

DISTRIBUTION, NESTING, AND VOCALIZATIONS OF THE BLACK-BANDED OWL (*CICCABA HUHULA ALBOMARGINATA*) IN ARGENTINA

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Resumen. – **Distribución, nidificación, y vocalizaciones de la Lechuza Negra (*Ciccaba huhula albomarginata*) en Argentina.** – La Lechuza Negra tiene una amplia distribución en el Neotrópico y su historia natural es poco conocida. Reportamos nuevos registros que extienden la distribución y describen nuevos ambientes para la especie en la Selva Atlántica de la provincia de Misiones, Argentina. Encontramos que la Lechuza Negra es la más rara de las grandes lechuzas de bosque en esta provincia. Seguimos dos nidadas ubicadas en la horqueta principal de un ejemplar vivo de anchico (*Parapiptadenia rigida*: Fabaceae). La cámara del nido estaba a 15,2 m de altura, protegido por epífitas y tres ramas verticales grandes. En octubre–noviembre 2010 el nido contenía un pichón, y en septiembre–noviembre 2012 un huevo blanco. Ambos miembros de la pareja llevaron alimento al pichón y defendieron el nido contra los investigadores, pero un solo individuo parecía incubar el huevo y empollar el pichón durante el día. El pichón fue alimentado con mariposas nocturnas grandes (Sphingidae: Lepidoptera), incluso *Manduca* spp. y *Neococytius* spp. Describimos un variado repertorio vocal y sonidos mecánicos (hechos con las alas) que parecerían ligados a la actividad reproductiva. Los aspectos de la nidificación descriptos fueron similares a los de la Lechuza Blanco y Negro (*Ciccaba nigrolineata*), su pariente más cercano, y a veces considerada como una misma especie.

Abstract. – The Black-banded Owl has a large distribution in the Neotropics but little is known about its life history. We report new records that extend the known distribution and add new habitats within the Atlantic forest province of Misiones, Argentina. We found the Black-banded Owl to be the least abundant of the large forest owls in the province. We followed two nesting attempts in the main fork of a living angico (*Parapiptadenia rigida*: Fabaceae). The nest chamber was at 15.2 m above ground, and protected by epiphytes and three large vertical branches. In October–November 2010, the nest contained one nestling, and in September–November 2012, it contained one white egg. Both adults brought food to the nestling and defended the nest against researchers, but only one individual seemed to incubate the egg and brood the nestling during the day. The nestling was fed large nocturnal moths (Sphingidae: Lepidoptera), including *Manduca* spp. and *Neococytius* spp. We describe a diverse vocal repertoire and a mechanical sound (made with the wings) that seem to be linked to reproduction. Aspects of nesting are similar to those of the Black-and-white Owl (*Ciccaba nigrolineata*), the species' closest relative and sometimes considered the same species. *Accepted 12 July 2013.*

Key words: Black-banded Owl, *Ciccaba huhula*, *Ciccaba huhula albomarginata*, Argentina, distribution, nesting, *Strix*, vocalizations.

INTRODUCTION

The Black-banded Owl (*Ciccaba huhula*) is a widespread but little-known owl of the Neotropics, inhabiting a variety of forest types from eastern Colombia, Venezuela, and the Guyanas, to Argentina and southeastern Brazil (Parker *et al.* 1996, Holt *et al.* 1999). Several points about its taxonomy remain unclear. Remsen *et al.* (2013) conservatively include it in the genus *Ciccaba*, along with Black-and-white Owl (*Ciccaba nigrolineata*), Mottled Owl (*Ciccaba virgata*), and Rufous-banded Owl (*Ciccaba albitarsis*). However, other authors assign Mottled and Rufous-banded Owls (Dickinson 2003) or all four *Ciccaba* species (König & Weick 2008) to the genus *Strix*. Moreover, some authors suggest that Black-banded Owl and Black-and-white Owl might best be considered the same species because they have similar vocalizations and respond to each other's calls (Ridgely & Greenfield 2001). However, playback experiments have shown that even the Rusty-barred Owl (*Strix hylophila*) responds to the vocalizations of the Black-banded Owl (Bodrati & Cockle 2006). Some authors argue that the vocalizations of Black-banded and Black-and-white owls are different and the two taxa overlap in range, so are unlikely to be the same species (König & Weick 2008). We follow Sibley & Monroe (1990) and Remsen *et al.* (2013) and conservatively maintain the species separately, in the genus *Ciccaba*. Finally, two subspecies of Black-banded Owl are generally recognized (Partridge 1956, Holt *et al.* 1999, König & Weick 2008; but see Ridgely & Greenfield 2001).

