

Riparian Raptor Breeding Season Report Big Bend National Park, Texas 2015



August 2016

Stacy M. Sirotnak
Biological Science Technician
Division of Science and Resource Management
Big Bend National Park, Texas 79834

Photographs: Stacy M. Sirotnak, Big Bend National Park
Cover photos: Common Black-Hawk at Rio Grande Village and Gray Hawk at Daniels Ranch

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ABSTRACT

The following report summarizes the breeding activity of riparian raptors during the summer of 2015 in Big Bend National Park, Brewster County, Texas. Efforts were focused on two Species of Concern due to their vulnerability to disturbance and loss of riparian habitat, the Common Black-Hawk (*Buteogallus anthracinus*) and the Gray Hawk (*Buteo plagiatus*). During the 2015 breeding season, a total of 93 visits were made to nesting territories. There were seven territorial pairs, seven occupied nests, and five successful nests by five raptor species. Of those, two occupied nests were recorded for Common Black-Hawks with two possible fledged young and two occupied nests were recorded for Gray Hawks with five possible fledged young. Management goals and conservation efforts should be aimed at maintaining the quality of riparian habitat needed for these Species of Concern.

INTRODUCTION

The following report summarizes the breeding activity of riparian raptors during the summer of 2015 in Big Bend National Park, Brewster County, Texas. Efforts were focused on two Species of Concern due to their vulnerability to disturbance and loss of riparian habitat. The Common Black-Hawk (*Buteogallus anthracinus*) and the Gray Hawk (*Buteo plagiatus*) are migrants in the southwestern United States. Both species' populations (breeding) are listed with a threatened status at the state level (Texas Parks and Wildlife 2015). Monitoring goals were to document presence (arrival and departure of the area), nesting chronology, and reproductive success of each species.

The Common Black-Hawk (hereafter Black Hawk) is a resident from northern Mexico extending south through Central America and into northern South America as well as occurring in Cuba. During migration, the northern breeding population extends into the southwestern United States (Arizona, New Mexico, south-eastern corner of Utah, and far west Texas) (Schnell 1994, Rodríguez-Flores et al. 2010). Migrants arrive in March and depart usually September/October. In the U.S., the Black Hawk breeding population is dependent upon riparian habitat (Schnell 1994). Nesting territories are found in mature riparian gallery forests, which usually include cottonwood and willow trees. Nest sites are in tall trees, especially cottonwoods, and are situated along perennial streams with a mostly permanent water flow and in areas of low human disturbance (Schnell 1994, Kaufman 1996). The Black Hawk has a variable diet depending upon food availability which consists of fish, frogs, lizards, small birds, snakes, rodents, and a variety of insects (grasshoppers and caterpillars) (Schnell 1994). Black Hawk breeding season begins early April and ends in July/August. Nests are built in close proximity to surface water (1-242 meters), 30-90 feet (9-30 meters) above ground, and consist of a platform of sticks and twigs lined with green leaves (Schnell 1994). Copulation occurs on a branch or rock about 50-295 feet (15-90 meters) from the nest (Steinwand 2001). Clutch size is usually 1-2 eggs (Kaufman 1996). Incubation is by both parents; however, the female spends more time in the nest (Rodríguez-Flores et al. 2010). Incubation lasts 37-40 days and the fledging period is between 41-52 days (Schnell 1994). Adults continue feeding juveniles for another 5-8 weeks (Schnell 1994).

The Gray Hawk, a resident throughout Mexico, Central America, and South America, is a short-distance migrant in the northern part of their range. Gray Hawk breeding populations arrive in the southwestern U.S. (Arizona, south Texas, and occasionally New Mexico) in March and depart by October (Bibles et al. 2002). Nesting territory habitats include mature riparian gallery forests, along or near permanent streams, and adjacent to mesquite woodlands (bosques) (Bibles et al. 2002). Gray Hawks exhibit high nest site fidelity (Kropp 2002) and use tall trees, primarily cottonwood trees, for nesting, with the nearby mesquite for hunting (Bibles et al. 2002). Their diet consists of lizards, snakes, birds, rodents, beetles, and grasshoppers (Cornell Lab of Ornithology 2015). Nests are usually well hidden (Kaufman 1996), in the upper half to upper third of the tree canopy, and in branches away from the trunk (Bibles et al. 2002). It is constructed with sticks, green leafy twigs, and lined with leaves. Clutch size in the U.S. is usually 2-3 eggs in early May (Kaufman 1996). Incubation is by the female and lasts 32-34 days and fledging occurs at about 42 days (Bibles et al. 2002).

