polygon. The maximum distance was calculated as the greatest straight-line distance that could be calculated from two points collected over the course of all days

Figure 12.—Mini camcorder (1080P HD Mini Camcorder, FoxOffer, Ltd., Shenzhen China) attached to a telescoping painter's pole and being inserted into a nest cavity to monitor nesting chronology of flickers).

tracked (e.g., the greatest distance across a MCP). Due to the sample size of data points collected, MCP and KHR estimates were developed with all available data points and not as a function of season.

RESULTS

Survey Results

Flickers were detected in the three sites surveyed (see figure 1), although the majority of the survey effort was done in the vicinity of Quartzite, Arizona. Surveys were localized primarily because: (1) earlier survey efforts by Reclamation's Lower Colorado Region personnel had detected flickers in this area, (2) civilian access to the U.S. Army's Yuma Proving Grounds is tightly controlled, and (3) flicker surveys near the Kofa NWR were limited to the area outside of the refuge boundary. Additional surveys were conducted on the

Bill Williams River NWR and the Salt River, near Mesa, Arizona. Flickers were detected at both locations and could present the opportunity to study flicker movement and home ranges in closer proximity to riparian areas.

In general, flickers were responsive to hand-held electronic calls in February and to some extent as the breeding season progressed. Unsolicited calls and response to call playback became less frequent as the season progressed into summer. In spring and summer, calls were more prevalent in the mornings and evenings. The three main vocalizations heard were "long," "peah," and "wicka" calls. While "peah" calls were the most frequently heard, all three vocalizations were noted during our survey efforts from February to August.

Within the Interstate 10 South study site, six males and a single female flicker were captured, of which four males (name and telemetry frequency = Dome Rock: 164.144, Cholla 1: 164.132, Cholla 2: 164.069, and Cholla 3: 164.206) and a single female (Dome Rock Female: 164.343) were outfitted with radio transmitters, and an additional male was used as a reference bird (Cholla Reference A; banded but not instrumented). Another male (Kofa Reference B) was captured within the U.S. Highway 95 site of our study area, southeast of Quartzsite along the border of the Kofa NWR (see figure 1), and used as a reference bird.

Of the seven flickers captured, three were initially captured using the modified hoop net (see figure 5), two were captured using forced flush (see figure 4), and two were captured using mist net arrays (see figures 2 and 3). The female was captured on April 9 by forced flush from a nesting cavity and outfitted with a 2.8-g backpack transmitter. However, she was found unable to fly the following evening, was recaptured, and the transmitter was removed. The bird was captured at dusk, so it was held in a cotton bird bag and then released the following morning. The nest cavity was subsequently found empty. The breeding pair (Dome Rock male and female) ultimately had a second clutch in the same cavity, which resulted in a surviving nestling. In general, the four males outfitted with backpacks did not appear to have any problems after being released. They were monitored several days after their capture (the "critical period," which consisted of 48 hours after instrumentation) and displayed no adverse effects to the backpacks.

Morphometric characteristics of captured birds are presented in attachment 2. Target netting of juvenile flickers did not occur in 2013 primarily because there were few observations of family groups that provided the opportunity for capture. As a result, no rectrix-mount transmitters were deployed. There were no mortalities associated with capture, handling, or tracking in 2013. All instrumented flickers appeared to fly normally immediately following release. During the observation periods immediately following release, flickers were observed picking at leg bands and preening. Recaptured birds had some feather loss at the base of the inner legs, likely a result of the harness material shifting slightly during daily activity or by preening activities of the bird. However, there was no apparent sign of irritation, abrasion, or swelling at this location or at the band locations. Some shed feathers and dead skin buildup on the elastic cord at the base of the inner legs was noted (figure 13) during these recaptures. Between mid-February and mid-April, three of four instrumented birds showed a gain in weight between initial capture and recapture (Cholla 1: + 3.7%, Cholla 2: + 2.8%, Cholla 3: - 3.0%, and Dome Rock: + 2.7%). The two reference birds collected in April were not able to be recaptured for comparison.

Figure 13.—Recaptured flicker (Cholla 3) being examined for injuries associated with the radio transmitter backpack harness.

All four radio-instrumented males within the Interstate 10 South study site provided data for preliminary home range and maximum distance estimates for the time period they were monitored (table 1). An average of 51 points (±15.4 standard deviation [SD], range of 35–72) was collected from February 15 – June 29, 2013 (figure 14). The flickers had average maximum movements of 3.5 kilometers (km) (±1.7 SD, range of 2.2–5.9). Flickers tracked in 2013 had a mean MCP of 2.9 square kilometers (km^2) (±1.2 SD, range of 1.9–4.5) and mean 50, 75, and 95% KHR probabilities of 0.4, 1.0, and 2.7 km^2 (±0.3 SD, range of 0.1–0.7 for 50% KHR; ±0.7 SD, range of 0.2–2.0 for 75% KHR; and ±2.3 SD, range of 06–5.8 for 95% KHR; table 1). An example of a 100% MCP shapefile for the Dome Rock (164.144) flicker is depicted on figure 15. The 100% MCPs developed for the other instrumented flickers are included in attachment 3.

