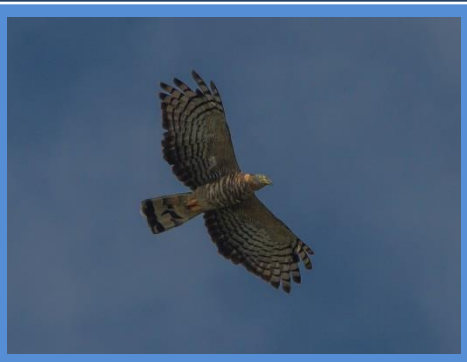
2013

Belize Raptor Watch Report



BELIZE RAPTOR RESEARCH INSTITUTE

TOLEDO INSTITUTE FOR DEVELOPMENT AND ENVIRONMENT TIDE

YA'AXCHÉ CONSERVATION TRUST

BELIZE FOREST DEPARTMENT

By

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Cover photos: 1) Monitoring team members, Victor Bonilla, Roni Martinez, and Liberato Pop (left to right), searching the sky for migrating raptors (photo Isael Mai) *2)* Migrating female Hook-billed Kite at count-site (photo Roni Martinez) *3)* A kettle of 350+ Mississippi Kites pass over the count-site, the largest recorded flock in Belize (photo Roni Martinez).

Belize Raptor Research Institute is a non-profit organization exempt from federal income tax under section 501 (c)3 of the Internal Revenue Code.

The Belize Raptor Research strives to protect Neotropical raptors in Belize through research, education and partnerships. BRRI conducts long term scientific research to learn about the status and needs of raptors in the wild, while building local capacity, working with policy makers and educating local and international communities about raptor conservation.

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ABSTRACT

The Belize coastline bordering the Caribbean Sea acts as a leading line for south-bound migrating raptors en route to their wintering grounds in Central and South America. In 2013, the Belize Raptor Research Institute in collaboration with the Toledo Institute for Development and the Environment and Ya'axche Conservation Trust, launched the first annual autumn raptor count in Belize. Daily standardized counts were conducted from 15 September to 7 December between 08:00 to 16:00 in Cattle Landing in the Toledo District. In 642 count hours during the first count season, a total of 8,457 raptors were observed, of which 2,858 (33.8%) were migrant individuals, representing 32 of the 46 diurnal raptor species (70%) that have been recorded in Belize. The mean number of raptors counted per hour was 13.2 and the mean number of raptors per day was 101.7, which included non-migratory individuals. Count totals for the five most common migrant species were: Mississippi Kite, *Ictinia mississippiensis*, 817; Hook-billed Kite, *Chondrohierax uncinatus*, 744; Peregrine Falcon, *Falco peregrinus*, 434; Osprey, *Pandion haliaetus*, 376; and Broad-winged Hawk, *Buteo platypterus*, 348. This count-site is exceptional in that it has the largest concentration of migrating Hook-billed Kites found anywhere throughout their distribution. Where these individuals are migrating from is unknown, but we presume it is a population from the Yucatán Peninsula that migrates in response to low snail detectability during the dry season. Of the 744 Hook-billed Kites observed, 61% that were identified to gender were females, 50.6% that were identified to age were adults and all others were juveniles. 48% of those categorized by plumage type were dark morphs. Two Belizeans were hired to coordinate this project and more than 100 community members and schools participated or visited the count-site, making this first year count a success for both research and community educational outreach.

INTRODUCTION

Hawk watching has been around for hundreds of years and so has the persecution of raptors (Bildstein 2006). Hawk watch sites are global, with 388 watch sites worldwide, and are critical programs for raptor research and conservation (Zalles and Bildstein 2000). Raptors are important environmental indicators, but can be logistically difficult and expensive to study (Whitacre 2012). Each year millions of raptors undertake a long distance migration including intercontinental movements making multinational conservation key to their survivorship. The passage of hundreds and sometimes thousands of individual raptors of multiple species involves large portions of populations and occasionally entire populations congregating in a single location. This makes them vulnerable to human persecution or other threats. These bottlenecks, or areas of high densities of migrating raptors, afford a unique opportunity to monitor raptor populations to better understand population fluctuations, abundance, age structure and change in seasonality due to climate change or other threats. This also is a productive way of educating the general public and community, while creating a long-term community-based research and conservation project. Currently, in Belize, few opportunities exist for locals to learn about or become involved with raptor conservation. By involving Belizeans and giving them opportunities to learn about and protect raptors, raptor conservation can succeed. Without community-based and citizen science conservation projects like

this, conservation efforts will likely fail as environmental education has proven to be effective in making conservation efforts effective (Curti and Valdez 2009). This project gives locals opportunities to participate in scientific research and monitor local raptor populations, ultimately protecting raptors from persecution, which is the primary threat to raptors in Belize as much of Belize's habitats are intact and protected.

Raptor migration through Mesoamerica is poorly studied and unknown outside of Costa Rica (Bildstein 2006). In the Neotropical region nearly 75% of migratory raptor populations are threatened, which make raptor watches critical in monitoring raptor populations and assisting in conservation action plans (Zalles and Blidstein 2000). With regional human population growth rates estimated at over 1% annually, local communities will continue to grow exponentially creating more threats to more species (Zalles and Blidstein 2000).

This project has and will continue to better understand the species and number of individuals passing through Belize during fall (September through November) migration. The coast and topography of the region creates a natural funnel causing the birds to congregate over the Punta Gorda area of southern Belize in the Toledo District (Figure 1). Anecdotal information has been obtained by us and other individuals, such as H. Lee Jones, author of "Birds of Belize," on the raptor migration through Belize, but scientific quantitative data and systematic monitoring is lacking in Belize and through most of Central America. Other annual watch sites in the region of Mexico and Central America include: Veracruz, Mexico; Guatemala; Costa Rica; and Panama (Figure 1), however information between these sites and along the Caribbean coast between Costa Rica and Mexico is lacking. Many migrating raptors, such as Swallow-tailed Kites, *Elanoides forificatus*, Sharp-shinned Hawks, *Accipiter striatus*, Peregrine Falcons, *Falco peregrinus*, and Ospreys, *Pandion haliaetus*, migrate to Central America via island hopping through the Caribbean islands or following the coastline and often making first contact with Mesoamerica through the Yucatán Peninsula by following the Belize coastline (Figure 1 and 2) (Bildstein 2004). As a result, large flocks of Broad-winged Hawks, *Buteo platypterus*, Swallow-tailed Kites, Mississippi Kites, *Ictinia mississippiensis*, and Hook-billed Kites, *Chondrohierax uncinatus* have been observed in Punta Gorda, Belize. We have scouted most of Belize for potential raptor watch sites and, to the best of our knowledge, the most productive and important site is in Punta Gorda due to the concentration of raptors from the coastline and its geography. Therefore, we have chosen it for this long-term Raptor Watch Program.

Species that were once thought to be sedentary, such as the Hook-billed Kite, have been observed migrating through Belize in large numbers, suggesting they may be a migratory species in the region (Jones 2002, Jones and Komar 2008). In 2001, over the course of a few days, H. Lee Jones observed 1,030 individuals migrating southbound through Punta Gorda in Belize during October and November (Jones 2002). Jones estimated that at least 5,000 Hook-billed Kites migrate through southern Belize during fall migration (Jones 2002), but there has not been any systematic monitoring to determine how many kites actually pass through. Meanwhile, where they are coming from and where they are going remains a mystery. This raptor species could be a key indicator species for

climate change due to its specialized diet of terrestrial snails; that fact that it breeds during the wet season, which is presumed to be due to the abundance of snails during wetter months; and its movements and migration (Whitacre 2012). As climate change and other threats continue to impact biodiversity, a better understanding of Hook-billed Kites can result in a better understanding of raptor populations and managing for these changes into the future. Therefore, the Hook-billed Kite is our target species for this long-term Raptor Watch and is being used to monitor environmental fluctuations and indictors of climate change impacts.

We partnered with the Toledo Institute for Development and Environment (TIDE) and Ya'axche Conservation Trust (YCT) on this project. This data has contributed to the Hawk Migration Association of North America's efforts. Two Belizean biologists were hired to coordinate and compile the count, while numerous raptor watch volunteers, locally and globally, participated in this research and conservation effort by counting raptors. The hiring of Belizean biologists has assisted in building local capacity, as well as giving the community members an opportunity to observe and count raptors while also learning about them.

STUDY AREA

The count was conducted on a soccer field located in the village of Cattle Landing in the southern extreme of Belize in the Toledo District (Figures 3a and 3b). Located in flat lowland broadleaved forest directly along the Belize coastline of the Caribbean Sea (Figures 1, 2, 3a and 3b), the count-site is 15 m from the ocean and 6.7 m a.s.l. located at 16.120218º latitude and -88.794307º longitude, approximately 2 km north of Punta Gorda.

Belize lies in the outer tropical zone or subtropical geographic belt with distinct dry and wet seasons. Temperatures vary depending on elevation, proximity to the coast, and the effects of the northeast trade winds off the Caribbean coast. The mean monthly temperature range is 24- 33º C in summer and 16- 28º C in winter. The rainfall varies much more than the temperature resulting in extreme climatic zones throughout Belize (Figure 4). Average rainfall for Belize varies dramatically from 1,016 mm (40 inches) in the north and west to 4,572 mm (180 inches) in the extreme south. The Punta Gorda area receives an annual rainfall average between 4,064 mm (160 inches) and 4,572 mm (180 inches). The wet season is extended in southern Belize with the onset in May and lasting through January with an average of 200 days with rain annually. Most of the rain during the season occurs as 'night rain,' caused by cool air moving down from higher elevations, cooling the air along the coastline resulting in rain. Therefore there were minimal days during the count that were impacted by rain.

BRRI chose Cattle Landing as the raptor watch site for a number of reasons: its proximity to the coastline, which south-bound migrating raptors use as a leading line to limit their over-ocean movement and reduce energy costs; its geographic location in accordance of what is known about raptor migration through the region based on other studies; and its proximity to a community,

making it easier for locals to participate in the effort making educational outreach efforts more effective.

South-bound migrating raptors pass through the count-site generally in one of three ways: by crossing the Gulf of Mexico and passing through the Yucatán Peninsula before following the Belize coastline; by passing through Mexico then moving eastward instead of the usual south route through Guatemala; or by island-hopping through the Caribbean Sea then making landfall in the Yucatán Peninsula or Belize, north of the count-site.

METHODS

Our count protocol followed the Hawk Migration Association of North America's (HMANA) protocol and their data sheets were adopted with some alteration of species. Diurnal raptor species and individuals, both migratory and non-migratory, were counted 7 days a week from 08:00 to 16:00. Peak movement, depending on weather, was between 09:00 and 11:00. We tested, which 8 hour period would produce the most results and we determined that counting later in the afternoon produced more migratory individuals than starting prior to 08:00. The count was led by the Project Coordinator and Compiler and assisted by interns and community members. These employees were trained by Ryan Phillips and Roni Martinez in raptor identification skills and hawk watching, but they were already skilled in raptor identification. The count-site was on a soccer field directly on the coastline with a full 360 degree view, so that most raptors passing within 2 km could be identified if they were soaring fairly high (Figures 5a-d). To the north and west there was forest obstructing the view of migrating raptors if they were low flying (<30 m) further than 500 m from the count-site (Figures 5a and 5b). To the east and south the view was unobstructed and on clear days land 25+ km away could be seen (Figures 5c and 5d).

