

Riparian Bird Population Monitoring at Saltcedar Biological Control Sites

Big Bend National Park, Texas



**U.S. Department of the Interior
Bureau of Reclamation
Albuquerque Area Office**

March 2009

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Cover: Rio Grande and Sierra Ponce downstream of Santa Elena Canyon, June 2008.

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Big Bend National Park, Texas

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Introduction

The National Park Service (NPS) has recently begun introduction of a biological control (biocontrol) agent to manage saltcedar (*Tamarix* spp.) growing in riparian areas at Big Bend National Park, Texas, including areas along the Rio Grande. Saltcedar is an exotic (non-native) tree or shrub introduced from Eurasia which has colonized hundreds of thousands of hectares of riparian land throughout the western U.S. and Northwest Mexico (DeLoach et al 2003). Saltcedar is a long-lived (50-100 years), hardy plant that grows in dense thickets along waterways, lakes, and wetlands. Where established, it aggressively invades riparian areas, often becoming dominant to native species and resulting in displacement and exclusion of native vegetation. In Big Bend National Park, saltcedar now occupies discontinuous patches along riparian floodplains of the Rio Grande and over 150 upland riparian areas (National Park Service 2007).

The U.S. Department of Agriculture's Agricultural Research Service (ARS) has researched and developed an effective biocontrol agent for saltcedar. For over 20 years, the ARS, in collaboration with other governmental agencies and researchers, has thoroughly tested saltcedar leaf beetles (*Diorhabda elongata*) from Eurasia and Africa for host specificity and effectiveness in defoliating saltcedar in North America. Because the beetle can only survive and successfully reproduce on *Tamarix* species, it purportedly does not harm native vegetation or crop plants (DeLoach et al. 2003). Research on *D. elongata* has included intensive laboratory tests and field tests followed by monitoring programs that measure the effects of *D. elongata* in several western states. To date, beetles have effectively defoliated large areas of saltcedar in Utah, Nevada, and Colorado (National Park Service 2007).

The NPS initiated an initial "caged release" of *D. elongata* in June 2008, which will be monitored for at least one year. Based on data gathered from the caged release, the Park would conduct an open release of *D. elongata* at one or more saltcedar-dominated sites within the Park. Following an open release, standard protocols would be used to monitor the survival and dispersal of *D. elongata*, monitor the effectiveness of *D. elongata*, and monitor ecosystem variables such as plant community composition and wildlife use of habitat. The project will be conducted at sites accessible by existing roads. The Park would conduct the work in phases using protocols established by USDA and U.S. Department of the Interior ecological scientists. Locations of treatment sites would be determined based on established protocols as well as on site-specific data obtained from ongoing monitoring associated with this project. This project would complement existing management methods for controlling invasive species in the Park, which were previously evaluated and approved by the Park's managers and environmental scientists (National Park Service 2007).

This report details the survey design and first year of data collection (pre-release) for monitoring of the riparian bird community in habitats where beetle releases are planned. By design, this monitoring program is intended to be repeated annually in order to detect responses by the avian community to any changes in habitat as a result of the release of *D. elongata* in Big Bend National Park.

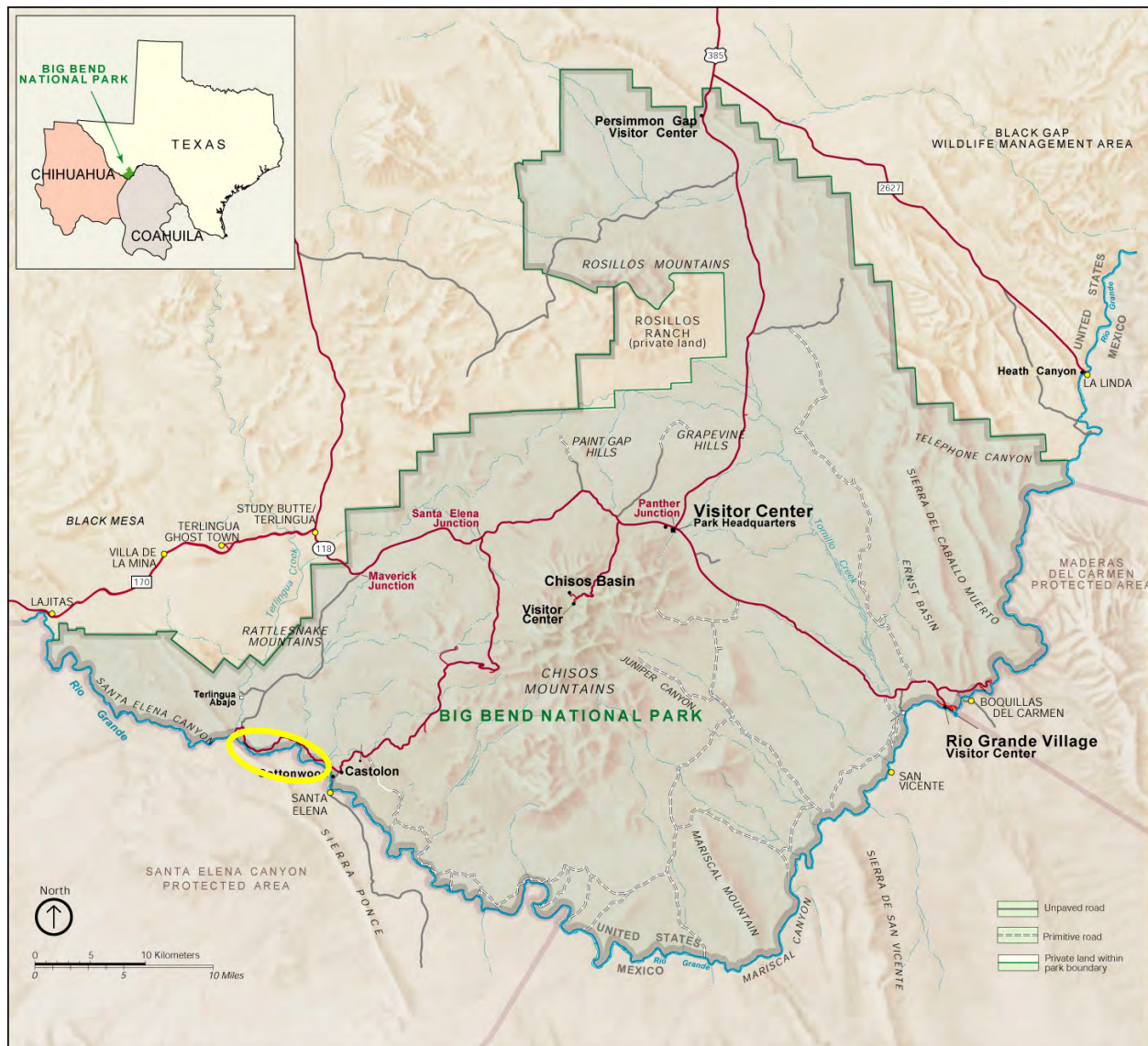


Figure 1. Location of Big Bend National Park, Texas. Yellow circle on the west side of the park denotes general location of saltcedar biocontrol and associated riparian bird population monitoring. (Map courtesy NPS.)

Methods

Field Methods

Distance-based point transects (Gregory et al. 2004) of breeding birds were conducted in June 2008 in riparian areas on the west side (Fig. 1) of Big Bend National Park, approximately 16 km south of Terlingua, Texas. The distance sampling method has four critical underlying assumptions that must be met in order to generate reliable density estimates for birds: all birds at

distance zero were detected; all birds were detected at the point in which they were first encountered; all birds are counted only once; and all distance measurements or estimates are accurate. Methods to ensure that these assumptions are met are described below.

Survey counting stations (points) were located in six general areas in the Rio Grande riparian corridor and at one location along Terlingua Creek, approximately 4.4 km upstream of the confluence with the Rio Grande (Table 1). Points were located in each of three beetle cage-release areas (Fig. 2) and four nearby sites without release and with slightly different habitat (Fig. 3), primarily dominated by honey mesquite (*Prosopis glandulosa*). Points were located 150 m apart at each site and placed so that each transect ran systematically through the habitat patches which were generally linear in occurrence (Figs. 4-10). Placement of points was made based on an initial point provided by NPS personnel and then the addition of other points using aerial photography to aid in systematic location through distinct habitat features. Positioning of systematic transects was done to allow for general inferences to be drawn about the samples areas (Bibby et al. 2000).



Figure 2. Saltcedar-dominated habitat at a “caged release” site for saltcedar leaf beetles. Metal frame would later support a tent to contain beetles.



Figure 3. Mesquite-dominated habitat within the Rio Grande floodplain of Big Bend National Park, Texas.

Table 1. Coordinates for riparian bird point transect locations at Big Bend National Park, Texas (all coordinates UTM zone 13R, NAD83 datum).

Site name	Point number	Easting	Northing
Beetle 1	B1	640614	3226518
	B11	640459	3226519
	B12	640309	3226510
	B13	640171	3226449
Beetle 2	B2	636068	3226432
	B21	636125	3226293
	B22	636023	3226575
	B23	635986	3226719
Beetle 3	B3	635222	3227511
	B31	635211	3227361
	B32	635353	3227584
	B33	635498	3227626
Mesquite 1	M1	644277	3223673
	M11	644229	3223816
	M12	644409	3223605
	M13	644512	3223495
	M14	644643	3223421
	M15	644752	3223316
Mesquite 2	M2	638590	3226032
	M21	638720	3226104
	M22	638846	3226185
	M23	638947	3226294
	M24	639073	3226377
Mesquite 3	M3	635906	3227051
	M31	635834	3227184
	M32	635757	3227311
	M33	635654	3227419
Cottonwood	M41	635648	3231165
	M42	635690	3231309
	M43	635788	3231423
	M44	635445	3231495



Figure 4. Overview of locations of riparian bird monitoring point transects on the west side of Big Bend National Park, Texas. (North is top of figure.)



Figure 5. Locations of riparian bird monitoring point transects at Big Bend National Park, Texas. Points shown are the Beetle 1 site. (North is to top of figure. Image date 5 August 2007.)

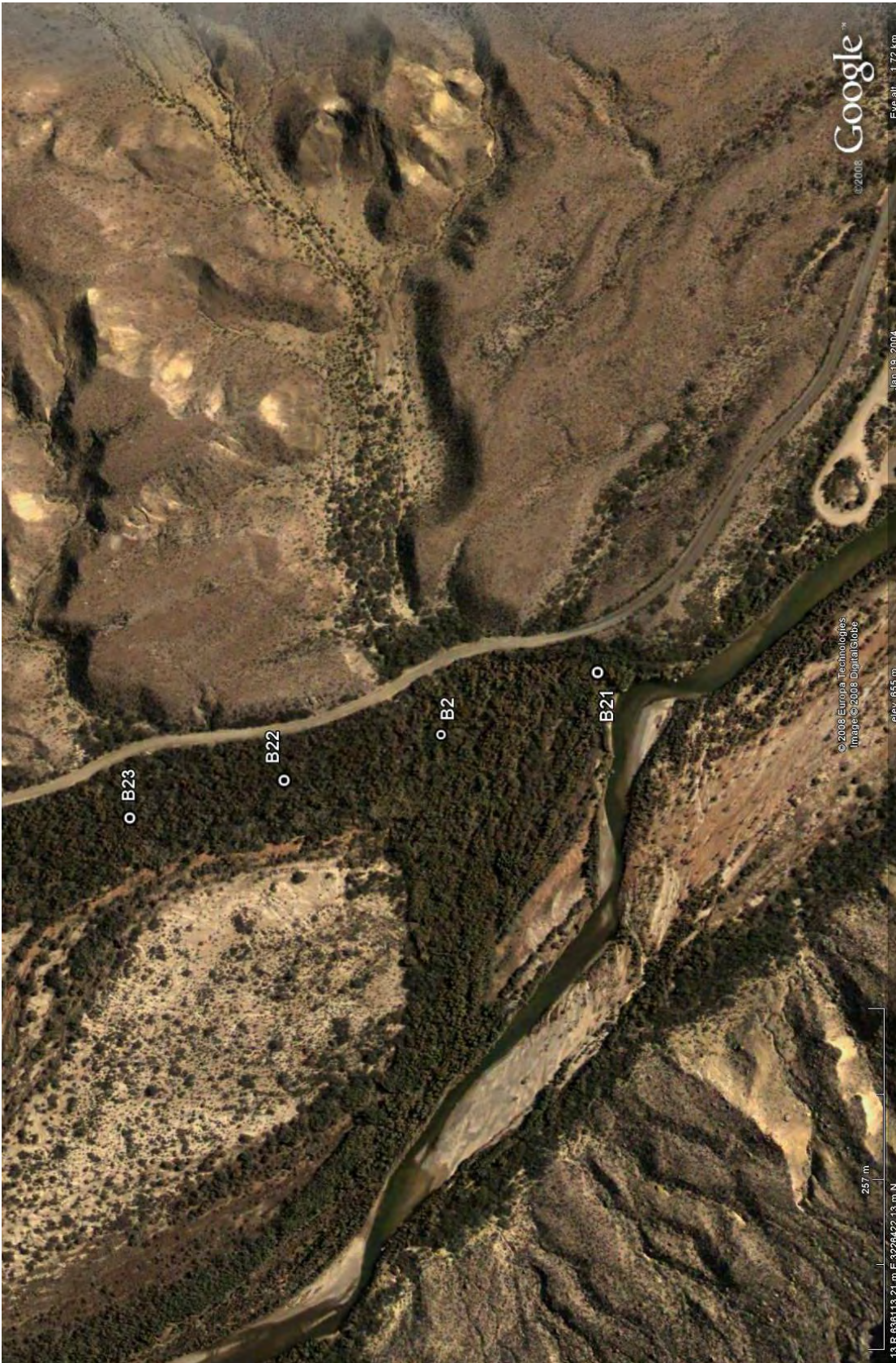


Figure 6. Locations of riparian bird monitoring point transects at Big Bend National Park, Texas. Points shown are the Beetle 2 site. (North is to top of figure. Image date 19 January 2004.)



Figure 7. Locations of riparian bird monitoring point transects at Big Bend National Park, Texas. Points shown are the Beetle 3 and Mexquite 3 sites. (North is to top of figure. Image date 19 January 2004.)



Figure 8. Locations of riparian bird monitoring point transects at Big Bend National Park, Texas. Points shown are the Mesquite 1 site. (North is to top of figure. Image date 5 August 2007.)



Figure 9. Locations of riparian bird monitoring point transects along the Rio Grande at Big Bend National Park, Texas. Points shown are the Mesquite 2 site. (North is to top of figure. Image date 5 August 2007.)



Figure 10. Locations of riparian bird monitoring point transects along Terlingua Creek, Big Bend National Park, Texas. Terlingua Abaja appears at the bottom-center of the image. Points shown are the Cottonwood site. Point M4 was not used. (North is to top of figure. Image date 19 January 2004.)

At each site, a point transect was composed of three to six point stations with a total of 31 point stations established over the survey area. All points were visited once by a single observer from 17 to 20 June 2008. At each point station, all birds detected visually or aurally were recorded for a five-minute period. Prior to recording these data, a waiting period of at least one minute was implemented to allow for birds to settle that may have been disturbed by the observer entering the habitat. Data collection occurred between dawn and 1030 CDT and during good weather conditions (no rain and wind at or below Beaufort 2). Distances from the observer to all birds encountered were estimated for all detections. All bird detections were placed into distance categories of 0-15 m, 15-30 m, and > 30 m. A laser rangefinder (Leica Rangemaster LRF 1200 Scan) was periodically used in the field to calibrate and verify distance estimates. Individual birds were tracked throughout the five-minute count, by marking moving birds on the field data sheets, so as to avoid double-counting individuals.

Data Analysis

Species richness was calculated for each of the three general sites—the saltcedar-dominated beetle release sites, the nearby mesquite-dominated sites, and the cottonwood site—as the total number of species encountered in all transects in each general habitat type. An estimate of species richness was also calculated on the basis of a jackknife estimator using observed abundance-distribution data by species using program SPECRICH (Hines 1996). This method, which considers detection probabilities differing by species, is described by Burnham and Overton (1979).

Program DISTANCE (Version 5.0, Release 2; Thomas et al. 2002) was used to obtain density estimates of birds from distance data obtained during point transects. Detection functions were constructed for all species with at least 40 observations, and preferably > 80 observations (Buckland et al. 2001). For each species, data were pooled from all habitats except when vegetation structure was thought to influence detection probability, such as in the open cottonwood site. The probability of detecting each species as a function of perpendicular distance from the transects was determined by using the following robust models recommended by Buckland et al. (2001): uniform key function with cosine and simple polynomial expansion series; the half-normal key function with cosine and hermite polynomial expansion series; and the hazard-rate key function with cosine and simple polynomial expansion series. Model suitability was evaluated through Akaike's information criterion corrected for small sample size (AIC_c). Density estimates are presented with standard errors and 95% confidence intervals.

Results

Species Richness

Throughout the survey, 282 individual birds of 30 species were detected (Table 2, Appendix). The most numerous species detected were Bell's Vireo, White-winged Dove, and Yellow-breasted Chat (Fig. 11). Observed species richness in the three general habitat areas were equal for the saltcedar-dominated beetle release sites (22 species; Fig. 12) and the mesquite-dominated sites (22 species; Fig. 13) and was lower for the cottonwood site with 8 species (Fig. 14). This

was likely in direct proportion to the number of point stations in each general habitat type. Species richness estimates with program SPECRICH ranged from 11 (SE $\pm$ 2.4) for the cottonwood site to 26 (SE $\pm$ 2.8) for the saltcedar-dominated, beetle release sites to 29 (SE $\pm$ 3.7) for the mesquite-dominated areas. These estimated values are larger than the actual observed values suggesting that more species could be recorded in the three survey areas.

Table 2. Bird species detected during riparian point transect surveys at Big Bend National Park, Texas, in June 2008.

Species	
Black Vulture	<i>Coragyps atratus</i>
Gray Hawk	<i>Buteo nitidus</i>
White-winged Dove	<i>Zenaida asiatica</i>
Mourning Dove	<i>Zenaida macroura</i>
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>
Greater Roadrunner	<i>Geococcyx californianus</i>
Black-chinned Hummingbird	<i>Archilochus alexandri</i>
Ladder-backed Woodpecker	<i>Picoides scalaris</i>
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>
Couch's Kingbird	<i>Tyrannus couchii</i>
Bell's Vireo	<i>Vireo bellii</i>
Verdin	<i>Auriparus flaviceps</i>
Carolina Wren	<i>Thryothorus ludovicianus</i>
Bewick's Wren	<i>Thryomanes bewickii</i>
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>
Black-tailed Gnatcatcher	<i>Polioptila melanura</i>
Northern Mockingbird	<i>Mimus polyglottos</i>
Lucy's Warbler	<i>Vermivora luciae</i>
Common Yellowthroat	<i>Geothlypis trichas</i>
Yellow-breasted Chat	<i>Icteria virens</i>
Summer Tanager	<i>Piranga rubra</i>
Black-throated Sparrow	<i>Amphispiza bilineata</i>
Northern Cardinal	<i>Cardinalis cardinalis</i>
Pyrrhuloxia	<i>Cardinalis sinuatus</i>
Blue Grosbeak	<i>Passerina caerulea</i>
Painted Bunting	<i>Passerina ciris</i>
Brown-headed Cowbird	<i>Molothrus ater</i>
Orchard Oriole	<i>Icterus spurius</i>
House Finch	<i>Carpodacus mexicanus</i>
Lesser Goldfinch	<i>Carduelis psaltria</i>

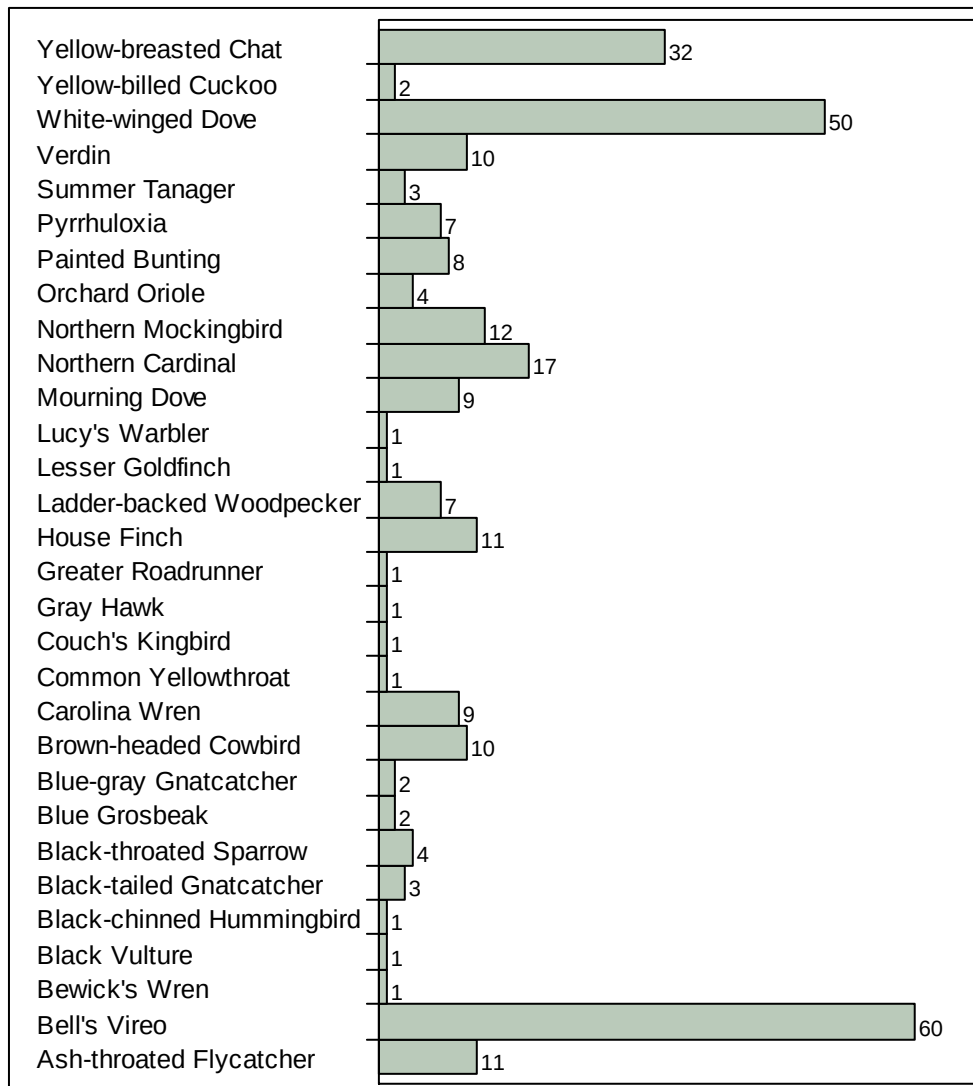


Figure 11. Total count of bird species detected in point transect surveys in the Rio Grande and Terlingua Creek riparian of Big Bend National Park, Texas, in June 2008.