STUDY AREA

Big Bend National Park is located in southern Brewster County, Texas, and encompasses 801,163 acres. The Rio Grande/Rio Bravo is the park's southern boundary and the international border between the United States and Mexico. The park is the largest protected area of the Chihuahuan Desert in the United States. The diverse landscape of canyons, mountains, desert, and river support the high species diversity within the park. Elevations range from 1,750 feet at the Rio Grande up to 7,825 feet at the top of Emory Peak, the highest peak in the Chisos Mountains. Average maximum temperatures range from 60.9 degrees F in January to 94.2 degrees F in June at Panther Junction Park Headquarters (3,750 feet). Average precipitation recorded in Panther Junction is about 15 inches/year with the majority of it received during the summer monsoon.

Black Hawks and Gray Hawks are known to occupy historical nesting areas within the riparian corridors of the park. Three areas were targeted for monitoring: Terlingua Abajo, Cottonwood Campground, and the Rio Grande Village-Daniels Ranch area. During the 2015 breeding season, known Black Hawk nesting territories included Terlingua Abajo and Rio Grande Village. Known Gray Hawk nesting territories included Cottonwood Campground and Daniels Ranch.

Nesting Territory Habitat Descriptions

Terlingua Abajo, a group of primitive roadside campsites in the west side of the park, is adjacent to Terlingua Creek. The territory is just up the creek from Terlingua Abajo, approximately 0.4 miles. Terlingua Creek, an intermittent stream with a perennial reach in the west side of the park, is a tributary of the Rio Grande near Santa Elena Canyon. The creek takes a bend about three miles upstream from the confluence where there usually is pooled water and a wide flood plain. The area consists of mature dense stands of cottonwoods (*Populus fremontii*), willows (*Salix exigua*) along the banks, exotic grasses and some salt cedar (*Tamarix spp.*) in the flood plain, and mesquite-acacia (*Prosopis spp.*, *Acacia spp.*) thickets on both sides of the creek.

Cottonwood Campground is a developed campground in the west side of the park near Castolon. The campground is manicured and maintained (mowed and irrigated) with an open understory and contains mature cottonwood trees (*Populus spp.*) of the same age/height and smaller stature native deciduous trees such as desertwillow (*Chilopsis linearis*), honey mesquite (*Prosopis glandulosa*), huisache (*Acacia farnesiana*), and a dense mesquite-acacia thicket that surrounds most of the area.

Rio Grande Village (hereafter, RGV) is a developed area and the primary visitor use hub in the east side of the park. The visitor center, store, and campgrounds (main, group, and RV) are located here; the grounds are manicured and maintained with irrigation ditches running through the area along the roadsides. The main campground consists of mature cottonwoods of the same age/height, mesquite, acacias, ash (*Fraxinus spp.*), and NewMexico locust (*Robinia neomexicana*) trees and is surrounded by dense mesquite/woody shrub thickets. Adjacent to the main campground is a wetland area (RGV Wetlands) with a small, but mature cottonwood canopy, willows, cattails (*Typha latifolia*), alkali sacaton (*Sporobolus airoides*), and mesquite/woody shrub thickets. The group campground contains an open understory with ash and locust trees and a more dispersed mature cottonwood canopy (same age/height). The RV campground is adjacent to an open field and mature cottonwoods, mesquites, and acacias along the road/irrigation ditch.

Since the early 2000's, the Black Hawk's historical nesting territory in RGV has been designated a sensitive nesting area. Signage indicates the area is closed and compliance is voluntary. The area is characterized by mature cottonwoods (mostly of the same age/height; however, some medium-sized trees are present that appear to be volunteers), a relatively open understory (Johnson grass, *Sorghum halepense*, present in about half of the area), with mature mesquite and acacia trees and thickets to the west and south, and the irrigation ditch to the north. The area is not maintained during the breeding season.

Along the north and south side of the road leading to Daniels Ranch from the Black Hawk nesting area are two groves of cottonwoods, ash, locust, and mesquite trees. Cottonwoods and sycamores line the south side of the road at the irrigation ditch. The area is manicured and maintained. A continuous stand of mesquite-acacia/woody shrub thicket borders these groves.

Daniels Ranch is a manicured and maintained visitor day-use area at RGV. The area consists of a mature cottonwood canopy, an open understory, and is bordered on the north and east by a continuous dense stand of honey mesquite and other woody shrubs. The cottonwoods are of the same age/height. An irrigation ditch borders the west and south side of the area at the road and to the northwest of the area are two settling ponds.