We adopted the Golden Gate Raptor Observatory's quadrant system for counting raptors where the cover area is divided into four sections by cardinal directions, preventing the team from focusing on only one area and potentially missing raptors. For this count-site, since nearly all migrating raptors were moving in a general north to south or northeast to southwest direction, we divided the count into an east and west quadrant. The team consisted of a trained and skilled day leader; a data recorder; and spotters. The data recorder would also spot raptors, when not recording, but his or her primary duty was to record information on the raptor species as provided to him by the spotters. Two data sheets were used (Figures 6a and 6b). The day leader managed the team for the day by assigning duties, assisting with identification, communicating with the team, and confirming with the recorder that the data was being recorded. There were a minimum of two spotters for each of the two quadrants with floater observers assisting in both. However, on some days there was only 1 spotter per quadrant. Spotters scanned the sky every 10 minutes with their binoculars using an M or S scanning technique between scanning without the aid of binoculars. When a raptor was observed, the spotter would inform the team and describe the location, so that identification could be made by multiple observers. For each raptor, identification of species, age, gender, and morph were recorded if they could be determined. Spotting scopes, binoculars and various field guides were used to assist

in identifications on-site. Individuals that could not be identified were recorded as an "unidentified raptor" if they could not be identified to genus. The primary identification references that were used were Clark and Wheeler (2001), Dunne et al. (2012), Liguori (2005), Liguori (2011), and Crossley et al. (2013).

During the count period there were between 2 and 6 trained counters during a count day, but usually there were 3 to 4. During the monitoring season there were 4 day leaders, Victor Bonilla, Roni Martinez, Ryan Phillips, and Liberato Pop, of which V. Bonilla and L. Pop were the day leaders for the majority of the count days. Assistants and interns were trained in the field and during identification training sessions held outside of the count times.

Attributes that were recorded at the start of each count-hour included: number of observers; number of visitors; wind speed; wind direction; temperature; barometric pressure; cloud cover; visibility; precipitation; average flight direction; and average height of flight. A Kestrel 2500 weather meter was used to record climatic conditions, and flight path direction was determined using a Brunton compass. Wind speed was determined using a 0-9 Beaufort scale with 0 being calm to no wind and 9 being a hurricane. Precipitation was recorded using a 0-5 scale with the following designations: 0= none; 1= fog or haze; 2= drizzle; 3= rain; 4= thunderstorms; and 5= hurricane type storm. Height of flight was recorded using a 0-7 scale: 0= below eye level; 1= eye level to 30 meters; 2= birds seen easily with unaided eye; 3= at limit of unaided eye; 4= beyond limit of unaided eye, but visible with binoculars; 5= at limit of binoculars; 6= beyond limit of binoculars and spotting scope; and 7= no predominant height.

RESULTS

Southbound raptor migration in Belize is a prolonged period compared to other count-sites in the Americas. The Swallow-tailed Kite migration commences as early as July (Zimmerman and Meyer 2004) and the Hook-billed Kite migration goes through early December, spanning nearly a 6 month period (July-December) for southbound migrating raptors. We counted the latter 2.75 months of this period because our focal species was the Hook-billed Kite, which has a late migration season. Therefore, we did not count during most of the Swallow-tailed Kite migration, all of the Plumbeous Kite migration, and a large portion of the Mississippi Kite migration.

In 2013, the first year of the count, a total of 8,457 raptors were recorded between 15 September and 7 December in 642 count hours (80.3 count days) between the hours of 08:00 and 16:00, which represented 32 of the 46 (70%) diurnal raptor species (Table 1) that have been recorded in Belize. Of these 2,858 (33.8%) were migrant individuals (Table 2). The mean number of raptors counted per hour was 13.2, which included non-migratory individuals. Re-counts most likely occurred, but were avoided if possible. The range of raptors observed in a single-day was 9 (7 December) - 420 (20 September) with a mean of 101.7 (Figure 7). The high single-day count was due to a kettle of 376 Mississippi Kites passing over the count-site in the 14:00-15:00 hour. There were 35 days with 100 or more raptors counted.

Of the 8,457 raptors recorded, 337 (4.0%) could not be identified to species, of which 19 were identified to *Falco*, 17 to *Buteo*, 20 to *Accipiter*, and 13 to *Cathartes*. And 268 were not identified to genus. On 3 November there was a kettle of approximately 200 raptors that were too far and seen too quickly to identify. With the timing they were most-likely Hook-billed Kites as the first peak of their migration is early November.

Of a possible 672 count hours (84 count days), 642 hours were counted. There were 8 days where the count had to be stopped between 1 and 8 hours due to heavy rainstorms and cloud cover. Once the rain dissipated and visibility improved the count would continue. The count continued in scattered or light showers if there was visibility. The count days that were impacted by weather were: 17 September; 25 October; 27 October; 28 October; 29 October; 8 November; 9 November; and 14 November.

Ten raptor species, five of which are migratory, comprised 93% of all observations. The two most common raptor species observed included the Black Vulture, *Coragyps atratus*, with 3,617 recorded and Turkey Vulture, *Cathartes aura*, with 853 counted. However, there were unequivocally re-counts of individuals as we did not observe any sign of migration of Black Vultures and only a few migrant Turkey Vultures. The other three abundant non-migratory species were Common Black-Hawk, *Buteogallus anthracinus*, Short-tailed Hawk, *Buteo brachyurus*, and King Vulture, *Sarcoramphus papa*. Count totals for the five most common migrant species, representing 95.2% of all migrating individuals, were: Mississippi Kite 817; Hook-billed Kite 744; Peregrine Falcon 434; Osprey 376; and Broad-winged Hawk 348. Nine migratory raptor species comprised 4.8% of the total observed migratory individuals with 139 individuals observed. In order of most abundant these included: Cooper's Hawk, *Accipiter cooperii*; Merlin, *Falco columbarius*; Swallow-tailed Kite, Sharp-shinned Hawk, American Kestrel, *Falco sparvarius*; Zone-tailed Hawk, *Buteo albonotatus*; Northern Harrier, *Circus cyaenus*; Swainson's Hawk, *Buteo swainsoni*; and Red-tailed Hawk, *Buteo jamaicensis*. Non-migratory species that were observed during the count can be observed in Table 1.

The majority (98%) of migrating raptors observed were moving in a northeast to southwest direction, which is the geographic orientation of the coastline at the count-site, which supports the hypothesis that many migrating raptors in Belize are using the coastline as a leading line during southbound migration. There were a few Merlins and Ospreys that were observed moving north, which we suspect were individuals that were wintering in the area. Most individuals were observed over land, but <5% were observed over the ocean moving south. The majority (approximately 99%) of these over-watering migrating individuals were observed within 1 km of the coastline and included Osprey, Mississippi Kite and Peregrine Falcon, except for a single American Kestrel that flew directly east over water and out of sight. Many of these individuals made land fall further south after they passed the count-site and some were observed in direct flight to Puerto Barrios, Guatemala. On average, the 09:00-10:00 hour count block had the most raptor activity with 1,769 observed comprising 20.7% of all raptors observed (Figure 8). Between 09:00-12:00, 53.6% of all the raptors were observed (Figure 8). There was a distinct peak of activity from 14:00-15:00 with 1,155 raptors comprising 13.5% of all raptors observed (Figure 8). On average the majority of migrating

individuals were flying at a height we categorized as 3, at the limit of the unaided eye. Typically early morning individuals were flying considerably lower at a 2, easily observed with unaided eye, and as the day went on the height of flight dramatically increased with some birds at a 5, at the limit of binoculars.

Species Accounts

Cathartidae

Black Vulture *Coragyps atratus*

Black Vultures were observed on every count day with a total of 3,617 recorded. The high day count was 116, but re-counts were probable throughout the day. There was no sign of a migration with this species. Large kettles were observed over the landfill area to the northwest of the count-site. Migration of Black Vultures has been observed in other areas of its range (Bildstein 2004), but there is no migration in Belize. However, movements in response to food can be observed. Black Vulture numbers are likely to rise in Belize due to increased human populations attributing to increased landfills and deforestation.

Turkey Vulture *Cathartes aura*

Turkey Vultures were observed on 77 count days (95.9%) with a range of 1- 46 observed in a day. A total of 853 were counted. The majority (>95%) of individuals were non-migrating. There were a few individuals that were high soaring and in a southeast migratory path. There was an individual with a distinct hole in one of its primaries that was observed over a 1 month period at the count-site. Most individuals observed appeared to foraging as they were coursing low over the canopy. This supports the hypothesis that Turkey Vulture migration is primarily restricted to the interior and Pacific slope.

Lesser Yellow-headed Vulture *Cathartes burrovianus*

Lesser Yellow-headed Vultures were uncommon and observed on 33 days at the count-site. A total of 48 were recorded. These were non-migrating individuals as they were coursing low over the forest. This was the most uncommon vulture species observed at the count-site. However, some *Cathartes* individuals observed at a far distance could have been Lesser Yellow-headed Vultures, but could not be identified. Therefore, *Cathartes burrovianus* may be more common than what we documented.

King Vulture *Sarcoramphus papa*

There were 106 King Vultures recorded on 42 days of the count. Most were adults (87%) as 14 sub-adults were observed. They were typically high soaring inland over broad-leaved forest approximately 2 km from the count-site.

Pandionidae

Osprey *Pandion haliaetus*

There were 376 Ospreys observed during the count period between 19 September and 7 December. This is the fourth most abundant raptor migrant species at the count-site. The day high count was 21 individuals on 23 October. There was two peak periods: one from 9-11 October and a more extended

period between 23 October and 7 November. With the exception of a single individual foraging over the ocean, all individuals were migrants soaring in a southeast or south direction (Figure 10). Most followed a distinct line directly along the coast over land. All Ospreys observed were of the *P. h. ridgwayi* subspecies, which is a migrant in Belize. This is a significant count-site for migrating Ospreys.

Accipitridae

Gray-headed Kite *Leptodon cayanensis*

Two sightings were made during the count period, one on 8 November and the other on 15 November. The first was a juvenile dark morph and the latter was an adult. This species is not known to migrate and is considered a resident in Belize. As expected we did not observe any sign of migration of this species.

Hook-billed Kite *Chondrohierax uncinatus*

The Hook-billed Kite was and is our focal species for the count due to Belize having the largest migration of the species, which was first documented by H. Lee Jones in 1999. We observed 744 individuals from 12 October to 4 December. There were two distinct abundance peaks, 7 November and 25 November (Figure 11). 25.3% were observed between the 10:00-11:00 hour block each day (Figure 12). Of the 744 Hook-billed Kites observed, 61% that were identified to gender were females (Figure 13a), 50.6% that were identified to age were adults and 49.4% were juveniles (Figure 13b), and 48% of those categorized by plumage type were dark morphs. The largest group observed was 43 individuals, which was exceptional, as groups ranged from 2-43 individuals (Figure 14a and 14b).