The subspecies *Ciccaba huhula albomarginata* is endemic to the Atlantic forest of southeastern Brazil, eastern Paraguay, and the province of Misiones in Argentina (Partridge 1956). In

Argentina, it is reported from five sites (Partridge 1956, Olrog 1985, Bodrati & Cockle 2006, König & Weick 2008, Bodrati *et al.* 2010; Table 1, Fig. 1). Partridge (1956) found it in the highland forest around Tobuna and Refugio Pinalitos, which corresponds to Cabrera's (1976) district of mixed forest with laurel (Lauraceae), guatambú (*Balfourodendron riedelianum*), and Paraná pine (*Araucaria angustifolia*). There, it was "not uncommon" in the 1950s (W. Partridge *vide* Olrog 1985). In contrast, Partridge (1956) noted that he never detected Black-banded Owls in the Alto Paraná region, which corresponds to Cabrera's (1976) mixed forest with laurel, guatambú, and palo rosa (*Aspidosperma polyneuron*). Recently, we have published records from Establecimiento La Alegría (Bodrati & Cockle 2006) and Parque Provincial Cruce Caballero, both in mixed forest with laurel, guatambú, and Paraná pine, where the Black-banded Owl is rare but resident (Bodrati *et al.* 2010). An observation from Parque Nacional Iguazú, in the district of laurel, guatambú, and palo rosa (König & Weick 2008) is the only published record from Misiones outside the district of laurel, guatambú, and Paraná pine.

Although listed as Least Concern by BirdLife International (2013), the species is considered threatened in Argentina (Aves Argentinas/AOP y SAyDS 2008). It was confirmed for Paraguay only in 1993 (Brooks *et al.* 1995) and is considered vulnerable there (Guyra Paraguay 2005). In neighboring states of Brazil, it is known from only a few records in Santa Catarina (do Rosario 1996), considered data deficient in Paraná (Straube *et al.* 2004), and is not mentioned by Belton (1984) for Rio Grande do Sul. Its status in Rio de Janeiro is unknown (Alves *et al.* 2000).

Scant information is available regarding the habits, diet, breeding, and vocalizations of



FIG. 1. Map of Misiones, Argentina, showing forest (dark green), cities, pastures and cultivated areas (lighter colors), historical records of the Black-banded Owl (triangles: 1953-1992), modern records (filled circles: 2004-2012), and localities we surveyed without recording the species (empty circles: 2003-2012). Numbers correspond to the records in Table 1.

the Black-banded Owl (König & Weick 2008). The only evidence of breeding appears to be a female specimen collected in eastern Paraguay on 30 September 1993. The specimen had active gonads, an almost fully developed egg in the ovary and more eggs developing, and

two bats of different species in the stomach (Ericson & Amarilla 1997). To clarify the phylogeny of the Black-banded Owl, König & Weick (2008) called for studies of its ecology, behavior, vocalizations, and breeding. We provide recent information on distribution and

habitat of the *albomarginata* subspecies in Argentina, and the first description of the nest and breeding behavior for the species, including vocalizations and an apparent wing-clapping display at the nest.

METHODS

We conducted bird surveys opportunistically during more than 1000 evenings and early mornings at 34 sites in the province of Misiones, Argentina, from 2003 to 2012. Eleven sites were in the district of mixed forest with laurel, guatambú, and palo rosa; 10 were in mixed forest with laurel, guatambú, and Paraná pine; 12 were in mixed forest with laurel and guatambú; and 1 was in the campos district (Cabrera 1976). More than half of our time was spent at Parque Provincial Cruce Caballero (26°31'S, 54°00'W, 550–600 m a.s.l.). We were always alert to vocalizations of Black-banded Owls (with which we were familiar from previous field work in Paraguay, 2000–2002). We also searched for the species using playback of published (Hardy *et al.* 1990, Straneck & Carrizo 1990) and our own unpublished recordings on > 200 nights.