Table 1.—Preliminary seasonal movement and home range data collected from four male flickers in 2013

Flicker ID/frequency (megahertz)	Dates tracked (2013)	Valid points (#)	Maximum seasonal movement (km)	100% MCP (km^2) – stationary arithmetic mean	Fixed KHR (km^2) 50% / 75% / 100%	Method[a]
Dome Rock (164.144)	4/9 – 6/28	48	2.2	1.9	0.3 / 1.0 / 2.7	LSCV
Cholla 1 (164.132)	2/19 – 6/29	49	3.2	4.5	0.7 / 2.0 / 5.8	Ad Hoc
Cholla 2 (164.069)	2/15 – 6/29	72	2.5	2.1	0.1 / 0.2 / 0.6	LSCV
Cholla 3 (164.206)	4/11 – 6/29	35	5.9	3.2	0.3 / 0.8 / 1.6	LSCV
Mean ± SD		**51 ± 15.4**	**3.5 ± 1.7**	**2.9 ± 1.2**	**0.4 ± 0.3 / 1.0 ± 0.7 / 2.7 ± 2.3**	

[a] Kernel width is determined by several methods within Biotas software; thus, the choice to use either Least Squares Cross Validation or Ad Hoc smoothing is based on exploratory analysis. The best width was determined from a variety of factors, including data continuity during tracking, and visual interpretations of polygon intercepts for all points collected.

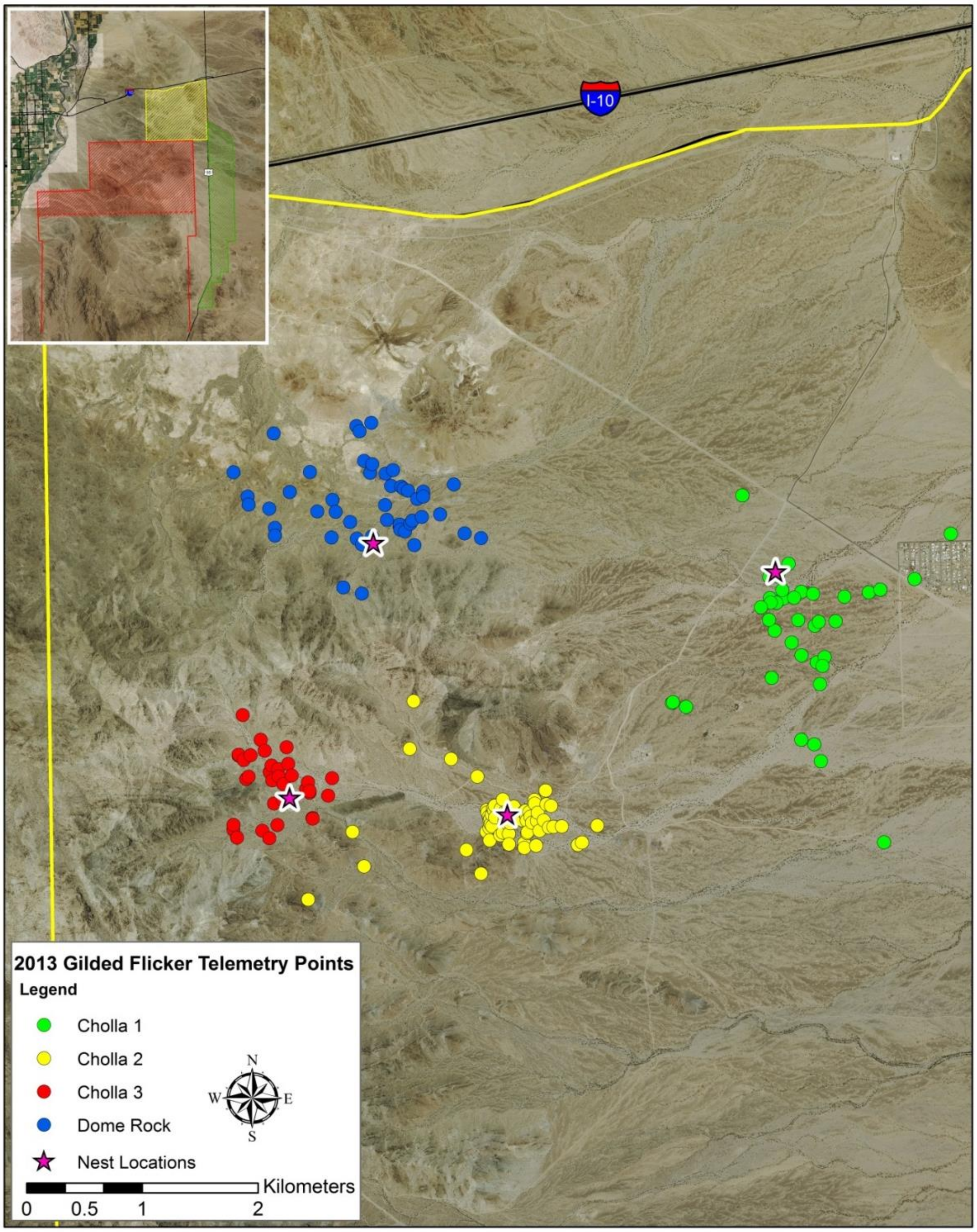

Figure 14.—Data points collected for adult flickers during 2013 data collection efforts.