Swallow-tailed Kite *Elanoides forficatus*

This count recorded only the tail end of the Swallow-tailed Kite migration, as they primarily migrate through Belize from August-early September (Zimmerman and Meyer 2004). We observed 21 individuals, of which 95% were observed from 15-22 September (Figure 15). We recorded the latest, to our knowledge, Swallow-tailed Kite for Belize on 11 October (Figure 16), which was a juvenile. We could not determine the subspecies (*E. f. yetapa* or *E. f. forficatus*), but we suspect it was the nominate subspecies migrating from the United States.

White-tailed Kite *Elanus leucurus*

White-tailed Kites were observed on 5 occasions during the count, most likely the same individual. Migration of this species was not observed, which confirms this species to be non-migratory in Belize.

Snail Kite *Rostrhamus sociabilis*

Two Snail Kites were observed flying southwest during the count: an adult male on 11 October (Figure 17) and another individual on 26 November. We do not suspect that this species migrates in Belize, but movements are expected throughout the year in response to water supply and apple snail abundance in aquatic ecosystems.

Mississippi Kite *Ictinia mississippiensis*
Mississippi Kite was the most abundant migrant species observed with a total of 817 individuals recorded, including the largest kettle recorded in Belize of approximately 375 on 20 September (Figure 18-19). Between 15 September and 16 October 97% of the observed individuals passed through, but the last counted Mississippi Kite for the season was on 4 November (Figure 20). By 3 October, 87.5% of the total observed Mississippi Kites were recorded. Of the Mississippi Kites that were identified to age, 130 were adults and 49 were juvenile (Figure 21). During a field-training day on 4 September, prior to the start of the official count, we observed 31 Mississippi Kites, which were not included in our results.

Mississippi Kites were first reported in Belize in 1988 by M. Meadows and were first well-documented in 1999 by H. L. Jones (Jones et al. 2002). Most of these kites were high-soaring beyond the naked-eye range, therefore we do not believe that the Mississippi Kite migration through Belize is a new phenomenon, but instead observers were not observing them because of the limited time they pass through Belize and their high-soaring behavior, which can easily be missed if not actively looking with binoculars. H. L. Jones states that Mississippi Kites are occasional autumn transients from mid-September to late October (Jones 2003).

Northern Harrier *Circus cyaenus*
Northern Harrier was rare at the count-site with only 11 individuals observed between 30 September and 30 November (Figure 22). All were migrating individuals that were high-soaring and moving in a southwesterly or south direction (Figure 23). Of the 9 individuals that could be identified to age and gender, 4 were adult females, 1 was an adult male, and 4 were juveniles.

Sharp-shinned Hawk *Accipiter striatus*
Sharp-shinned Hawks were rare on the count with a total of 18 individuals observed. All were high-soaring and moving in a southwest or south direction over land directly along the coastline. The first individual was observed on 18 September and the latest on 19 November (Figure 24). Twelve individuals were identified to age, of which 83.3% were adults (Figure 25). There was no statistically significant peak as the high day count was two individuals, but 61% of the Sharp-shinned Hawks observed were seen between 14-26 October.

Cooper's Hawk *Accipiter cooperii*
Surprisingly, Cooper's Hawks were more common than Sharp-shinned Hawks with 36 observed. We had suspected to count fewer Cooper's due to their limited range and abundance in Central America, while the Sharp-shinned Hawk's range is more extensive. The earliest Cooper's Hawk was observed on 22 September and the latest on 2 December (Figure 26). 78% of all Cooper's Hawks observed passed through between 22 September and 3 December. All were observed moving in a southeast or southern direction. Of all individuals identified to age (n=21) 76.2% were adults.

Common Black-Hawk *Buteogallus anthracinus*
The Common Black-Hawk is considered non-migratory in Belize and our count confirms this. This species was common at the count-site and seen nearly daily. We made 318 observations, of an estimated 5-7 resident individuals. At one time we observed a juvenile (Figure 27) and 4 adults (Figure 28) soaring over the count-site and vocalizing.

Great Black-Hawk *Buteogallus urubitinga*
There was one Great Black-Hawk observed during the count on 19 September soaring over the forest inland. This species is non-migratory in Belize.

Roadside Hawk *Buteo magnirostris*
Surprisingly Roadside Hawks were very uncommon at the count-site with only 8 observed. This is the most common widespread raptor in Belize, but appears to be less common on the coastline. No migration of this species was observed.

Broad-winged Hawk *Buteo platypterus*
The Broad-winged Hawk was the fifth most common migrant species observed with 348 individuals counted, between 22 September and 2 December (Figure 29). All were migrating in a southwest or south direction over land (Figure 30), typically soaring high at the extent of the naked-eye. The single day high count was 92 individuals on 4 November, with the single largest flock being 41 individuals. 90.5% of all the Broad-winged Hawks recorded passed through between 25 September and 4 November. Of the individuals that were identified to age (n= 165), 65.5% were adults.

Gray Hawk *Buteo plagiatus*
Gray Hawks were uncommon at the count-site and observed on 21 occasions between 19 September and 4 December. Some individuals were soaring high in a southwest or south direction, suggesting migration. However, we believe these individuals to have been dispersers or non-breeding 'floaters,' as there was no seasonality of movements observed.

Short-tailed Hawk *Buteo brachyurus*
Short-tailed Hawks were common at the count-site and were observed on 263 occasions. There was no sign of migration by this species at the count-site, as all individuals were observed aerial foraging over the forest. Both light and dark morphs were observed.

Swainson's Hawk *Buteo swainsoni*
Six Swainson's Hawks were observed during the count period. They were observed between 28 September and 8 October. This is not unusual as the Swainson's Hawk was first recorded in Belize in 2001 (Jones 2003). This species primarily uses the Pacific coast as its migration route, thus avoiding Belize (Fuller et al. 1998). Four were identified to age; 3 adults and 1 juvenile and all were light morph individuals.

Zone-tailed Hawk *Buteo albonotatus*
Zone-tailed Hawks were very uncommon at the count-site with 11 individuals observed between 22 September and 15 November (Figure 31). All were soaring in a southwest direction. 81.8% of all individuals were observed between 15 October and 3 November. The single day high count was on 18 October when 4 individuals were observed. 55.6% of individuals identified to age (n= 9) were adults.

Red-tailed Hawk *Buteo jamaicensis*
Exceptional records included 2 Red-tailed Hawks soaring southwest. A light morph juvenile on 15 October and a light morph adult on 28 November. Outside of Mountain Pine Ridge, Red-tailed Hawks are exceptionally rare with fewer than 10 records (Jones 2003). Belize lowland individuals are either migrants of the *B. j. borealis* or *B. j. calurus* subspecies, or dispersers from the Mountain Pine Ridge population of the *B. j. kemsiesi* (W. Clark considers this not a valid subspecies and considers it the *B. j. costaricensis* subspecies). These birds could not be identified to subspecies.

Black Hawk-Eagle *Spizaetus tyrannus*
Black Hawk-Eagles were rare with only 3 counted. All were adults and 2 were observed soaring together on 23 September inland from the count-site. This species is non-migratory.

Ornate Hawk-Eagle *Spizaetus ornatus*
A single adult Ornate Hawk-Eagle was observed at the count-site on 22 September. This species is rare at the count-site and is non-migratory.

Falconidae
Crested Caracara *Caracara cheriway*
An adult Crested Caracara flew over the count-site in a southwest direction on 9 October. This was the only observation of this species at the count-site. In Belize, fewer than 10 records of this species have been reported outside of Cayo District, the location of the known Crested Caracara nest in the country. We expect this species to increase in Belize due to the increase of human altered landscapes. This species is non-migratory; therefore the observed individual is most-likely a floating non-breeding individual.

Laughing Falcon *Herpetotheres cachinnans*
Laughing Falcons were observed on only 3 occasions during the count; two individuals on 15 November and another individual on 3 December. This species is non-migratory.

American Kestrel *Falco sparverius*
American Kestrels were very uncommon at the count-site with 11 individuals observed between 15 October and 6 November. With the exception of an individual soaring over the count-site then flying east over the ocean and out of sight, all individuals were flying in a southwest or south direction. The

single day high count was 3 individuals and they were only observed on 8 count days. 66.7% of the individuals identified to gender (n=6) were females.

Merlin *Falco columbarius*
Merlins were uncommon at the count-site with 23 individuals observed between 24 September and 2 December. All were low-flying at a level 1(eye-level to 30 m). An individual was observed moving north in reverse migration late in the day. We suspect this was a wintering individual. 52% of the observed individuals were observed between 22 October and 3 November. The single day high-count was 5 individuals on 2 December, which we suspect were re-counts of wintering individuals, as the majority of individuals passed through in October and early November. All individuals that could be identified to subspecies were of the *F. c. columbarius* (Boreal) type.

Bat Falcon *Falco rufigularius*
Bat Falcons are non-migratory and we observed them foraging over the forest on 5 occasions.

Orange-breasted Falcon *Falco deiroleucus*
On 3 October an exceptionally rare Orange-breasted Falcon perched near the count-site, so that proper identification of the species could be made. Photos were also obtained to document this record (Figure 32). The individual was a juvenile and did not have a band (The Peregrine Fund has a release program in Belize). This species is non-migratory and this individual was unequivocally a dispersing bird, as there are no known nest-sites in close proximity.

Peregrine Falcon *Falco peregrinus*
The Peregrine Falcon was the third most common migrant species observed with 434 individuals observed between 17 September and 21 November (Figure 33). 76.7% of all the individuals were observed between 8 and 24 October. The single day high count was 85 individuals on 12 October. Of all the migrant species observed, the Peregrine Falcon showed the most distinct single peak during its southbound migration at the count-site (Figure 33). Every individual that could be identified to subspecies was of the *F. p. tundrius* subspecies (Figure 34). Of the individuals that could be identified to age (n=296), 90.9% were adults (Figure 34). >95% were migrating southwest directly along the coastline and over the count-site. Few individuals were observed flying over water and when they did they were within 300 m of the coastline.

Two Belizeans from the Toledo District were hired on this project, one as Coordinator, Victor Bonilla (Figure 35) and the other as Count Compiler and Leader, Liberato Pop (Figure 36). Isael Mai, a Belizean from San Antonio Village in the Cayo District, volunteered as an intern for the duration of the count, where he gained invaluable knowledge on raptor research and conservation. There were also two interns from the United States that volunteered for 2-5 weeks. More than 100 community members and school children participated or visited the count-site (Figures 37-40), making this first year count a success for both research and community educational outreach.

