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## Raptor Migration at Concepción, Bolivia

Matias A. Juhant<sup>1,2</sup>

**ABSTRACT.**—I conducted the second austral autumn raptor count at Concepción Watch Site in the eastern Bolivian lowlands to document species composition, timing, and abundance of migrating raptors between 10 March and 6 April 2009. I counted migrants for 26 days (134.5 hrs) recording 6,979 migrating raptors of 16 species. Mississippi Kites (*Ictinia mississippiensis*) comprised 80% ( $n = 5,571$ ), Black Vultures 11% (*Coragyps atratus*,  $n = 747$ ), and Snail Kites 5% (*Rostrhamus sociabilis*,  $n = 396$ ). The remaining 4% ( $n = 265$ ) included 13 species and other unidentified raptors. I also recorded non-raptor species on migration from the lookout, including 36 Maguari Storks (*Ciconia maguari*), a flock of 11 Anhinga (*Anhinga anhinga*), and thousands of Barn Swallows (*Hirunda rustica*). My observations confirm previous records suggesting a significant raptor migration occurs at the Concepción Watch Site in the austral autumn. Raptor monitoring should continue at Concepción annually and the site used to promote raptor conservation and awareness in Bolivia. Received 12 December 2011. Accepted 16 April 2012.

Raptor migration in South America is largely undescribed with few published papers using standardized migration monitoring protocols. This topic is understudied, but of international concern (Juhant 2011). Thirty-five raptor migration watch sites have been recognized in South America of which eight are in Bolivia (Juhant 2011). Concepción Watch Site in the eastern Bolivia lowlands was previously identified for conducting long-term studies of raptor migration in both austral spring and autumn (Davis 1989; Zalles and Bildstein 2000; Olivo 2001, 2005, 2007a, b).

The first studies of raptor migration at Concepción Watch Site began in the mid 1980s when several thousand Mississippi and Plumbeous kites (*Ictinia mississippiensis*, *I. plumbea*) were counted in two consecutive austral springs (Davis 1989). Olivo (2001) conducted the first systematic raptor migration count at Concepción Watch Site in 2000 counting >40,000 raptors during late

October. These included >37,000 Mississippi Kites (Olivo 2001). Subsequent austral spring counts in 2001 and 2003 recorded >120,000 and >150,000 raptors, respectively, between late-September and late-November (Olivo 2005, 2007a, b). The Mississippi Kite was the most common species in both seasons with >115,000 and >145,000 kites recorded (Olivo 2004, 2007b). The first and only study of raptor migration during austral autumn was conducted in March 2003 and recorded 5,000 raptors (Olivo 2007a, b). These included ~4,000 Mississippi Kites (Olivo 2007b). These studies reveal a large number of soaring raptors have been recorded at Concepción, but migration patterns at the site are not well understood (Olivo 2004).

I documented species composition, timing, and abundance of migrating raptors at Concepción Watch Site, Bolivia during austral autumn 2009 using standardized migration monitoring techniques.

### METHODS

**Study Area.**—Concepción town (16° 08' S, 62° 02' W), Ñuflo de Chávez Province, Santa Cruz Department, Bolivia is 270 km (by road) northeast of Santa Cruz de la Sierra. Concepción Watch Site is 2 km southwest of the town center in the gated community, *Guantánamo*. The lookout is on a pier at the foot of Sapocó Lake created by a dam and has a view of 360 degrees. Floristically, the vegetation of the area contains elements of evergreen tropical rainforest of the Amazon Basin and subtropical thorn-scrub of the Gran Chaco (Davis 1993). The region has dry (May–Oct) and wet seasons (Nov–Apr) with rainfall exceeding 1,100 mm, and an average temperature of 24.5 °C (Davis 1993).

**Sampling.**—I counted migrating raptors at the Concepción Watch Site during austral autumn 2009. The count was conducted over 26 days (134.5 hrs) in March and April: 21 days in March (10–12, 14–31; 113 hrs) and 5 days in April (2–6; 21.5 hrs). I counted 6 hrs per day (0900–1500 hrs). The count was during the wet season, and 66% (88 hrs) of the count days were overcast, 26% (35 hrs) were sunny, and 8% (11.5 hrs) were

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TABLE 1. Raptor counts by species at Concepción Watch Site, Bolivia during austral autumn 2009 (10 Mar–6 Apr).