METHODS

Monitoring was conducted from April 8–October 6, 2015. The two species of concern, Black Hawk and Gray Hawk, were the focus of the monitoring efforts; however, other raptor species were recorded as well. No specific protocol was followed; however, observations, data

collection, and reporting was largely based on the Raptor Breeding Season Report for Pinnacles National Monument (Emmons 2008) and elements of the American Peregrine Falcon Monitoring Program in Big Bend National Park (Powell 2003).

Observations were conducted opportunistically, as part of routinely scheduled tasks, and in conjunction with other work tasks based on the location. The nesting territories in the RGV-Daniels Ranch area were visited on a weekly basis, usually the same day of the week and at approximately the same time.

Territories were visited by vehicle and/or hiking. During a visit, the observer used binoculars/spotting scope and/or walked around the site to confirm presence of individuals, either by sight or sound. Observations were of a short duration and made from spots to maximize visibility and from concealed spots when possible to minimize disturbance. All visits and observations were recorded and photo/video documented as needed. The number of visits was based on visits to each species' territory within an area. For example, a weekly visit to RGV to monitor Black Hawks and Gray Hawks and their respective nest sites resulted in one visit for each species.

A variety of equipment (park and personal) were used during monitoring. Equipment included: tripod and Nikon spotting scope (20x60), Eagle Optics binoculars (8x42) and (10x50), digital cameras, Nikon 70-300mm lens, and a digiscoping digital camera adapter.

Reproductive success was measured in terms of productivity (the number of young that reach the minimum acceptable age for assessing success) and success of a nest (a nest which at least one young reaches the minimum acceptable age for assessing success) (Steenhof and Newton 2007). Nesting productivity was reported for all breeding raptors which included the number of: territorial pairs, nesting pairs, occupied nests, successful nests, possible fledglings, and fledglings per nest. A breeding summary was reported per nesting territory which included: the number of young hatched, the number of possible fledglings (young in or at the nest at the estimated minimum acceptable age), the number of known fledglings that were visually confirmed away from the nest/nest tree, estimated arrival/departure dates of the species into the area, and details of the nest used during the breeding season. Nest phenology was reported per nesting territory which included the estimated arrival date, onset of incubation, hatch, and fledge date, potential abandoned/failed date, and the numbers of nestlings and fledglings.

The minimum acceptable age for assessing success (MAA) is 80% of the nestling age prior to fledging (Steenhof and Newton 2007).

Black Hawk: 80% of average fledge period (46.5 days) = 37.2 days; 9.3 days from fledging

Gray Hawk: 80% of average fledge period (42 days) = 33.6 days; 8.4 days from fledging

Nesting chronology was based on actual date observations or as calculations using the following data:

Black Hawk: Hatch date calculated using average incubation period of 38.5 days; Fledge date calculated using average fledging period of 46.5 days (Schnell 1994).

Gray Hawk: Hatch date calculated using average incubation period of 33 days; Fledge date calculated using average fledging period of 42 days (Bibles et al. 2002).

The appendix contains the terminology used in this report which is largely derived from Postupalsky (1974), the Raptor Research and Management Techniques manual (Steenhof and Newton 2007), and the Prairie Falcon Monitoring Protocol for Pinnacles National Monument (Emmons et al. 2011).

RESULTS

During the 2015 breeding season, a total of 93 visits were made to nesting territories (Table 1). There were seven territorial pairs, seven occupied nests, and five successful nests by five raptor species. Of those, two successful nests were recorded for Black Hawks with two possible fledged young and two successful nests were recorded for Gray Hawks with five possible fledged young (Table 2).

Table 1. Number of visits made to nesting territories during the 2015 breeding season.

2015								
Species / Territory	April	May	June	July	Aug	Sept	Oct	Subtotals
Common Black-Hawk								
<i>RGV Black-Hawk Nesting Area</i>	4	5	5	4	4	5	1	28
<i>Terlingua Abajo</i>	1		1	1				3
Gray Hawk								
<i>Daniels Ranch</i>	4	5	5	4	4	5	1	28
<i>Terlingua Abajo</i>	1		1	1				3
<i>Cottonwood Campground</i>	1	2	2	1	2	1		9
<i>RGV Wetlands</i>		1	5	4	4	5	1	20
Peregrine Falcon								
<i>Santa Elena</i>			1					1
<i>South Rim</i>			1					1
Subtotals	11	13	21	15	14	16	3	
Total								93

Table 2. 2015 Breeding Raptor Nesting Productivity.