DISCUSSION

The Belize southbound raptor migration is prolonged over 6 months. Our count covered 2.75 months of it. We originally planned to count until 1 December, but we extended the count period for another week because we observed 60 migrating Hook-billed Kites on 30 November. Within the next week we observed 91 individuals. Therefore, for the 2014 Raptor Watch we will be counting from 1 October through 15 December, since our focal species is the Hook-billed Kite. As a result we will be missing the Swallow-tailed Kite and the majority of the Mississippi Kite southbound migration. Future counts should include the northbound raptor migration, which has not been studied in Belize, as large raptor flocks have been reported. Counts should also occur during July and August to determine the migrant population of Swallow-tailed Kites, Plumbeous Kites, and Mississippi Kites. The Swallow-tailed Kite has experienced population declines in the United States and is of conservation concern. If a majority of these individuals pass through Belize it may be more critical to monitor this species at this count-site. We may conduct a single-year study counting migrating Swallow-tailed Kites in the near future to have a baseline number on how many pass through Belize.

According to Heintzelman's (2004) scale, this site rates Good (93-138) for raptors-per-day and Fair (12-22) for raptors-per-hour. Belize is a not a major flyway zone (10,000 + migrants) for southbound migrating raptors, compared to other sites in regards to numbers, such as Veracruz, Mexico, Kekoldi, Costa Rica, or Cape May, New Jersey, but it has the largest migration of the enigmatic Hook-billed Kite and is a key monitoring site for Ospreys and Peregrine Falcons. Of the major count-sites within the Nearctic-Neotropical migration system, Belize ranks in the top ten for Ospreys and Peregrine Falcons. The mean count total for Ospreys at Veracruz, Mexico, the biggest Osprey migration site, is 3,090 (Lott 2006). Florida Keys has the highest mean total count for Peregrine Falcons with 1,908. We observed 376 Ospreys and 434 Peregrine Falcons, which is comparable to these major sites. To our knowledge, only four other count-sites in the Nearctic-Neotropical region, Florida Keys, Costa Rica, Veracruz, and Cape May, have a higher count total of Peregrine Falcons than Belize. This new count-site in Belize is important for monitoring the populations of these two species.

Most raptors during their southbound migration passing through Mexico tend to bypass Belize by following the Pacific coastline, or they pass through Guatemala, which is a more direct route to South America. The raptors passing through Belize are species that are known to make large over-water passages, relying more on power flight than thermal flight, such as Ospreys and Peregrine Falcons. Tracking studies on Osprey, Peregrine Falcon, and Swallow-tailed Kite have proven that the Belize coastline is a key leading line for migrating raptors, and our first-year count supports this. Therefore, the majority of raptors that we counted were most likely individuals using the Mississippi flyway crossing over the Gulf of Mexico and passing through the Yucatán before following the Belize coastline, or they were individuals using the Atlantic flyway passing through Florida and Cuba before making landfall in the Yucatán, Mexico or Belize. The latter are also referred to as 'island hoppers.' However, there are a number of individuals that pass through Belize that are certainly

birds that have gone off course from their normal route, whether because they were blown off route by weather conditions; they were juveniles without the guidance of birds knowing the way; or a combination of factors. Since all of the Peregrine Falcons that were identified to sub-species were of the *F. p. tundrius* , we conclude that the source migrant population in Belize is from the northern extent of North America.

The Hook-billed Kite migration phenomenon is exceptional in Belize and was first documented by H. L. Jones in 1999 (Jones unpublished data). It commences in early to mid-October and continues through early December. The earliest date we observed migrating Hook-billed Kites was 12 October and the latest date was 4 December. H. L. Jones' earliest record of Hook-billed Kites was 4 October in 2012 (in which he conducted counts July-November) and his latest was 15 November (this was his latest count date) (Jones unpublished data). From 2000-2002, Jones observed a significant peak migration of Hook-billed Kites between the last few days of October through 10 November. We observed two significant peaks during the first and last weeks of November. Jones did not record a late November migration because he did not count during those days. The number of migrating Hook-billed Kites we observed was considerably lower than Jones' (2002) estimate of 5,000 kites passing through in a season (2001), which was extrapolated by him from recording 1,030 individuals and his limited count days and times (2-3hrs each morning, 06:00-9:00) (Jones 2002, Whitacre 2012). We agree that the number of Hook-billed Kites migrating in 2001 observed by Jones exceeded 1,000 individuals, but believe 5,000 is a high estimate. We observed a daily activity peak between 10:00-11:00 (Figure 12), where Jones did not count during this time period and made most of his observations of Hook-billed Kites between 08:00-09:00 (Jones unpublished data). Jones' single day high count was 338 on 1 November 2001 (Jones unpublished data) compared to our 143 on 25 November 2013 (Figure 11), even though we did observe a peak migration 6- 8 November. We will need consecutive years of data to determine if there has been a slight shift in peak migration from Jones' surveys 12 year prior, as well as to explain why we observed significantly fewer individuals. We suggest that rainfall may play a role in how many Hook-billed Kites migrate in a given year. The rainfall was extensive in 2013, which may have constituted fewer individuals than normal, but this is pure speculation. Further research by us on Hook-billed Kites and the role of diet, weather, and habitat on their behaviors will assist in better understanding this species' migration patterns.

From 1991-2001, a mean of 60 migrating Hook-billed Kites were recorded at the Veracruz, Mexico hawkwatch site (Whitacre 2012). It is possible that a few of these individuals pass through southern Belize, but we believe that the migrants in Belize are from a migratory population of the Yucatán Peninsula, Mexico and southern Mexico in response to an extreme dry season during which snails may not be easily detectable. Where these migrants are going remains a mystery as Costa Rica does not record migrating Hook-billed Kites during the hawkwatch. Tracking these birds through telemetry would provide many answers to this species' mysterious migration. We will begin this effort in 2015.

Data from this count will contribute to the Raptor Population Index (RPI), which estimates population trends for North American raptors. As 2013 was the first-year of this long-term

monitoring site, we will need at least another 3 years, so we can calculate the coefficient of variation from year to year to establish what species can be monitored over time. From our first year of data, we suspect that Osprey, Peregrine Falcon, and Hook-billed Kite can be statistically analyzed and populations can be monitored through this raptor watch.

This count-site is not only for monitoring raptors and conducting research. A key component to this project is the educational outreach and community involvement. The first year was a success in this endeavor as over 100 community members and school children visited the site or assisted with counting. In 2014, we will be increasing our outreach efforts by visiting at least one school per week, visiting all surrounding communities to inform them of the project and to teach them about the importance of raptors. We will display educational posters and information on raptors at the count-site. We will also be building a 40 foot tall observation platform, which will give us a better counting range, but will also draw more attention to the count-site resulting in an increase in visitors.

ACKNOWLEDGEMENTS

First and foremost we would like to thank the Belize Forest Department for their continued support and great enthusiasm for this project. There are so many people and organizations to thank for all their support. First, we would like to thank our partners, Toledo Institute for Development and the Environment (TIDE) and Ya'axche Conservation Trust (YCT), specifically Celia Mahung, Lee McLoughlin and Maarten Hofman, for the on the ground support and use of their facilities. Wil Maheia kindly opened his arms to us with his greatly appreciated support allowing us to use his cabin and office at the count-site and any support we needed, including airing our work on PGTV. Lee Jones, author of Birds of Belize, inspired this count with his initial migration studies in Belize starting in the late 1990's and his discovery of this Hook-billed Kite migration. Lee also supplied us with his knowledge and support. Allen Fish and the Golden Gate Raptor Observatory kindly allowed us to use their Hawkwatch Manual as a template for our manual. We would like to thank our two interns, Maria Goller and Karlee Buckles, Belcampo Lodge and Emmanuel Chan, Fredy Pineda, and Lee Jones for their assistance during the count. Thanks to Marta Curti for her edits on earlier versions and Jan Meerman for supplying a rainfall map of Belize. Thanks to all the schools that made a visit to the count-site to educate their children on raptor research and conservation. We encourage you to make it an annual visit. To all of our donors, this project would not have been possible without your financial support; we greatly appreciate your continued support for raptor research and conservation. We thank the support of the Idea Wild who supported our Solitary Eagle Project, in which binoculars and field equipment were used during this project from that grant. We would like to acknowledge the following people that donated specifically to the construction of an observation tower, which is planned to be built in 2014: Gregory and Jean Myers, James Robenolt and Mary Minnows, Beverly Sloane, Nandu and Neela Srinivasan, and Marina and Jay Zucca. Thanks to everyone that visited the count-site. We hope to see you again in 2014.

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FIGURES

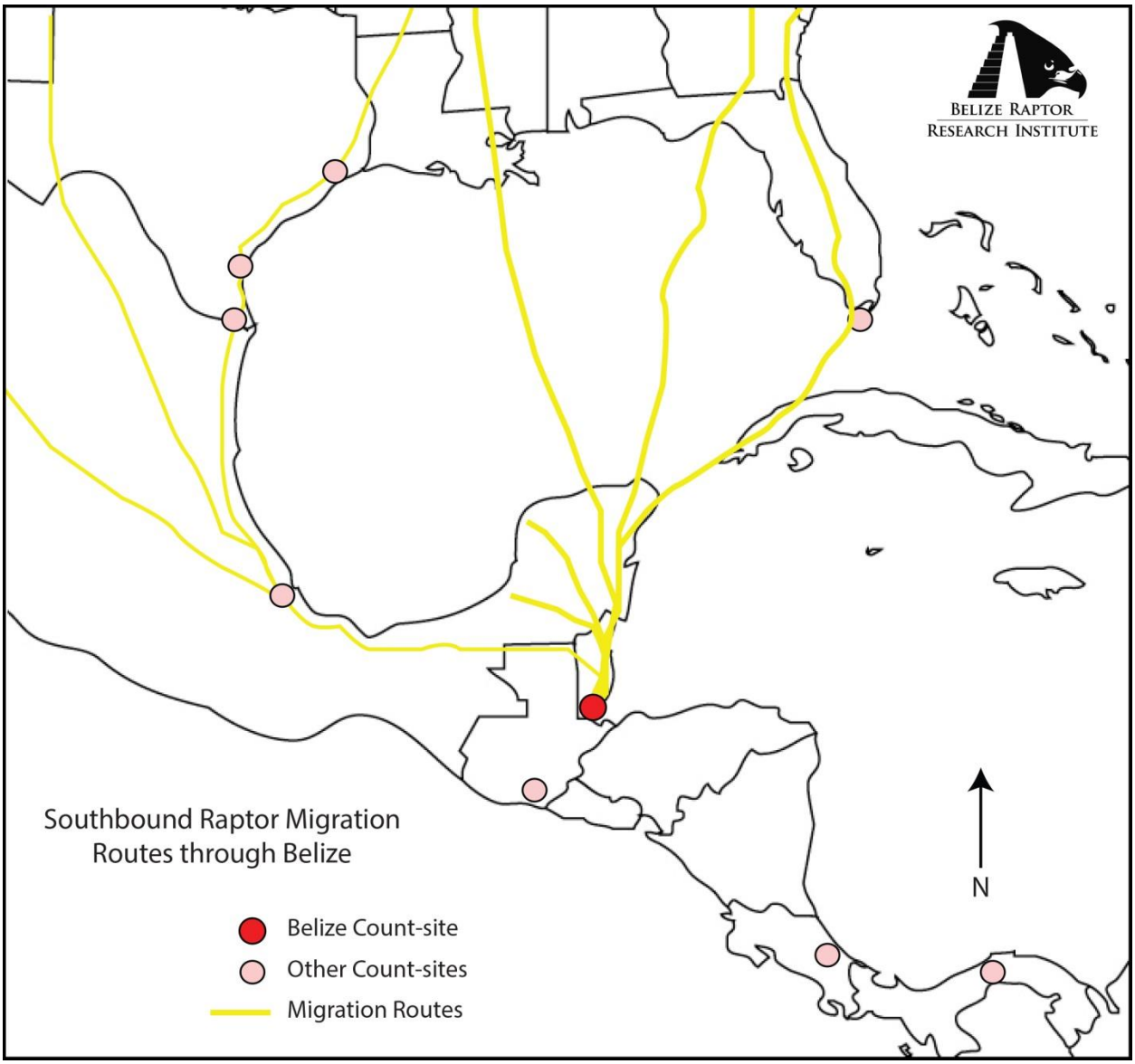

FIGURE 1. SOUTHBOUND RAPTOR MIGRATION ROUTES THROUGH BELIZE AND COUNT-SITE LOCATION IN RELATIONSHIP TO OTHER HAWKWATCH SITES.