Species	Total	Migration peak		Largest flock	
		Count	Date	Size	Date
Black Vulture <i>Coragyps atratus</i> <sup>c</sup>	747	104	14 Mar	40	14 Mar
Turkey Vulture <i>Cathartes aura</i> <sup>c</sup>	26	6	17 Mar	4	5 Apr
King Vulture <i>Sarcoramphus papa</i> <sup>b</sup>	30	13	17 Mar	12	17 Mar
Western Osprey <i>Pandion haliaetus</i> <sup>a</sup>	5	2	17 Mar		
Hook-billed Kite <i>Chondrohierax uncinatus</i> <sup>b</sup>	2	2	25 Mar		
Snail Kite <i>Rostrhamus sociabilis</i> <sup>c</sup>	396	130	23 Mar	80	20 Mar
Rufous-thighed Kite <i>Harpagus diodon</i> <sup>b</sup>	12	6	2 Apr		
Mississippi Kite <i>Ictinia mississippiensis</i> <sup>a</sup>	5,571	2,507	29 Mar	2,000	29 Mar
Long-winged Harrier <i>Circus buffoni</i> <sup>c</sup>	1	1	19 Mar		
Rufous-thighed Hawk <i>Accipiter erythronemius</i> <sup>c</sup>	12	7	15 Mar		
Great Black Hawk <i>Buteogallus urubitinga</i> <sup>c</sup>	2	1	14 Mar		
Savanna Hawk <i>B. meridionalis</i> <sup>c</sup>	1	1	27 Mar		
Swainson's Hawk <i>Buteo swainsoni</i> <sup>a</sup>	4	2	29 Mar		
White-tailed Hawk <i>B. albicaudatus</i> <sup>c</sup>	1	1	29 Mar		
Yellow-headed Caracara <i>Milvago chimachima</i> <sup>c</sup>	2	1	11 Mar		
Southern Crested Caracara <i>Caracara plancus</i> <sup>c</sup>	14	5	28 Mar		
Unidentified	153				
Totals	6,979				

<sup>a</sup> Nearctic–Neotropic migrant.

<sup>b</sup> Neotropic–Intra-tropical migrant.

<sup>c</sup> Unknown migrant.

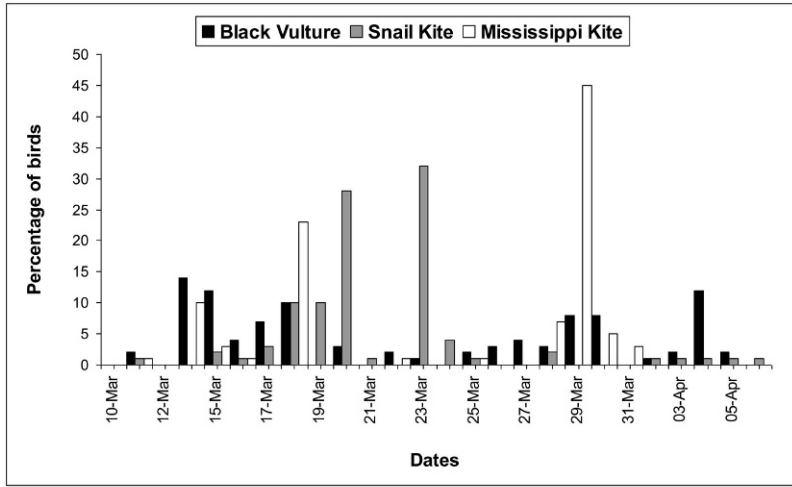
rainy. I identified all migrating raptors at the count site using Swarovski 10 × 50 binoculars. I scanned the southern sky in a 180 degrees arc, from east to west, to locate migrants. Raptors were considered migrating if they appeared on the horizon and flew north past the watch site using powered or soaring flight. Black Vulture (*Coragyps atratus*), Turkey Vulture (*Cathartes aura*), and Snail Kites (*Rostrhamus sociabilis*) are common in the study area, and I identified these species as migrants only if they passed the lookout from the south using unidirectional flight and flying high. Data were collected hourly using the standardized daily report protocol of Hawk Migration Association of North America (Dunne et al. 1986). I selected days with consistent high numbers of birds counted to document migration timing. Wind speed and ambient temperature were recorded using a Kestrel 2000 Pocket Weather Station (Nielsen Kellerman, Chester, PA, USA).

**Raptor Identification.**—The following field marks were used to identify species of raptors: underwing and upperwing color patterns, flight silhouette, and position of the wings in different flying modes. I consulted raptor field guides (Clark and Wheeler 2001, Ferguson-Lees and Christie 2001) as needed.