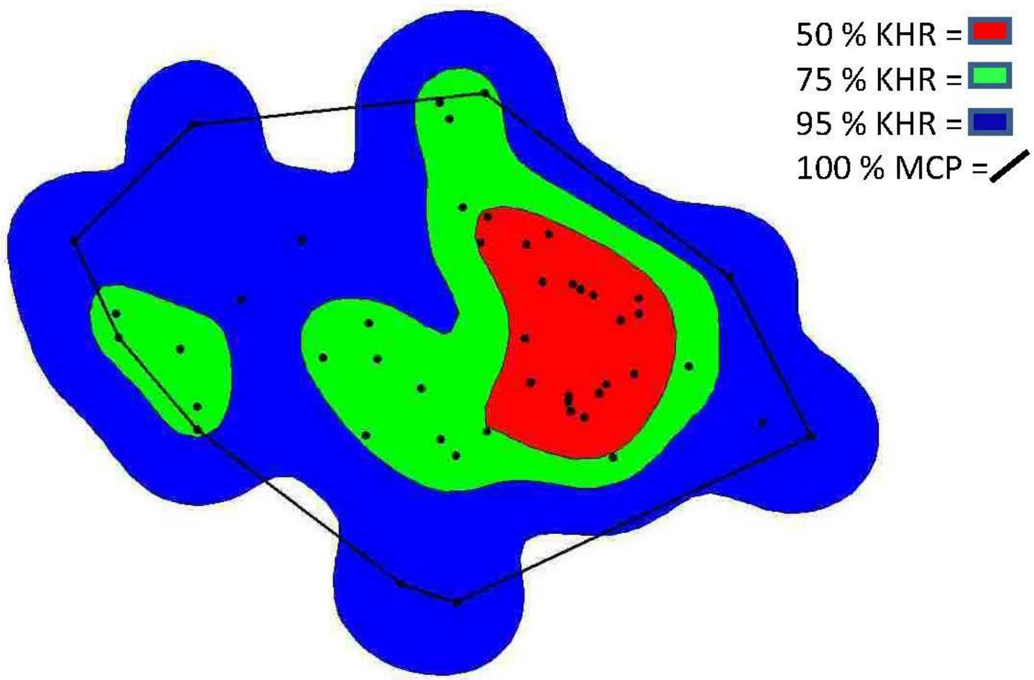

Figure 15.—KHR (50–75–95%) and MCP (100%) shapefile developed for Dome Rock flickers during year 1 pilot efforts.

Presence/absence surveys continued on a monthly basis at our previously located territories as there were no longer any active tags to track. Survey efforts through the rest of 2013 only detected one pair present in their known home range, male 164.206 with an adult female assumed to be his mate. There were no signs of a family group after their two chicks fledged, and the only vocalizations heard between male 164.206 and the adult female were "peah" calls.

Monitoring of nest cavities within the Interstate 10 South and U.S. Highway 95 sites was conducted in 2013 (table 2). The Dome Rock flicker pair (164.144 and 164.343) abandoned its first nest in early April but successfully re-nested in the same cavity in May. It is assumed that five of six flicker nest cavities produced at least one fledgling based on last nest checks (and, in some cases, post-fledge observation of family groups in proximity to instrumented birds). The Cholla 1 flicker (164.132) and its mate were observed using what was presumed to be a nest cavity on several occasions during the early breeding season; however, the identified cavity was never used based on monitoring efforts from February to June. It is possible that the Cholla 1 pair had a nest cavity and may have fledged chicks that went undetected. The mean clutch sizes for instrumented (4.5 eggs) and reference birds (4.5 eggs) were the same, suggesting radio tagging did not impair reproduction efforts. Nest cactus and cavity measurements are compiled in attachment 2.

Table 2.—Flicker nest chronology data
(Chronologies are calculated based on compiled northern flicker data found in Wiebe and Moore [2008])

Flicker ID/frequency (megahertz)	Egg laying initiated[a]	Clutch size (date detected)	Incubation initiated[b]	First egg hatch date[c]	First fledge date[d]	Nestlings at last check (date)
Dome Rock (164.144)	*Initial nest:* Unknown	4 eggs (4/9/13)	Unknown	N/A	N/A	Abandoned (4/14/13)
	Second nest: 5/2/13 (1 egg)	4 eggs (5/9/13 and 5/14/13)	≈5/5/13	≈5/15/13	≈6/7/13	1 nestling (5/28/13)
Cholla 1* (164.132)	N/A	N/A	N/A	N/A	N/A	N/A
Cholla 2 (164.069)	≈3/26/13	5 eggs (N/A)	≈4/1/13	≈4/11/13 (3 nestlings, 2 eggs)	≈5/3/13	1 nestling (4/30/13)
Cholla 3 (164.206)	Unknown	5 eggs (4/8/13)	Unknown	Unknown	Unknown	3 nestlings (4/30/13)
Reference A	Unknown	4 eggs (4/11/13)	Unknown	Unknown	Unknown	2 nestlings (4/30/13)
Reference B	Unknown	3 nestlings, 1 egg (4/12/13)	≈4/1/13	≈4/11/13	≈5/4/13	2 nestlings (4/30/13)

[a] Assumes 1 egg per day.
[b] Assumes incubation begins 1 day before last egg laid.
[c] Assumes 10-day incubation prior to first egg hatch.
[d] Assumes 24 days from hatch to fledge.
* Presumed nest cavity for Cholla 1 apparently never became active although male and female were seen using cavity over subsequent visits.

DISCUSSION

Comparison of Capture Techniques

Three different techniques were successfully employed to capture flickers in 2013. The use of mist nets placed within a territory (see figure 2) required waiting until dawn, when there was enough ambient light for the flicker to exit their cavity. This technique was most effective in the very early morning because the net was nearly invisible, and it is likely the most successful method when precise nesting or roosting cavities are unknown. However it was difficult to find favorable conditions for mist netting with the lack of contiguous tall trees or shrubs within territories at the study sites. With the knowledge of an inhabited cavity, capture was much more likely with a hoop net or forced flush. Flickers were observed to be attracted to electronic calling while netting but did not necessarily display aggressive or overtly curiosity-based behavior toward the electronic calls that resulted in consistent captures.