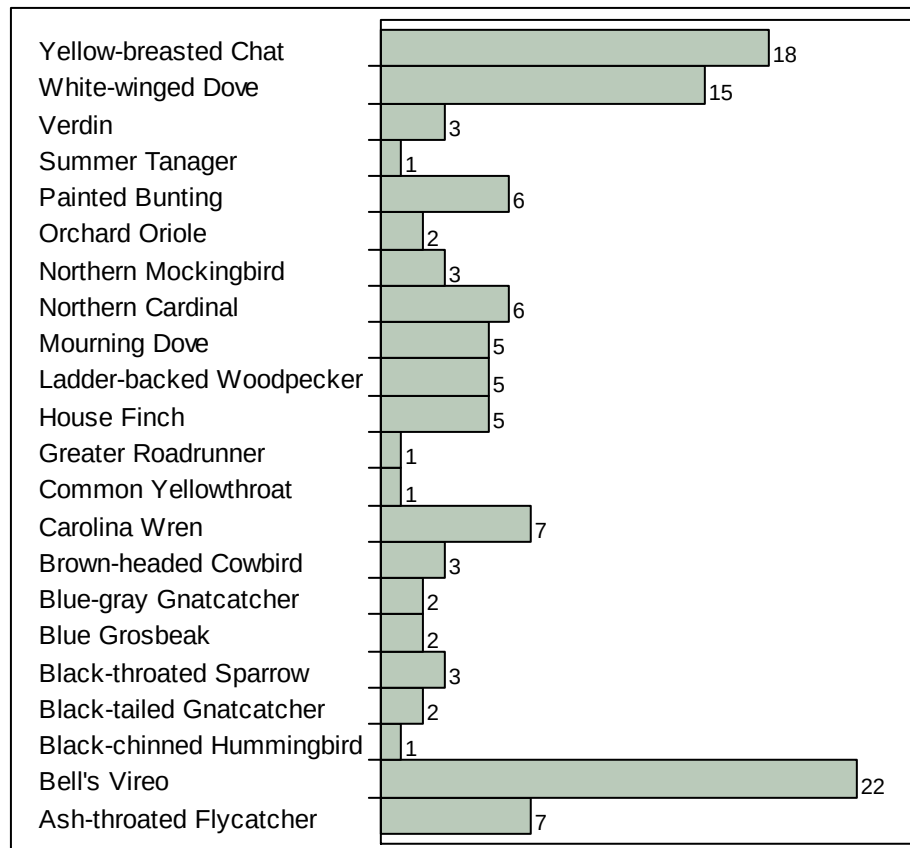


Figure 12. Total observed species in generally saltcedar-dominated (beetle release) sites in the Rio Grande riparian.

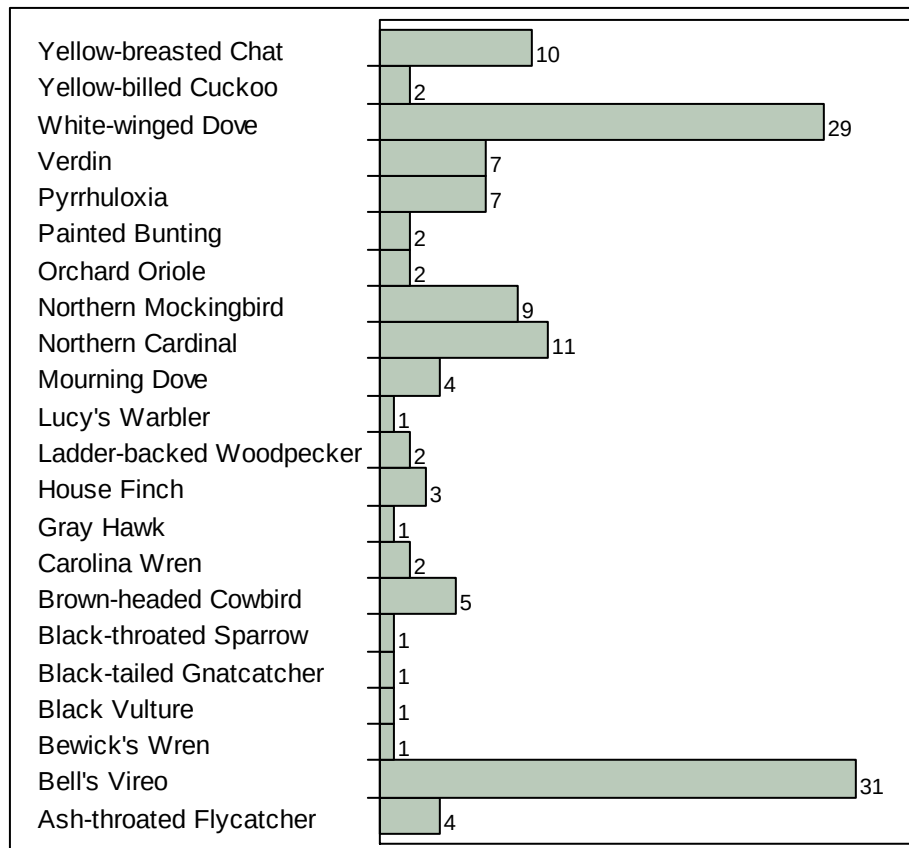


Figure 13. Total observed species in generally mesquite-dominated habitats in the Rio Grande Riparian.

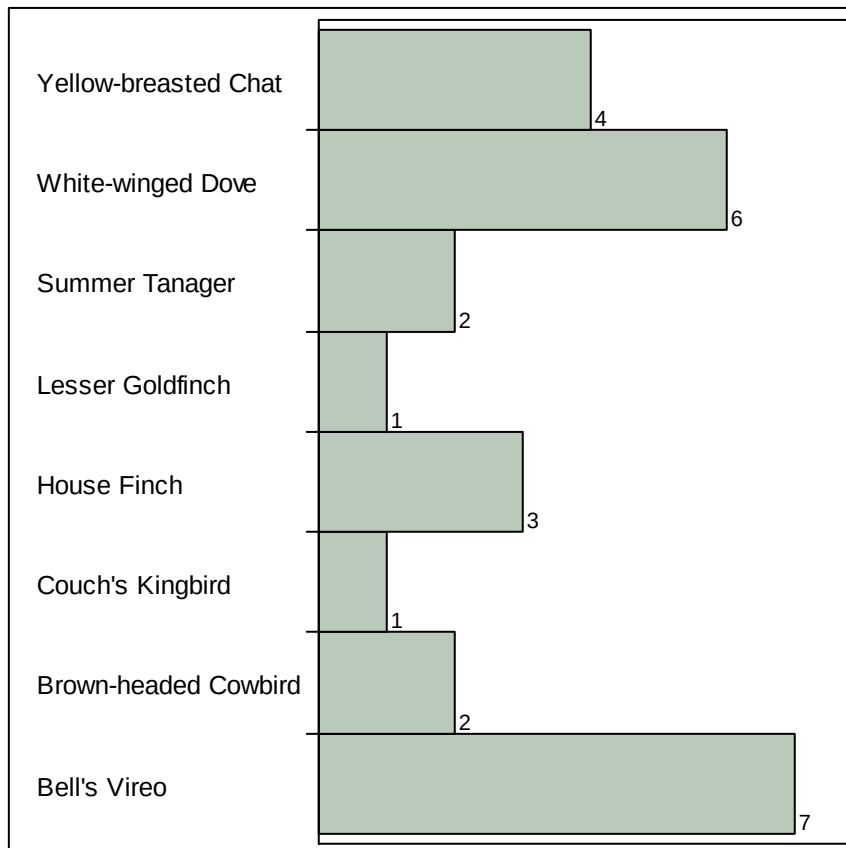


Figure 14. Total observed species in generally cottonwood-dominated sites on Terlingua Creek.

Species Composition

In all three general habitat types three species proved to be the most abundant: Bells' Vireo, White-winged Dove, and Yellow-breasted Chat. Bell's Vireo was detected at every point, except one, making this the most widespread species across all of the general habitat types. White-winged Doves were also quite numerous, being detected at all points but two. Yellow-breasted Chats were found at 24 of the 31 total point stations.

Many of the other bird species detected were found on smaller numbers of points and almost a third of the total species were unique to one point (Fig. 11) suggesting they occur in the area in relatively low densities (e.g., Orchard Oriole), occur in habitats that were not well-sampled in this survey (e.g., Common Yellowthroat), or were species common of habitats other than riparian (e.g., Black-chinned Sparrow). A number of habitat-generalist bird species, encountered in moderate number, included Northern Mockingbird, Northern Cardinal, and the parasitic Brown-headed Cowbird.

Population Densities

Because of the need for > 40 detections to build detection functions to estimate species densities using program DISTANCE (Buckland et al. 2001), densities could only be estimated for two species—Bell’s Vireo and White-winged Dove—and only for all survey areas combined. Using this method, Bell’s Vireo density estimates for all transects combined was 6.6 birds/ha (SE $\pm$ 0.4, 95% CI = 5.8–7.6). For White-winged Doves, the estimated density for all point transects was 3.1 birds/ha (SE $\pm$ 0.8, 95% CI = 1.9–5.3).

Discussion

The results of this initial survey give baseline information on bird species richness, composition, and, to a lesser extent, density in the Rio Grande riparian corridor of Big Bend National Park where saltcedar leaf beetles are to be released. Findings of bird density, from the limited amount of data that were obtained, show that, overall, the most wide-spread and abundant species encountered was Bell’s Vireo. This bird was present at all survey points. Since only male Bell’s Vireos sing (Brown 1993), the estimated density of birds calculated for this survey, 6.6 birds/ha, can be assumed to represent the number of pairs within the survey area. This density is quite high, compared to other studies that report a low of 1.4 pairs/40 ha (or 0.035 pairs/ha) in native urban habitat in Arizona (Mills et al. 1989) to 200.2 pairs/40 ha (or 5.0 pairs/ha) in mesquite riparian forest, also in Arizona (Brown 1987).

The estimated density of White-winged Doves may not be very accurate because this species tends to be clumped in its distribution on the landscape due to its affinity to breed colonially (Schwertner et al. 2002). Nonetheless, since the species was present at most all point stations, it is apparent that the riparian corridor is likely an important location for breeding activity.

Density estimations for both Bell’s Vireo and White-winged Dove were combined over all general habitat types so inferences could not be made about what density each species occurred in for a particular habitat. This pooling of observations was done due to the small number of detections obtained and the large number of detections required for producing density estimates in program DISTANCE. The expansion of surveys, combined with habitat delineations and quantifications, could help to allow for adequate density estimates for these species, and others, in future years.

Because no vegetation quantification was available for the three general habitat types, statistical comparisons were not made between species detected in each of these areas. In all habitats there were components of both saltcedar and mesquite, which were typically the dominant canopy cover type, with one species typically more prevalent than the other. Having some level of habitat quantification for future surveys would help to make valid paired comparisons of birds occurring in each type.

Several bird species unusual or uncommon in this area were detected during the survey and are worth noting. A single Gray Hawk was detected, calling, at point M33. An adult of this species was also observed at the Cottonwood Campground (not related to the survey) near an apparent

nest. Flippo (2004) lists Gray Hawk as an uncommon nesting species in Big Bend National Park.

Two Yellow-billed Cuckoos were detected at two different point stations (M12 and M13). Though listed in the Park as fairly common (Flippo 2004), these birds may be of the western subspecies (*C. a. occidentalis*), a distinct population segment which is currently considered a candidate for listing under the Endangered Species Act (U.S. Fish & Wildlife Service 2008).

One Couch's Kingbird was located at point M44 which is on Terlingua Creek. This bird was observed in the cottonwood canopy, calling frequently and showing preference for a particular spot in the tree canopy. This behavior may be suggestive of nesting so future surveys should be aware of the possible expanding presence of this species in the Park. Flippo (2004) currently notes that Couch's Kingbird is present in the Park during the post-breeding period.

Carolina Wrens, considered rare in the park (Flippo 2004), were detected at eight point count stations (9 individuals). This level of occurrence suggests that the species is likely increasing its range in the park, apparently spreading westward up the Rio Grande (M. Lockwood, pers. comm.), and may be an important component of the avifauna to monitor.

This survey represents an initial effort at establishing an avian monitoring scheme to detect changes in bird species richness, composition, and density that may arise from saltcedar leaf beetle introduction at Big Bend National Park. It is intended that this monitoring be repeated annually, during the peak of breeding activity in June, and results be compared across years in order to detect changes in the riparian avian community. By repeating the above methods and introducing the following refinements, this monitoring effort should, over time, effectively allow for the detections of changes in the riparian bird community that may result from changes to their associated habitats.

Recommendations

1. Surveys at the existing points should be conducted annually in order to detect any response from the riparian bird community to changes in habitat that may result from the activity of introduced saltcedar leaf beetles.
2. Bird surveys should use the existing points established in 2008. In order to have an adequate number of detections to produce reliable density estimates of birds using distance sampling methods, more points should be incorporated into the current design.
3. A separately-located, saltcedar-dominated control site should be selected and incorporated into the monitoring effort to better elucidate the effects of saltcedar leaf beetles on the riparian bird communities.
4. Habitat measurements to quantitatively distinguish general habitat types in the riparian areas should be incorporated to help accurately categorize bird species associations on transects.

Acknowledgements

Joe Sirotnak of the National Park Service (Big Bend National Park) provided assistance in the coordination of logistics and permitting for field work. This work, conducted in calendar year 2008, was done under NPS Permit # BIBE-2008-SCI-0028 (permit period: 12 June 2008 to 12 June 2009) for NPS Study # BIBE-00276. Funding for this work was provided by the Bureau of Reclamation's Technical Service Center, Denver, CO.

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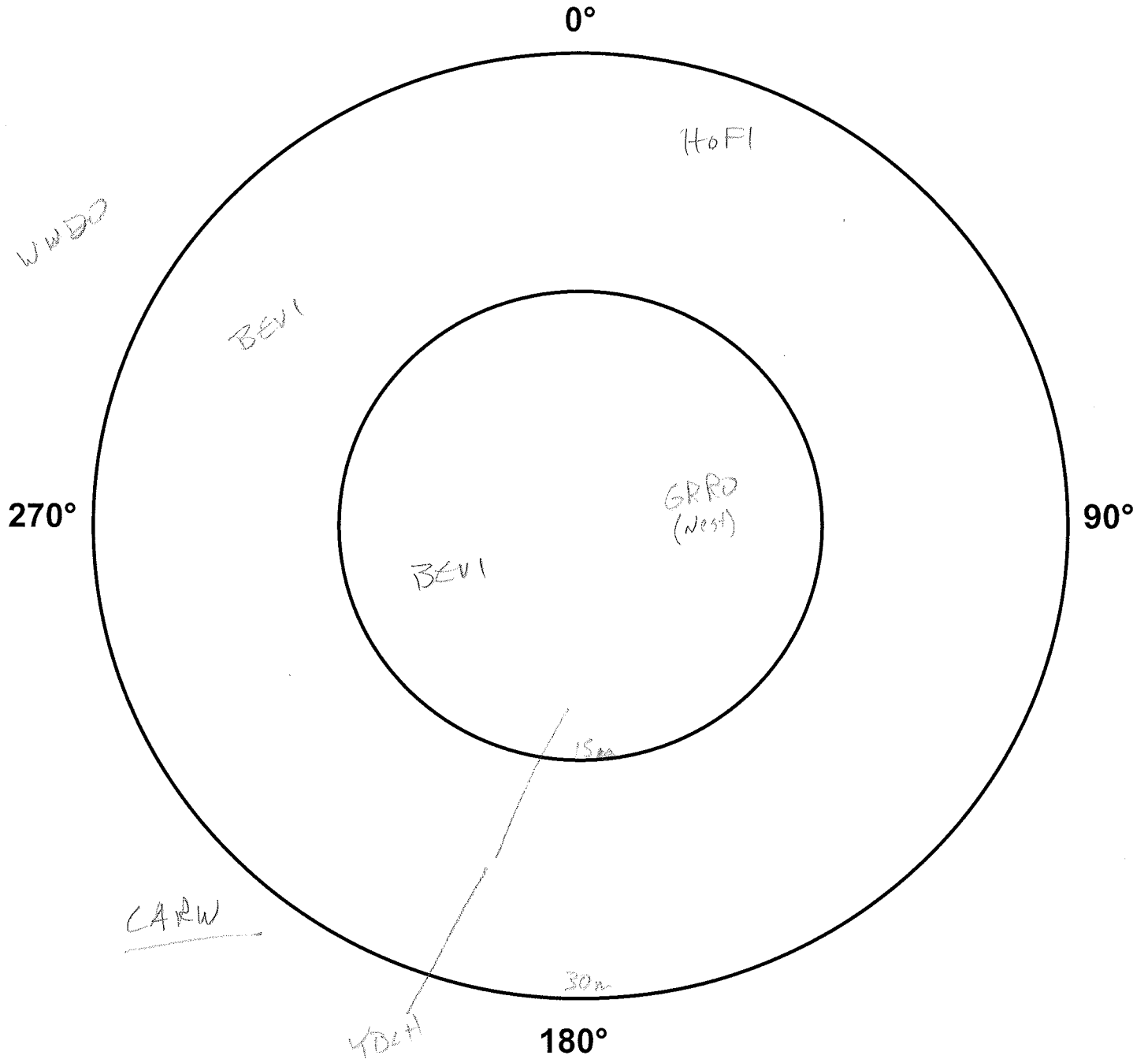
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Appendix

Copies of completed point count data sheets from surveys conducted in June 2008 at Big Bend National Park follow this page. The final page is a blank field data sheet intended to be reproduced for surveys in following years.