FIGURE 2. BELIZE COASTLINE NORTH OF PUNTA GORDA, WHICH MIGRANTS USE AS A LEADING LINE ON THEIR SOUTHBOUND MIGRATION ROUTE.

FIGURE 3A. CATTLE LANDING COUNT-SITE (RED CIRCLE), NORTH OF PUNTA GORDA.

FIGURE 3B. COUNT-SITE IN CATTLE LANDING ON THE SOCCER FIELD: EAST VIEW.

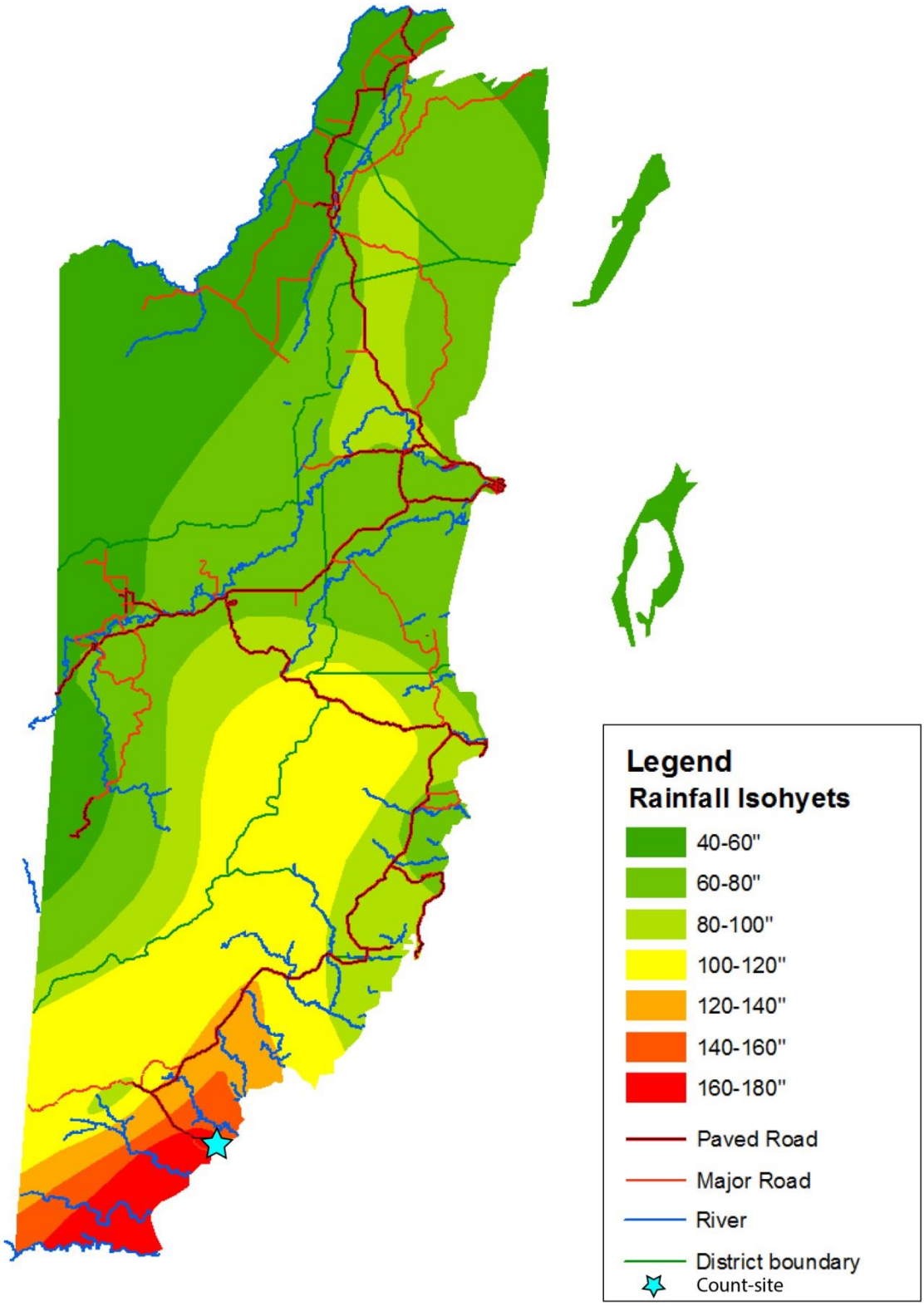

FIGURE 4. RAINFALL DISTRIBUTION IN BELIZE IN RELATIONSHIP TO THE COUNT-SITE. MAP PRODUCED AND PROVIDED BY JAN MEERMAN.

FIGURE 5A. NORTH VIEW FROM COUNT-SITE.

FIGURE 5B. WEST VIEW FROM COUNT-SITE.

FIGURE 5C. SOUTH VIEW FROM COUNT-SITE, PUNTA GORDA IN THE BACKGROUND.

FIGURE 5D. EAST VIEW FROM COUNT-SITE, CARIBBEAN SEA.

BELIZE RAPTOR RESEARCH INSTITUTE

Belize Raptorwatch Daily Form

Date _____

Count Leader _____

Count Team _____

TIME	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3			Comments
Wind Speed											
Wind Dir. (From)											
Temp. (Deg. C)											
Humidity											
Bar. Pressure											
Cloud Cover											
Visibility											
Precipitation											
Flight Direction											
Height of Flight									Total		
No. of Observers											
No. of visitors											
Dur. of Obs. (min)											
Turkey Vulture										TV	
Black Vulture										BV	
King Vulture										KV	
Osprey										OS	
Gray-headed Kite										GK	
Hook-billed Kite										HK	
Swallow-tailed Kite										SK	
White-tailed Kite										WK	
Snail Kite										SK	
Double-toothed Kite										DK	
Mississippi Kite										MK	
Plumbeous Kite										PK	
Northern Harrier										NH	
Sharp-shinned										SS	
Cooper's Hawk										CH	
White Hawk										WH	
Gray Hawk										GH	
Common Black-Hawk										CB	
Roadside Hawk										RH	
Broad-winged										BW	
Short-tailed Hawk										SH	
Swainson's Hawk										SW	
White-tailed Hawk										WT	
Zone-tailed Hawk										ZT	
Red-tailed Hawk										RT	
Laughing Falcon										LF	
American Kestrel										AK	
Merlin										ML	
Aplomado Falcon										AF	
Peregrine Falcon										PF	
Unid. Vulture										UV	
Unid. Accipiter										UA	
Unid. Buteo										UB	
Unid. Eagle										UE	
Unid. Falcon										UF	
Unid. Raptor										UU	
Other (From Back)										OO	
TOTAL										TH	

FIGURE 6A. DAILY COUNT DATA SHEET.

Belize Raptorwatch: Age, Sex, Morph Structure Form

Date: Location: Observers:

Species	AGE			SEX			MORPH				Total
	Juvenile	Immature	Adult	Male	Female	Unknown	Light	Int.	Dark	N/A	Ind.
L. Y.-head Vulture											
Turkey Vulture											
Black Vulture											
King Vulture											
Osprey											
Gray-headed Kite											
Hook-billed Kite											
Swallow-tailed Kite											
White-tailed Kite											
Snail Kite											
Double-toothed Kite											
Mississippi Kite											
Plumbeous Kite											
Black-collared Hawk											
Northern Harrier											
Sharp-shinned Hawk											
Cooper's Hawk											
Bicolored Hawk											
Crane Hawk											
White Hawk											
Gray Hawk											
Common Black-Hawk											
Roadside Hawk											
Broad-winged Hawk											
Short-tailed Hawk											
Swainson's Hawk											
White-tailed Hawk											
Zone-tailed Hawk											
Red-tailed Hawk											
B&W Hawk-Eagle											
Black Hawk-Eagle											
Ornate Hawk-Eagle											
Barred Forest-Falcon											
Collared Forest-Falcon											
Crested Caracara											
American Kestrel											
Merlin											
Aplomado Falcon											
Peregrine Falcon											
Total											

FIGURE 6B. DAILY COUNT DATA SHEET ON AGE, SEX, AND MORPH.

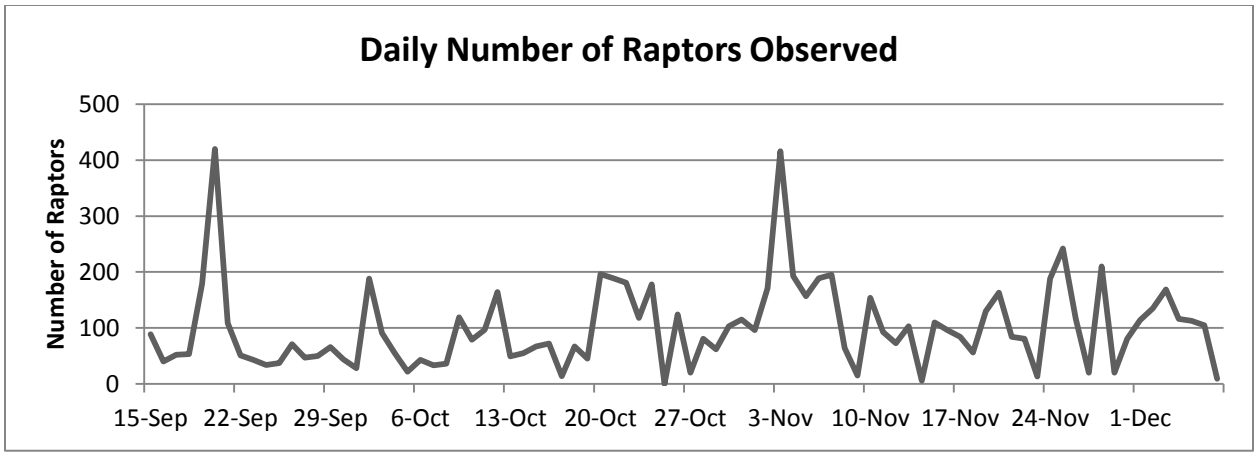

FIGURE 7. TOTAL NUMBER OF ALL RAPTORS (INCLUDING NON-MIGRANTS) OBSERVED DAILY OVER THE COUNT PERIOD.

