SEASONAL AND TEMPORAL ACTIVITY PATTERNS OF THE HARRIS'S HAWK (*Parabuteo unicinctus*) IN A COASTAL FORESTED AREA OF CENTRAL CHILE

Patrones de actividad estacional y temporal del peuco (*Parabuteo unicinctus*) en un área boscosa de Chile central

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ABSTRACT.- Knowledge about activity patterns of raptors in different habitats is important to understanding their behavioral flexibility and adaptive ability. During nine months, we surveyed the activities of Harris's Hawks (*Parabuteo unicinctus*) for a total of 199 hours over 22 observation days in a coastal forested area of central Chile. The time spent in a particular activity was measured using the focal-animal sampling method. Perching was the prevalent activity within each season and day. Harris's Hawks perched more often during winter and autumn (83−95% of total time hawks were observed, N = 11,940 min), and flew more often during spring and summer (21.6−33.6% of total time hawks were observed). Except in winter, perching activity exhibited a daily, bimodal pattern. Harris's Hawks perched more often during mid-morning (09:00−11:00 h) and midday (12:00−14:00 h) in winter, during mid-morning and mid-afternoon (16:00−17:00 h) in spring and autumn, and during mid-morning and late-afternoon (19:00−21:00 h) in summer. Six flight modes were identified: gliding, cruising, soaring, hovering, diving and parachuting. Soaring was the most frequent flight mode throughout the year (46−87% of total flying time, N = 628.5 min). Within each season, time budgets for soaring differed markedly throughout the day. The Harris's Hawk's prevalent tendency to perch could be explained by its stereotyped sit-and-wait foraging mode. Perching behavior could also have conferred the advantage of access to the interior of forest remnants, allowing better exploitation of such prey patches. The prevalent use of soaring could be explained because it confers multiples advantages such as exploration, better detection of prey or intruders, territorial displays or courtship, and thermoregulation. Temporal variations in flight activities of Harris's Hawks in our study site were consistent with concurrent climate and ecological conditions. The prevalent use of perching and the diversified flight modes of Harris's Hawks probably confer a greater adaptive ability in forested areas. **KEY WORDS.-** Cruising, gliding, Harris's Hawk, hovering, *Parabuteo unicinctus*, perching, sclerophyllous forest, soaring.

RESUMEN.- Conocer los patrones de actividad de las aves rapaces en hábitats distintos es importante para comprender su flexibilidad conductual y capacidad adaptativa. Durante nueve meses monitoreamos la actividad de un grupo de peucos (*Parabuteo unicinctus*) por un tiempo total de 199 horas dentro de 22 días de observación en un área boscosa de Chile central. El tiempo consumido en una actividad particular fue medido usando el método de muestreo del animal focal. El perchado fue la actividad prevalente dentro de cada estación climática y del día. Los peucos percharon más a menudo durante el otoño y el invierno (83−95% del tiempo total de avistamiento, N = 11.940 min), y volaron más a menudo durante primavera y verano (22−34% del tiempo total de avistamien-

to). Excepto en invierno, la actividad de perchado tuvo un patrón bimodal a lo largo del día. Los peucos fueron observados perchando más a menudo durante la media mañana (09:00−11:00 h) y el medio día (12:00−14:00 h) en invierno, la media mañana y la media tarde (16:00−17:00 h) en primavera y otoño, y la media mañana y el fin de la tarde (19:00−21:00 h) en verano. Seis modos de vuelo fueron identificados incluyendo el vuelo planeado, vuelo batido, vuelo encumbrado, vuelo sostenido, vuelo picado y vuelo descendente a modo de paracaídas. El vuelo encumbrado fue el modo de vuelo más observado a lo largo del año (46−87% del tiempo total de vuelo, 628,5 min). Dentro de cada estación, el tiempo dedicado al vuelo encumbrado varió marcadamente a lo largo del día. La tendencia prevalente a perchar por parte de los peucos puede ser explicado por su modo de forrajeo estereotipado "al acecho". La conducta de perchado pudo haber conferido también la ventaja de acceder al interior de remanentes de bosque, permitiendo explotar mejor esos parches de presas. El uso prevalente del vuelo encumbrado podría explicarse por las múltiples ventajas que otorga tales como exploración, mejor detección de presas o intrusos, despliegues territoriales o de cortejo, y termorregulación. Las variaciones temporales en las actividades de vuelo en nuestro sitio de estudio fueron consistentes con las condiciones climáticas y ecológicas concurrentes. La prevalencia por perchar y los diversos modos de vuelo del peuco posiblemente otorgan una mayor capacidad adaptiva en áreas boscosas. **PALABRAS CLAVE.-** Bosque esclerófilo, *Parabuteo unicinctus*, perchado, peuco, vuelo batido, vuelo encumbrado, vuelo planeado, vuelo sostenido.