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Beelle 1 Point No.: B1 Date: 6-17-08 Time: 9:56
Observer: R. Doster Temperature: 92 Sky: 1 Wind: 1

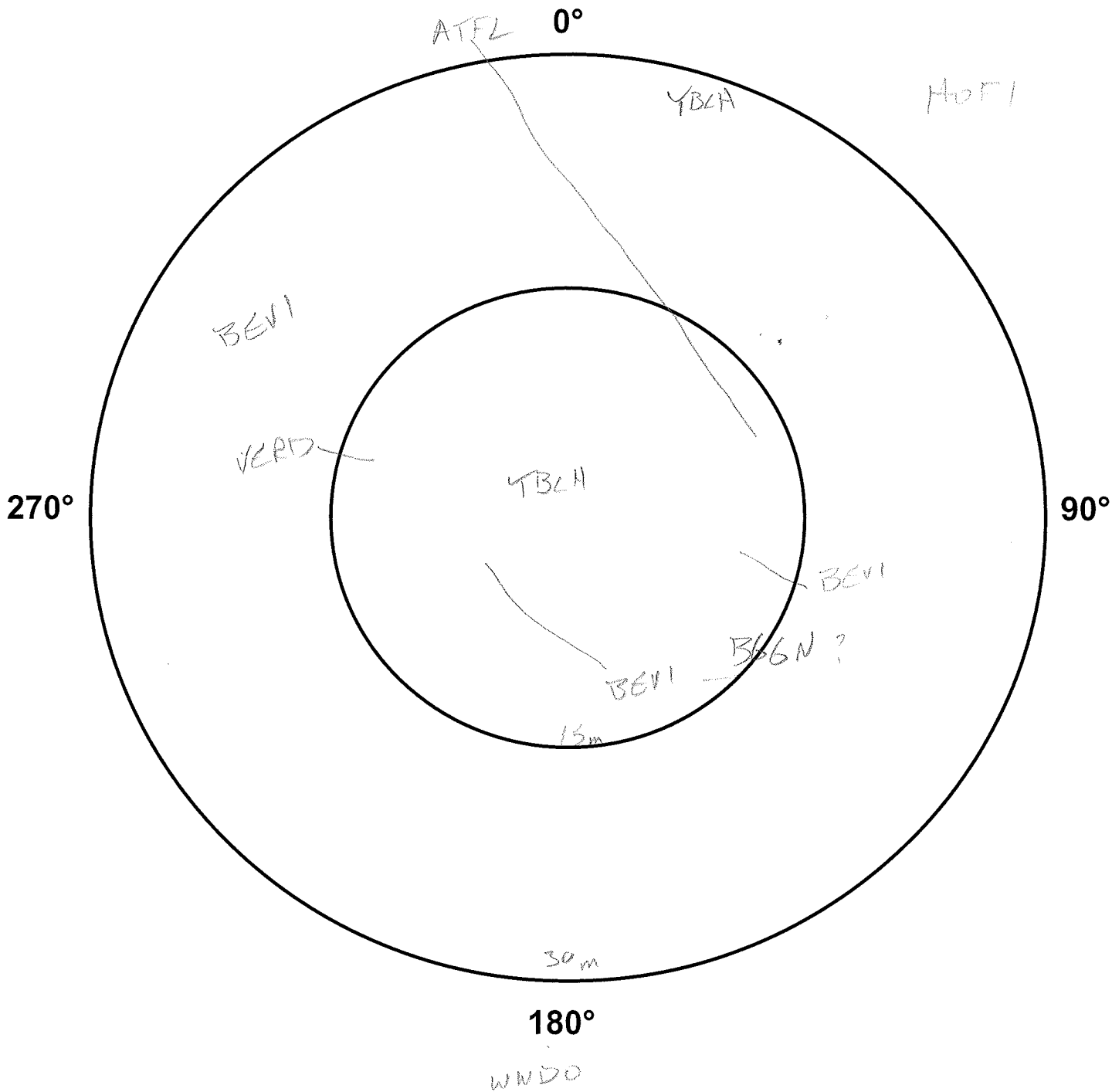


Flyovers:

Notes: 6. Rockrunner nest w/ at least 1 young visible. Nest in shadow.

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

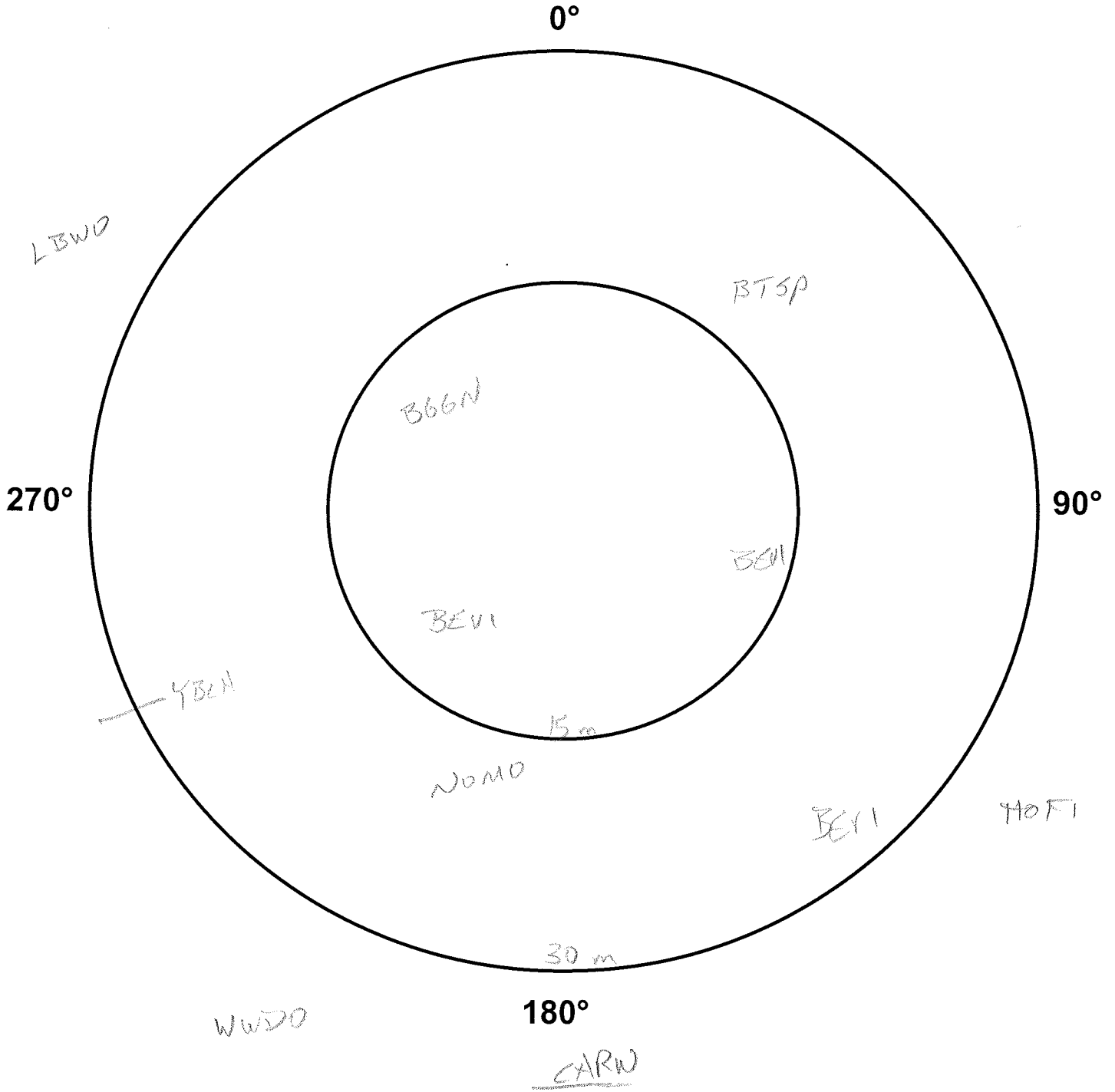
Site: Beetle Point No.: B11 Date: 6-17-08 Time: 10:11
 Observer: R. Doster Temperature: 93 Sky: 0 Wind: 1



Flyovers: WVDO
 Notes: Carolina Wren started singing as point finished.

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

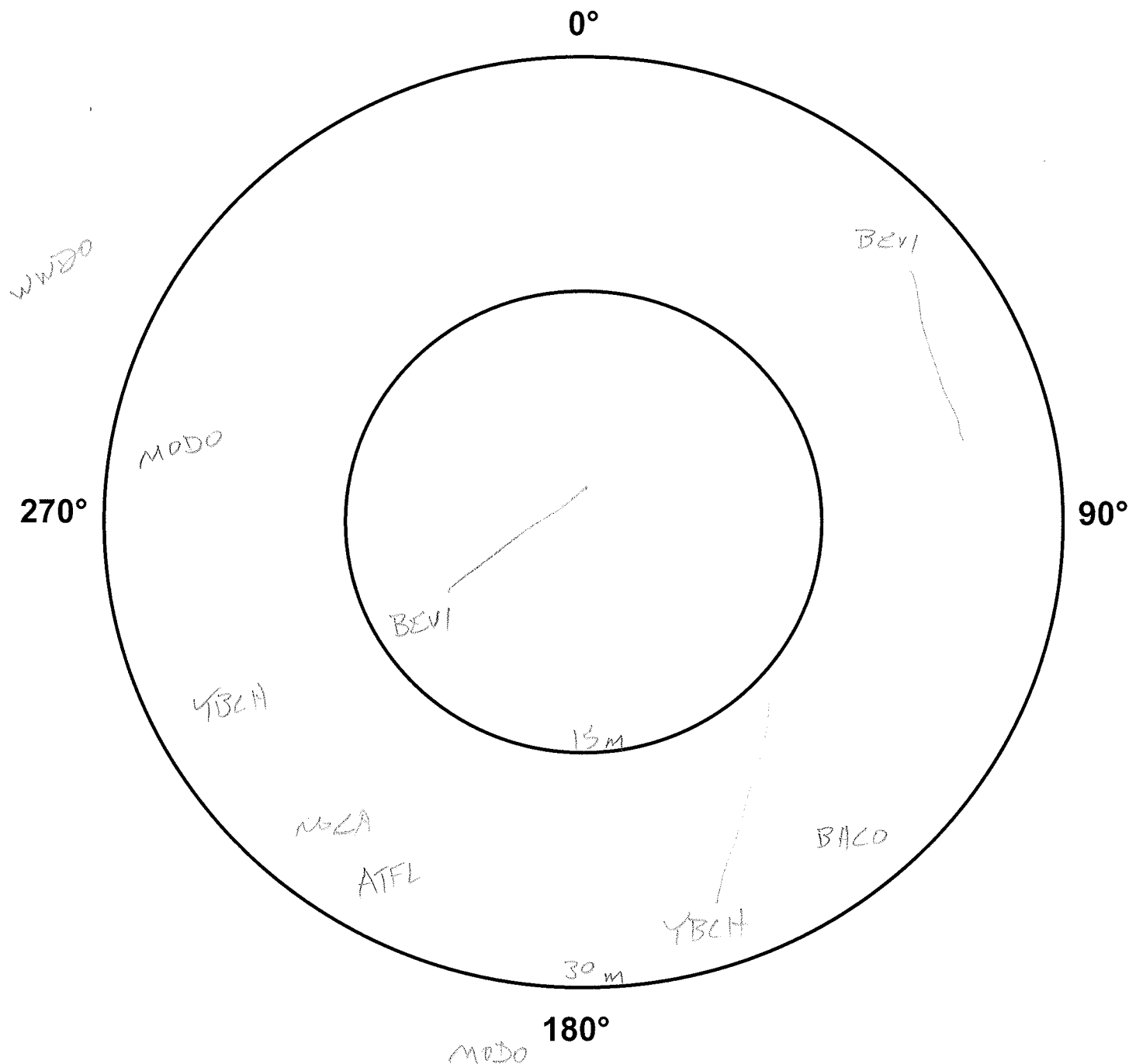
Site: Beattle 1 Point No.: B12 Date: 6-17-04 Time: 10:31
Observer: R. Doster Temperature: 96 Sky: 0 Wind: 1



Flyovers: _____
Notes: _____

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

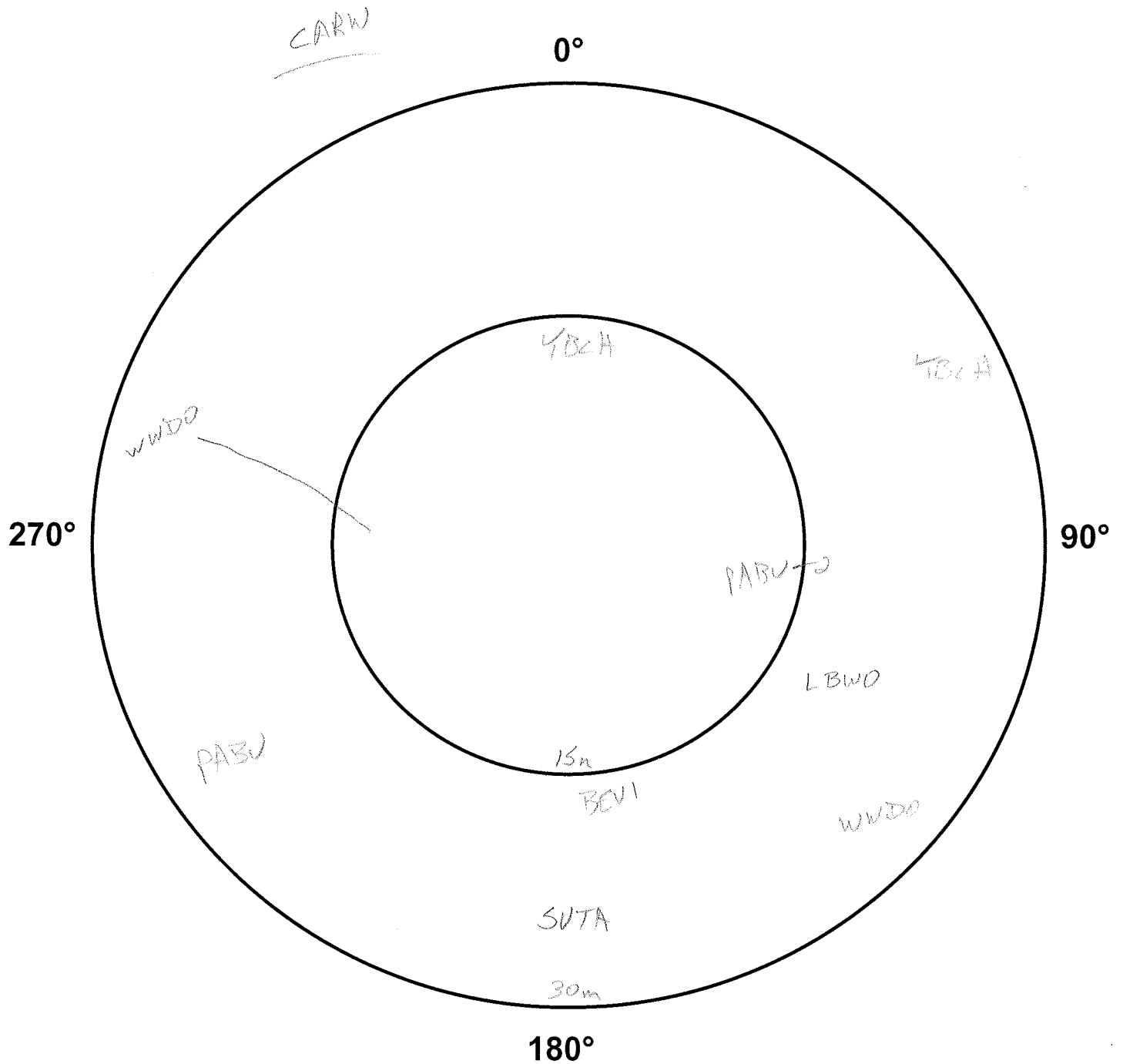
Site: Baile 1 Point No.: B13 Date: 6-18-08 Time: 7:22
Observer: R. Doster Temperature: 81 Sky: 1 Wind: 0



Flyovers: BHCO
Notes: Habitat all mesquite. No salt cedar.

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Beelle 2 Point No.: B2 Date: 6-18-08 Time: 9:26
 Observer: R. Doster Temperature: 86 Sky: 1 Wind: 0



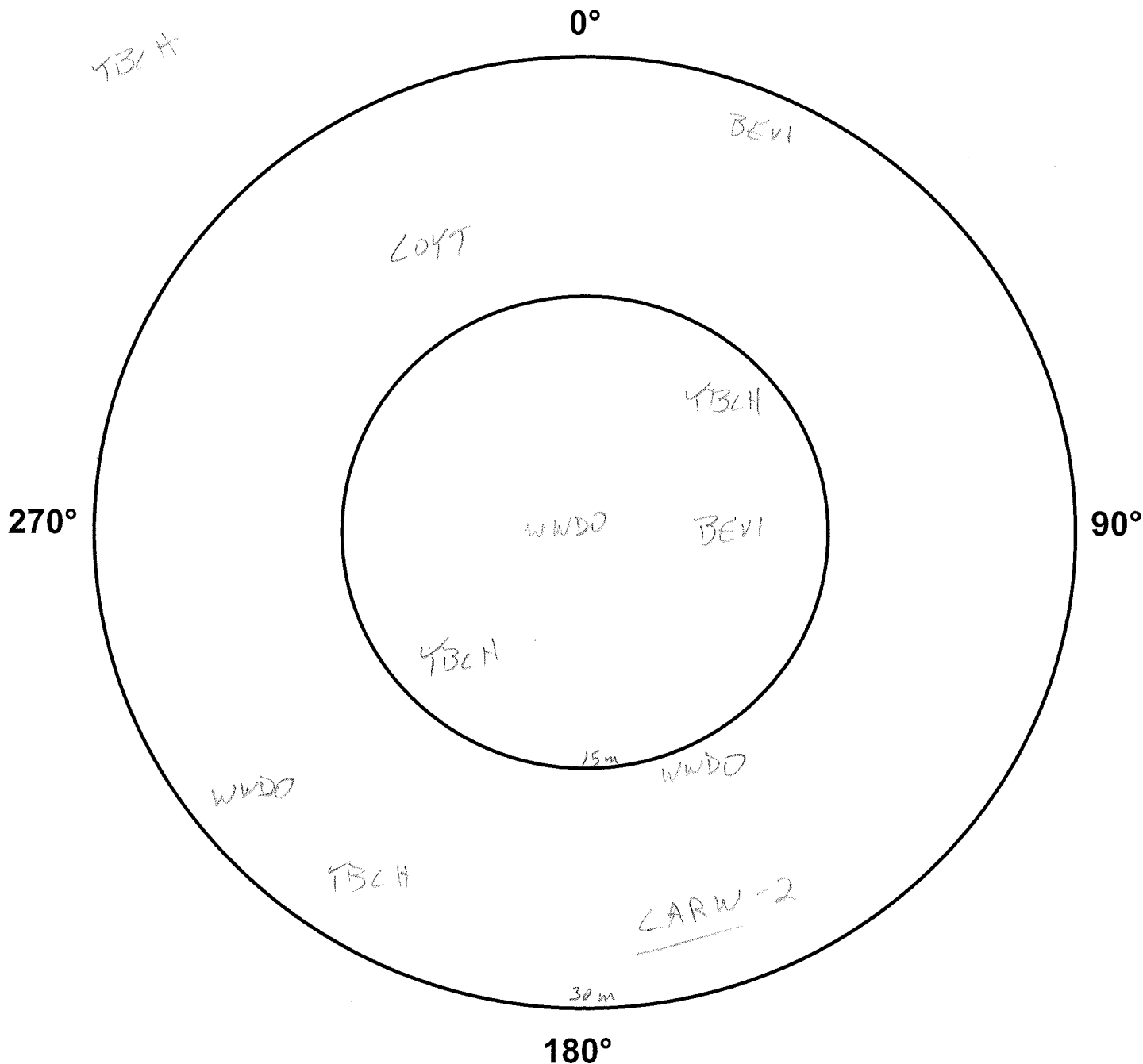
Flyovers: _____

Notes: _____

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Belle 2 Point No.: B21 Date: 6-18-08 Time: 9:47
 Observer: R. Doster Temperature: 87 Sky: 0 Wind: 0



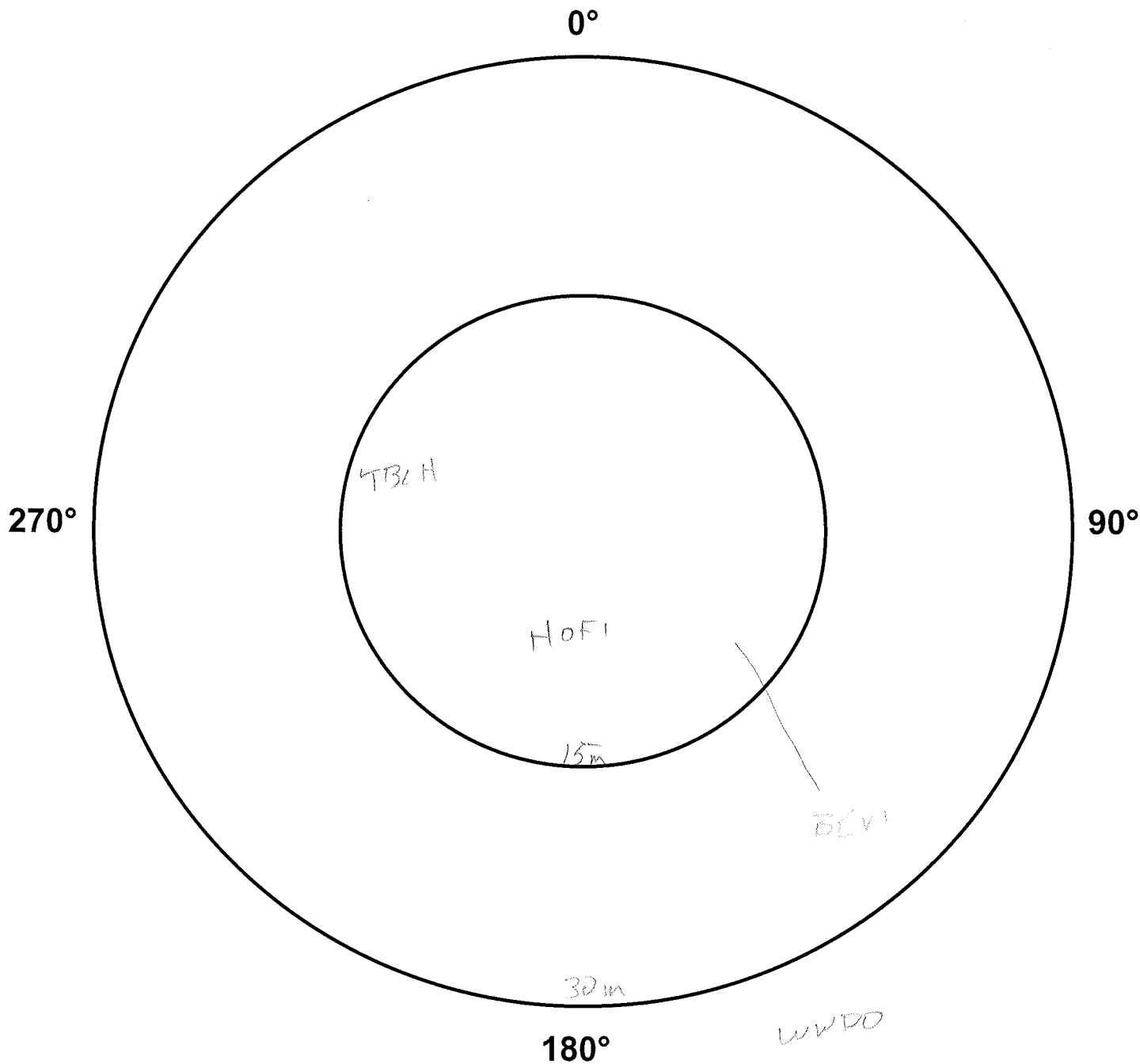
Flyovers:

Notes: Large Javelina "Den" near point. Smelled very musky.