Locating an inhabited cavity was time intensive. The observation of a flicker entering a cavity was a difficult task, as several evenings may be required to refine the general location of a roost before watching a bird enter a specific cavity before dark. The difficulty was compounded because flickers would not always utilize the same roost. Roost cavities of males were often more easy to find, as they would be more vocal in the evening than females, which would draw an observer's attention to the male's location. Most often males and females roosted in separate cactuses at varying distance from each other. Pairs were documented utilizing the same cactus for a roost when multiple cavities were available but never in the same cavity. If flickers could be observed entering a cavity for roosting, the mist net sets using a blocker and encircling the saguaro were effective. Hoop nets were found to be very useful because they eliminated the need to work in very close proximity and at cavity height on a given saguaro cactus. The hoop nets could be used at any time of the day when a flicker was within a cavity (see figures 3 and 5). Another advantage of the hoop net technique was that birds captured did not seem to abandon future or active nest cavities when this technique was used. This may not have been the case when using the forced flush technique (see figure 4). For example, the Dome Rock female abandoned her nest cavity after being captured with this technique in mid-April (proved to be temporary by re-nesting in May), so subsequent use of this technique was abandoned.

Tracking Methodology and Equipment

In general, the flicker tracking methodologies and equipment permitted the collection of precise data points over a short period of time. The desert vegetation overstory complex within the Interstate 10 South site was dominated by saguaro cactus, palo verde, ocotillo, and ironwood trees, with understory vegetation such as creosote, and cholla cactus also common. The vegetation permitted good visibility for biologists moving toward an instrumented flicker, often allowing for visual detection of the bird before disturbance. Also, the relatively small home range sizes permitted rapid re-detection of birds following movements. Because we were typically able to visually locate instrumented flickers, our employed method permitted precise location estimates. When care was taken to move in slow, methodic back and forth movements toward an auditory signal emitted by a radio tag, we could generally locate the bird without a noticeable flushing disturbance, and often a visually located bird could be observed for significant time periods (10–15 minutes) before moving out of the location. Also, it appeared “flushed” birds, moving out of a location as a result of anthropogenic influence, typically returned to normal behaviors (e.g., feeding and preening) within the selected 15-minute time period between data collection efforts.

Under ideal conditions (clear line of sight), radio tags could be detected nearly a kilometer away and operated within parameters as indicated by the manufacturer. A single transmitter suffered a broken antenna, which greatly reduced the signal detection range. This may be a function of frequent confinement within a cavity. Problems with transmitters arose as temperatures increased during our pilot year. The advertised maximum operating temperature of tags (40 degrees Celsius [°C]) was reached in July, as air temperatures exceeded 46 °C. The signal strengths of the tags were found to fluctuate greatly or completely stop during such conditions. The tags would often resume functionality as the temperatures decreased in the evenings. However, given the climate, and our desire to collect accurate year-round positional data, future data collection efforts during this study will incorporate the use of lighter tags that advertise a maximum operating temperature of 50 °C, and design considerations for cavity-dwelling birds will be discussed prior to development.

Home Range Sizes

We were able to generate preliminary home range estimates on four instrumented male flickers in 2013. This was done opportunistically, as the main focus of work (based on the 2013 study plan) was to verify capture techniques, assess the radio-backpack effects on instrumented birds, and to establish a study area based on flicker surveys. We are not aware of any other quantitative home range or movement data for this species; thus, the dataset has immediate utility for managers within the LCR MSCP. The data should be interpreted with caution, as the sample size was small, it reflected activity only for part of the year, and because of the periodic tracking that was conducted, the home range sizes were possibly underestimated. These issues will be addressed as the study progresses. Obviously, home range estimates depend on healthy specimens behaving normally, despite having been captured and instrumented. We are confident that the capture, handling, and harness attachment were minimally detrimental to birds tracked in 2013 as evidenced by recapture examination and successful breeding. The exception was the Dome Rock female (164.343) that was instrumented April 9, 2013, which was most likely immediately after or during clutch formation (four eggs were in cavity at this time). The Dome Rock bird was found to be unable to fly the following day, and the transmitter removed, the thought being that the added stress during this time period was too much for the bird. This proved to be temporary, as she did re-nest, which was successful. Future efforts to capture birds during this study will avoid time periods when birds may be overly stressed, such as during clutch formation.

Preliminary data collected on these flickers indicates several interesting observations.

1) There appears to be no major long-distance movement (> 6 km) of instrumented flickers from February to June.

2) Juvenile flickers are difficult to locate or detect, and as a result, their movement patterns were not quantified.

3) Flicker movements in the study area may be influenced by anthropogenic activity. For example, one flicker was observed (on multiple occasions) at a bird bath in one of the small settlements southwest of Quartzite.

4) We were unable to discern if there is territory overlap during the breeding season based on telemetry. The Cholla 3 male and its mate were in very close proximity to the Cholla Reference A pair (0.75 km nest to nest), suggesting some tolerance to territory overlap.

Nest Chronology

The nesting chronology data collected in 2013 resulted in an incomplete picture of flicker recruitment. Nest cavity monitoring was done opportunistically in order to document if instrumented flickers would successfully breed and rear chicks to fledge and to test our nest monitoring equipment and methodology. Based on sample size and incomplete fledgling data, we were unable to discern a difference in nest success between instrumented and reference flickers. The mini camcorder used for nest cavity monitoring worked well and is likely a minimally intrusive manner of monitoring flicker nest cavities.