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IINTRODUCTION

Activity patterns are a fundamental part of the species' natural history and represent a pivotal aspect of animal behavior (Enright 1970, Nielsen 1983). Activities of top predators are mainly influenced by prey, energy costs, environmental factors, and human activity, or a combination of these factors (Theuerkauf *et al*. 2003, Vila *et al*. 1995, Klinka & Reimchen 2002). In general, birds of prey tend to synchronize hunting activity with the activity of their prey, or with times when the prey are most vulnerable (Bechard 1982, Sarasola & Negro 2005). Because most birds of prey have specialized in active searching, they have diversified their flight modes (Videler 2005), hunting with several techniques that vary both in rate of energy expenditure and return (Tarboton 1978, Wakeley 1978, Sarasola & Negro 2005). Thus, most species that actively search for prey synchronize hunting activities with environmental conditions ideal for flying (Ballam 1984). Understanding how raptors allocate their time in different perching and flight activities is important to assessing their behavioral ecology (Jaksic 1985, Masman *et al*. 1988).

The Harris's Hawk (*Parabuteo unicinctus*) is an American species inhabiting mainly open lands such as desert, arid shrub lands, savannahs, open woodlands, and prairies with scattered trees (Brown & Amadon 1968, Bednarz 1995). Although in Chile it is conspicuous and common (1–5 individuals can be detected daily; Jaksic & Jiménez 1986), little is known about its basic behavior there (Jiménez & Jaksic 1993). Previously, Jiménez & Jaksic (1993) studied the behavioral ecology of Harris's Hawks in an evergreen scrub on the Andean foothills of central Chile concluding that the species primarily uses perching and soaring, without diurnal or annual variation in flight activity (Jiménez & Jaksic 1993). Harris Hawk activity patterns in forested areas have not been examined. Therefore, we investigated the species' behaviors in forest remnants and compared these activity patterns to those reported from open areas. We expected this comparison across different habitats to reveal aspects of the species' flexibility and adaptive potential. Here we describe perching and flight activity patterns of the Harris´s Hawk in a coastal forested area of central Chile, and speculate about how such patterns could be influenced by environmental and ecological factors.

MATERIALS & METHODS

We studied the activity patterns of the Harris's Hawk in the Oasis la Campana Private Reserve 10,000 ha), Valparaíso region, central Chile. This Reserve is adjacent to La Campana National Park (31°55' S, 71°08' W) located in the Coastal mountain range. It is characterized by relatively rough topography (300–1800 m elevation, slopes 30–40°). The vegetation of the area is typical of the sclerophyllous forest sub-region (Gajardo 1994). The climate is Mediterranean-arid (di Castri & Hajek 1976) with a range of annual rainfall and a mean temperature of 100–118 mm and 20° C, respectively (Saiz *et al*. 1989, Pliscoff 2002). Wind velocities fluctuate between 10 and 60 km/h during winter and summer, respectively (Dirección Metereológica de Chile 2015).

The size of forest stands in the study area ranged 8.8−90 ha (N = 4). Forest vegetation was composed

of sclerophyllous (*Cryptocarya alba* [dominant], *Peumus boldus*, *Schinus latifolius*) and higrophyllous (*Aristotelia chilensis*, *Beilschmiedia miersii*, *Dasyphyllum excelsum*, *Drymis winteri*) trees, interspersed with palm trees (*Jubaea chilensis*). Tree height and diameter at breast height (d.b.h.) ranged from 10 to 25 m and 10 to 100 cm, respectively. Canopy cover ranged from 50 to 80%, and the understory was sparse and mostly composed of *Escallonia* spp., *Maytenus boaria*, *Equisetum bogotense*, and saplings of native trees.