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Boyle 2 Point No.: B22 Date: 6-16-08 Time: 10:00
 Observer: R. Doster Temperature: 89 Sky: 0 Wind: 0

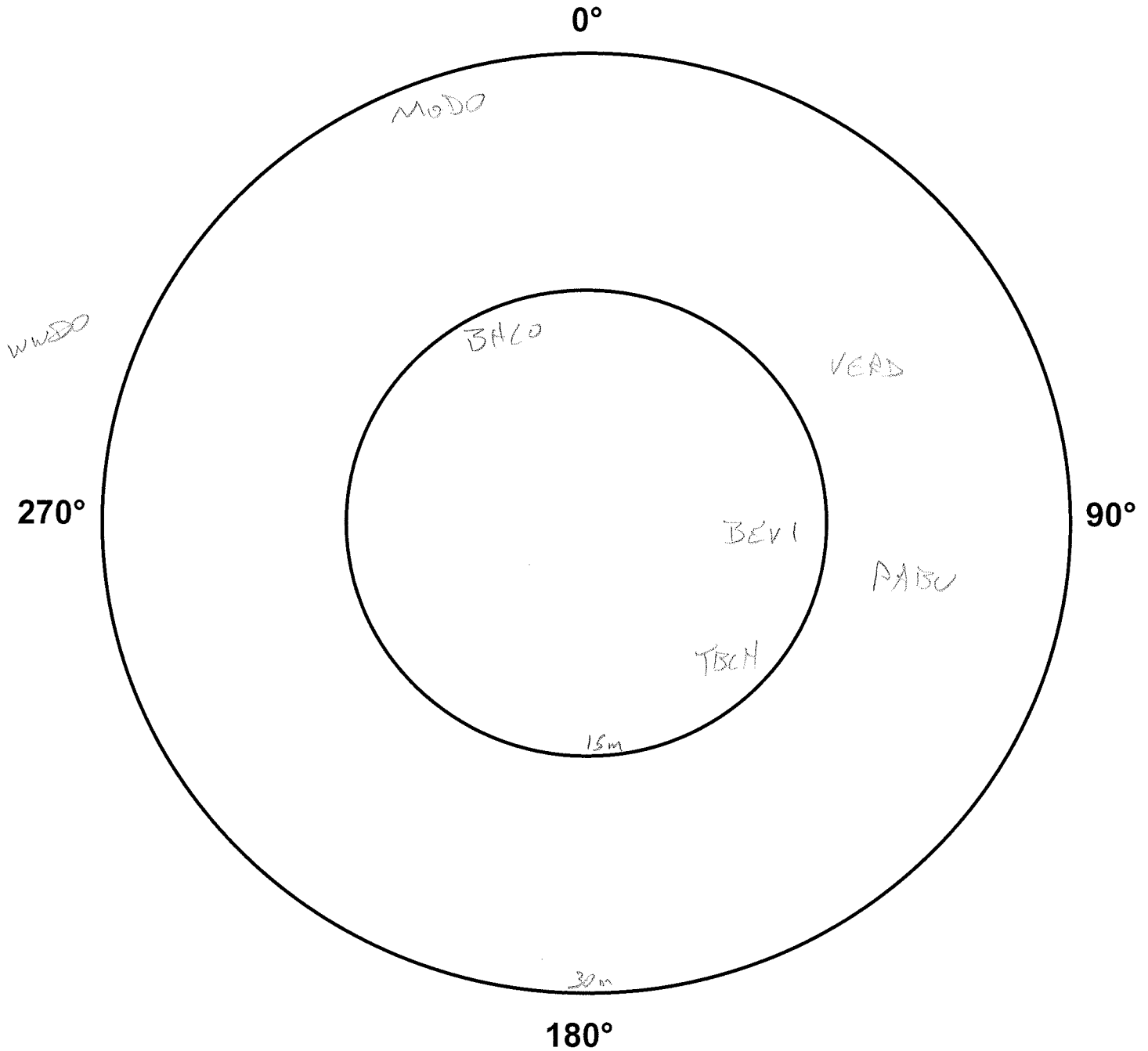


Flyovers: BHCO
 Notes: Saltcedar / Mesquite mix. Baccharis present in good quantity.
Recently-burned strip of saltcedar by road,

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Bottle 2 Point No.: B23 Date: 6-16-08 Time: 10:27
Observer: R. Doster Temperature: 91 Sky: 0 Wind: 0

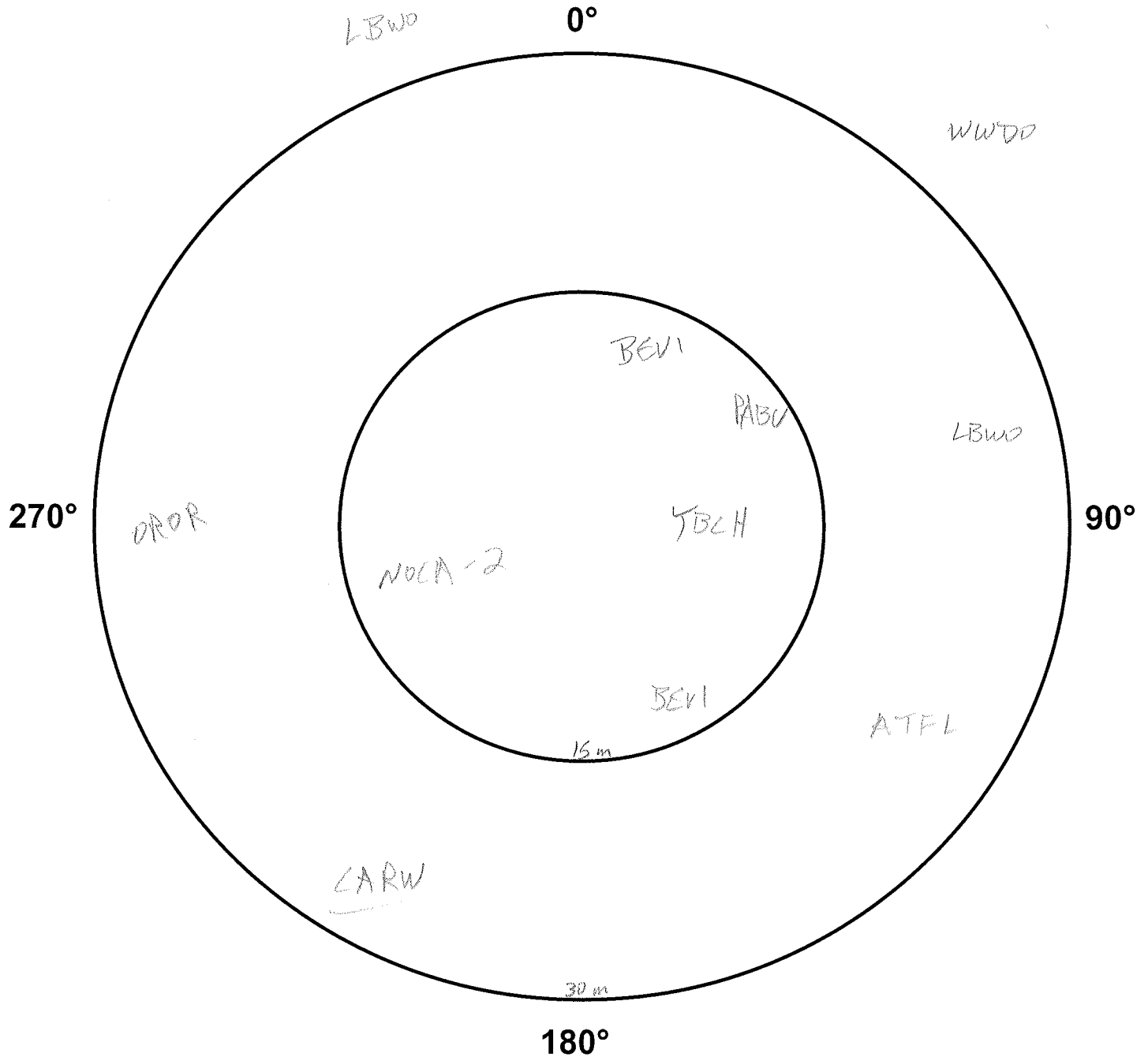


Flyovers: TUVU-2
Notes: Edge of burned salt cedar
Juv. Hawk - Gray Hawk? - flushed when entering habitat.

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

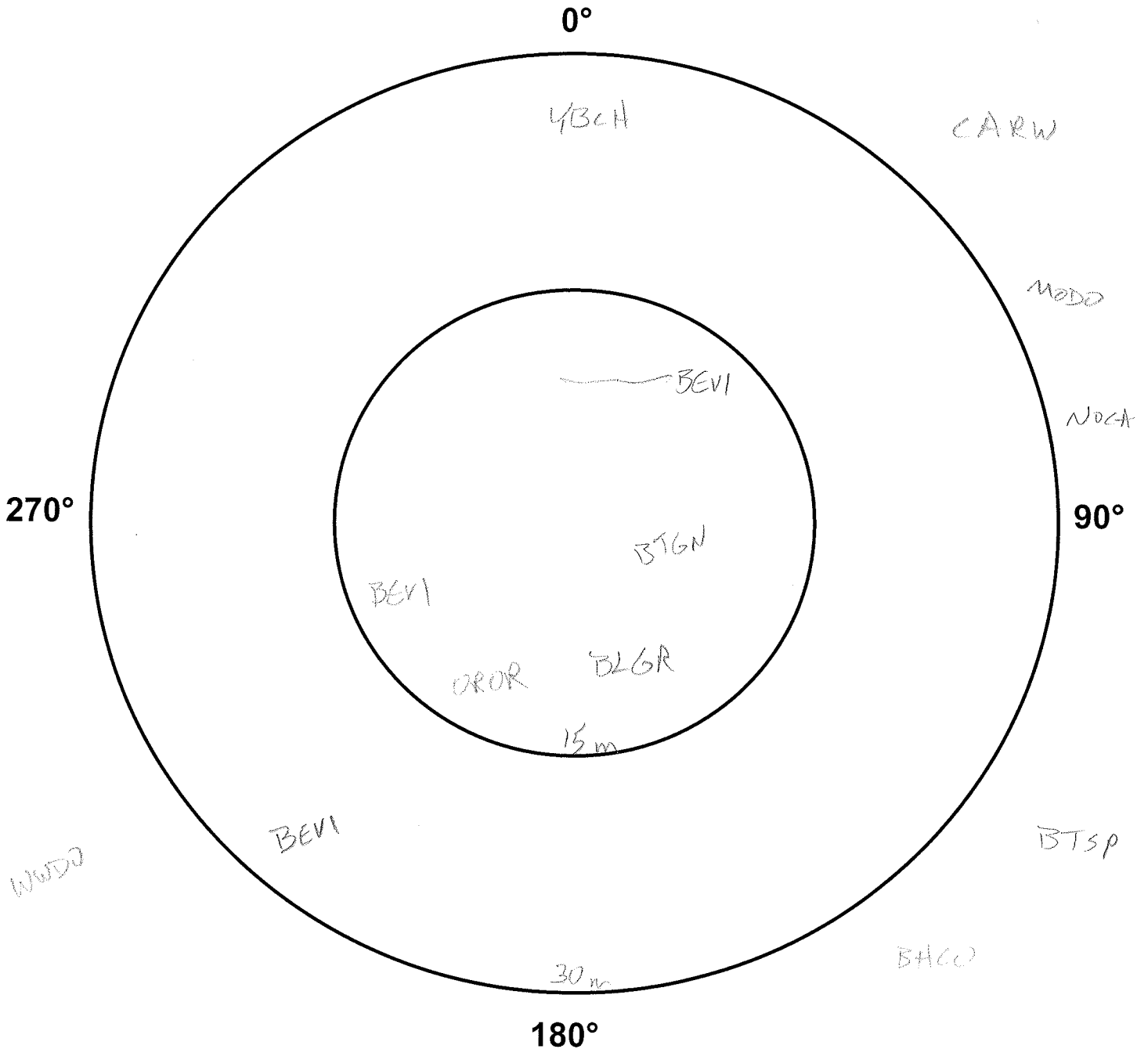
Site: Beetle 3 Point No.: B3 Date: 6-19-08 Time: 9:09
Observer: R. Doster Temperature: 86 Sky: 0 Wind: 0



Flyovers: CORA-2
Notes: Noise from helicopter present for part of count (Border Patrol?).
White-throated Swifts fly over before count.

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Beetle 3 Point No.: B31 Date: 6-19-08 Time: 9:27
Observer: R. Doster Temperature: 90 Sky: 0 Wind: 1

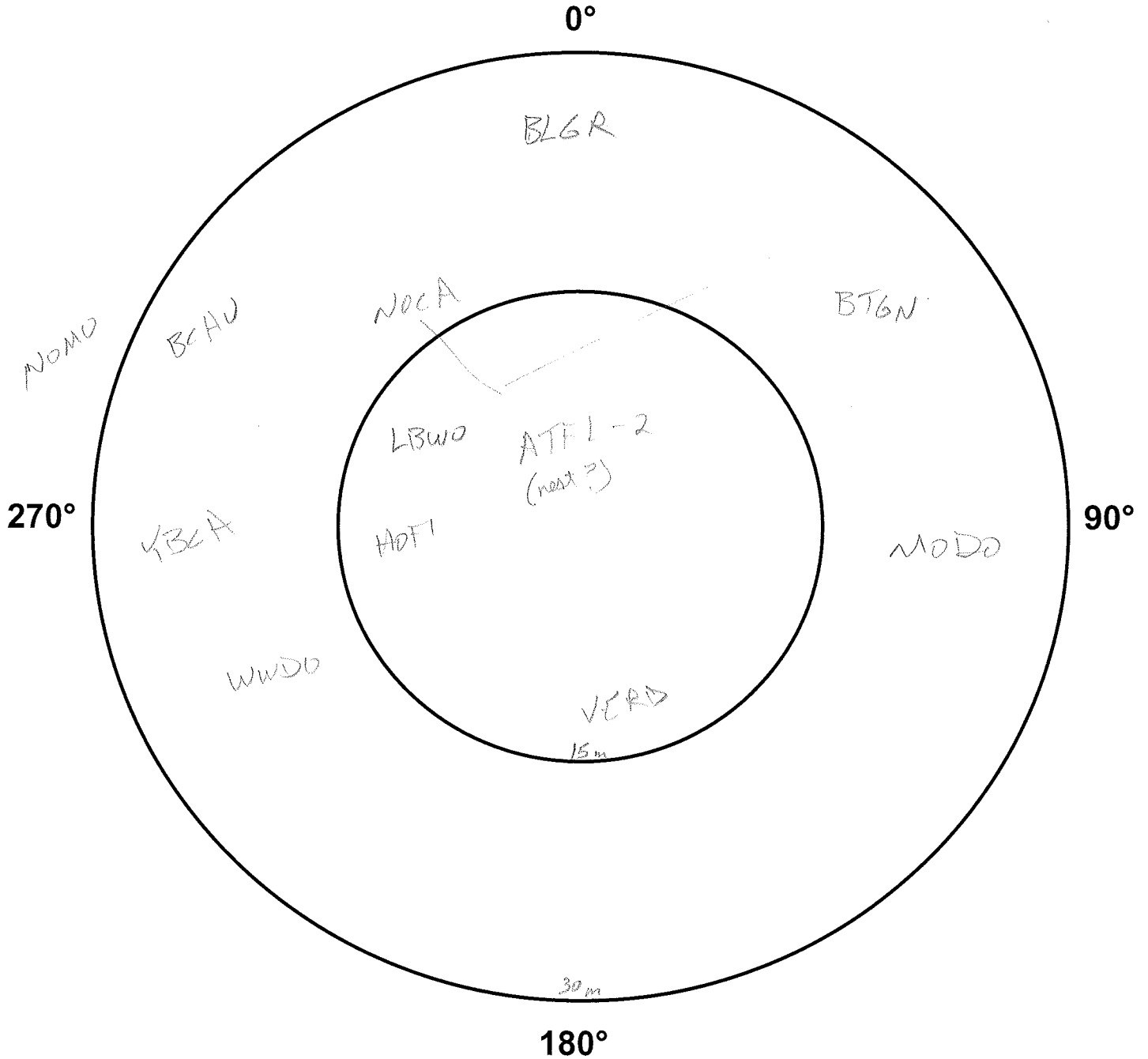


Flyovers: CORA

Notes:

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Beetle 3 Point No.: B32 Date: 6-19-08 Time: 8:44
Observer: R. Doster Temperature: 89 Sky: 1 Wind: 1

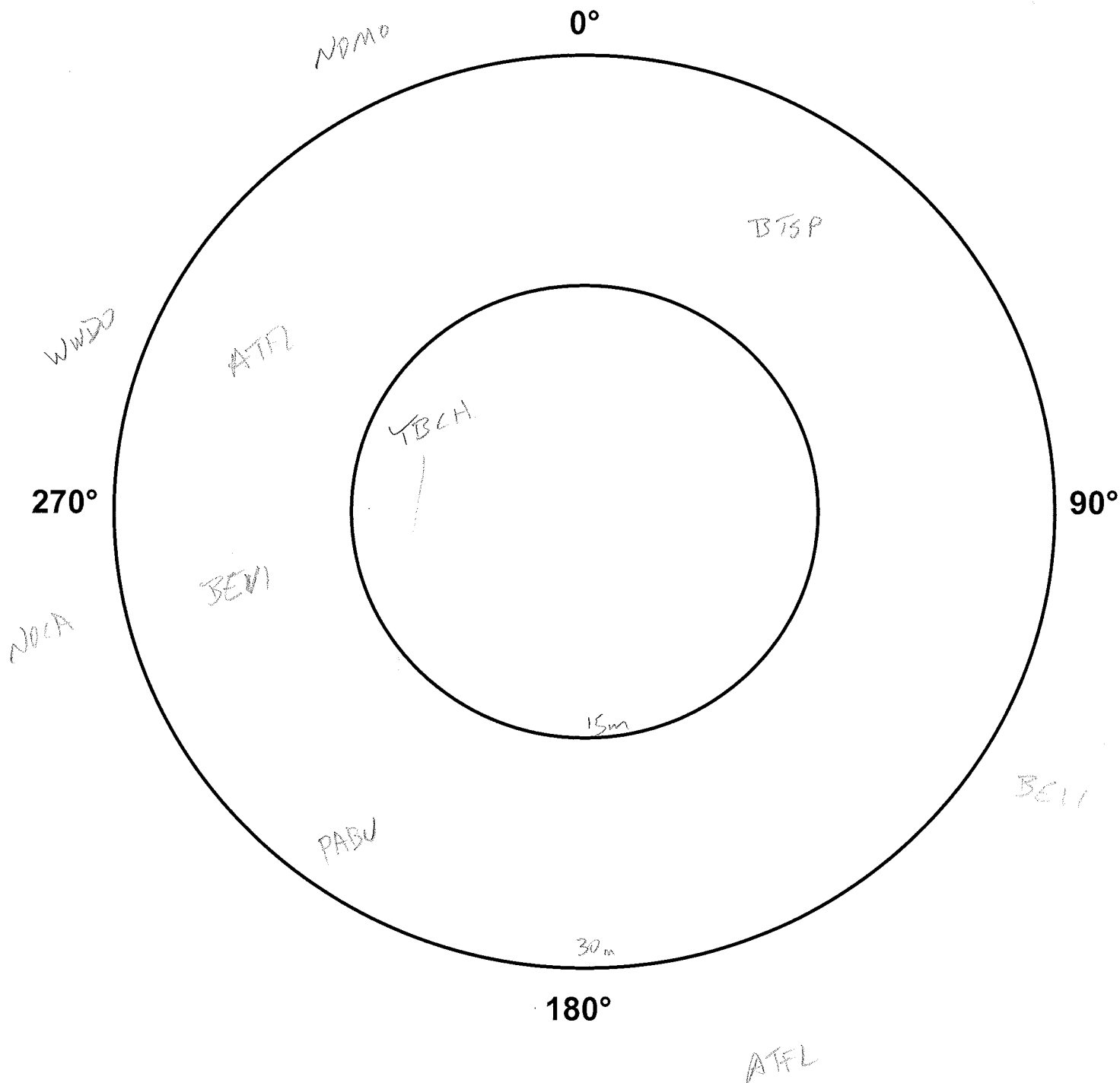


Flyovers:

Notes: New edge of burn. Mostly saltcedar.