Species	Territorial Pairs	Nesting Pairs	Occupied Nests	Successful Nests	# Possible Fledglings	# Fledglings / Nest
<i>Common Black-Hawk</i>	2	2	2	2	2	1
<i>Gray Hawk</i>	2	2	2	2	5*	2.5
<i>Great-horned Owl</i>	1	1	1	1	2	2
<i>Peregrine Falcon</i>	1	1	1	U	U	ID
<i>Swainson's Hawk</i>	1	1*	1*	U	2*	ID
*included observations by C. Boal and M. Flippo (pers. comm.)						
ID = Insufficient data; U = Unknown						

Observations are summarized by species below (Black Hawk, Gray Hawk, and Other).

Common Black-Hawk

Territory - RGV Black Hawk Nesting Area

The Black Hawks nested in one of the known historical nests in the nesting area. The nest tree, a mature cottonwood, was approximately 60 feet tall. The nest, in the upper one-half of the tree, was constructed of sticks and twigs, cone-shaped with the trunk completing its frame, and fairly protected/concealed with hanging branches. The nest tree was approximately 670 feet from the Rio Grande and 50 feet from the irrigation ditch (distances calculated using Google Earth 2015).

Copulation was observed (and took place approximately 70 feet from the nest tree) April 8, the first visit to the area. Incubation began on/before April 22 with visual confirmation of an adult hawk in the nest (estimate incubation date as April 15-22; no hawks were seen in the area on the April 15 and it was the last visit prior to April 22). A food exchange between adults was observed (appeared to be a frog) at a dead tree perch near the nest which was then followed by a switch in incubation duties on May 12. Both adults attended nest and vocalized while peering down into nest from the edge of the nest on May 26. A nestling was first seen, covered in pale yellow down and wobbly, on May 29. Hatch date was recorded as between May 26-29. An adult hawk was observed performing nest maintenance by adding a live tree branch to nest on May 29 and June 16. The last date that the nestling was observed to be sitting in the nest or at the nest edge was June 30. The fledgling was seen perched in low branch of tree at the roadside near the nesting area on July 14. Fledge date was recorded to be between July 8-July 14 (July 8 was the first visit that the young was not seen at or near the nest).

Adult Black Hawks were observed foraging/hunting in the nesting area on the ground in the Johnson grass on June 3 and June 23 and along the irrigation ditch near the nesting area on August 12 (caught and ate a large grasshopper). The juvenile was seen with a large, dead snake (red racer, *Masticophis flagellum*) in talons on the ground on August 12, just west of the nesting

area. The last day the Black Hawks were observed in the area (adult pair perched and then soaring/circling with vultures) was September 1.

Figure 1. 2015 RGV Black Hawk Nesting Area, Black Hawk occupied nest, Black Hawk juvenile.



Territory - Terlingua Abajo

The Black Hawks nested in a mature cottonwood, approximately 60-80 feet tall, west of Terlingua Creek. The nest was in the upper one-third of the tree in a group of dead branches off of the main trunk. The nest was somewhat loosely constructed of sticks and twigs, lacking in a defined shape, and set on the smaller branches for support with the main branch completing its frame. The nest was fairly exposed with little foliage providing shelter from the weather. The nest tree was approximately 200 feet from the creek where there was pooled and intermittent running surface water.

The adult pair of Black Hawks was confirmed in the area on April 25. The nest was located on June 18, as well as confirming presence of a nestling sitting at the nest edge. The young raptor was observed on a branch (branching) above the nest on July 1. There was insufficient data to determine incubation, hatch, and fledge dates.

Figure 2. 2015 Black Hawk nesting territory at Terlingua Abajo, Black Hawk occupied nest and young.



Table 3. 2015 Common Black-Hawk Breeding Summary.

Nesting Territory	Arrival Date	Date Last Seen/Heard	Date Last Search/Visit	# Young Hatched	# Possible Fledglings	# Known Fledglings	Nest Used
RGV Black Hawk Nesting Area	< 4/8	9/1	10/6	1	1	1	Existing; history of use unknown
Terlingua Abajo	< 4/25	7/1	7/1	U	1	U	History of use unknown

Gray Hawk

Territory - Cottonwood Campground

Two potential nests were located for Gray Hawks in the campground. The first nest (this ended up being the alternate nest) was located in early April while the second nest (occupied nest) was located in August, well after the young had fledged. The nests were in mature cottonwoods, 60-80 feet tall, in adjacent campsites. Both nests were in the upper one-third of the tree, near the top, in a group of dense branches off of the main trunk. The nests were constructed of sticks and twigs, bowl-shaped, and fairly concealed. The nest trees were approximately 220-266 feet from the Rio Grande.