We searched for nests from 2006 to 2012 by watching for owl movements at dawn and dusk, and checking hundreds of tree cavities that appeared suitable for cavity-nesting birds, or had previously been used by cavity-nesting birds (Cockle *et al.* 2011, 2012), at Parque Provincial Cruce Caballero and remnant forest on nearby farms. We inspected potential and actual nest sites using both single-rope climbing techniques and a small video camera lit by three LEDs and mounted on a 15 m telescoping pole. The pole-mounted video camera was used to check nests every few nights (10 times in 2010 and 16 times in 2012). We tried to time our visits so that the female would be off the nest, which proved relatively easy during the nestling period (2010) but difficult during the incubation period (2012).

We watched and listened to activity at nests from positions 10–30 m from the base of the nest tree, for a total of 8 h during the incubation period and 24 h during the nestling period. Sometimes two observers watched the nest simultaneously from different directions to facilitate detection of adult movements. Sometimes we could hear the sound of plants rubbing or breaking as adults landed at the nest. We calculated nest-visitation rate only when there was some daylight or bright moonlight to reveal adult movements. Vocalizations were documented using a Marantz PMD-222 tape recorder and Sennheiser ME-66 shotgun microphone and are available at www.xeno-canto.org.

RESULTS

Distribution, abundance, and habitat. We found Black-banded Owls at seven sites in Misiones, and report previously unpublished records of other authors from two additional sites (Fig. 1). We found Black-banded Owls at 1 of 11 sites in the laurel, guatambú, and palo rosa forest district, 4 of 10 sites in the laurel, guatambú, and Paraná pine forest district, and 2 of 12 sites in the laurel and guatambú district. We did not find Black-banded Owls at the one site we visited in the campos district. We detected one solitary individual or one pair at each site, with the exception of Establecimiento La Alegría where we detected one individual and one pair. Black-banded owls occurred in a range of forest conditions including primary forest, selectively logged forest, remnant forest in a farming area, and a plantation of Paraná pine (Table 1).

Nest description. We found a single nest site of the Black-banded Owl, used in 2010 and 2012. In September and October of 2010, we noticed a concentration of vocal activity (Fig. 2A), sometimes before dusk, about 100 m northwest of the campsite at Parque

TABLE 1. Records of Black-banded Owl (*Ciccaba hubula*) in Misiones, Argentina. Forest district is classified according to Cabrera (1976): LG = laurel (Lauraceae) and guatambú (*Balfourodendron riedelianum*), LGPR = laurel, guatambú, and palo rosa (*Aspidosperma polyneuron*), LGP = laurel, guatambú, and Paraná pine (*Araucaria angustifolia*). Localities 9–11 are within Reserva de Biósfera Yaboty.

Locality	Forest district	Elevation (m a.s.l.)	Date	Forest condition	Observation	Source
1. Parque Nacional Iguazú	LGPR	250	26 Aug 1992	secondary	pair heard duetting	König & Weick 2008
2. Yacutinga Lodge	LGPR	240	2000–2001	unknown	tape recorded; registered on 50% of visits	G. Pugnali <i>in litt.</i>
3. Seccional 101, Parque Provincial (PP) Urugua-í	LGPR	350	4 Jun 2005	well conserved	1 recorded following playback	this study
4. Refugio Piñalito (Norte)	LGP	450	11 Nov 1954	unknown	1 heard and collected	Partridge 1956
5. Establecimiento La Alegría	LGP	580	15 Feb 2004	selectively logged	1 attracted by playback to cleared area with houses	Bodrati & Cockle 2006
			20 Feb 2004	selectively logged	pair responded to playback at a site 5 km from previous observation	Bodrati & Cockle 2006
6. PP Cruce Caballero	LGP	600	3 and 4 May 2005	primary	pair responded to playback	this study
			Aug 2008–Dec 2012	primary	pair recorded near campsite on most visits	Bodrati <i>et al.</i> 2010; this study
7. Tobuna	LGP	600	29 Sep 1953	unknown	pair heard and collected high in canopy of Paraná pines	Partridge 1956
			23 Nov 2006	logged, fragmented	1 heard and observed	this study
8. Ruta 12, 5 km from Jardín América	LG	200	15 Oct 1984	mature plantations of Paraná pine	dead individual photographed on the side of the highway	S. Salvador <i>in litt.</i>
9. PP Caá Yari	LGP	520	17 May 2009	mature	1 individual heard without playback	this study
10. Area Experimental Guaraní	LG	500	20 Jul 2004	lightly logged, tall forest and gallery forest	pair singing at dusk	this study
11. PP Esmeralda	LG	500	26 Nov 2004	selectively logged	1 heard without playback	this study