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Beetle 3 Point No.: B33 Date: 6-19-08 Time: 8:13
Observer: R. Doster Temperature: 87 Sky: 1 Wind: 0



Flyovers:

Notes: Near edge of burn.

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Mesquite 1

Point No.: M1

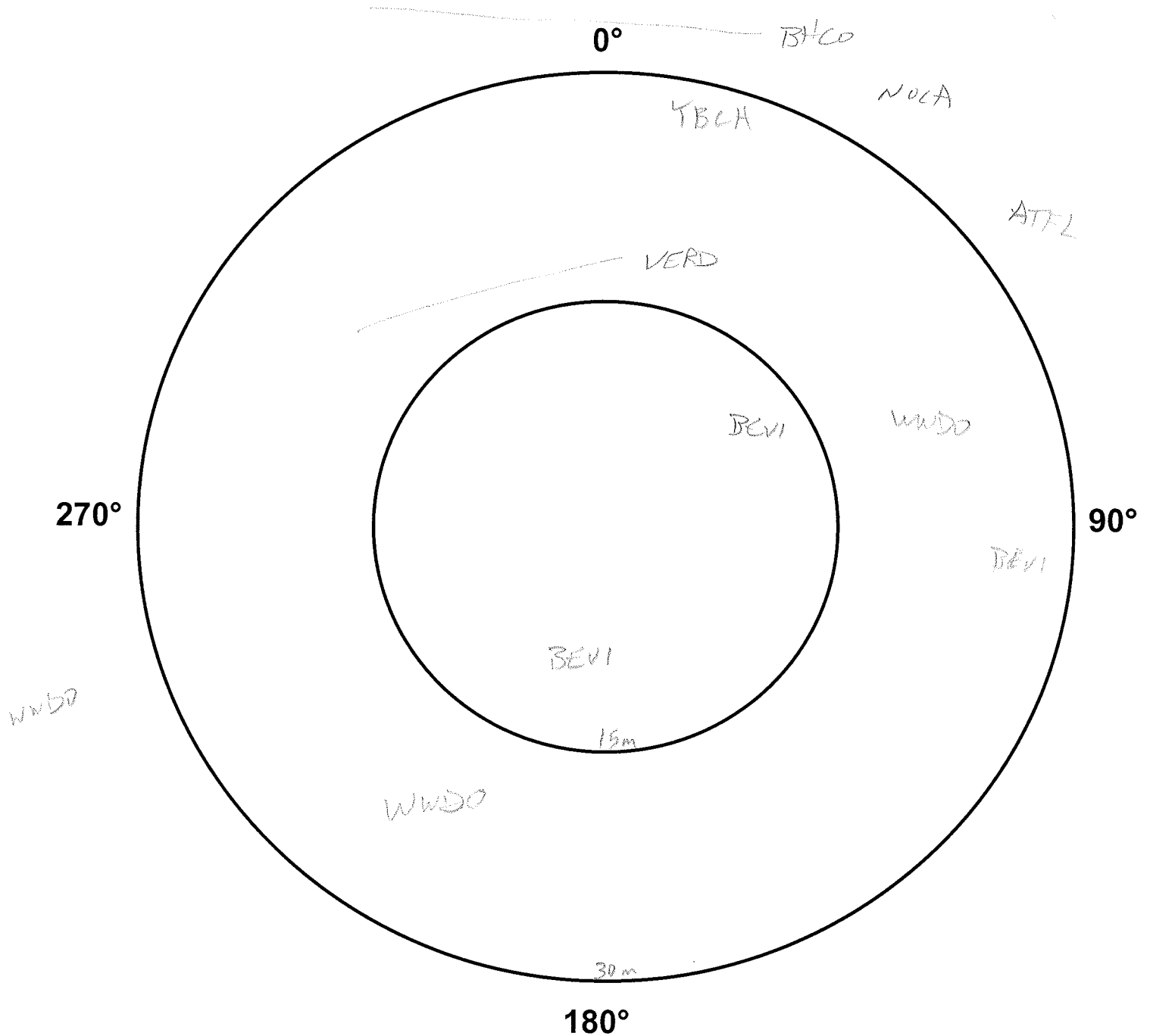
Date: 17 Jun 2008 Time: 7:57

Observer: R. Doster

Temperature: 84

Sky: 1

Wind: 0



Flyovers:

Notes:

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Mesquite 1

Point No.: M11

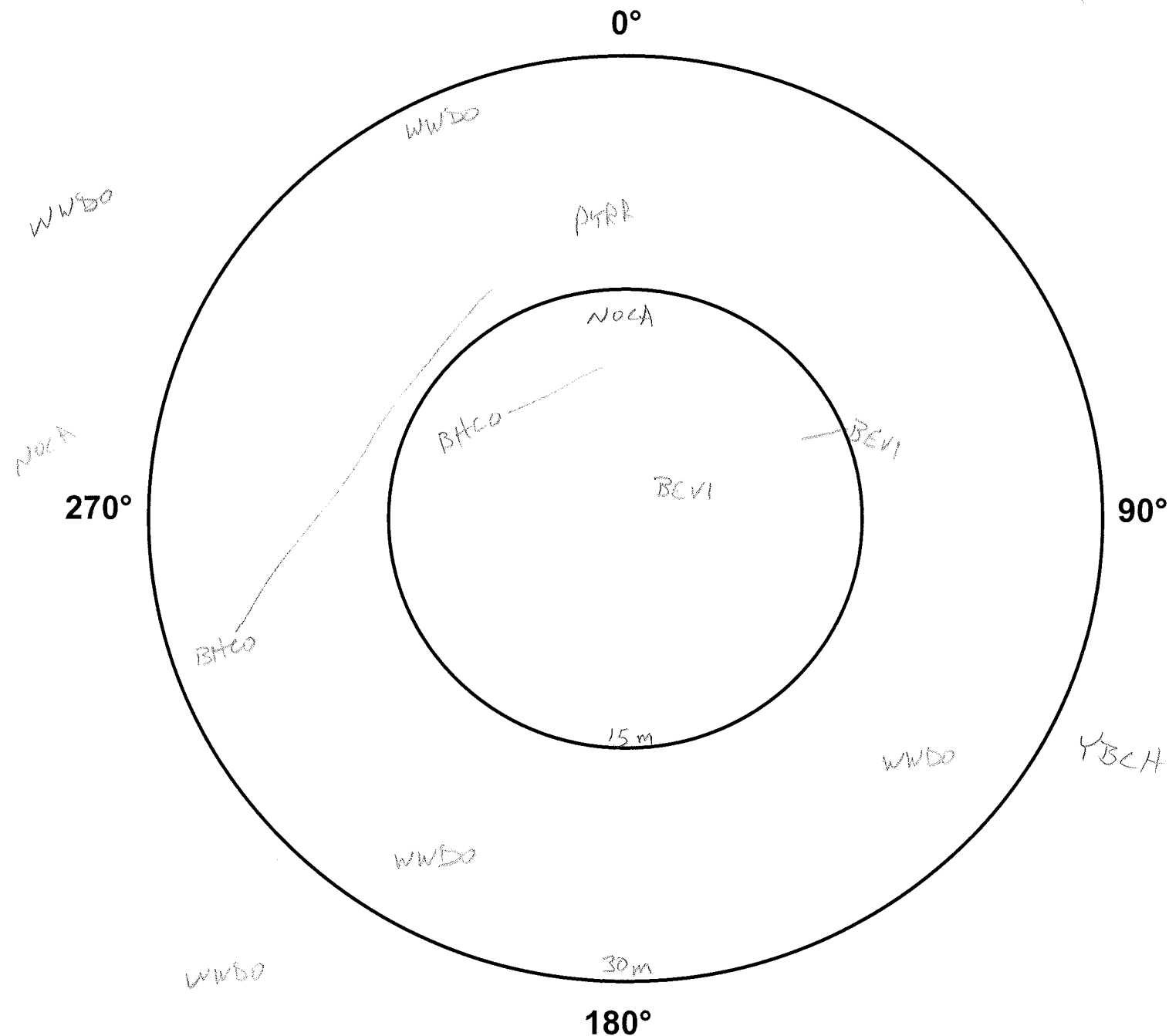
Date: 17 June 2004 Time: 7:39

Observer: R. Doster

Temperature: 82

Sky: 1

Wind: 0



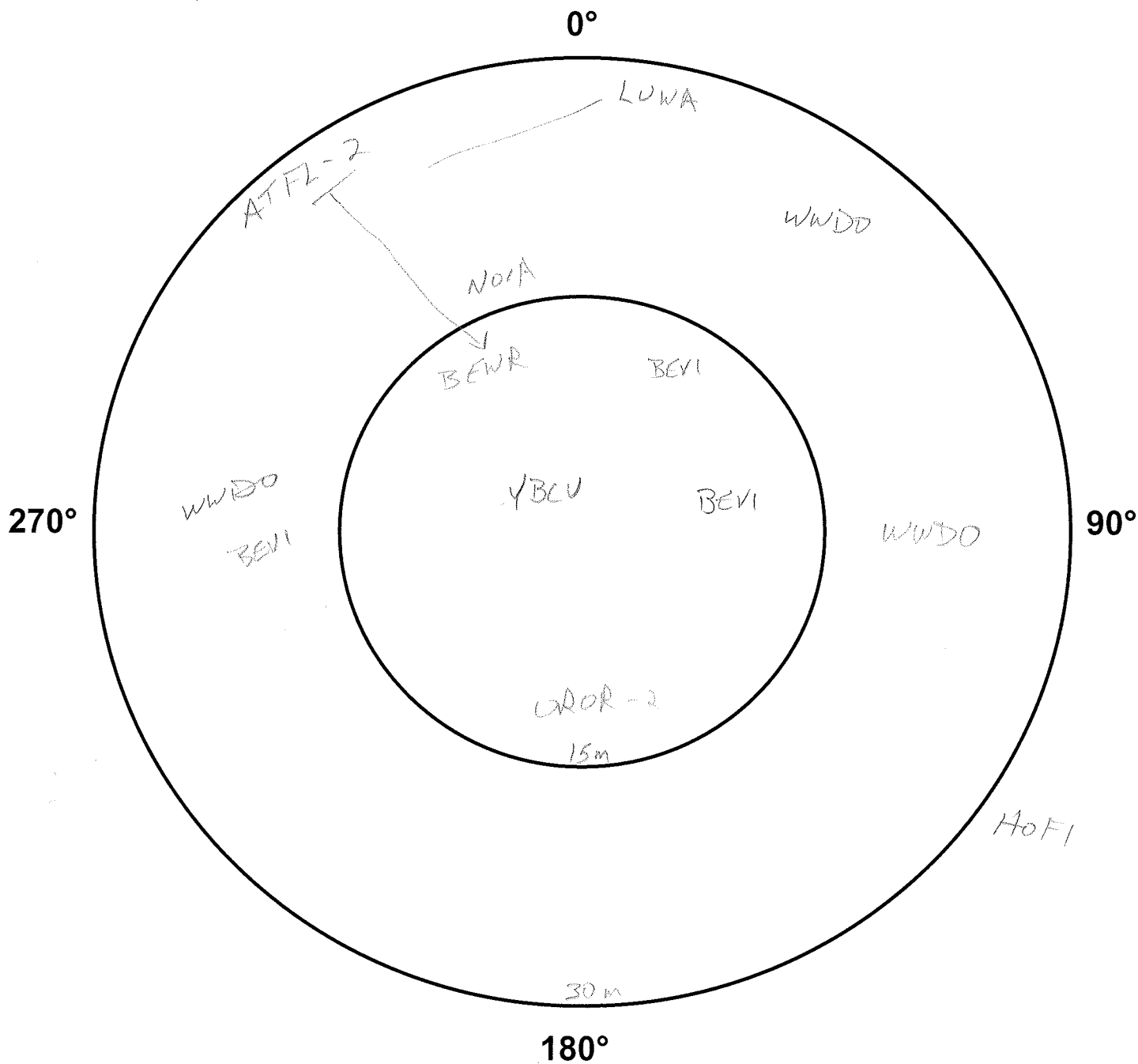
Flyovers:

Notes:

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Mesquite 1 Point No.: M12 Date: 6-17-08 Time: 8:12
 Observer: R. Doster Temperature: 65 Sky: 1 Wind: 0



Flyovers:

Notes:

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Mesquite 1

Point No.: M13

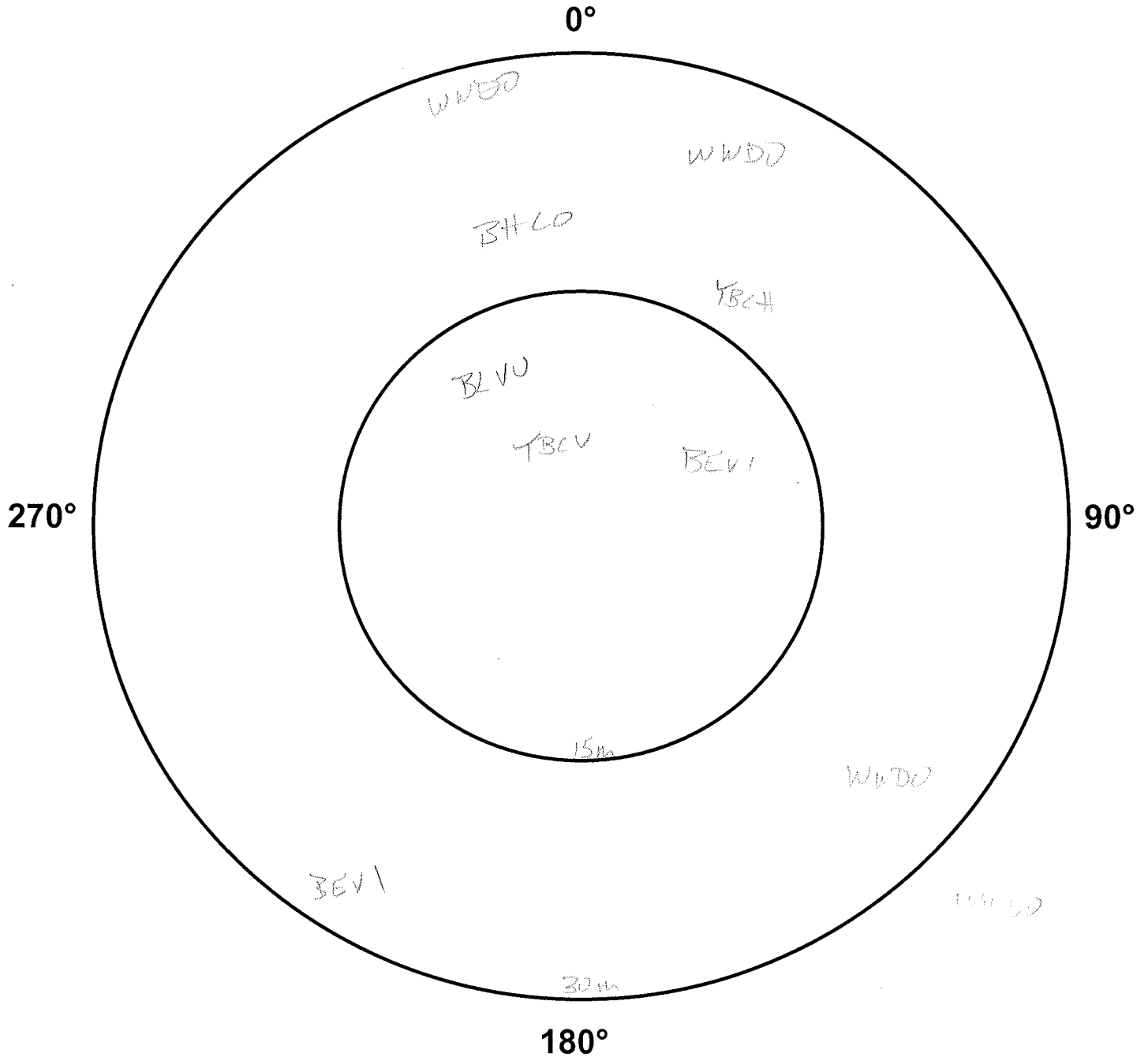
Date: 17 June 2008 Time: 8:30

Observer: R. Doster

Temperature: 86

Sky: 1

Wind: 0



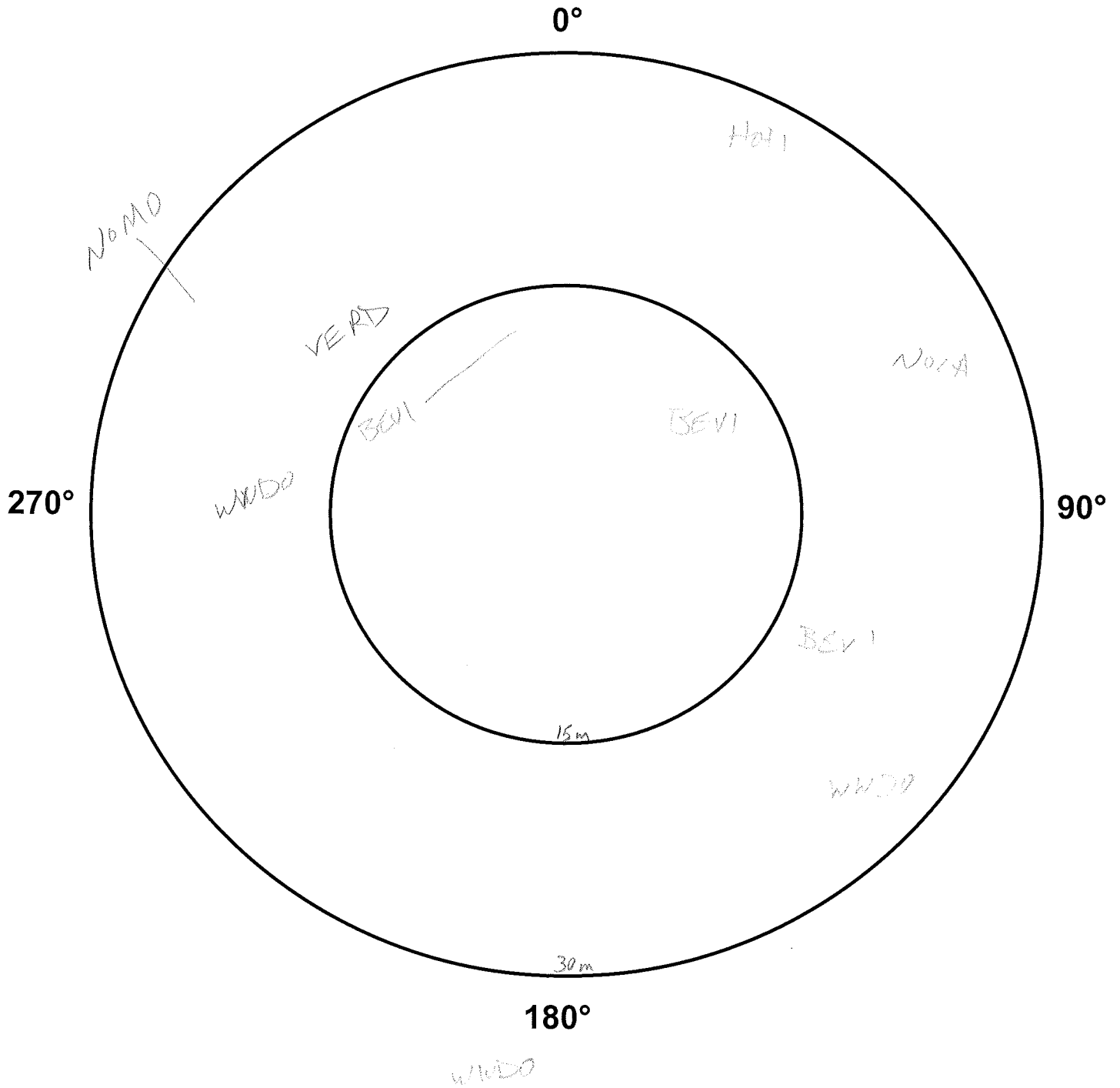
Flyovers: _____

Notes: _____

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Mesquite 1 Point No.: M14 Date: 6-17-08 Time: 8:53
Observer: R. Doster Temperature: 87 Sky: 1 Wind: 0