An adult Gray Hawk was seen in the area on April 16 and May 1. An adult pair was confirmed on May 20, flying and calling in the campground. A fledgling Gray Hawk was seen perched at the top of a tree in the campground on July 16; an adult Gray Hawk was flying and calling in the area. Fledge date was recorded as occurring before July 16. A single juvenile Gray Hawk was seen on each subsequent visit, August 3 and August 18. An adult Gray Hawk was heard outside of the area on August 18 and subsequently observed perched on a utility pole near the campground. The actual (occupied) nest was discovered on August 18. There was insufficient data to determine incubation and hatch dates.

Additional observations from other sources were included to supplement nesting territory data deficiencies. Clint Boal (pers. comm.) confirmed an adult pair of Gray Hawks in the area on June 11-12; however nest location or status was not determined. Mark Flippo (pers. comm.) also found the first nest (alternate) and noted that it was in poor condition. He later confirmed the nesting pair and the occupied nest. Additionally, Flippo reported seeing two young in the Gray Hawk occupied nest on July 7. A young raptor was sitting in the nest and another young raptor/fledgling executed an awkward short flight to a nearby tree.

Figure 3. 2015 Gray Hawk nesting territory at Cottonwood Campground, Gray Hawk occupied nest, Gray Hawk juvenile.



Territory - Daniels Ranch

The Gray Hawks nested in a mature cottonwood, one of the tallest trees in the 60-80 foot range. The occupied nest was in the upper one-third of the tree, near the top, in a group of dense branches off of the main trunk. The nest was constructed of sticks and leafy twigs, bowl-shaped, and concealed. The nest tree was approximately 500 feet from the Rio Grande and about the same distance to the settling ponds. The distance from the nest tree to the irrigation ditch was approximately 160 feet and 130 feet to the mesquite thicket. The Gray Hawk nesting territory was approximately 0.4 miles from the Black Hawk nesting territory.

An adult pair of Gray Hawks was confirmed and exhibited courtship and territorial behavior on April 8 (bringing food, a lizard), April 15 (flying and circling together), and on April 22 (flying/circling together, defensive calling in the nest area from the pair). The nest location was confirmed on April 29. Incubation began on/before April 29 with visual confirmation of an adult hawk in the nest. Incubation date was recorded as between April 22-29. A nestling was first seen in the nest, covered in white-pale yellow down and wobbly, on June 3. The following week, June 9, three nestlings were seen in the nest. Hatch dates were recorded as between May 29-June 3 for the first nestling (May 29 was the last visit/sighting of an adult in the nest) and between June 3-9 for the other two nestlings. Three nestlings were seen in nest through June 30. Two nestlings were seen in nest on July 8. Four Gray Hawks were flushed and observed flying amongst the tree canopy in the nesting area on July 14, adults and young were seen. Fledge date was recorded to be between June 30-July 8 for the first nestling and July 8-14 for the other two nestlings.

From mid-July to September 1, adult and/or juvenile Gray Hawks were observed in Daniels Ranch and extending east, to the north and south groves along the road. An adult Gray Hawk was seen flying low and hunting over the open desert scrub area behind the nesting area on August 12. A juvenile hawk was seen on the ground in the nesting area, drinking pooled irrigation water, with a turkey vulture and three ducks nearby, on August 19. Two juvenile hawks were seen or heard in close proximity to one another frequently (July 22, August 4, 12, and 26, and September 1). The adult pair tended to be very vocal throughout the season, with

defensive/alarm calling tapering off during the post-fledging period. The last day the Gray Hawks were observed in the area, an adult, was September 22.

Figure 4. 2015 Gray Hawk nesting territory at Daniels Ranch, Gray Hawk occupied nest, Gray Hawk nestlings in nest, Gray Hawk juveniles.



Territory - RGV Wetlands

A single adult Gray Hawk was observed on several visits to the area from May 12 through September 11. The individual was seen flying/circling and calling over the wetlands and perched on one occasion in one of the tallest cottonwood trees in the area. Other sightings were of the adult perched on various utility poles (repeatedly the same ones) in the area. A potential nest was not located. The distance from the RGV Wetlands area to the Gray Hawk nesting area at Daniels Ranch was 1.2 miles.

Territory - Terlingua Abajo

This territory was first visited on April 25 and no Gray Hawks were detected in the area. An adult Gray Hawk was seen and heard in a dense stand of cottonwoods on the east side of Terlingua Creek just upcreek from the Terlingua Abajo campsites and downcreek from the Black Hawk nest on June 18 and July 1. Both visits resulted in unconfirmed breeding pair, young, or nest. There was insufficient data to determine breeding status or productivity.

Boal reported hearing a pair of very vocal Gray Hawks and nestlings/fledglings food begging from a June 11-12 visit; however, the nest was not located. Flippo reported possible pairs of Zone-tailed Hawks and Gray Hawks nesting in the area.