Our specific study site covered an area of almost 25 km^2 and was characterized by being surrounded by five small hills (1700–2000 m elevation). Our study spanned nine months (late June 2007−late March 2008) and took place during all seasons (winter: 29 June–9 September, spring: 29 September–9 December, summer: 9–12 January, autumn: 27–30 March). The number of survey days varied among seasons: 6 in winter, 9 in spring, 4 in summer, and 3 in autumn. We searched for hawks on the ground and in the sky continuously from dawn to dusk (winter: 10:00–18:00 h, spring: 09:00–19:00 h, summer: 08:00–21:00 h, autumn: 09:00–20:00 h), except during some days when we only observed them from mid-day to dusk, or from dawn to mid-day. Searches were conducted from a vantage point by unaided eye and with binoculars (10×50), or spotting scopes (60×) when necessary. For each individual we measured the time spent in a particular activity using the focal-animal sampling method (Altmann 1974, Lehner 1998, Gaibaini & Csermely 2007); i.e., when we spotted a hawk, we observed it until it flew out of sight.

We recorded the following activities: (1) perching, either on a tree, shrub, boulder, or on the ground; (2) gliding, a flight at variable speed with wings extended and wingtips relatively tucked, without wing-flapping and making use of horizontal wind and thermal updrafts; (3) cruising, a horizontal high-speed flapping flight; (4) soaring, a vertical flight in circles on thermal or wind updrafts (> 30 m altitude) showing a pronounced forward sweep of the wings and with primary feathers spread; (5) diving, a straight high-speed flight with closed wings; (6) hovering, a stationary flight wherein hawks face into wind or thermal updrafts and control their position with wing beats and tail movements; and (7) parachuting, a directed aerial descent at a steep angle with wings held upward, similar to that observed in *Elanus* kites when they strike (for details see Warner 1931, Raspet 1960, Jaksic & Carothers 1985, Videler 2005, Dudley *et al*. 2007).

For purposes of comparison, observations of flight activity were grouped on a seasonal and daily basis. Seasonal variations in perching and flying were evaluated on the basis of the percentage of time (in minutes) spent in each activity. We divided the daily observation time into 13 one-hour intervals (08:00–21:00 h). Because the sampling effort varied among days and seasons, we standardized the observations for each season by summing the amount of time spent in each activity daily for each hourly interval, and dividing sums by number of observation days.

Sex and age classes were combined. Because it is possible that most of the time we had measured the same birds (we studied non-marked hawks), and what a bird does one minute is very likely to influence what it will be doing the next minute, our observations could be not independent. Thus, we did not evaluate differences in the amount of time spent in each activity on a statistical, inferential basis.

RESULTS

We surveyed the activities of Harris's Hawks for a total of 199 hours: winter = 39 h, spring = 77 h, summer = 42 h, autumn = 41 h. At least 10 hawks (6 adult, 4 juvenile) were observed in the study area throughout the year. Hawks were observed perching 20.1% of the time (N = 11,940 min). In contrast, hawks were observed flying only 5.4% of the time. During the time that hawks were seen flying (628.5 min), they engaged mostly in soaring (76.4%), gliding (12.3%), cruising (6.3%) and wind-hovering (3.5%). Diving and parachuting accounted for only 1.3% and 0.1% of all the flying time, respectively.

Seasonal activity

The overall level of activity varied among seasons. Hawks tended to perch more often during winter and autumn, and to fly more often during spring and summer (Fig. 1). Soaring was the prevalent flight mode during all seasons, although this activity decreased noticeably in winter (Fig. 2). During winter, the percentage of time spent gliding and cruising was proportionately similar (Fig. 2). Hovering and parachuting were not observed in winter.