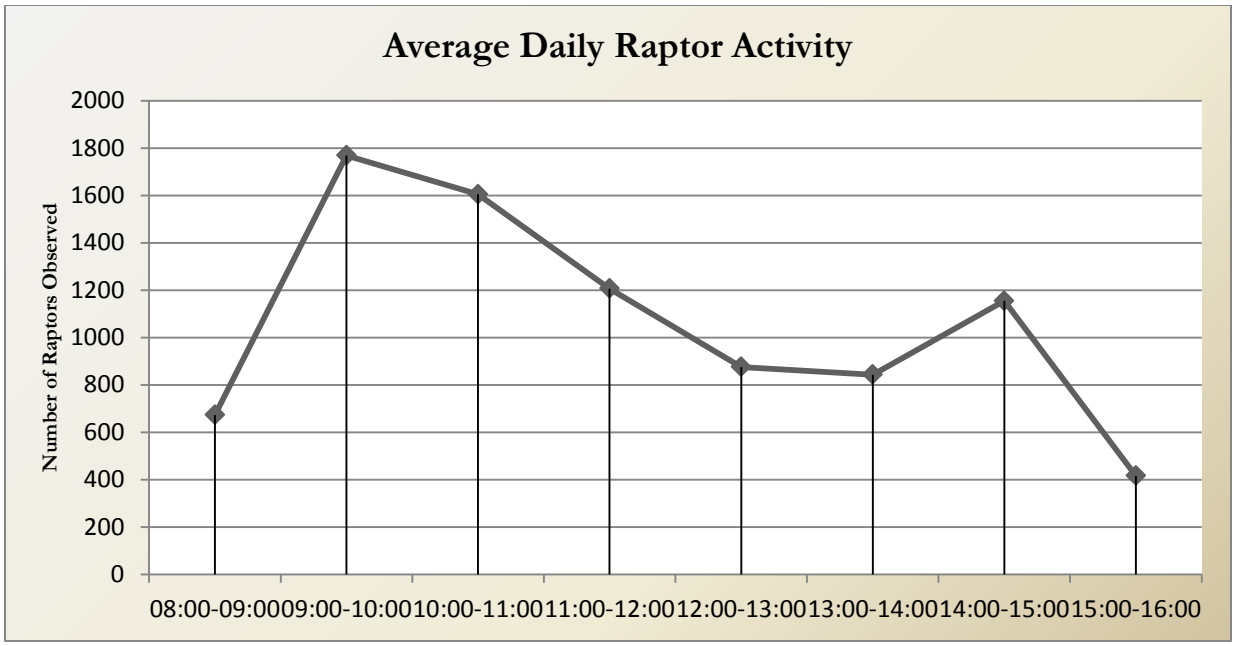

FIGURE 8. AVERAGE DAILY RAPTOR ACTIVITY FOR ALL SPECIES OBSERVED.

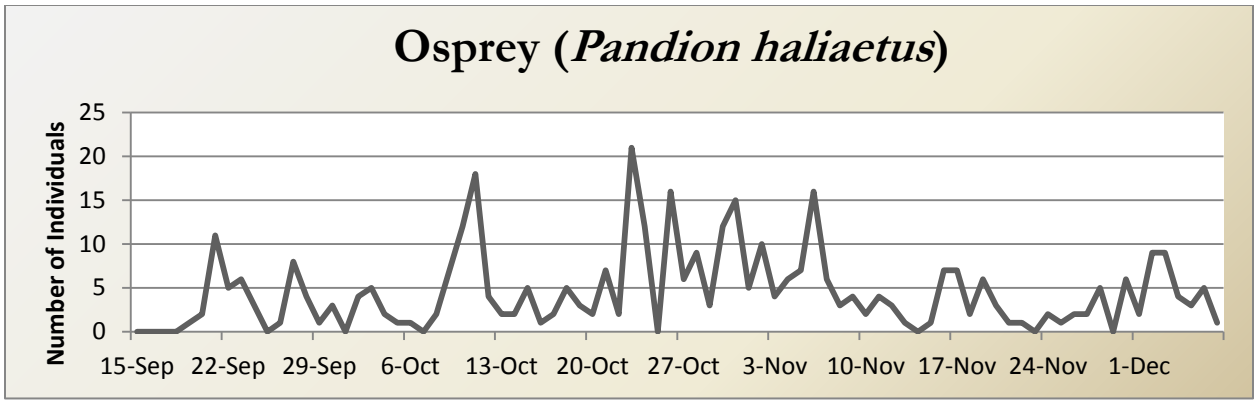

FIGURE 9. TIMING AND ABUNDANCE OF OSPREYS.

FIGURE 10. AN ADULT OSPREY MIGRATING SOUTHWEST OVER THE COUNT-SITE.

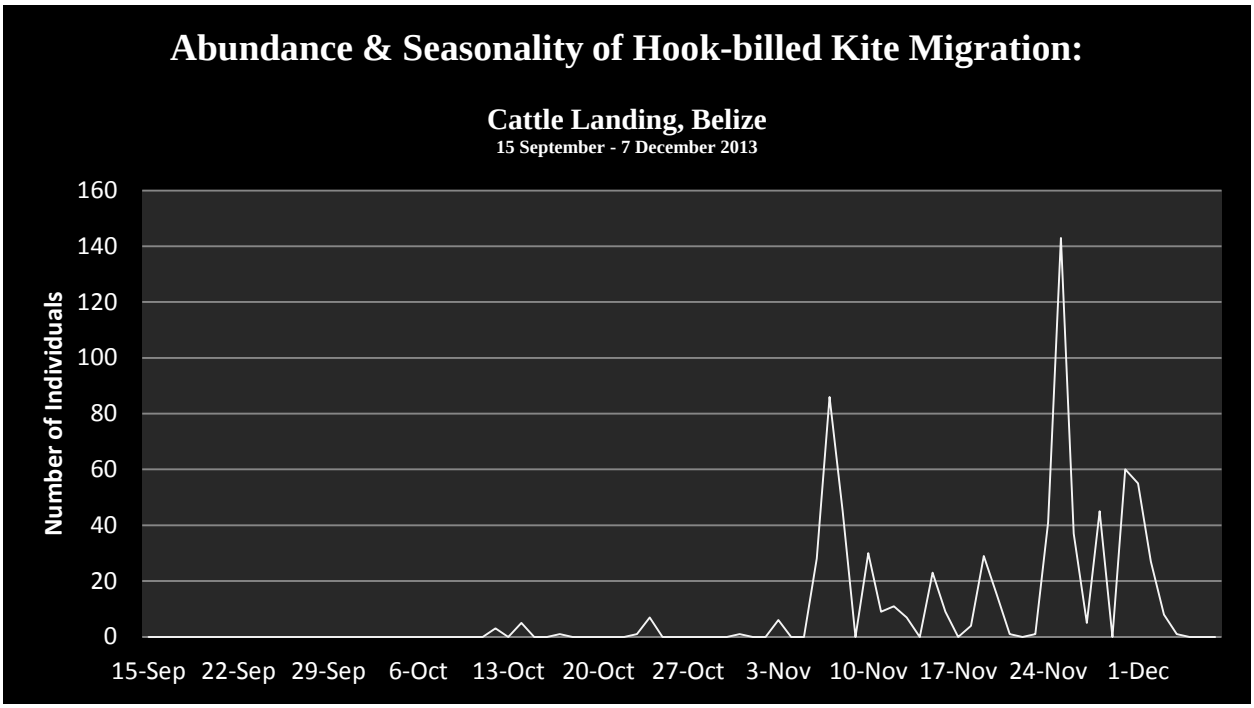

FIGURE 11. ABUNDANCE AND TIMING OF MIGRATING HOOK-BILLED KITES.

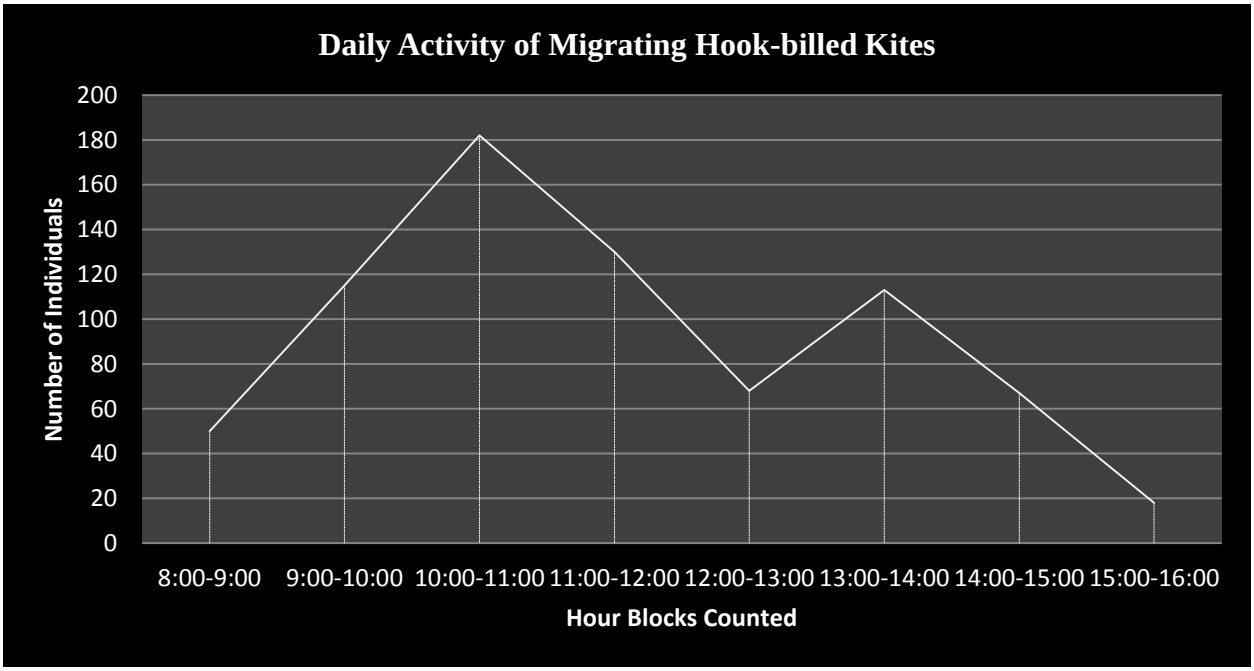

FIGURE 12. DAILY ACTIVITY OF MIGRATING HOOK-BILLED KITES.

FIGURE 13A. AN ADULT FEMALE HOOK-BILLED KITE MIGRATING.