Provincial Cruce Caballero, and so concentrated our nest searches there. AB and Luis Pagano saw one of the adults fly to the

nest site from a nearby perch on 26 October 2010. We inspected the nest site using the pole-mounted camera and confirmed the

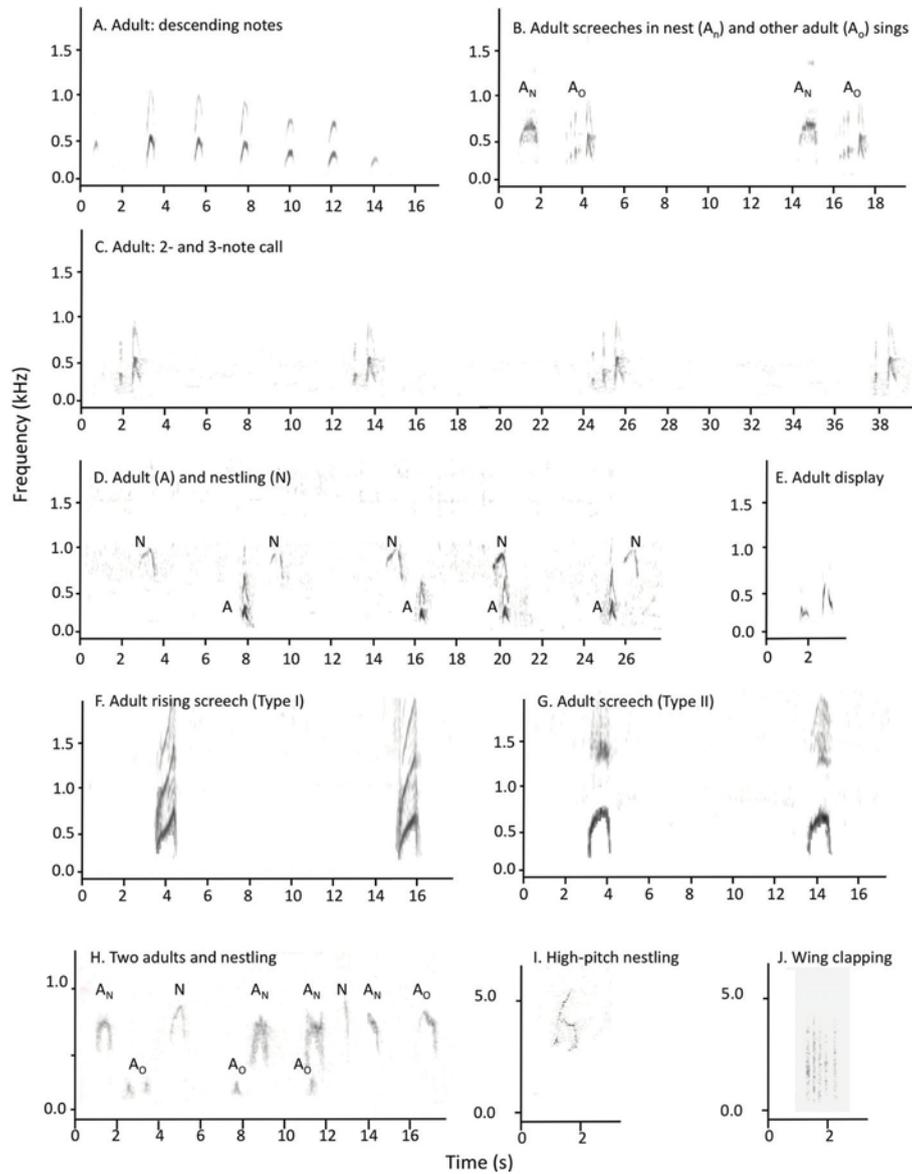


FIG. 2. Sounds of Black-banded Owls at and around their nest at Parque Provincial Cruce Caballero, recorded by AB during evenings in the nestling period. Note different scales on X and Y axes. A) descending notes emitted as the first vocalization in the evening, 14 Nov 2010; B) one adult screeches in nest and the other adult sings the typical song from a perch 50 m away, 16 Nov 2010; C) 2- and 3- note adult call, 14 November 2010; D) adult and nestling calls, 10 Nov 2010; E) adult display after playback, 14 Nov 2010; F) adult rising screech (Type I), 9 Nov 2010; G) adult screech (Type II), 9 Nov 2010; (H) one adult (A_N) and nestling (N) screech from nest and second adult (A_O) emits 1- and 2-note calls from nearest tree, 19 Nov 2010; (I) high-pitched nestling call, 10 Nov 2010; (J) Adult clapping wings, 10 Nov 2010.

presence of a single nestling on 28 October 2010.