Daily activity

During all seasons, the time budgets for activities differed throughout the day. Except in winter, perching activity exhibited a bimodal pattern (Fig. 3). Depending on the season, Harris's Hawks perched more often during mid-morning (09:00−11:00 h) and mid-afternoon (16:00−17:00 h), or late-afternoon (19:00−21:00 h). The amount of time Harris's Hawks devoted to perching markedly decreased towards the mid-day (12:00−14:00 h), and early-afternoon (14:00−15:00 h). During winter, the daily amount of time spent perching was always greater than that spent flying (Fig. 3). Depending on the season, we observed two to three daily peaks in the level of flight activity. During winter, these peaks were noticeably low

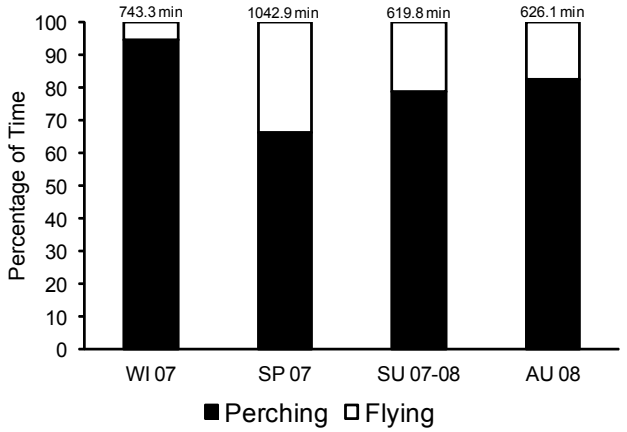

Figure 1. Seasonal variation in the frequency of Harris's Hawk perching and flying behaviors in Oasis La Campana, Coastal mountain range, central Chile, 2007—2008. Values above the bars indicate the total time that hawks were observed. Seasons: WI = winter, SP = spring, SU = summer, AU = autumn.

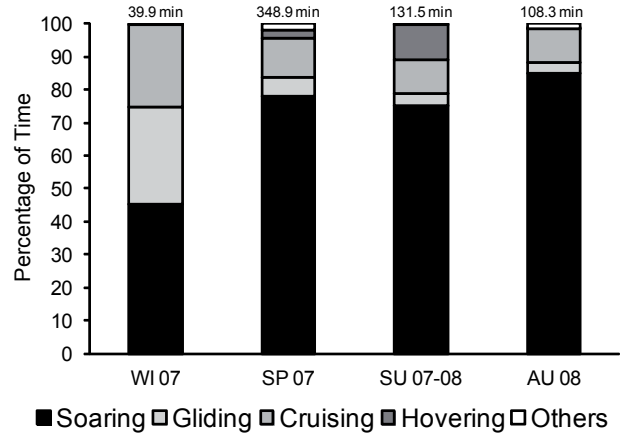

Figure 2. Seasonal variation in the time spent in the diverse flight modes used by the Harris's Hawk in Oasis La Campana, Coastal mountain range, central Chile, 2007—2008. Values above the bars indicate the total time that hawks were observed in flight. "Others" = diving and parachuting combined. Seasons: WI = winter, SP = spring, SU = summer, AU = autumn.

and occurred at mid-day and early-morning (Fig. 3). During the remaining seasons, the levels of flight activity were evidently higher (Fig. 3).

Within each season, time budgets of soaring differed markedly throughout the day (Fig. 4). During winter, Harris's Hawks exhibited only two slight peaks in soaring, which occurred between mid-day and early-morning. During spring, the time spent soaring was substantially higher at mid-morning, with two secondary peaks between mid-day and early-morning. During summer, Harris's Hawks soared substantially more often toward late-afternoon, with a secondary peak at mid-morning. During autumn, soaring peaked at mid-afternoon, with a secondary,