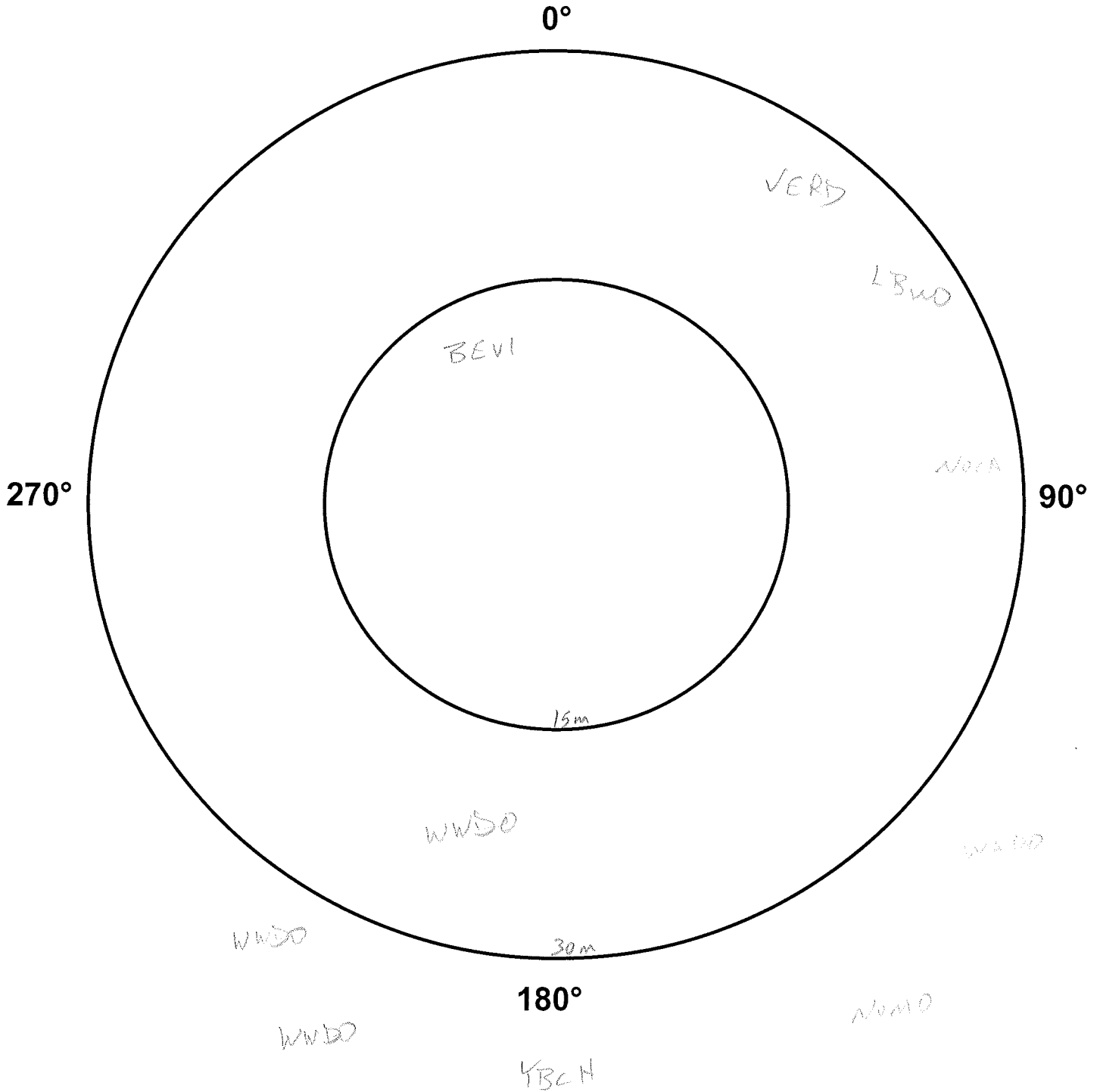


Flyovers: _____
Notes: _____

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Mesquite 1 Point No.: M15 Date: 6-17-04 Time: 9:11
Observer: R. Doster Temperature: 89 Sky: 1 Wind: 0

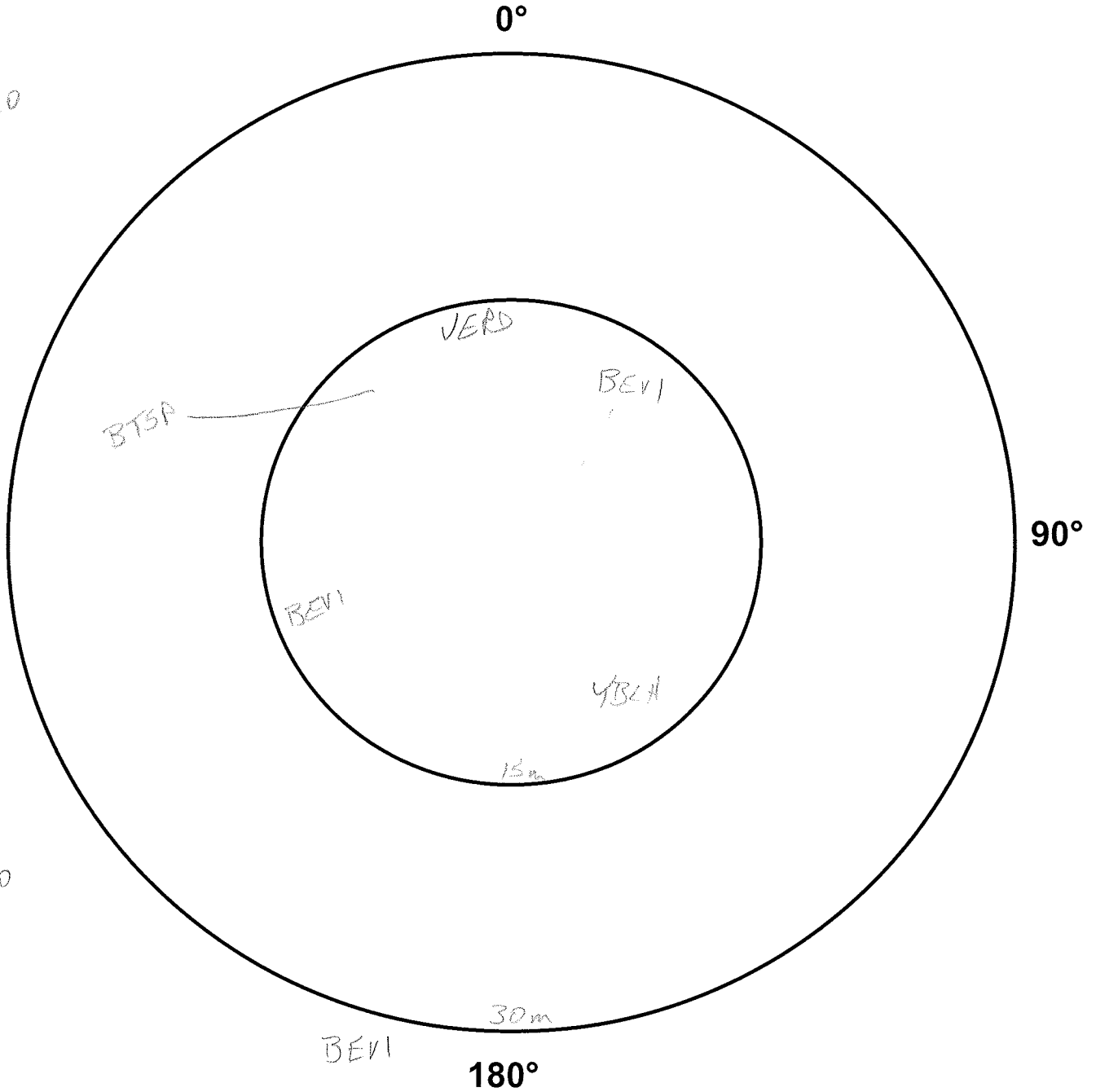


Flyovers: _____
Notes: _____

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Mesquite 2 Point No.: M2 Date: 6-18-08 Time: 8:20
Observer: R. Doster Temperature: 85 Sky: 2 Wind: 1



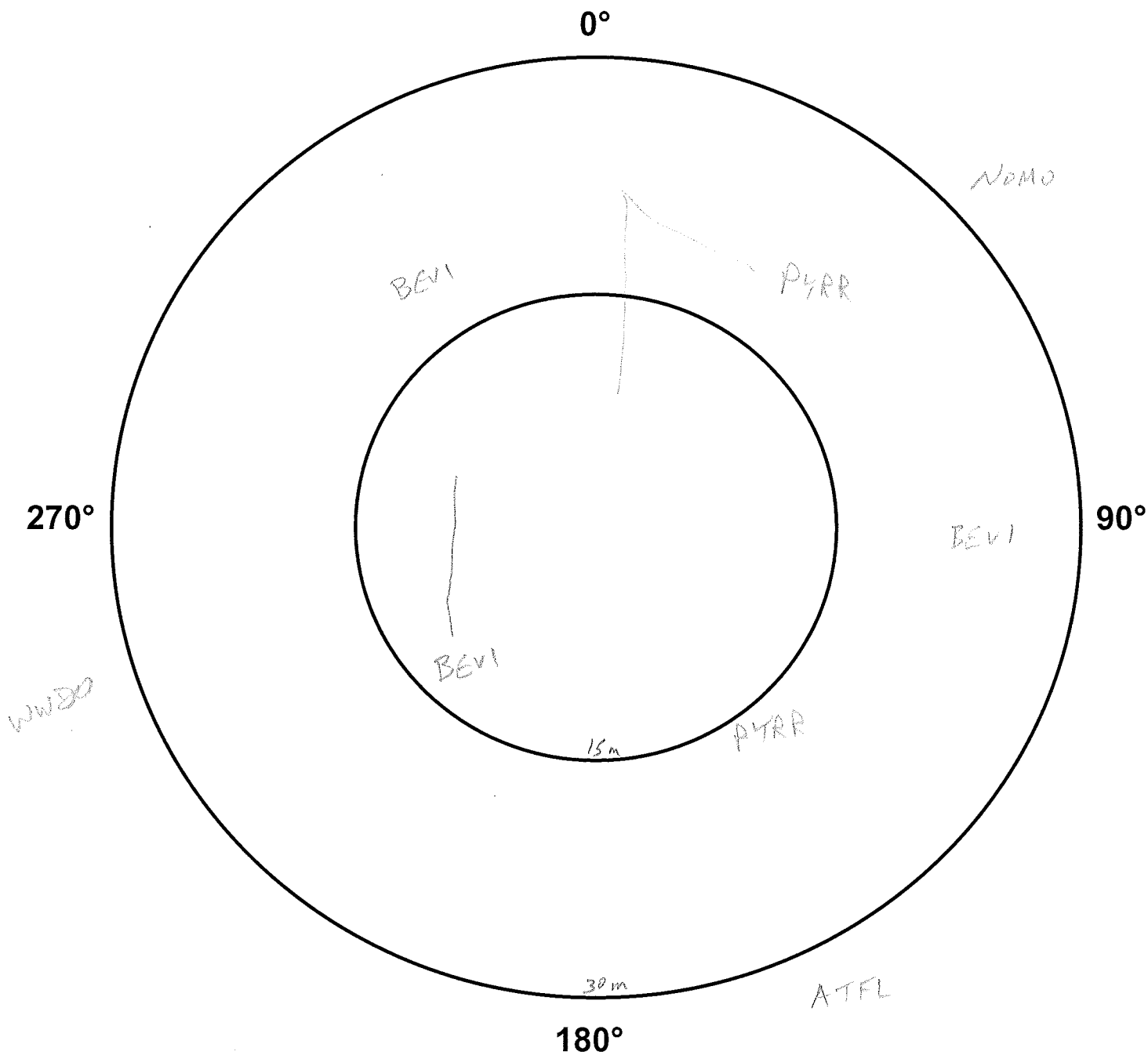
Flyovers: _____

Notes: _____

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Mesquite 2 Point No.: 1121 Date: 6-18-09 Time: 8:38
Observer: R. Doster Temperature: 84 Sky: 2 Wind: 1

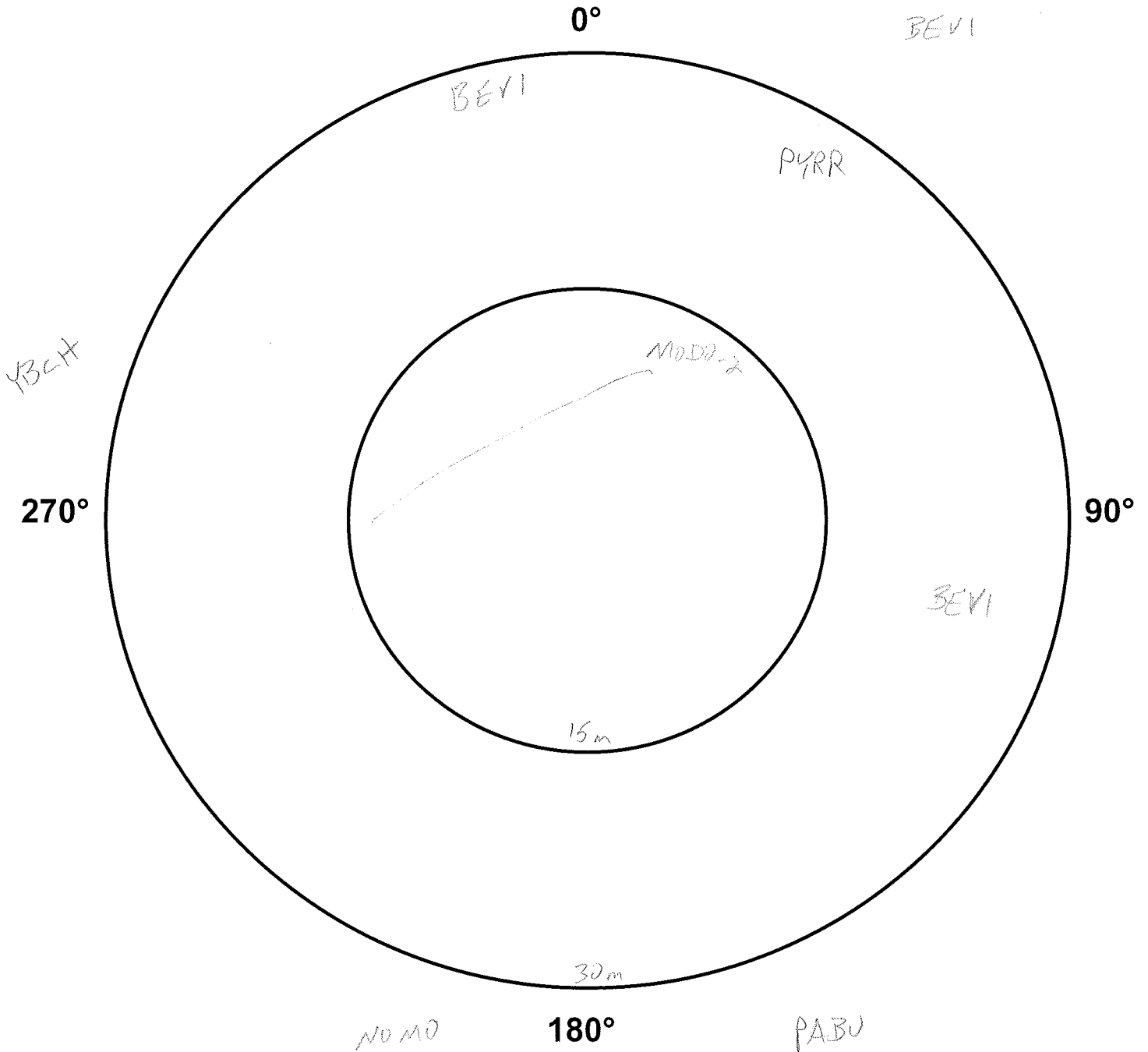


Flyovers: BHCO
Notes:

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Mesquite 2 Point No.: M22 Date: 6-16-08 Time: 8:56
Observer: R. Doster Temperature: 85 Sky: 2 Wind: 1



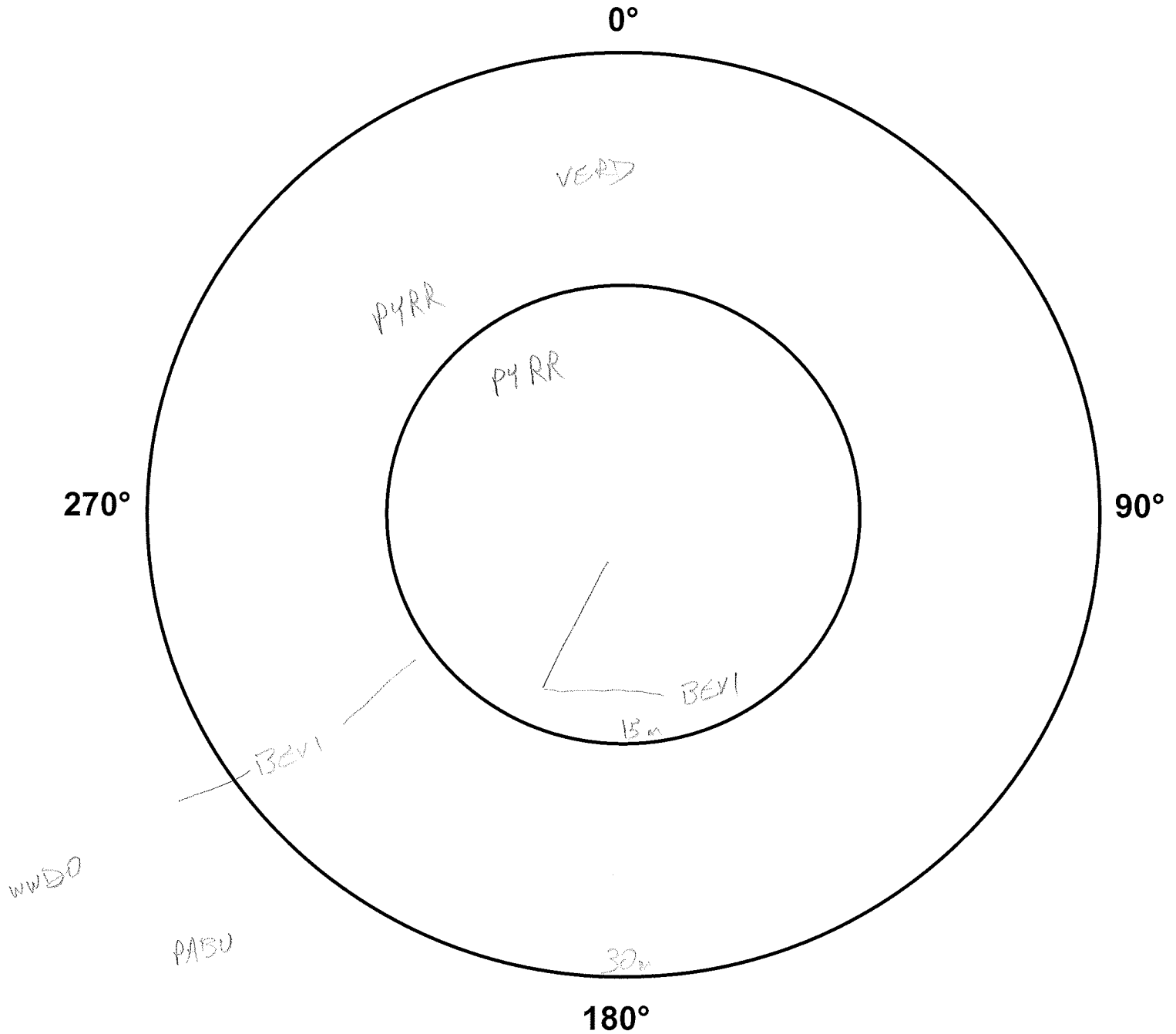
Flyovers:

Notes:

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Mesquite 2 Point No.: M23 Date: 6-18-08 Time: 8:01
Observer: R. Doster Temperature: 84 Sky: 1 Wind: 1



Flyovers: _____
Notes: _____

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Mesquite 2

Point No.: M24

Date: 6-18-06

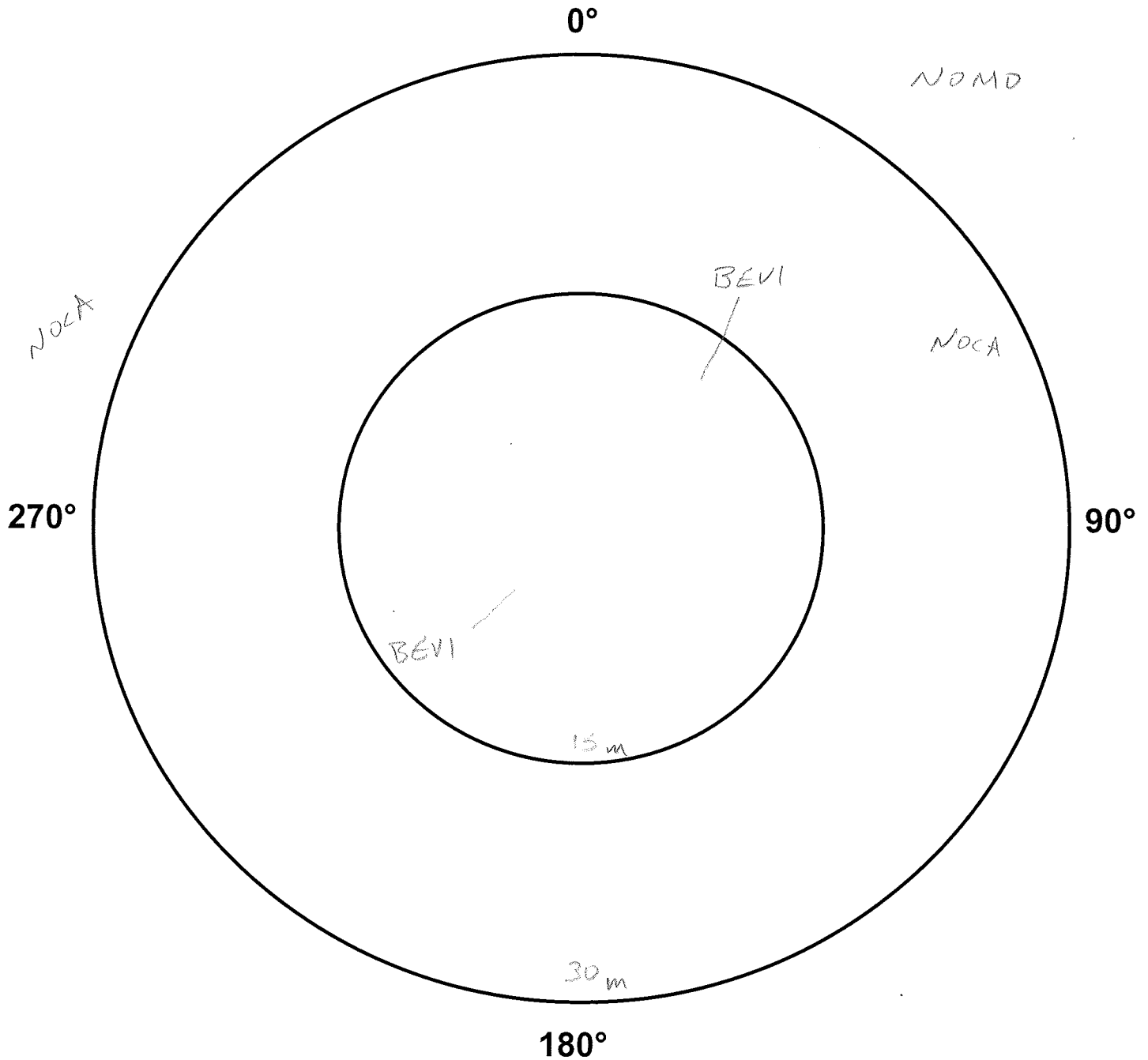
Time: 7:47

Observer: R. Doster

Temperature: 84

Sky: 1

Wind: 1



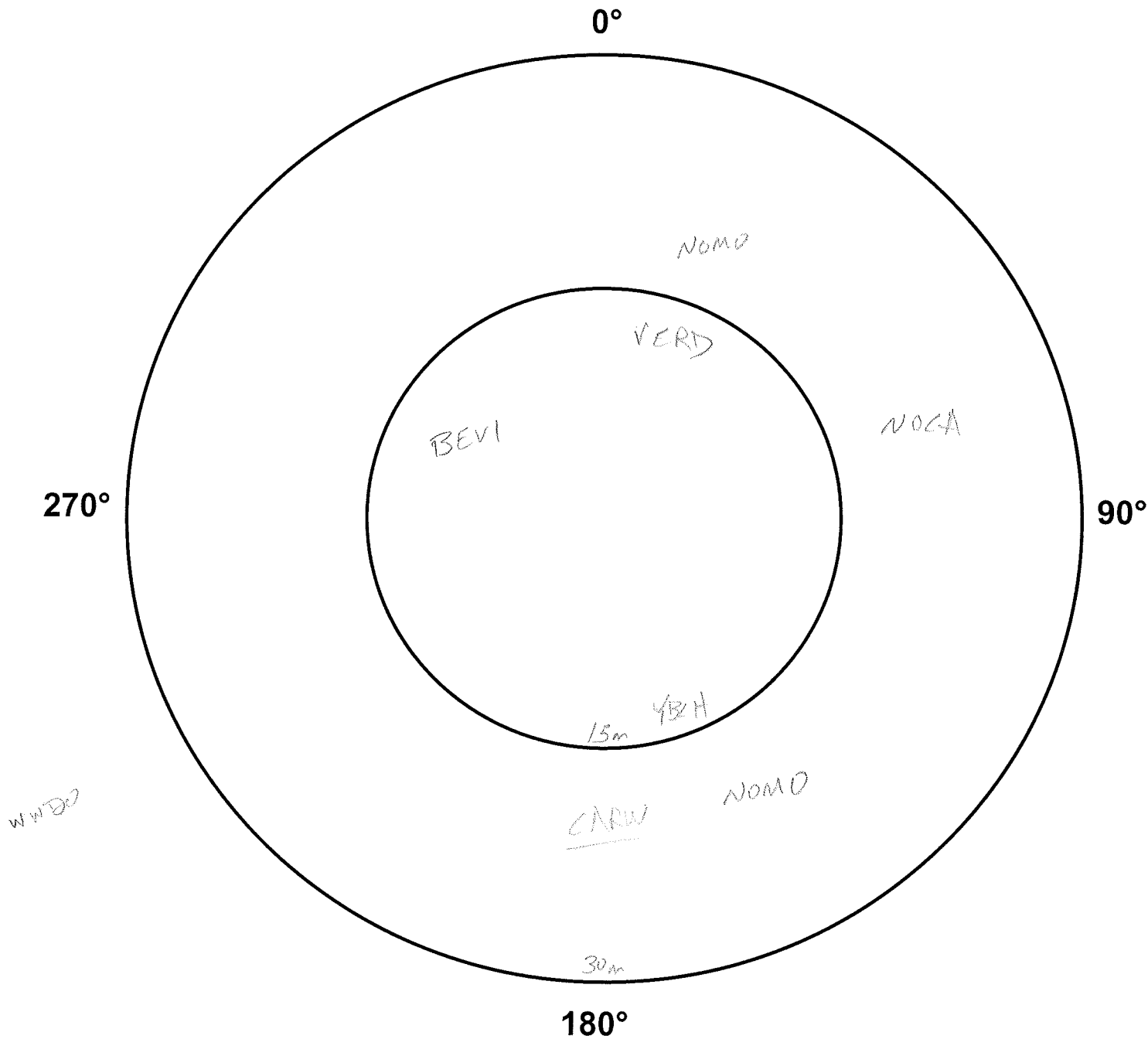
Flyovers: MODD

Notes: Edge of habitat recently burned.

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Mesquite 3 Point No.: M3 Date: 6-19-08 Time: 7:18
Observer: R. Foster Temperature: 83 Sky: 1 Wind: 0



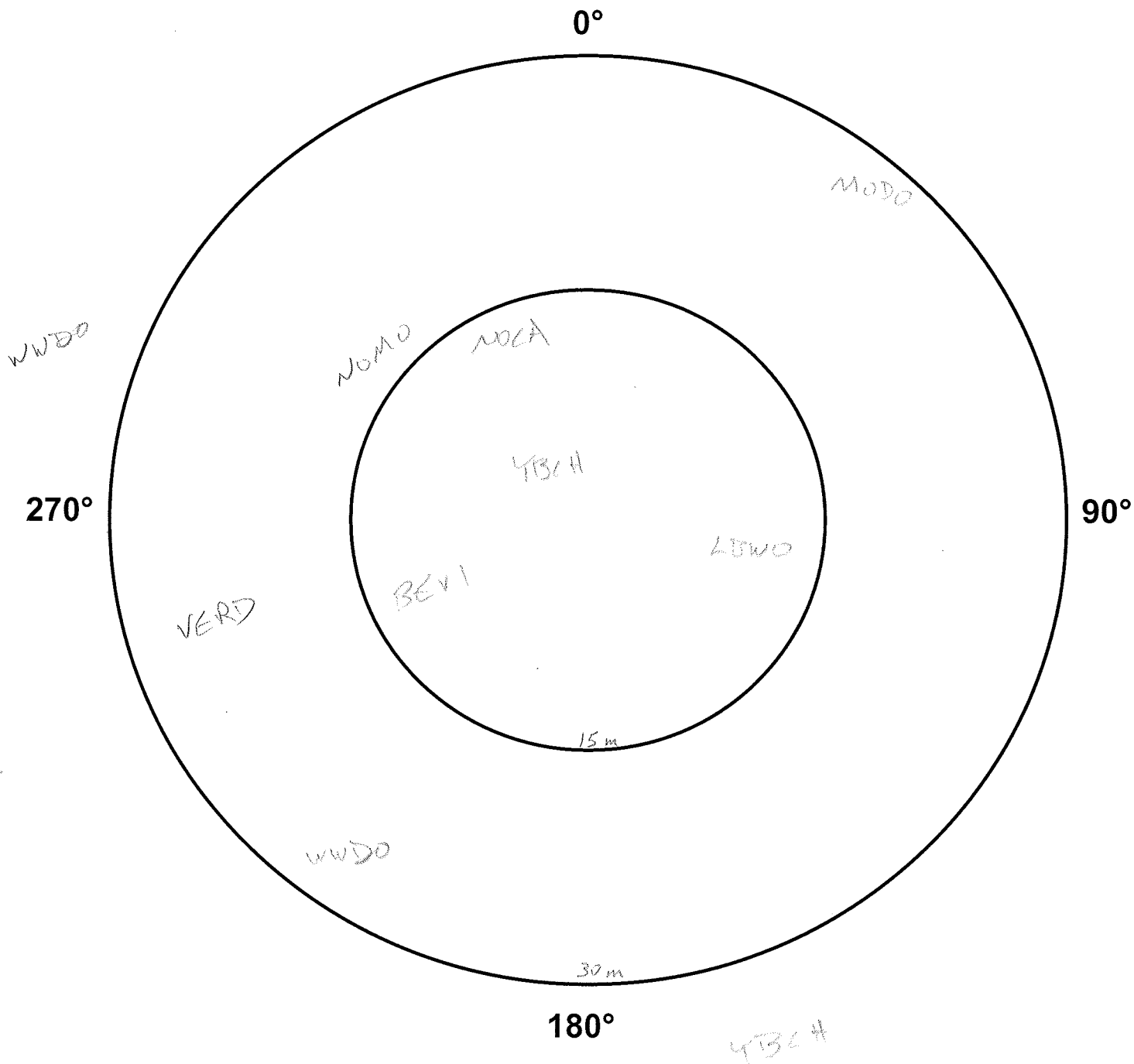
Flyovers:

Notes:

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Mesquite 3 Point No.: M31 Date: 6-19-08 Time: 7:41
 Observer: R. Doster Temperature: 85 Sky: 1 Wind: 0

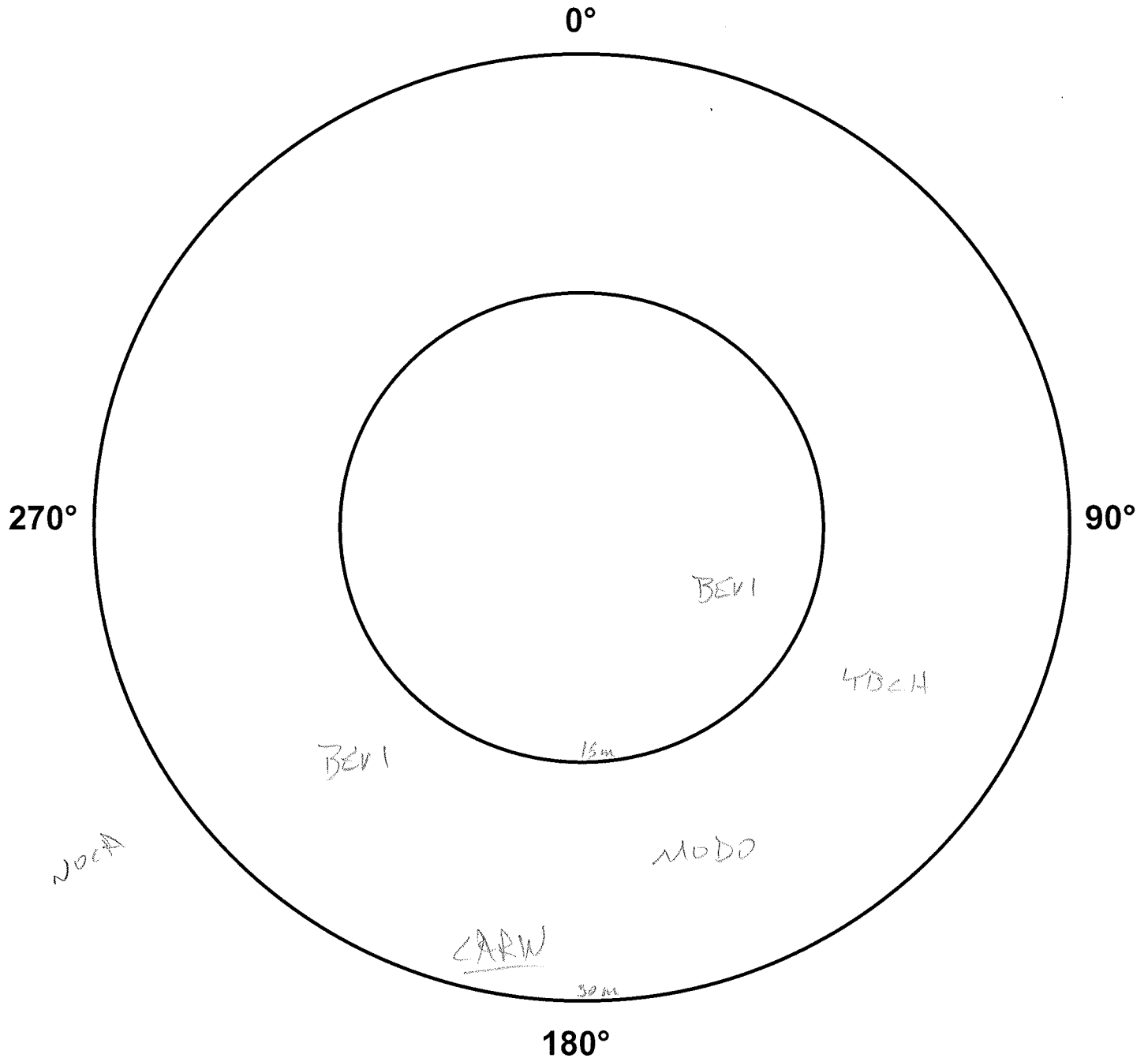


Flyovers: CORA
 Notes: _____

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Mesquite 3 Point No.: M32 Date: 6-19-08 Time: 10:06
Observer: R. Doster Temperature: 92 Sky: 0 Wind: 1-2

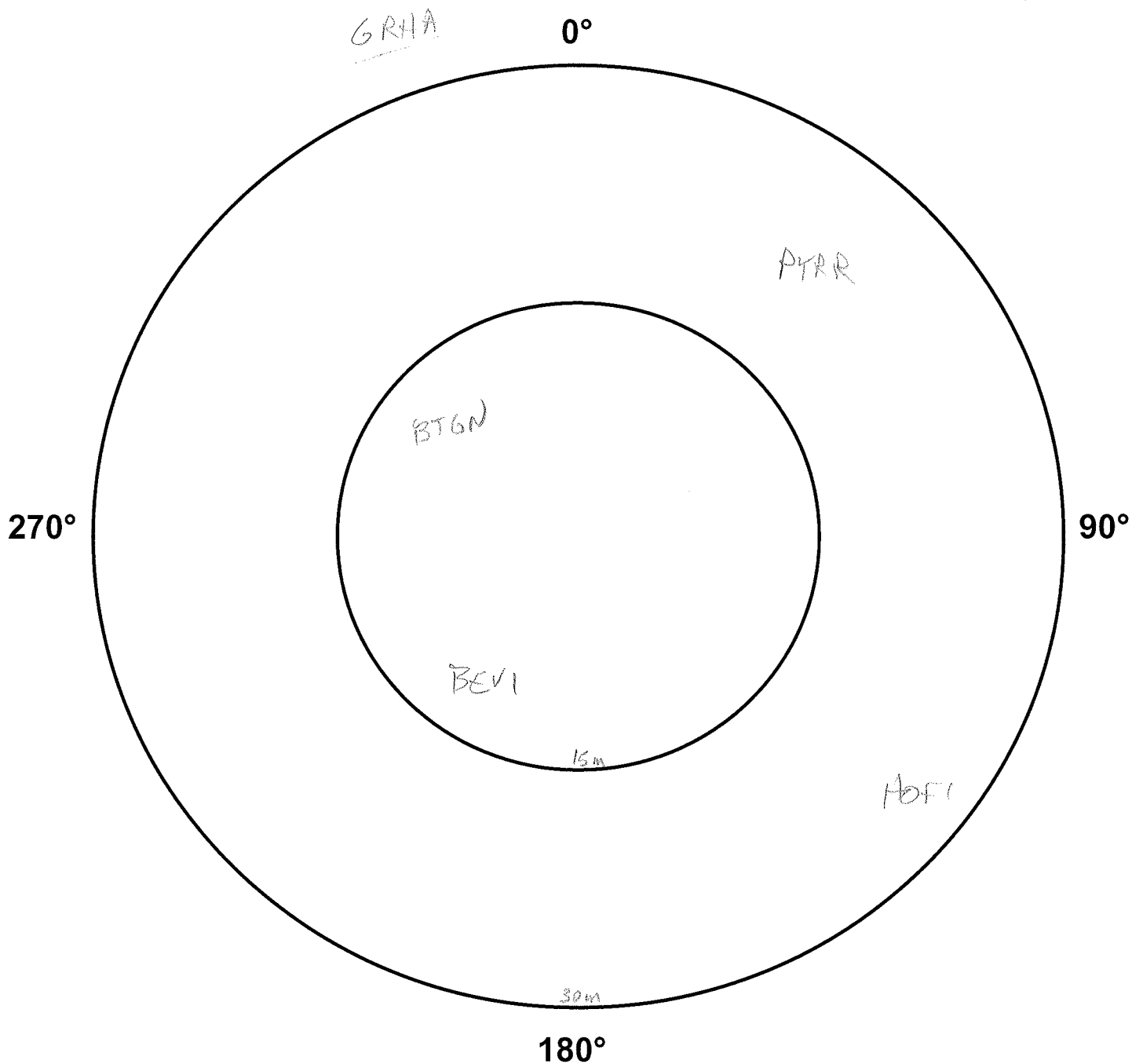


Flyovers: BHCO-2
Notes: Site burned; quite open. Little mesquite. Arundo, Baccharis, &
Salix more prevalent.