Recommendations for 2014–15

Capturing adult flickers with mist netting and modified hoop nets is an effective method, as it permitted rapid immobilization (< 3 and < 1 minute, respectively) and processing (≈ 15 minutes per flicker). The year 1 data also suggest outfitting adult flickers with backpack radio transmitters of an appropriate weight likely does not significantly affect health, flight, or reproductive success. Therefore, the use of a backpack radio transmitter is an option for future efforts aimed at tracking movements or estimating home ranges of adult flickers.

The nature of flickers as cavity nesters, as well as the environmental conditions they are exposed to, are important considerations when selecting effective telemetry equipment. Problems with a transmitter and antenna can greatly reduce the range or even prevent signal detection all together. Temperature ranges for optimal transmitter function should be considered, as well as antenna material, angle of placement, and how well it connects to transmitter, as frequent confinement within a cavity can produce repeated stress to the equipment.

Unfortunately, we were unable to successfully capture juvenile flickers during our year 1 efforts. Therefore, the effects of smaller rectrix-weaved transmitters is undetermined and would require additional testing for effectiveness if juveniles are to be studied.

As anthropogenic-influenced behaviors/data are always a major concern, our study plan implemented a 15-minute period between successive data collection efforts. This seemed to be appropriate, as it apparently did not affect instrumented flicker behavior. To adhere with standardized radio tracking methodology for northern flickers as published in the scientific literature, temporal periods between successive data collection efforts for all future endeavors could be extended to 30 minutes (Elchuk and Wiebe 2002) to allow for comparison with northern flicker results. As mentioned, there were not a sufficient amount of independent data points to calculate robust home range estimates, particularly for the development of seasonally dependent estimates. Therefore, the study protocol will be updated to obtain a minimum of 50 independent data points per radio-instrumented flicker within each of four specifically defined seasons (Garton et al. 2001) when seeking to estimate home ranges.

Finally, our year 1 study area provided ample opportunity to test sampling and monitoring methodologies to satisfaction. However, with our telemetry dataset limited from February to June, we detected no significant long-range adult flicker movements. If it is determined that the flickers on the Quartzite study area do not migrate outside of their immediate territories at any time of the year, then data relevant to the LCR MSCP will be lacking. While it may be the case that flickers can live and breed in areas devoid of riparian habitat, the LCR MSCP (2004) requires usable data in order to inform management for lower Colorado River riparian areas. The location of a study area that provides empirical data for the LCR MSCP (for this species) is already defined within Conservation Measure GIFL1: "*Of the 5,940 acres of created cottonwood-willow, at least 4,050 acres will be designed and created to provide habitat for this species,"* and within Monitoring and Research Measure 1 (MRM1): *"Conduct surveys and research to better identify covered and evaluation species habitat requirements."* Future efforts to quantify home range and seasonal use of riparian habitats would be most informative if these studies were conducted on flickers that are located near, and possibly influenced by, riparian habitat.

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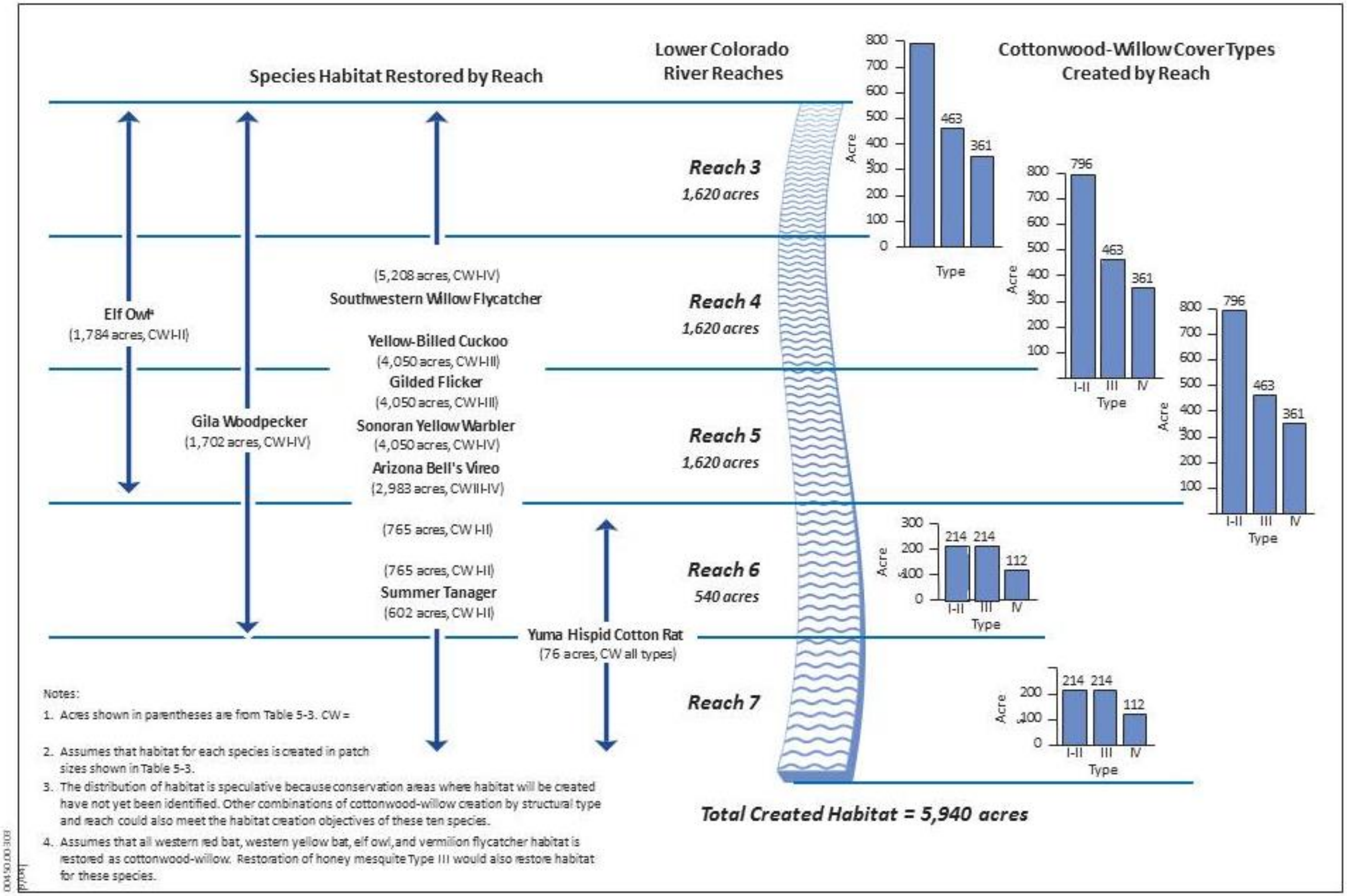
ATTACHMENT 1