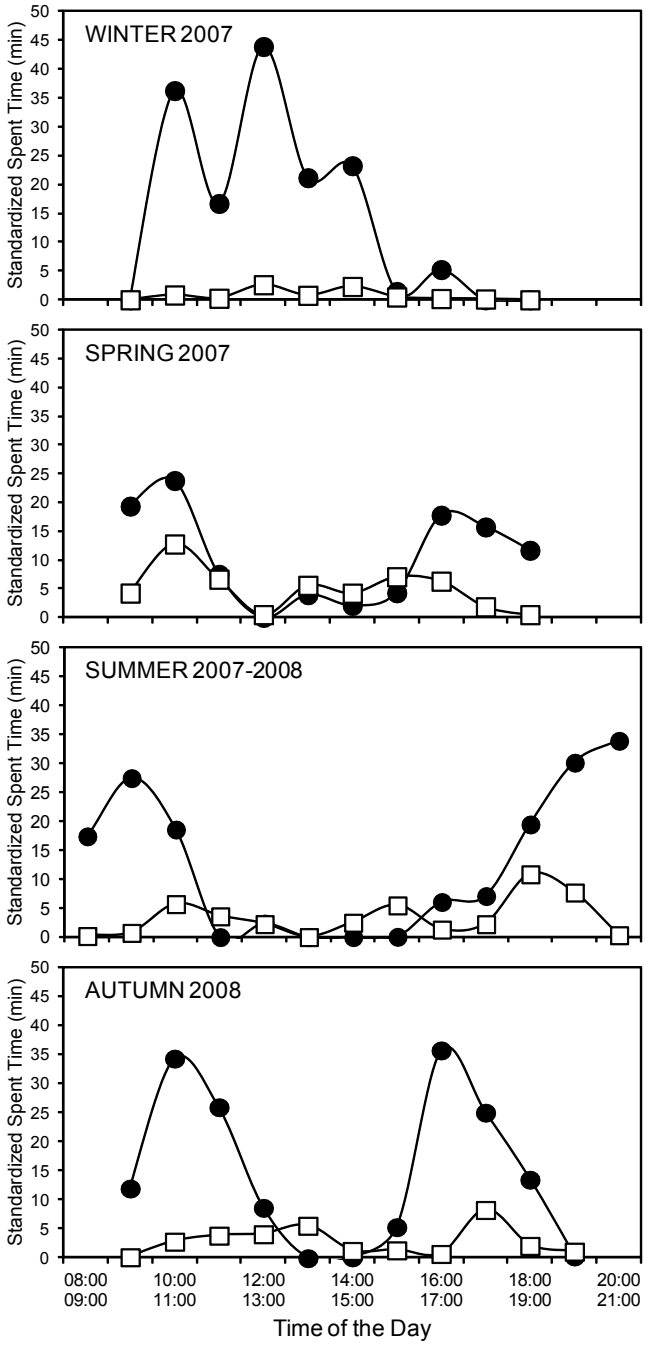

Figure 3. Temporal variation in Harris's Hawk perching (black circles) and flying (white squares) behaviors by season in Oasis La Campana, Coastal mountain range, central Chile. Observation effort: winter = 2280 min on 5 days, spring = 4620 min on 8 days, summer = 2520 min on 4 days, autumn = 2460 min on 4 days.

but sustained increase between mid-morning and mid-day. Gliding and cruising activities showed only slight increases in all seasons. Both flight modes tended to be higher at mid-morning and/or mid-afternoon. Hovering showed a noticeable peak at early-afternoon only in summer; this flight mode was not observed in either winter or autumn.