Table 4.2015 Gray Hawk Breeding Summary.

Nesting Territory	Arrival Date	Date Last Seen/ Heard	Date Last Search/ Visit	# Young Hatched	# Possible Fledglings	Known Fledglings	Nest Used
Cottonwood Campground	< 4/16	8/18	9/28	U	2*	1	Not detected **
Daniels Ranch	< 4/8	9/22	10/6	3	3	2	Existing; history of use unknown
*included observations by M. Flippo (pers. comm.)							
**Nest not detected until after fledging (initial nest being watched was in fact a potential/alternate nest)							

OTHER SPECIES

American Kestrel, *Falco sparverius*

Male and female American kestrels were observed separately but perched near top of the same dead tree in the groves near Daniels Ranch on September 11. Two kestrels were seen on the Mexican side of the Rio Grande on September 22. During the same sighting, the female kestrel then flew to perch in same dead tree as week before. A male kestrel was observed flying/hunting in the RGV Wetlands area on September 29.

Great-horned Owl, *Bubo virginianus*

Great-horned owls nested in Cottonwood Campground during the season. The presumed nest was in cavity of a cottonwood in one of the campsites. The cavity was approximately 20 feet above ground. The nest tree was approximately 230-260 feet from the Gray Hawks potential nests.

Two owl nestlings were observed on the edge of a cavity opening in a cottonwood on May 1. A park ranger reported that one of the nestlings was out of the tree due to high winds on May 5. The adult pair of owls was seen (roosting) and heard on May 20 (hooting) and June 5 (hooting and clicking bill). The adult pair and 2 juveniles were seen roosting in separate but nearby trees on June 18. An adult was seen roosting near nest tree on the last visit, September 28.

Osprey, *Pandion haliaetus*

Two ospreys were observed flying together and then perched in adjacent trees on the Mexican bank of the Rio Grande, near Daniels Ranch, on April 8.

Peregrine Falcon, *Falco peregrinus*

Two historical Peregrine Falcon eyries were visited during the season. An adult pair and young were confirmed at the South Rim eyrie on June 1. The pair was flying and returned to eyrie in response to food wail from young. There was no visual confirmation of young or nest. An adult falcon flew into a recessed area and out of view at the Santa Elena eyrie on June 18. Additionally, two falcons (unknown age/plumage) were observed flying high over Daniels Ranch on July 14.

Swainson's Hawk, *Buteo swainsoni*

At Terlingua Abajo, upcreek of the Black Hawk nest, an adult Swainson's Hawk was observed with an unidentified raptor on April 25. They were flying and circling together. An adult pair (light morph) was observed flying/soaring together on July 1 (the same area as in April).

Boal reported an occupied nest with an adult shading two nestlings from a June 11-12 visit. Flippo also reported two sightings of an adult Swainson's Hawk in this same area.

Unknown

An unidentified raptor was flying/gliding among the cottonwood canopy at Daniels Ranch at the end of the season, on September 29. It was flying low, was silhouetted, and had broad wings. The same morning, two unidentified raptors were seen flying together and interacting among the smaller stature trees in the groves east of Daniels Ranch. A good visual of one individual revealed a long tail, white at the top of the tail, and a dark back.

A summary of nesting phenology and success for Black Hawk and Gray Hawk follows:

Table 5. 2015 Nest Phenology and Success for Common Black-Hawk (CBHA) and Gray Hawk (GRHA).

Species	Nesting Territory	Arrival Date	Begin Incubation	Hatch Date	Fledge Date	Abandon Date	Failed Date	# of Nestlings	# Possible Fledglings	# Known Fledglings
CBHA	RGV Black Hawk Nesting Area	< 4/8	4/15-22	5/26-29	7/8-14			1	1	1
CBHA	Terlingua Abajo	< 4/25	ID	ID	ID			U	1	U
GRHA	Cottonwood Campground	< 4/16	ID	ID	< 7/16			U	2*	1
GRHA	Daniels Ranch	< 4/8	4/22-29	5/29-6/3 N1; 6/3-9 N2 and N3**	6/30-7/8 N1; 7/8-14 N2 and N3**			3	3	2
*included observations by M. Flippo (pers. comm.)										
**N = Nestling; N1, N2, etc. to differentiate between individuals										
ID = Insufficient data										

DISCUSSION

Time constraints, due to seasonal appointment timing and irregularly scheduled visits, resulted in incomplete datasets. The arrival of the migratory species went undocumented and the breeding season was already in progress by the time monitoring commenced.