Hypothetical Distribution of Cottonwood-Willow Creation that Would Meet Habitat Requirements for All Covered Species Associated with Cottonwood-Willow



(Figure from Bureau of Reclamation [2004], page 255).

ATTACHMENT 2

Annotated Capture Data and Measurement Metrics for Gilded Flickers Captured in 2013

Annotated Nest Cactus and Nest Cavity Data Collected in 2013

CHOLLA 1

Date: 2/19/13
Capture location: 11S 0752320 3722765
Sex: Male
Weight: 111 grams
Central rex: 110 millimeters
Tarsus: 34.4 millimeters
Wing chord: 149 millimeters
Bill length: 29.6 millimeters
Bill depth: 8.8 millimeters
Bill width: 10.1 millimeters
Band number: 1713-21903 (left tarsus)
Darvic band combo (right tarsus, top to bottom): White, blue
Blood sample (PermaCode): Yes
Feather sample: Yes
Fecal sample: No
Transmitter frequency: 164.132 megahertz
Capture technique: Mist net

Saguaro/Cavity Measurements

Saguaro location: 11S 0752320 3722765
Roost/nest: Nest
Saguaro height: 26.9 feet
Cavity height: 16 feet
Cavity orientation: 111 degrees
Cavity opening diameter: N/A
Cavity depth (horizontal): N/A
Opening to back: N/A
Cavity depth: N/A
Cavity width (at opening): N/A

CHOLLA 2

Date: 2/13/13
Capture location: 11S 0750160 3720864
Sex: Male
Weight: 114 grams
Central rex: 105 millimeters
Tarsus: 41.8 millimeters
Wing chord: 148 millimeters
Bill length: 32.5 millimeters
Bill depth: 8.8 millimeters
Bill width: 9.1 millimeters
Band number: 1713-21901 (left tarsus)
Darvic band combo (right tarsus, top to bottom): Yellow, red
Blood sample: No
Feather sample: Yes
Fecal sample: No
Transmitter frequency: 164.069 megahertz
Capture technique: Mist net

Saguaro/Cavity Measurements

Saguaro location: 11S 0750003 3720664
Roost/nest: Nest
Saguaro height: 21.3 feet
Cavity height: 17 feet 5 inches
Cavity orientation: 45 degrees
Cavity opening diameter: N/A
Cavity depth (horizontal): N/A
Opening to back: N/A
Cavity depth: N/A
Cavity width (at opening): N/A

CHOLLA 3

Date: 2/18/13
Capture location: 11S 0748379 3720703
Sex: Male
Weight: 129 grams
Central rex: 114 millimeters
Tarsus: 35.5 millimeters
Wing chord: 152 millimeters
Bill length: 31.6 millimeters
Bill depth: 8.5 millimeters
Bill width: 9.0 millimeters
Band number: 1713-21902 (left tarsus)
Darvic band combo (right tarsus, top to bottom): Green, white
Blood sample (vial): Yes
Feather sample: Yes
Fecal sample: Yes
Transmitter frequency: 164.206 megahertz
Capture technique: Flush/sock net

Saguaro/Cavity Measurements

Saguaro location: 11S 0748379 3720703
Roost/nest: Roost
Saguaro height: N/A
Cavity height: 9 feet 5 inches
Cavity orientation: 331 degrees
Cavity opening diameter: 58 millimeters high x 67 millimeters wide
Cavity depth (horizontal): 140 millimeters
Cavity depth: 317 millimeters
Cavity width (at opening): N/A

Saguaro/Cavity Measurements

Saguaro location: 11s 0748127 3720810
Roost/nest: Nest
Saguaro height: N/A
Cavity height: 9 feet 5 inches
Cavity orientation: 331 degrees
Cavity opening diameter: 58 millimeters high x 67 millimeters wide
Cavity depth (horizontal): 140 millimeters
Cavity depth: 317 millimeters
Cavity width (at opening): N/A

DOME ROCK

Date: 2/20/13
Capture location: 11S 0748845 3723011
Sex: Male
Weight: 112 grams
Central rex: 100 millimeters
Tarsus: 36.0 millimeters
Wing chord: 146 millimeters
Bill length: 27.4 millimeters
Bill depth: 9.2 millimeters
Bill width: 8.6 millimeters
Band number: 1713-21904 (left tarsus)
Darvic band combo (right tarsus, top to bottom): Blue, yellow
Blood sample (card and vial): Yes
Feather sample: Yes
Fecal sample: Yes
Transmitter frequency: 164.144 megahertz
Capture technique: Flush/sock net