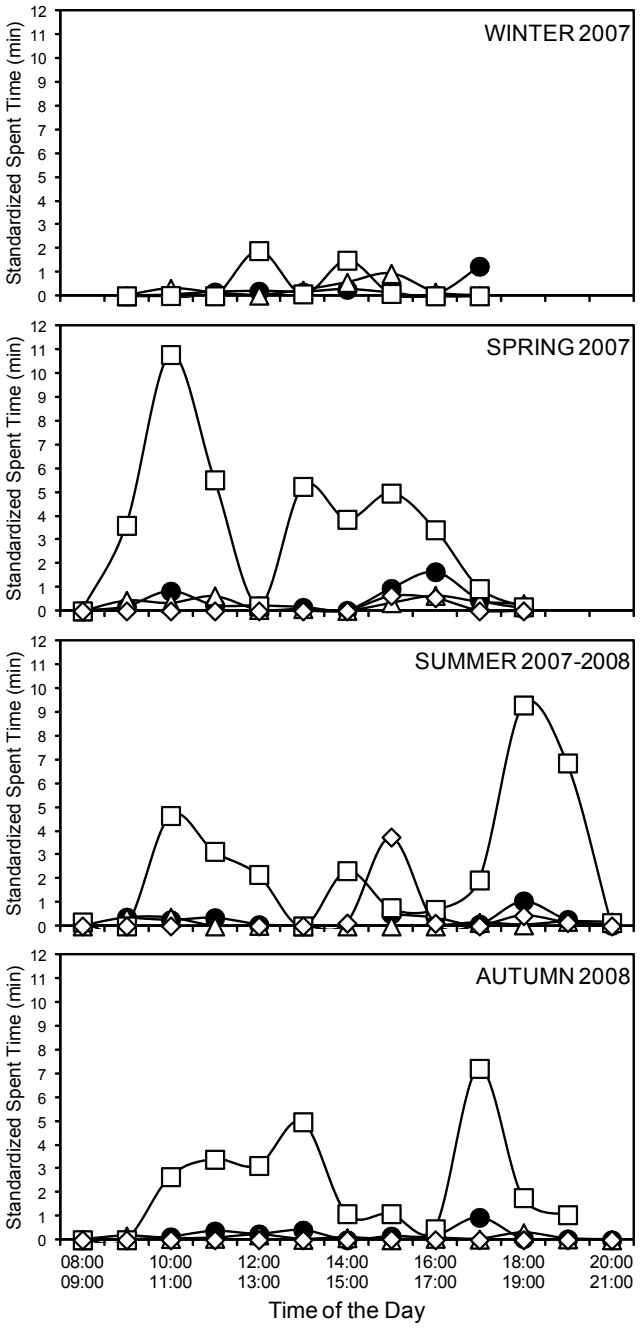

Figure 4. Temporal variation in the four most frequent flight modes used by Harris's Hawk in Oasis La Campana, Coastal mountain range, central Chile. Flight modes: white squares = soaring, black circles = gliding, white triangles = cruising, white diamonds = hovering. Observation effort: winter = 2280 min on 5 days, spring = 4620 min on 8 days, summer = 2520 min on 4 days, autumn = 2460 min on 4 days.

DISCUSSION

Our results are similar to flight activity patterns reported for Harris's Hawks in North America, where the species has been observed gliding, cruising, soaring and hovering (Mader 1975, McElroy 1977, Palmer 1988). Consistently, all of these flight modes are commonly used by buteonine hawks (e.g., Pennycuick 1972, Preston 1981, Soltz 1984, Hedenström 1993). Presumably, alternate flight modes allow raptors access to a greater variety of prey types (e.g., Rudolph 1982, Collopy & Koplin 1983). Consistent with this idea, the Harris's Hawk in Chile has a highly diverse prey base including animals with differing life modes (Jiménez & Jaksic 1993, Figueroa & González-Acuña 2006, Santander *et al*. 2011).

Local differences in activity patterns

Our results suggest that perching and soaring are pervasive activities of Harris's Hawks in Oasis La Campana. Jiménez & Jaksic (1993) reported similar findings for Harris's Hawks in an area with evergreen scrub in Apoquindo, on the Andean foothills near Santiago, central Chile. In Apoquindo, the amount of time spent perching and soaring accounted for 3.6−64.4% and 15.8−47.3% throughout the year, respectively. As in Oasis La Campana, other flight modes were much less prevalent in Apoquindo. Nonetheless, we detected some strong differences between our study and that of Jiménez & Jaksic (1993). First, in contrast to the report from Apoquindo, perching was the prevalent activity of Harris's Hawks in our study site throughout the year. Second, Harris's Hawks of Oasis La Campana soared more often during spring, but in Apoquindo, soaring was observed more often in autumn. Third, contrary to Apoquindo, Harris's Hawks in Oasis La Campana showed noticeable peaks of flight activity throughout the day (Fig. 3−4). Finally, in contrast to Jiménez & Jaksic (1993), we witnessed the use of hovering flight by Harris's Hawks in Oasis La Campana. This flight mode was briefly observed (0.05−3.3 min) in males and females that were either adults, subadults or juveniles, from spring to autumn.

We do not have a clear explanation for such differences, but they may be due to a number of factors. First, sampling effort and timing differed. The total survey time was substantially less in Apoquindo than in Oasis La Campana (13 vs. 199 hours). Second, it is possible that these differences simply reflect idiosyncratic responses of individuals. Finally, differences in flight activity could have been caused by environmental conditions that are location-dependent (e.g., microclimate). The physiognomy of both study sites is similar, but perhaps greater proximity to the sea at Oasis La Campana, and a greater daily thermal oscillation in the Andean site (Sepúlveda 2003) could have differentially influenced wind dynamics and updraft availability.