## RESULTS

**Raptor Counts.**—I counted 6,979 migrating raptors of 16 species at Concepción Watch Site (Table 1). The Mississippi Kite was the most common species representing 80% ( $n = 5,571$ ) of the individuals counted, followed by Black Vulture with 11% ( $n = 747$ ), and Snail Kite with 5% ( $n = 396$ ). Unidentified raptors accounted for 2% ( $n = 153$ ). The remaining 2% ( $n = 112$ ) were: Turkey Vulture ( $n = 26$ ), King Vulture (*Sarcoramphus papa*,  $n = 30$ ), Western Osprey (*Pandion haliaetus*,  $n = 5$ ), Hook-billed Kite (*Chondrohierax uncinatus*,  $n = 2$ ), Rufous-thighed Kite (*Harpagus diodon*,  $n = 12$ ), Long-winged Harrier (*Circus buffoni*,  $n = 1$ ), Rufous-thighed Hawk (*Accipiter erythronemius*,  $n = 12$ ), Great Black Hawk (*Buteogallus urubitinga*,  $n = 2$ ), Savanna Hawk (*B. meridionalis*,  $n = 1$ ), Swainson's Hawk (*Buteo swainsoni*,  $n = 4$ ), White-tailed Hawk (*B. albicaudatus*,  $n = 1$ ), Yellow-headed Caracara (*Milvago chimachima*,  $n = 2$ ), and Southern Crested Caracara (*Caracara plancus*,  $n = 14$ ) (Table 1). I also recorded migrating non-raptor species from the lookout, including 36 Maguari Storks (*Ciconia maguari*), and a flock of 11 Anhinga (*Anhinga anhinga*). I also recorded thousands of Barn Swallows (*Hirundo rustica*)

(A)



(B)

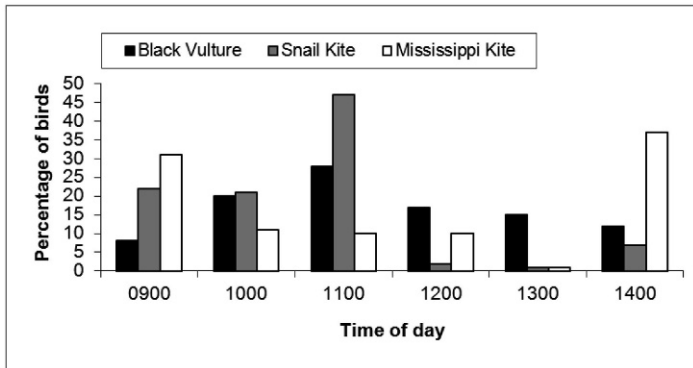


FIG. 1. (A). Daily percentage of Black Vultures, Snail Kites, and Mississippi Kites counted at Concepción Watch Site, Bolivia during austral autumn 2009 (10 Mar–6 Apr). (B). Pattern of Black Vulture, Snail Kite, and Mississippi Kite migration through the day (percentage of observed/hr) at Concepción Watch Site, Bolivia during austral autumn 2009 (10 Mar–6 Apr).

which peaked during the last week of March with only a few passing in early April.

Raptors were observed flying mostly in two directions in migration, 47% ( $n = 3,300$ ) of individuals migrated on the south-to-north axis, 43% ( $n = 3,010$ ) on the southeast-to-northwest axis with only a small fraction 10% ( $n = 699$ ) flying in other directions. Count days exceeded 500 raptors on 14, 18, and 29 March; the counts were 665, 1,527, and 2,575 raptors, respectively.

*Migration Timing.*—Black Vulture ( $n = 747$ ) migration exhibited two peaks in passage, one between 14 and 18 March when 47% of migrants ( $n = 349$ ) were observed, and another between 29

March and 4 April when 31% ( $n = 232$ ) were observed (Fig. 1A). Most Black Vultures (56%,  $n = 418$ ) migrated past between 0900 and 1200 hrs (Fig. 1B).

The Snail Kite ( $n = 396$ ) migration peaked between 15 and 25 March when 92% ( $n = 364$ ) of the individuals were counted (Fig. 1A). Most Snail Kites (90%,  $n = 356$ ) migrated past between 0900 and 1200 hrs (Fig. 1B).

The Mississippi Kite ( $n = 5,571$ ) migration exhibited two peaks in passage rate, one on 18 March when 23% of migrants ( $n = 1,296$ ) were observed, and another on 29 March when 45% ( $n = 2,507$ ) were observed (Fig. 1A). Mississippi

Kites had a bi-modal distribution in time of passage with 31% ( $n = 1,747$ ) flying by between 0900 and 1000 hrs and 37% ( $n = 2,080$ ) between 1400 and 1500 hrs (Fig. 1B).