Saguaro/Cavity Measurements

Saguaro location: 11S 0748845 3723011
Roost/nest: Roost/nest
Saguaro height: 22 feet
Cavity height: 12 feet 4 inches
Cavity orientation: 350 degrees
Cavity opening diameter: 55 millimeters high x 63 millimeters wide
Cavity depth (horizontal): 80 millimeters
Cavity depth: 425 millimeters
Cavity width (at opening): 160 millimeters

DOME ROCK FEMALE

Date: 4/9/13
Capture location: 11S 0748845 3723011
Sex: Female
Weight: 110 grams
Central rex: 95 millimeters
Tarsus: 30.6 millimeters
Wing chord: 173 millimeters
Bill length: 30.6 millimeters
Bill depth: 7.9 millimeters
Bill width: 9.3 millimeters
Band number: 1713-21905 (left tarsus)
Darvic band combo (right tarsus, top to bottom): Black, yellow
Blood sample: No
Feather sample: Yes
Fecal sample: No
Transmitter frequency: 164.343 megahertz
Capture technique: Flush/sock net

Saguaro/Cavity Measurements

See GIFL4

CHOLLA REFERENCE A

Date: 4/10/13
Capture location: 11S 0749291 3720820
Sex: Male
Weight: 118 grams
Central rex: 97 millimeters
Tarsus: 39.5 millimeters
Wing chord: 149 millimeters
Bill length: 30.6 millimeters
Bill depth: 8.5 millimeters
Bill width: 10 millimeters
Band number: 1713-21906 (left tarsus)
Darvic band combo (right tarsus, top to bottom): Red, green
Blood sample: No
Feather sample: Yes
Fecal sample: No
Transmitter frequency: Not telemetered
Capture technique: Hoop net

Saguaro/Cavity Measurements

Saguaro location: 11S 0749291 3720820
Roost/nest: Nest
Saguaro height: 23 feet 6 inches
Cavity height: 20 feet 11 inches
Cavity orientation: 175 degrees
Cavity opening diameter: N/A
Cavity depth (horizontal): N/A
Cavity depth: N/A
Cavity width (at opening): N/A

KOFA REFERENCE B

Date: 4/12/13
Capture location: 11S 0761559 3712152
Sex: Male
Weight: 122 grams
Central rex: 110 millimeters
Tarsus: 34.2 millimeters
Wing chord: 141 millimeters
Bill length: 29.7 millimeters
Bill depth: 9.5 millimeters
Bill width: 10.6 millimeters
Band number: 1713-21907 (left tarsus)
Darvic band combo (right tarsus, top to bottom): White, black
Blood sample: No
Feather sample: Yes
Fecal sample: No
Transmitter frequency: Not telemetered
Capture technique: Hoop net

Saguaro/Cavity Measurements

Saguaro location: 11S 0761559 3712152
Roost/nest: Nest
Saguaro height: 25 feet
Cavity height: 20 feet 1 inch
Cavity orientation: 338 degrees
Cavity opening diameter: N/A
Cavity depth (horizontal): N/A
Cavity depth: N/A
Cavity width (at opening): N/A

ATTACHMENT 3

Minimum Convex Polygons (100%) and Kernel Home Range for Radio Telemetry Tracked Gilded Flickers Southwest of Quartzsite, Arizona