Possible explanations for the prevalence of perching and soaring behaviors

The greater amount of time spent in perching by Harris's Hawks in Oasis La Campana is consistent with

observations made in New Mexico where this hawk species tends to perch > 90% of the time throughout the year (Bednarz 1995). The tendency for the Harris's Hawk to perch could be explained by its two primary hunting modes: (1) sit-and-wait foraging, and (2) short-flight-perch hunting (Dawson 1988, Bednarz 1995). In Oasis La Campana, as in Arizona (Dawson 1988), some individuals remained perched for long periods of time (30 min to > 2 h). This behavior is consistent with the high consumption of small mammals that are more easily hunted from perches. In fact, rodents and lagomorphs are the main prey in terms of frequency of Harris's Hawks in Chile throughout the year (Yañez & Jaksic 1978, Jaksic *et al*. 1980, Jiménez & Jaksic 1993, Figueroa & González-Acuña 2006, Santander *et al*. 2011).

The short-flight-perch hunting mode is commonly employed during cooperative hunting (Dawson 1988). Only once did we witness what appeared to be cooperative hunting (i.e., two or more hawks searching coordinately for prey; Ellis *et al*. 1993). More study is needed to determine the occurrence of this hunting mode in our study area.

The prevalence of soaring in Oasis La Campana was also in agreement with general activity patterns of Harris's Hawks in North America (Bednarz 1995). Because soaring allows hawks to gain greater height, this flight mode can promote exploration, facilitate detection of prey or intruders, and can be used for territorial displays or courtship (Mader 1975, Soltz 1984, Wakeley 1978, Ballam 1984, Whaley 1986, Videler 2005, Mandel & Bildstein 2007). Complementarily, in warm regions such as central Chile soaring could have a thermoregulatory function (Wakeley 1978, Ballam 1984).

Another important factor that could be influencing the prevalence of perching and soaring in coastal forests is the wing loading. In general, diurnal raptors that use mixed hunting modes have a heavier linearized wing loading (LWL) than those that depend only on active searching (Jaksic & Carothers 1985). The linearized wing loading calculated for the Harris's Hawk (LWL = 0.238) is within the range of those raptors tending to use mixed hunting modes (Jaksic & Carothers 1985). In fact, the Harris's Hawk has one of the heavier LWL among raptors of the Order Accipitriformes, which is consistent with their sedentary mode of hunting from perches (Bednarz 1995). Likewise, the heavier LWL makes the Harris's Hawks more prone to soaring because this flight mode requires less energy than other flight modes (Wakeley 1978, Soltz 1984).

The landscape features could also have influenced the prevalent use of perching by Harris's Hawks. A mosaic of habitat comprising sparse shrublands, dense shrublands, and open forests characterizes oasis La Campana. Thus, Harris's Hawks possibly tended to perch more to increase success of prey capture in those highly vegetated sites. This presumption is supported by information on the diet of this hawk in the area (Santander *et al*. 2011). One of the most frequently consumed prey species is Bennett's chinchilla rat (*Abrocoma bennetti*), a rodent living in caves among rocks covered by shrubs, tree patches (Mann 1978), or forest remnants (Alvarado *et al*. 2007). In addition, most prey species were typical forest-dwellers including the moon-toothed degus (*Octodon lunatus*), and several bird species. Thus, the perching behavior could have conferred the advantage of access to relatively dense habitats, and thereby, better exploitation of prey living in these patches. In fact, in southern Chile, Harris's Hawks have been observed hunting and nesting within dense forest remnants (Figueroa & Corales 2015, this issue). Such behavior would reflect that of a forest-dweller ancestor. Raposo do Amaral *et al*. (2006) proposed that the Harris's Hawk and White-rumped Hawk (*Buteo leucorrhous*) diverged from a common forest ancestor, but the first evolved to hunt in more open habitats while the latter remained a forest specialist.