There were obvious challenges encountered in the interpreting of observations. Hatch dates were difficult to determine as it was not possible to see into the nest and observations from the ground did not reveal a hatchling/nestling until it had developed the strength and mobility to become visible (> 4 days old). The posture and behavior of the attending adult(s) became a fairly reliable indicator that hatching was underway. Fledge dates were difficult to determine as well. It was difficult to differentiate between a young raptor that was branching and a young raptor that had in fact fledged but returned to perch in the nest tree or near the nest. Whether the young was branching or had in fact fledged, it was concluded that the nest was a successful nest because the young raptor had reached the MAA for assessing success.

Usually, detecting young raptors in the post-fledging period could be achieved. However, detecting and differentiating between multiple fledglings/juveniles from a given nest was much more difficult. The Gray Hawk Daniels Ranch territory produced 3 possible fledglings, with one young fledging before the other two. After fledging, no more than two juveniles were observed at one time. It is not known if these were the same two individuals seen each visit. One juvenile did appear to have darker streaking overall than the other juvenile seen during the same visits. Using the MAA for assessing success helps with the issues of detection in the post-fledging period.

The Gray Hawk Cottonwood Campground territory occupied nest was not detected until after fledging had occurred which resulted in insufficient nesting phenology data. The inclusion of Mr. Flippo's observations supported the nesting productivity of this nesting pair.

It is not known whether the adult Gray Hawk seen on numerous visits in the RGV Wetlands is one of the adults from the Daniels Ranch territory or a different individual. Gray Hawks were reported to have small home ranges (possibly the smallest of North American Buteos), averaging 59.2 hectares, according to a study of their productivity and nest-site characteristics in southern Arizona (Bibles and Mannan 2004). As stated in the results, this potential territory was 1.2 miles from the established nesting territory at Daniels Ranch. The hawk exhibited defensive/territorial behavior (flying and circling overhead, calling) upon entering the area at the beginning of the breeding season. It is possible that this is expansion of Gray Hawk territory.

Gray Hawk territory at Terlingua Abajo could not be located. The area was checked repeatedly and the nest was not found nor was there visual confirmation of a breeding/nesting pair or young. This is due to the very dense foliage and size of the cottonwood stand and time constraints. Observations from Boal and Flippo support nesting activity, but again, not confirmed. Unfortunately, there was insufficient data to determine breeding status or productivity for this territory. More frequent visits to Terlingua Abajo territories were required

to determine breeding status and a more accurate nesting phenology for both species of concern.

Peregrine Falcon South Rim territory was recorded as an occupied nest because the adults were observed responding to the young's food wail, even though the nest site itself was out of view. It received an "unknown" for success because the territory was not revisited and there was no additional information on this nesting attempt. Swainson's Hawk Terlingua Abajo territory was recorded as an occupied nest because Boal confirmed an occupied nest with an adult and young. It also received an "unknown" for success because the territory was not revisited and there was no additional information on this nesting attempt.

MANAGEMENT CONSIDERATIONS

The Black Hawk and the Gray Hawk, Species of Concern in Big Bend National Park, are vulnerable to loss of habitat (largely a result of forest/woodland clearing and a depletion of groundwater) (Schnell 1994, Bibles et al. 2002, Bibles and Mannan 2004, Cornell Lab of Ornithology 2015). The Black Hawk, an obligate riparian breeding species associated with mature, riparian gallery forests (Schnell 1994), exhibits a low reproductive rate (Steinwand 2001). The Gray Hawk depends upon riparian habitat for breeding with adjacent areas of mesquite bosques for hunting. Both species exhibit high nest site fidelity and territories are fairly consistent from year to year. Of the two species, Black Hawks are more sensitive to human disturbance near nests and have been known to abandon nesting areas (Schnell 1994, Kaufman 1996, Bibles et al. 2002). Maintaining adequate habitat in protected areas for these raptors may be the best way to ensure that future riparian and woodland habitat is available for these breeding populations.

Management goals and conservation efforts should include:

- Monitor and manage riparian gallery forests along the Rio Grande/Rio Bravo, Terlingua Creek, and other perennial streams or rivers and the stands of mature cottonwoods/mesquite bosques in the developed visitor use areas to maintain the quality of riparian habitat needed for these species.
- Promote forest growth and tree regeneration, either naturally or hand planting where necessary to supplement existing stands of mature trees. This action may require regular irrigation, especially to encourage successful growth of young cottonwoods.
- Maintain mesquite/woody shrub thickets adjacent to riparian forests.
- Maintain adequate levels of groundwater in cottonwood forests/stands and mesquite bosques to ensure long-term presence of habitat.
- Continue to limit human disturbance in key nesting areas.