#### DISCUSSION

My observations, together with those of Olivo (2001, 2004, 2005, 2007a, b), demonstrate that significant movements of soaring raptors occur at Concepción, where 23 migratory species converge during both austral autumn and spring. These studies show a continentally important migration site exists, but migration timing and number of migrants recorded at Concepción are not well understood, especially during autumn. Concepción ranks as one of the top areas to study seasonal timing and abundance of migrating raptors in the southern cone of South America (Juhant 2011).

The three species of vultures recorded at Concepción are considered sedentary in the southern part of their distribution (Ferguson-Lees and Christie 2001). However, these species were previously counted on migration at the site by Olivo (2001, 2005, 2007a). The Black Vulture is the most common vulture recorded with an average of 810 birds counted in autumn (Olivo 2007a, this study), and 895 birds in spring (Olivo 2005, 2007a). Satellite data of breeding Black Vultures from the Argentine Pampas reveals they migrate short-distances within the country ([www.vulturemovements.org/hms/hms\\_tv.htm](http://www.vulturemovements.org/hms/hms_tv.htm)). The number of Black Vultures, together with the low number of King Vultures, may indicate local migration movements within the lowlands of Bolivia. Breeding Turkey Vultures from the Argentine Pampas migrate northward east of the Andean foothills of Bolivia and Brazil to overwinter ([www.vulturemovements.org/hms/hms\\_tv.htm](http://www.vulturemovements.org/hms/hms_tv.htm)). Thus, vultures counted at Concepción could originate from southern latitudes.

The migration route of Snail Kites throughout its range is largely unknown, but the species has been recorded at many watch sites in South America (Juhant 2011). The migration time of Snail Kite in the lowlands of Bolivia is between mid-February and early-April (Zalles and Bildstein 2000, Dobbs and Huizinga 2005, Olivo 2007a, this study), and between late-September and late-November (Zalles and Bildstein 2000; Olivo 2001, 2005, 2007a). It is not known if kites recorded at Concepción belong to the Austral–Neotropical and Neotropical–Intra-tropical migration systems or both. Study of migration of Snail Kites

in the Neotropics remains a fertile ground for future research.

Mississippi Kites comprised nearly 80% of the migrating raptors. The high numbers of kites recorded in this study coincide with previous counts at the site during austral autumn and spring (Olivo 2001, 2004, 2007a). The average number of kites counted in autumn is 4,710 (Olivo 2007b, this study), whereas the average number of kites counted in spring is 132,080 birds (Olivo 2004, 2007b). The difference in kite numbers recorded between seasons may be caused by seasonal factors. First, kites may migrate northward primarily in late Austral summer. A single flock of 10,000 kites was counted on 20 February, 1,000 km south of Concepción Watch Site migrating northward in Fuerte Esperanza town ( $25^{\circ} 11' S$ ,  $61^{\circ} 55' W$ ) in the Chaco lowlands of Argentina (Areta and Seipke 2006). Second, kites may fly very high to avoid storms or fly within the clouds in the autumn (wet season), making it difficult to detect them from the ground on migration (Smith 1985). Finally, they may have an elliptical northward migration route or may fly north in a more dispersed (broader) front, avoiding this site. The migration time of Mississippi Kites at Concepción is through March (Olivo 2007b, this study) and between late-September and late-November (Olivo 2004, 2007b).

The migration route and wintering distribution of Mississippi Kites throughout South America is largely unknown (M. A. Juhant and J. I. Areta, unpubl. data), and the species has been recorded on migration principally at Concepción, which is the only bottleneck area known for the species south of the Panamanian isthmus (Juhant 2011). Mississippi Kites have been reported in several countries of South America but, despite the growing number of reports, it is considered scarce, rare or transient in every country where it is found during the boreal winter.

More research is needed to completely describe timing of the raptor migration in the austral autumn at Concepción. An annual season-long count by experienced observers from mid-February to mid-May (northbound migration) and from mid-September to late-November (southbound migration) is recommended to gain a better understanding of migration timing and composition at this important site. A full-time annual count could potentially provide critical long-term monitoring data for several species of Nearctic and Neotropical raptors, as done at many North American sites

(Goodrich and Smith 2008). It would be fruitful to involve and train local residents in the phenomenon of observing long-distance migrating raptors as Concepción affords an exceptional opportunity to study and appreciate raptor migration in South America.

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