Seasonal and temporal variation in flight activity

The seasonal variability in flight activities of Harris's Hawks at our study site was consistent with concurrent climate and ecological conditions. The greater amount of time spent perching and the noticeably lesser time spent flying during winter appears to be due to rainy weather, weak solar radiation, and lower wind velocities (Bildstein 1987, Jiménez & Jaksic 1989). At the same time, the greater abundance of native rodents during this season (Jaksic *et al*.1981, Jaksic 2001) could have stimulated Harris's Hawk to hunt more from perches. Alternatively, if hunting success rates are higher under these conditions, perhaps the hawks perch more because they are soon satiated and resting (J. O. Coulson, pers. comm.). All these factors could also have influenced the prevalent use of perching throughout the day during winter. The greater amount of time spent soaring during spring can be attributed to a combination of increased courtship behavior, foraging activity and greater availability of wind updrafts (Ballam 1984, Soltz 1984). The increased gliding activity during this season is probably also a result of courtship plus foraging activity. The increased amount of time spent soaring during summer can be accounted for either by the greater availability of thermal updrafts, foraging activity, thermoregulation, or territorial defense (Ballam 1984, Soltz 1984). The gradual decreases in soaring activity toward autumn can be attributed to the diminished presence of thermal updrafts. The occurrence of hovering

flight from spring to early autumn is attributable to greater availability of wind and thermal updrafts.

The observed variation in levels of flight activity of Harris's Hawks throughout the day (Fig. 4) can be attributed mainly to microclimate factors. In general, Harris's Hawks in Oasis La Campana flew much more at those times of the day when thermals and wind currents were strongest. The increased frequency of soaring flight during mid-morning, midday, and mid-afternoon in our study site was consistent with those times of day having higher solar radiation and more wind; i.e., when more vertical convections are produced (Warner 1931, Raspet 1960, Strahler 1997). Similarly, variations in daily activity associated with environmental conditions have been observed in a number of buteonine hawks (Bildstein 1987, Jiménez & Jaksic 1991, 1993, Sarasola & Negro 2005, Dellacasa *et al*. 2011). Although the greater amount of time spent perching during specific moments of the day might be accounted for by a decrease in the availability of updrafts, this was not evident in our study. In most cases, the high frequency of perching coincided with those times of day with high availability of wind or thermal currents. Perhaps, the decision to perch during such daylight times depended on ecological (e.g., foraging activity, prey availability) rather than microclimate factors. It is also possible that Harris Hawks prefer to perch when wind velocities are higher than what they are comfortable flying in (40−48 km/h, J. O. Coulson, pers. comm.).

Our results confirm that Harris's Hawks have diverse flight modes, but with a prevailing use of perching and soaring. Our comparison with previous work also suggests that the frequency of each flight mode of Harris's Hawk could be location-dependent. The primary hunting modes of the Harris's Hawk have been dichotomized as active searching and sit-and-wait (Jaksic & Carothers 1985). Nonetheless, it is not so clear how soaring flight is used for active hunting. It is possible that soaring confers advantages for detecting the most profitable prey (e.g., lagomorphs, large rodents or birds) such as occurs with other soaring raptors (e.g., Wakeley 1978, Ballam 1984, Soltz 1984, Mandel & Bildstein 2007). Captive Harris's Hawks have been known to soar on thermals above the falconer in search of lagomorphs and other ground quarry (Coulson & Coulson 2012). The added height appears to increase the hawk's search radius, facilitate detection of prey animals moving and hiding between shrubs, provide a steeper angle of attack, and thus increase the velocity of the stoop (J. O. Coulson & T. D. Coulson, pers. comm.). Further studies on the functions of soaring in foraging, and other activities, are necessary to better understand the activity patterns of Harris's Hawks.

How activity patterns of animals differ across habitats is important to understanding the organism's behavioral flexibility and adaptive ability (Wright *et al*. 2010). In the case of the Harris's Hawk, a typically open-habitat raptor, there is a striking lack of knowledge about activity patterns in forested areas. Possibly, its diversified flight behavior could confer on it a greater ability to adapt to forests. But, at the same time, the presence of forest remnants could influence activity patterns, either by habitat structure or prey availability. Studies in forested areas of southern Chile could provide further insight because forest patches are denser and larger.

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