NOTES

I would like to thank Mr. Clint Boal and Mr. Mark Flippo for allowing inclusion of their observations. Additional thanks are given to Mr. Boal for his time in providing the preliminary review of this document and expertise. The valuable feedback and suggested reference materials were much appreciated.

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Appendix. Terminology.

Term	Definition
Alternate nest	One of multiple nest structures within the nesting territory of one pair of birds. Nests may be in the same tree or adjacent trees; history of use of the nest is unknown ⁴
Axillaries	Wing pits
Brancher/Branching	Nestling/young raptor that has moved to branches adjacent to nest (still in nest tree) just prior to fledging ^{1, 5}
Breeding season	The period from courtship and nest preparation to independence of fledged young ^{3, 6}
Courtship behavior	An adult pair engaged in activities that included nest site preparation, display flights, food exchanges, and copulation
First-year (FY, HY)	First year age classification based on calendar based system (Jan 1 - Dec 31), also called hatching year, HY; a juvenile
Fledge	When a young bird voluntarily leaves the nest tree for the first time
Fledgling	A young bird recently fledged or has become capable of flying from the nest tree; still dependent on adults ⁶
Immature	A young bird that has not attained adult plumage and is not aged as an adult. For this report, birds not hatched during the current breeding season and non-adults are immatures
Juvenal plumage	First complete plumage acquired before a bird leaves the nest; for raptors, usually worn for 7 months to almost one year ²
Juvenile	A young bird in its first/juvenal plumage; not an adult bird. For this report, first-year (hatching year) birds are juveniles
Minimum Acceptable Age for Assessing Success (MAA)	A standard nestling age at which a nest can be considered successful; 80% of the nestling age before fledging. ⁶ (For this report, a young raptor seen branching has achieved the minimum age in infer a successful nest).
Nesting activity	Activities that support nest building, egg laying and hatching, and rearing of young. Activities included nest building/maintenance/attendance, food exchange between adults, food wail/call and other vocalizations, young sitting in nest, and food drops
Nesting pair	A pair of raptors nesting in a specific territory confirmed by at least one of the following: 1) incubation of eggs or hatchlings at nest, 2) feeding of hatchlings or nestlings at nest, 3) feeding of fledglings at or near nest ³
Nesting territory	A defended area that contains (currently or historically) one or more nests within the range of a mated pair ^{4, 6}
Nestling	A young raptor in nest, covered in natal down initially, and unable to fly; dependent upon parental care and feeding
Nestling period	The period between the first egg hatching and when the first young voluntarily leaves the nest (fledges) ⁶

Occupied nest	A nest that satisfied at least one of the following during a breeding season: 1) young were raised, 2) eggs were laid, 3) one adult was observed sitting low in the nest, presumably incubating, 4) 2 adults present on or near the nest, regardless of any current nest refurbishment, 5) one adult and one bird in immature plumage at or near a nest, if mating behavior was observed, 6) or a recently repaired nest with fresh sticks. Excluded these scenarios: 1) one adult near an empty unrepaired nest, or 2) 2 adults seen together during the breeding season with no known nest. ⁴ For this report, successful and unsuccessful nests are considered occupied nests.
Pin feathers	A developing feather that is encased in a waxy sheathing
Productivity	The number of young that reach the minimum acceptable age for assessing success
Rectrices	Tail feathers
Remiges	Primary and secondary feathers of the wings
Second-year (SY)	Second year age classification based on calendar based system (Jan 1 - Dec 31), the year after hatching; an immature
Successful nest	A nest in which at least one young reaches minimum acceptable age for assessing success, there was at least one confirmed fledgling ^{4,6} , or at least one nestling was observed branching (for this report, a brancher is assumed to have reached the minimum acceptable age for assessing success as they are on the verge of fledging)
Territorial behavior	Included perching, flying, territorial disputes and defense, stooping, scold and defensive/alarm calling
Territorial pair	A pair of raptors occupying a specific territory confirmed by at least one of the following: 1) an adult pair actively defending and sleep-roosting in an area, 2) adults engaged in courtship or reproductive activity or nest defense/affinity, 3) incubation 4) feeding of young at or near nest. Included pairs that did not nest, may have had a nest failure, or may have abandoned a territory ³
Unsuccessful nest	An occupied nest from which there are no young fledged due to: 1) no eggs were laid, 2) eggs were destroyed or otherwise lost, 3) eggs failed to hatch, or 4) young hatched, but are known to have died prior to fledging (nest failure) ⁴
1 = (Bibles et al. 2002); 2 = (Clark 2007); 3 = (Emmons et al. 2011); 4 = (Postupalsky 1974); 5 = (Schnell 1994); 6 = (Steenhof and Newton 2007)	