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Mesquite 3 Point No.: M33 Date: 6-19-08 Time: 9:51
Observer: R. Doster Temperature: 93 Sky: 0 Wind: 1-2



Flyovers:

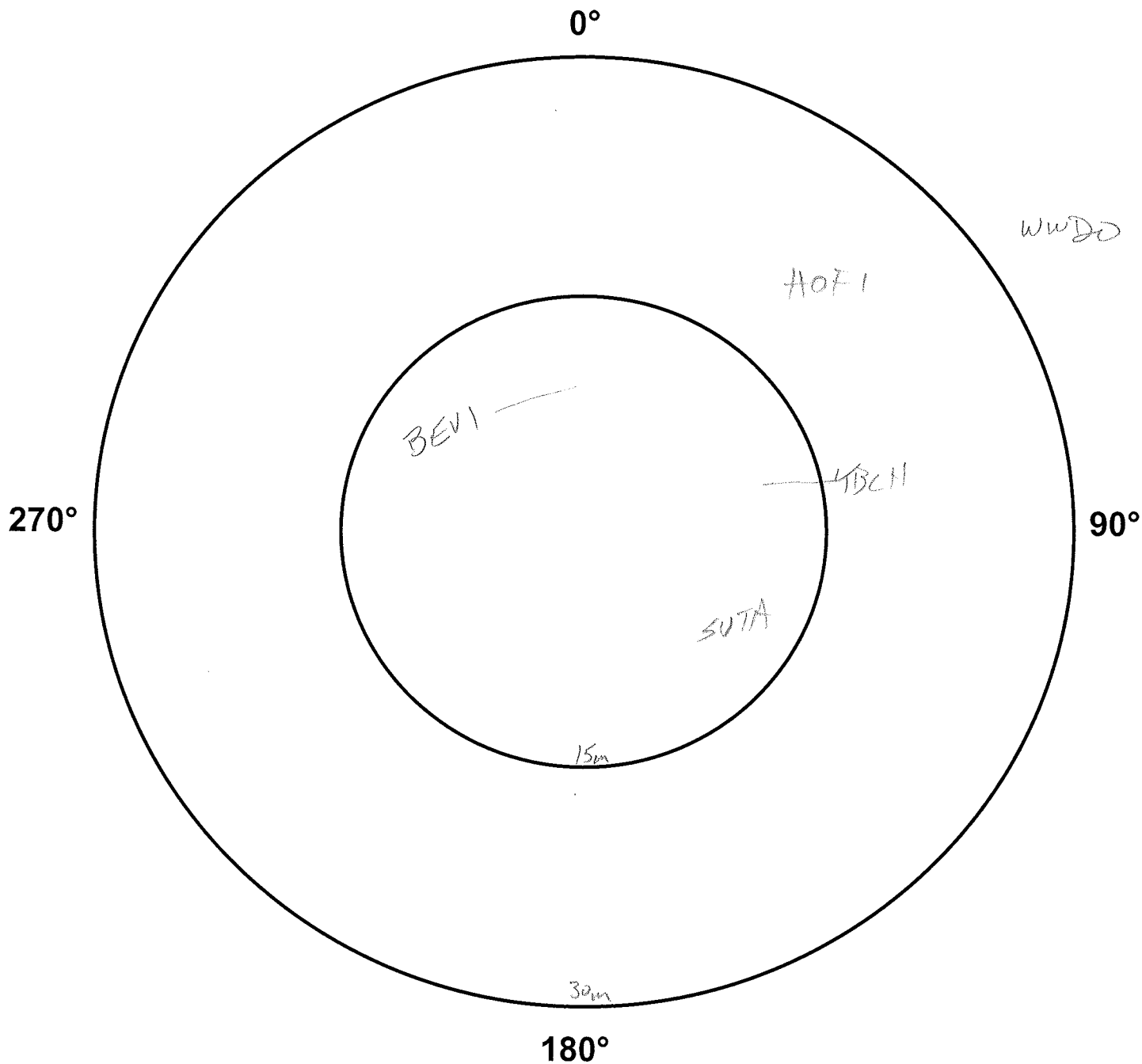
Notes: Mesquite / saltcedar mix.

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: cottonwood Point No.: M41 Date: 6-20-08 Time: 8:00

Observer: R. Dwyer Temperature: 82 Sky: 0 Wind: 1



Flyovers:

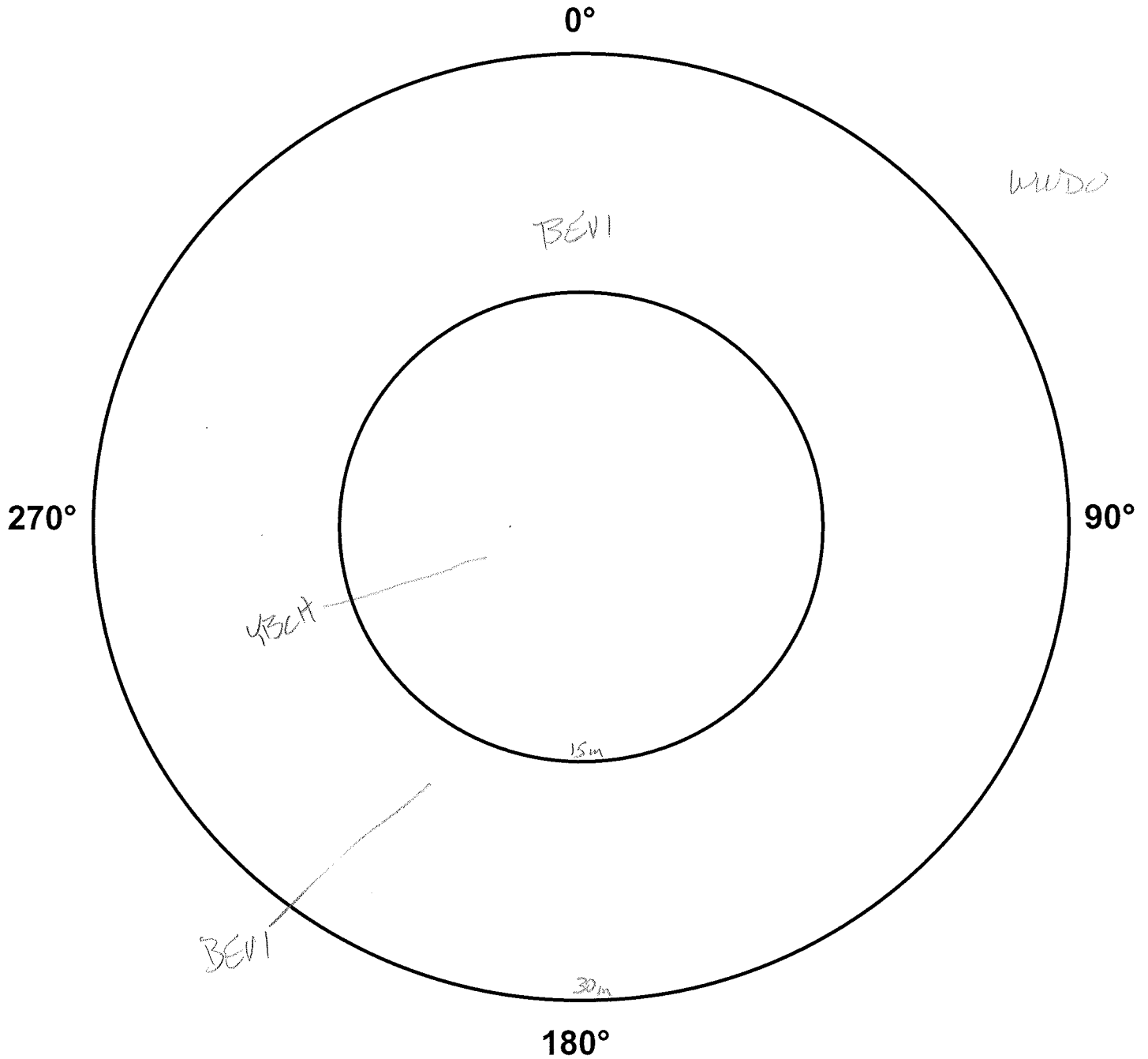
Notes:

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Gottonwood Point No.: M42 Date: 6-20-08 Time: 8:15

Observer: R. Doster Temperature: 43 Sky: 0 Wind: 2

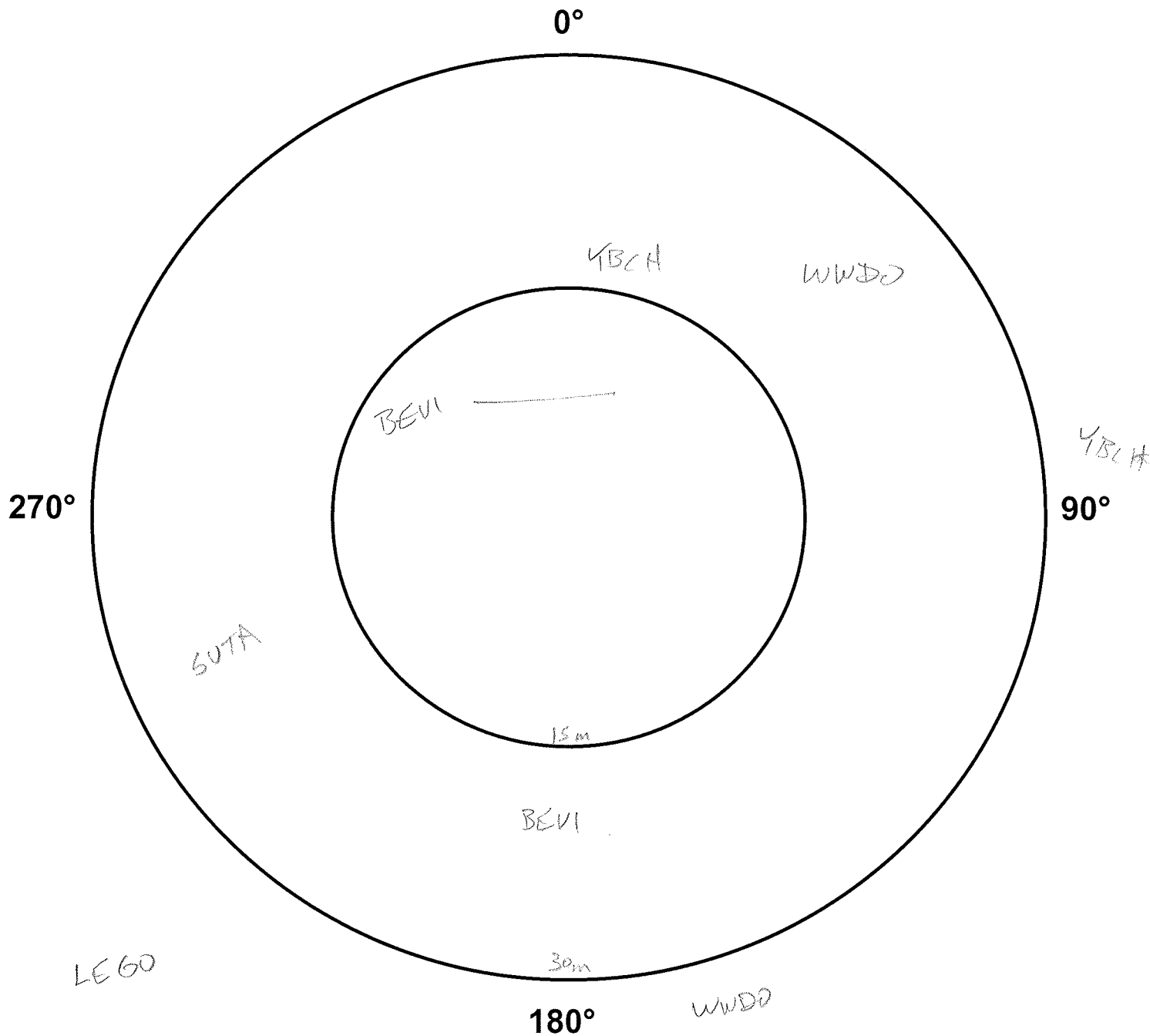


Flyovers: _____

Notes: wind picked up - suppresses bird song,

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Cottonwood Point No.: M43 Date: 6-20-08 Time: 8:31
Observer: R. Doster Temperature: 60 Sky: 0 Wind: 2-3

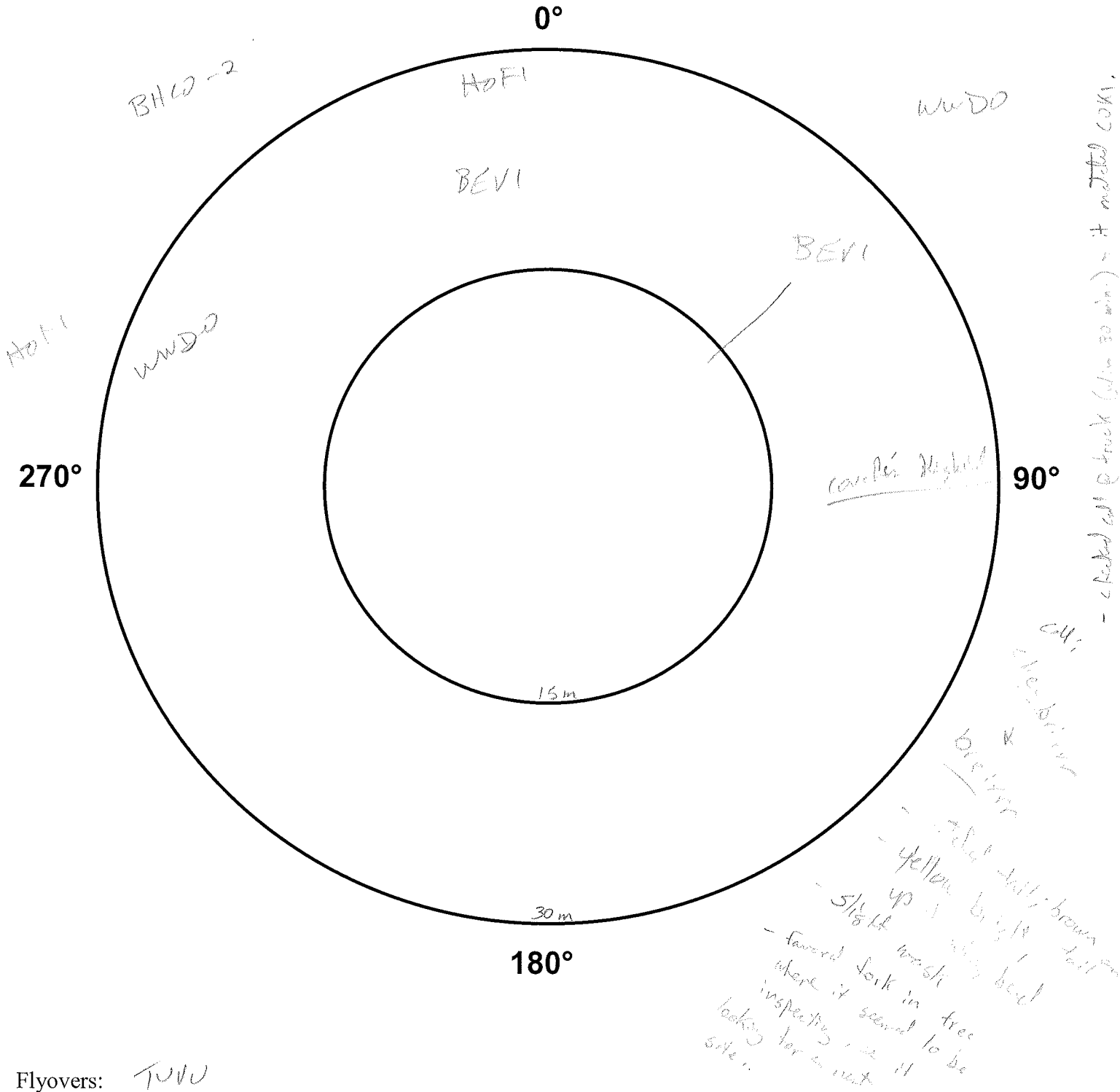


Flyovers: TUVU
Notes: Wind gusts to 3. Very open site.

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: Cottonwood Point No.: M44 Date: 6-20-06 Time: 6:50
 Observer: R. Doster Temperature: 63 Sky: 0 Wind: 2



Flyovers: TUVU

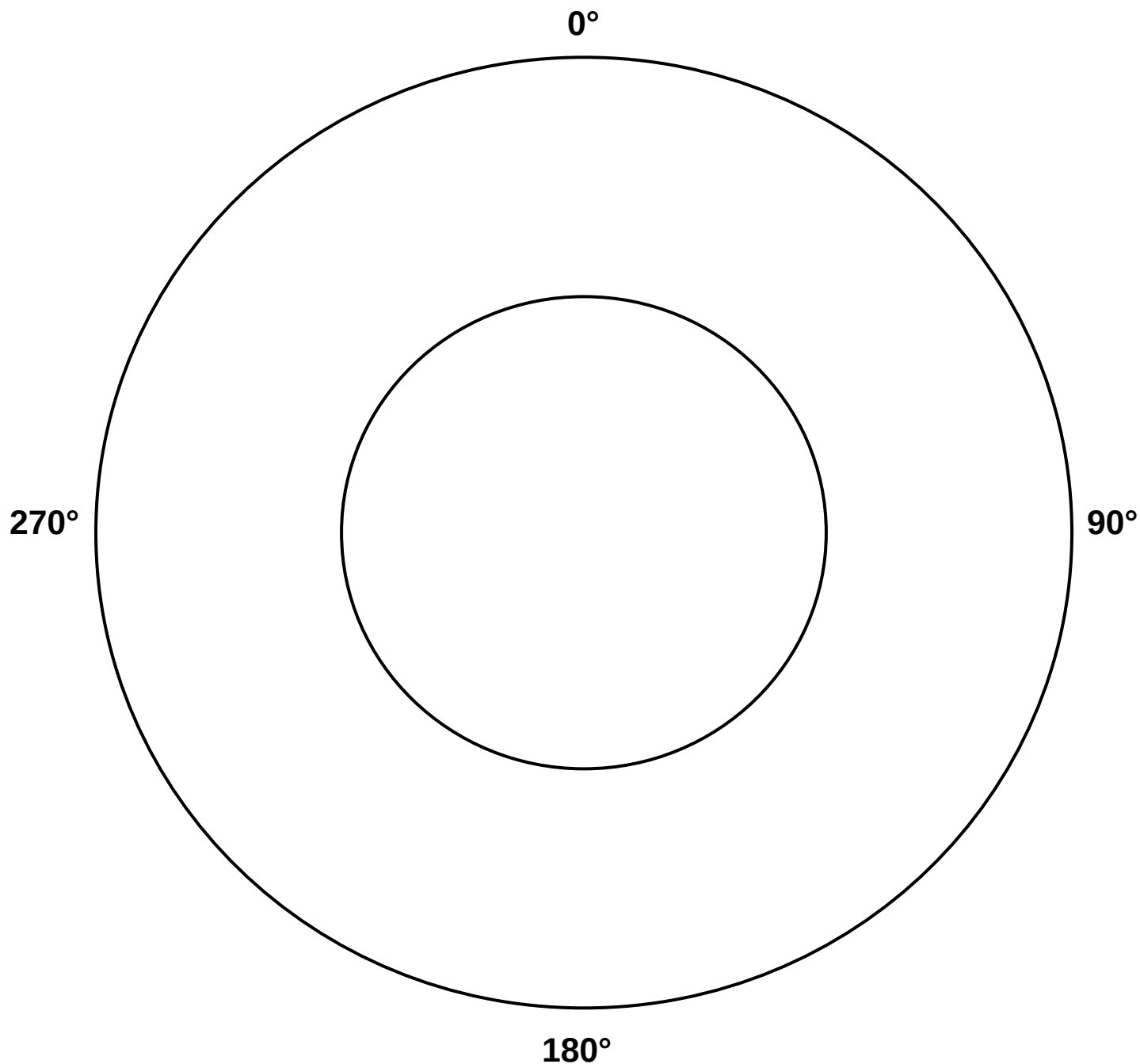
Notes: Across (west side) creek.

✓

Riparian Bird Monitoring Point Count Data Sheet – Big Bend National Park, Texas

Site: _____ Point No.: _____ Date: _____ Time: _____

Observer: _____ Temperature: _____ Sky: _____ Wind: _____



Flyovers: _____

Notes: _____