FIGURE 13B. A JUVENILE (PREFORMATIVE) FEMALE HOOK-BILLED KITE MIGRATING SOUTH.

FIGURE 14A. A MIGRATING KETTLE OF HOOK-BILLED KITES.

FIGURE 14B. A MIGRATING KETTLE OF HOOK-BILLED KITES.

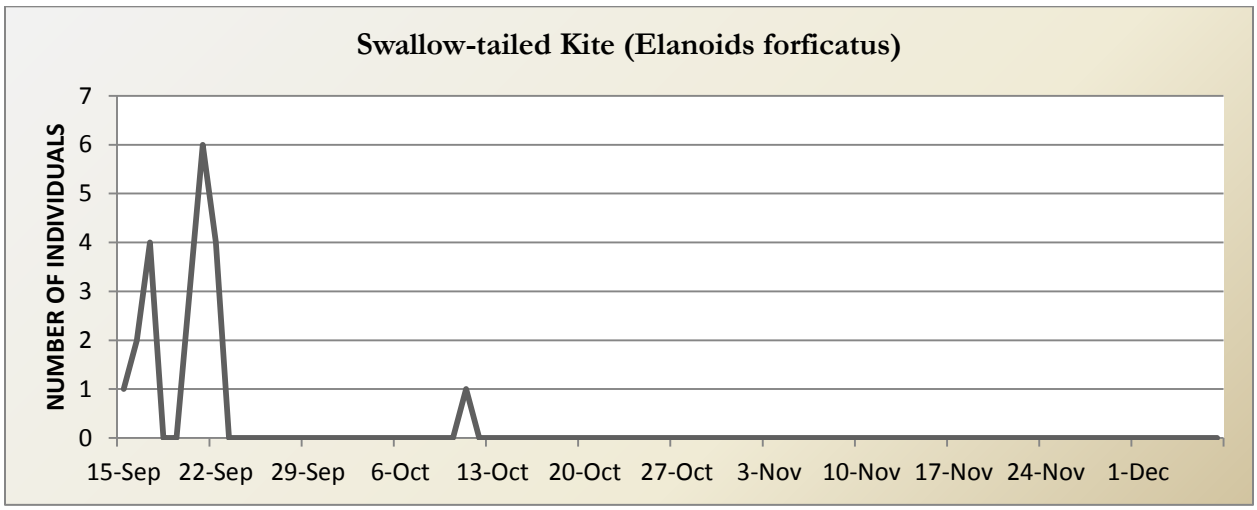

FIGURE 15. TIMING AND ABUNDANCE OF SWALLOW-TAILED KITES.

FIGURE 16. THE LATEST RECORDED SWALLOW-TAILED KITE FOR BELIZE OBSERVED ON 11 OCOTBER 2013. THE SHORTER TAIL SUGGESTS JUVENILE.

FIGURE 17. ADULT MALE SNAIL KITE PASSING OVER THE COUNT-SITE ON 11 OCTOBER.

FIGURE 18A. KETTLE OF MISSISSIPPI KITES.

FIGURE 18B. A STREAM OF MISSISSIPPI KITES MIGRATING SOUTH.

FIGURE 19. LARGEST RECORDED MISSISSIPPI KITE FLOCK FOR BELIZE ON 20 SEPTEMBER 2013.

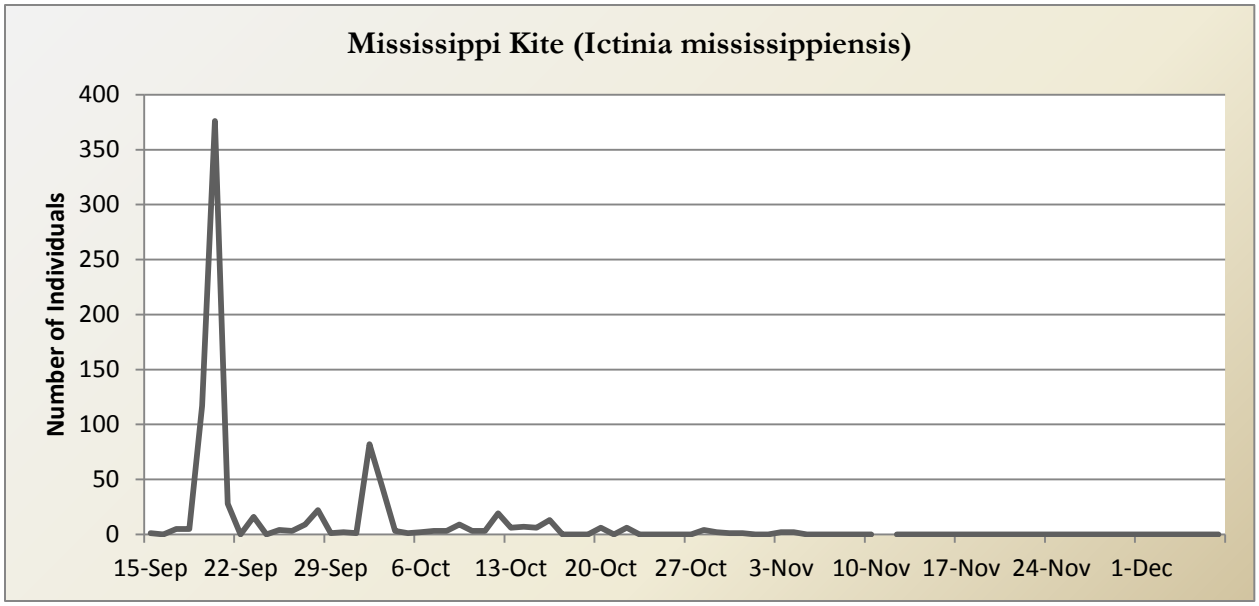

FIGURE 20. TIMING AND ABUNDANCE OF MISSISSIPPI KITES.

FIGURE 21. A JUVENILE MISSISSIPPI KITE MIGRATING SOUTH.

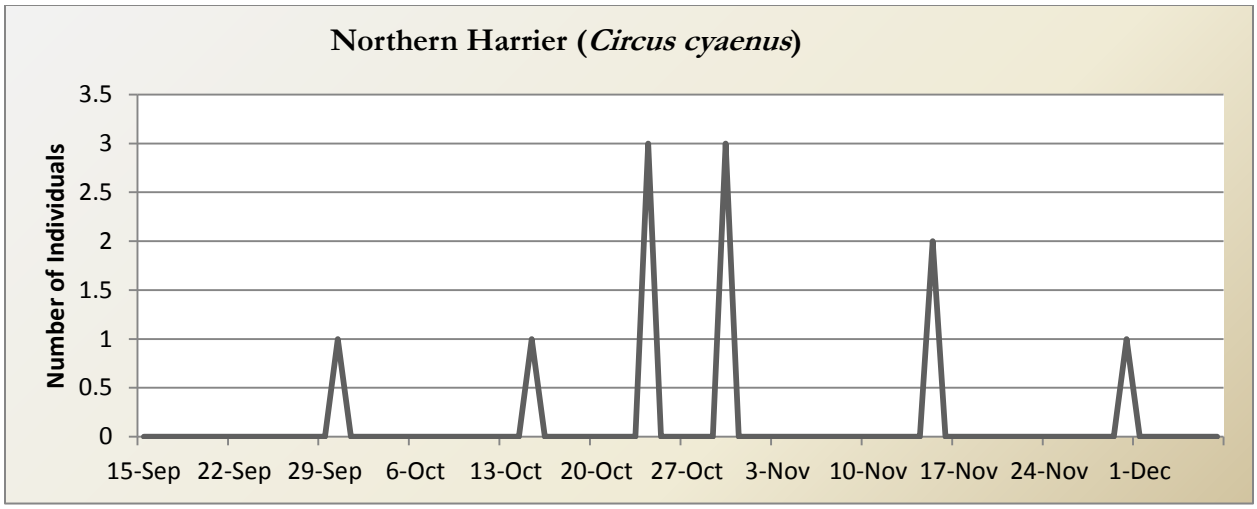

FIGURE 22. TIMING AND ABUNDANCE OF NORTHERN HARRIERS.

FIGURE 23. A JUVENILE NORTHERN HARRIER MIGRATING SOUTH.

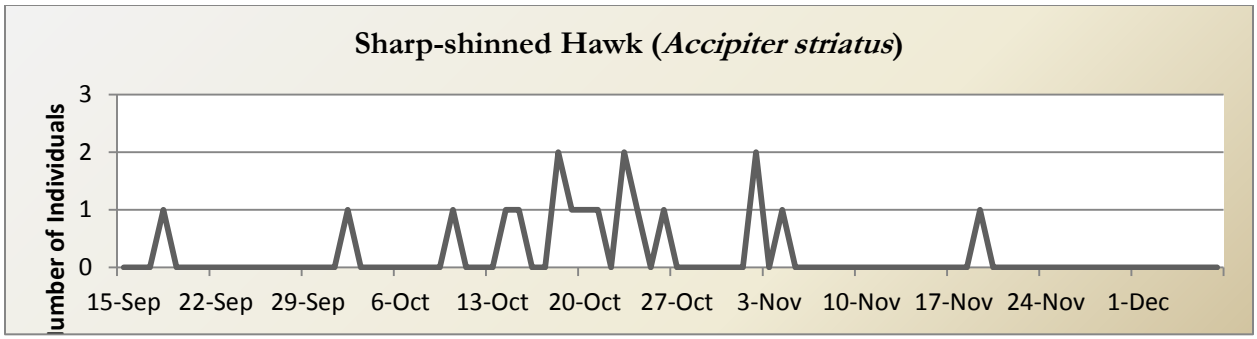

FIGURE 24. TIMING AND ABUNDANCE OF SHARP-SHINNED HAWKS.

FIGURE 25. A JUVENILE SHARP-SHINNED HAWK MIGRATING SOUTH ON 23 OCTOBER.

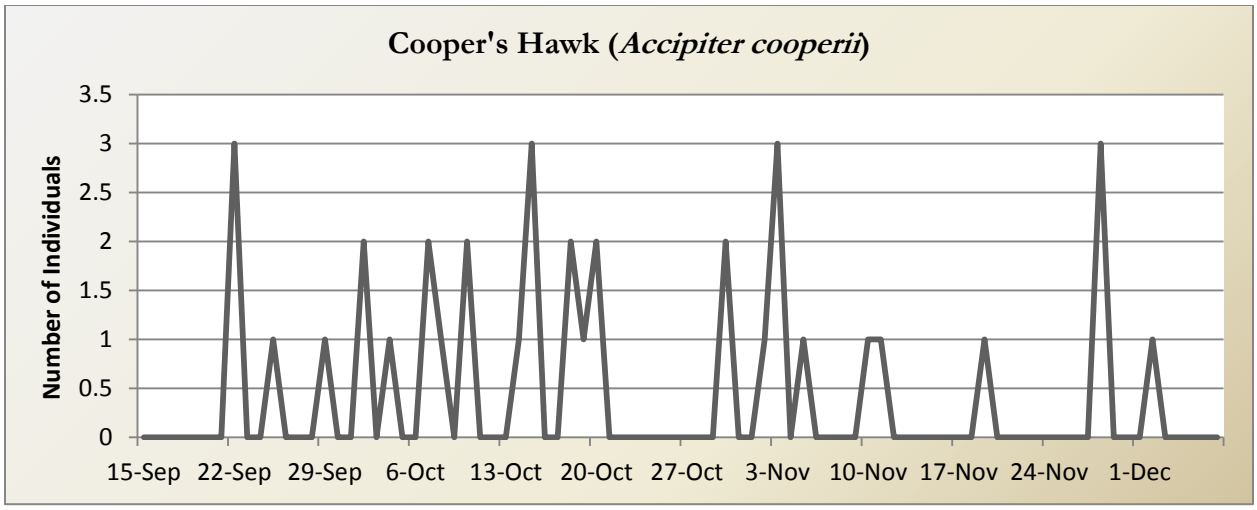

FIGURE 26. TIMING AND ABUNDANCE OF COOPER'S HAWKS.