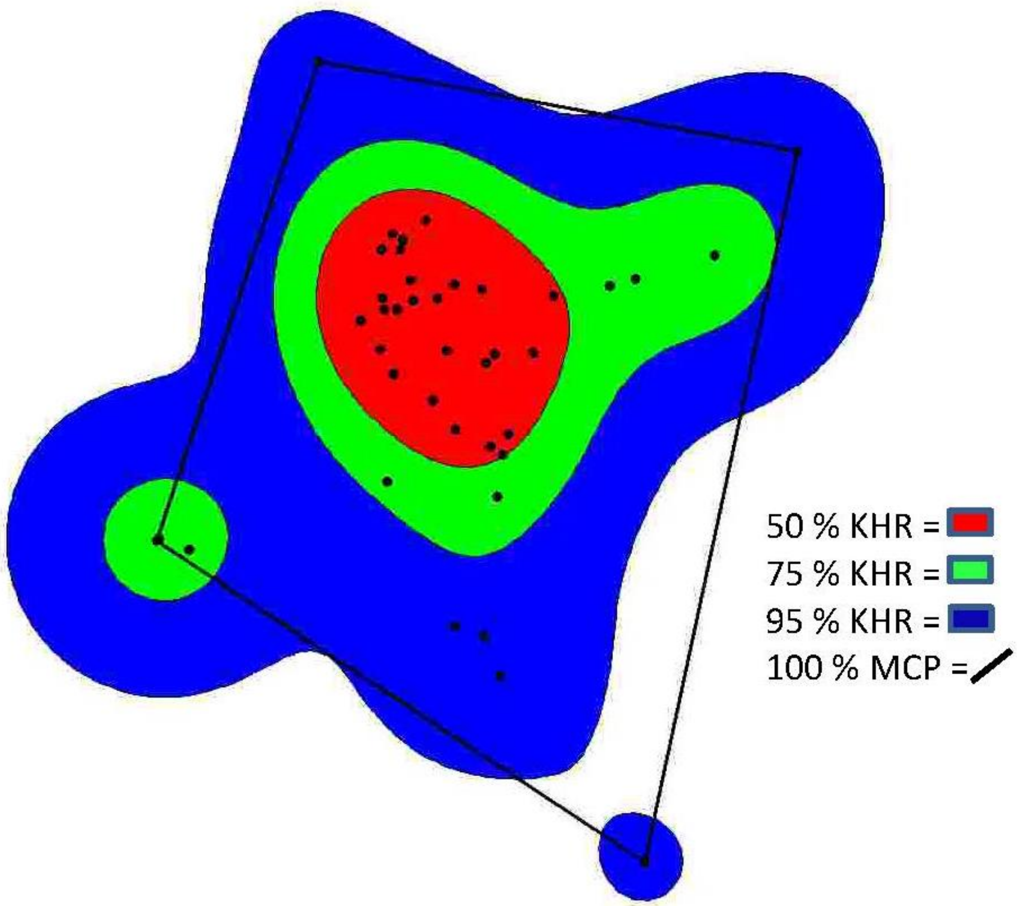


Figure 3-1.—Kernel home range (50–75–95%) and minimum convex polygon (100%) developed for the Cholla 1 bird during year 1 pilot efforts.

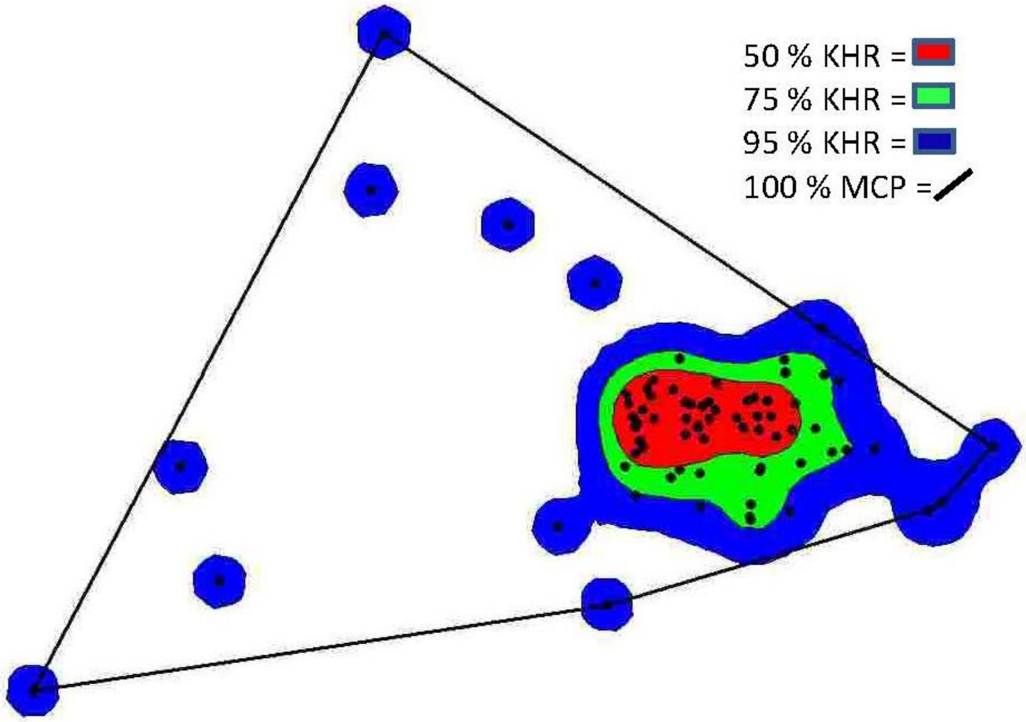


Figure 3-2.—Kernel home range (50–75–95%) and minimum convex polygon (100%) developed for the Cholla 2 bird during year 1 pilot efforts.

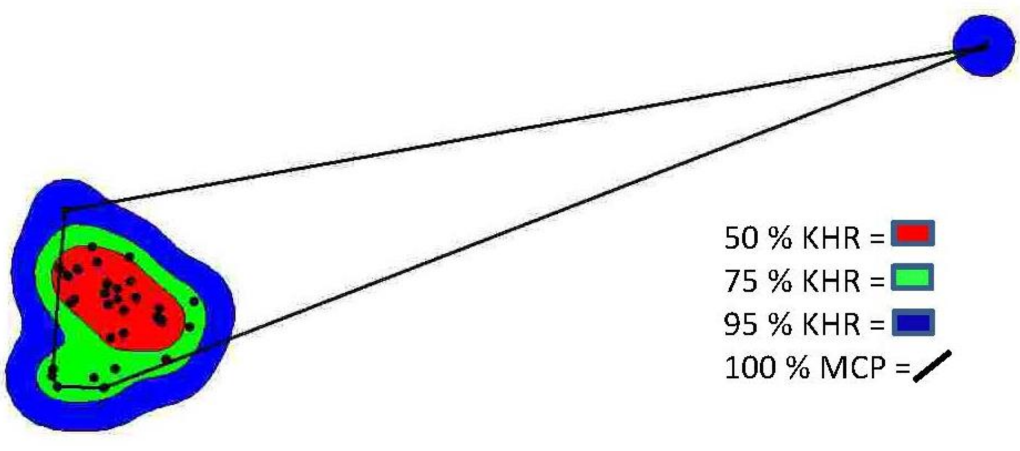


Figure 3-3.—Kernel home range (50–75–95%) and minimum convex polygon (100%) developed for the Cholla 3 bird during year 1 pilot efforts.