FIGURE 27. A JUVENILE COMMON BLACK-HAWK FREQUENTLY OBSERVED.

FIGURE 28. AN ADULT COMMON BLACK-HAWK. COMMON AT THE COUNT-SITE.

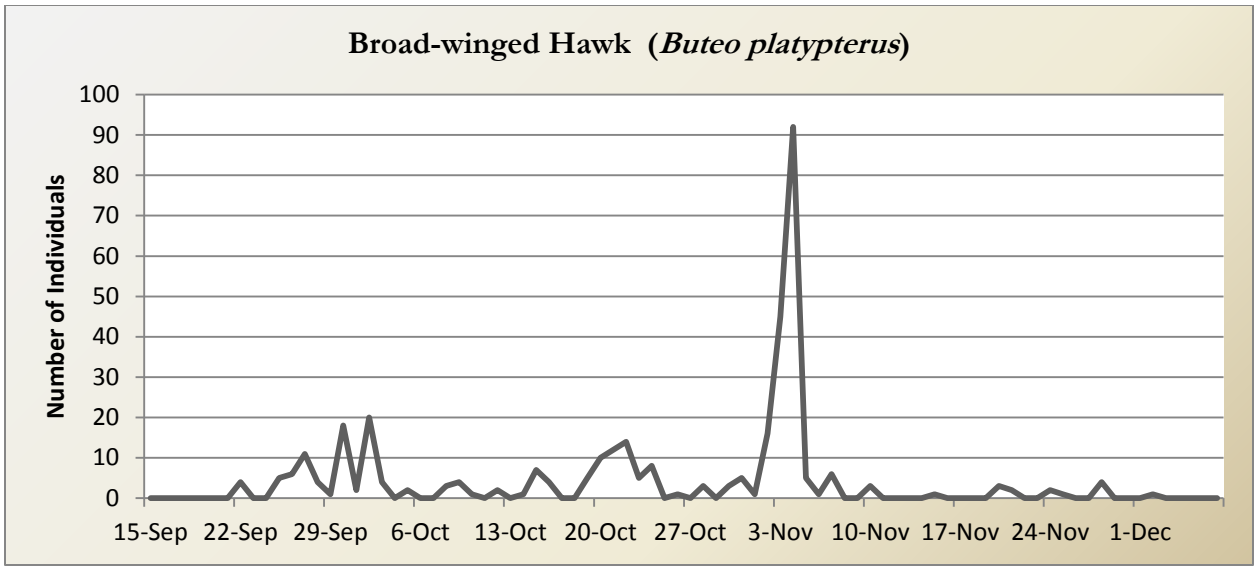

FIGURE 29. TIMING AND ABUNDANCE OF BROAD-WINGED HAWKS.

FIGURE 30. THREE BROAD-WINGED HAWKS MIGRATING SOUTHWEST.

FIGURE 31. A JUVENILE ZONE-TAILED HAWK MIGRATING SOUTH OVER THE COUNT-SITE.

FIGURE 32. AN EXCEPTIONALLY RARE JUVENILE ORANGE-BREASTED FALCON PERCHED AT THE COUNT-SITE.

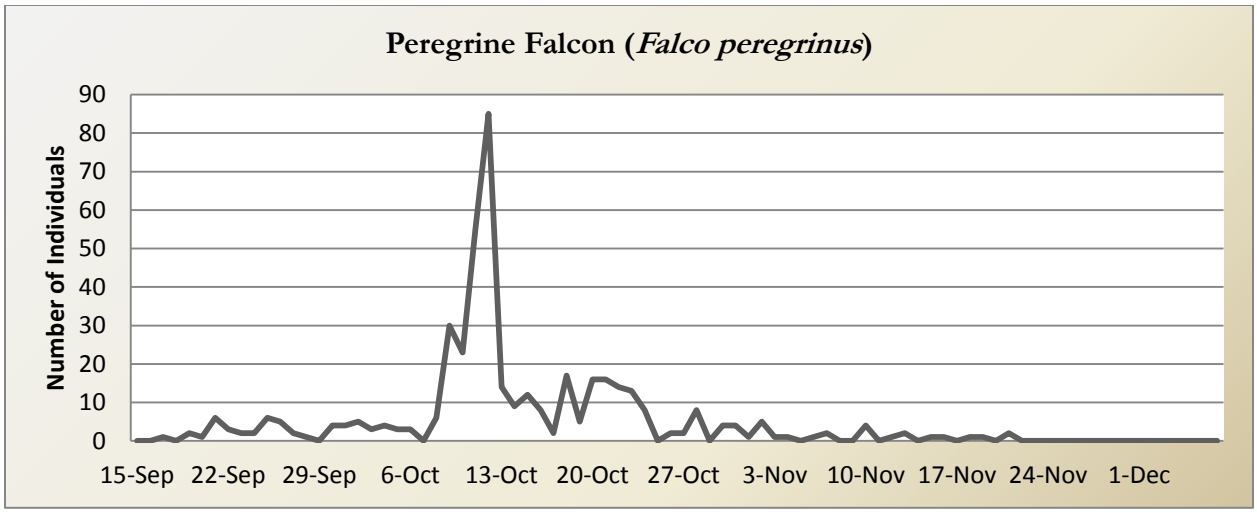

FIGURE 33. TIMING AND ABUNDANCE OF PEREGRINE FALCONS.

FIGURE 34. AN ADULT PEREGRINE FALCON OF THE *F. P. TUNDRIUS* SUBSPECIES.

FIGURE 35. PROJECT COORDINATOR, VICTOR BONILLA, INSPIRING THE YOUNGER GENERATION TO CONSERVE THEIR RAPTORS AND ENVIROMENT.

FIGURE 36. PROJECT COUNT LEADER AND DATA COMPILER, LIBERATO POP, EDUCATING THE CHILDREN OF CATTLE LANDING ABOUT RAPTORS.

FIGURE 37. OVER 50 COMMUNITY MEMBERS VISITED THE COUNT-SITE ON THE COMMENCMENT DAY.

FIGURE 38. A VISIT BY THE SAN MIGUEL SCOUT UNIT LED BY WIL MAHEIA.

FIGURE 39. A LOCAL SCHOOL GROUP VISITING THE COUNT-SITE AND ENJOYING USING THE SPOTTING SCOPE.

FIGURE 40. LOCAL SCHOOL CHILDREN COUNTING RAPTORS.

TABLES

TABLE 1. TOTAL SIGHTINGS AND MEAN DAILY SIGHTINGS FOR ALL SPECIES DURING 2013.

SPECIES	SIGHTINGS PER SEASON	MEAN PER DAY
Black Vulture	3,617	45.04
Turkey Vulture	853	10.62
Lesser Yellow-headed Vulture	48	0.60
King Vulture	106	1.32
Osprey	376	4.68
Gray-headed Kite	2	0.02
Hook-billed Kite	744	9.27
Swallow-tailed Kite	21	0.26
White-tailed Kite	5	0.06
Snail Kite	2	0.02
Mississippi Kite	817	10.17
Northern Harrier	11	0.14
Sharp-shinned Hawk	18	0.22
Cooper's Hawk	36	0.45
Common Black-Hawk	318	3.96
Great Black-Hawk	2	0.02
Roadside Hawk	8	0.10
Broad-winged Hawk	348	4.33
Gray Hawk	21	0.26
Short-tailed Hawk	263	3.28
Swainson's Hawk	6	0.07
Zone-tailed Hawk	11	0.14
Red-tailed Hawk	2	0.02
Black Hawk-Eagle	6	0.07
Ornate Hawk-Eagle	1	0.01
Crested Caracara	1	0.01
Laughing Falcon	3	0.04
American Kestrel	11	0.14
Merlin	23	0.29
Bat Falcon	5	0.06
Orange-breasted Falcon	1	0.01
Peregrine Falcon	434	5.40

TABLE 2. COUNT TOTALS, PERCENTAGES, PASSAGE DATES, AND SINGLE DAY HIGH COUNT AND DATE FOR MIGRATORY SPECIES.

Species	*total*	*% of all migrants*	*passage dates*	*single day high*	*single day high date*
Mississippi Kite *Ictinia mississippiensis*	817	28.6	15 Sep - 4 Nov	376	20 Sep
Hook-billed Kite *Chondrohierax uncinatus*	744	26.0	12 Oct - 4 Dec	143	25 Nov
Peregrine Falcon *Falco peregrinus*	434	15.2	17 Sep - 21 Nov	85	12 Oct
Osprey *Pandion haliaetus*	376	13.2	19 Sep - 7 Dec	21	23 Oct
Broad-winged Hawk *Buteo platypterus*	348	12.2	22 Sep - 2 Dec	92	4 Nov
Cooper's Hawk *Accipiter cooperii*	36	1.3	22 Sep - 2 Dec	3	*
Merlin *Falco columbarius*	23	<1.0	24 Sep - 2 Dec	5/4	2 Dec/30Oct
Swallow-tailed Kite *Elanoides forficatus*	21	<1.0	15 Sep - 11 Oct	6	21 Sep
Sharp-shinned Hawk *Accipiter striatus*	18	<1.0	18 Sep - 19 Nov	2	**
American Kestrel *Falco sparverius*	11	<1.0	15 Oct - 6 Nov	3	15 Oct
Zone-tailed Hawk *Buteo albonotatus*	11	<1.0	22 Sep - 15 Nov	4	18 Oct
Northern Harrier *Circus cyaenus*	11	<1.0	30 Sep - 30 Nov	3	24 & 30 Oct
Swainson's Hawk *Buteo swainsoni*	6	<1.0	28 Sep - 8 Oct	3	28 Sep
Red-tailed Hawk *Buteo jamaicensis*	2	<1.0	15 Oct - 28 Nov	1	15 Oct/28 Nov
Total	2,858				

*Multiple dates: 22 Sep; 15 Oct; and 3 & 28 Nov
**Multiple dates: 18 Oct; 23 Oct; and 2 Nov

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