From September to December 2011 we searched the area for nests but found none. The old nest site was not re-used in 2011, and although we heard one Black-banded Owl vocalizing for short periods on many nights we did not hear vocal activity on the scale of 2010 (see Vocalizations, below). We again observed Black-banded Owls at the nest site on 14 September 2012, when one emerged from the nest site and swooped at the first author. We confirmed that the nest contained a single white egg on 16 September 2012 (Fig. 3).

The nest site was 15.2 m above ground in the major fork of a live, healthy angico (*Parapiptadenia rigida*: Fabaceae). The nestling sat on a flat area measuring 49 x 20 cm, between three large vertical branches (one of them dead) and the large vertical stems of three epiphytic guembés (*Philodendron* spp.). In the spaces between the branches grew ferns, orchids, and other epiphytes, such that the nestling and adult were completely concealed from the ground during the day.

Egg and incubation. In 2012 the egg was incubated all day and almost constantly at night, with off-bouts (time when no adult was on the nest) of only 5–10 min. On 30 November 2012, 2.5 months after we found the egg, the adult still exhibited this behavior (i.e., appeared to be incubating) and the egg had not hatched. Our field assistant Juan Klavins climbed the tree, measured and photographed the egg, which we deemed to be not viable (Fig. 3). It was white but dirty, quite round, measured 47.2 x 39.4 mm, and weighed 23.4 g, although this weight does not likely reflect the weight of a viable egg.

Nestling. Our description of the nestling is limited to observations via the pole-mounted video camera. On 28 October 2010, the nest-

ling had a yellow bill and its feet were densely covered in white down, including the tarsi. It stood and lifted its wings, did not seem to have opened its eyes, and we believed it to be less than a week old. Two weeks later, on 13 November 2010, the nestling appeared twice as large. Its face was still covered in white down, but much of the body was now covered in horizontal black barring, similar to an adult. Above the eyes, which were open, the head appeared dark grey. On 18 November 2010, its body and wings were mostly pale grey, with horizontal black barring. The face bore a heart-shaped black mask around the eyes and bill, with a white border. The legs and bill were yellow, as in adults. It walked around the nest and was quite active. By 27 November 2010, the amount of black on the body had increased, though pale grey still dominated (in contrast to the blacker adult).

Parental care. One adult roosted on the nest throughout the day during the incubation period (September–November 2012) and at least the first three weeks of the nestling period (27 October–18 November 2010, and possibly thereafter). We assume this adult was always the female because only females are known to incubate in all other owl species that have been studied (Holt *et al.* 1999). We never saw the adults outside the nest during the day, except on 28 October 2010 when we flushed the female from the nest (see below).

Early in the nestling period, the female was usually on the nest at night, leaving for short breaks (presumably to be fed by the male as in all other species of owls that have been studied; Holt *et al.* 1999), for example, for 5 min just before dawn on 31 October 2010. On 12 occasions during the early days of the nestling period, the male passed food items to the female on a perch, and the female took the prey to the nest. Later in the nestling period, one adult (presumed female) was sometimes on the nest when the other



FIG. 3. Black-banded Owl egg among epiphytes in tree fork nest, 30 Nov 2012 (photo: Juan Klavins).

arrived; other times an adult arrived alone, fed the nestling, and then either stayed on the nest (presumed female) or left immediately (presumed male). For example, on the

evening of 16 November 2010, the female left the nest, and the male captured a moth in flight and took it directly to the nest. Overall, between dusk and midnight and in the hour

before dawn, nest visitation rate was 1.2–3.7 visits/hr (mean \pm SD = 2.3 ± 0.97 , $n = 6$). On the one night in which we kept a nearly complete watch (16–17 November 2010), the adults made no visits to the nest between 24:00 and 01:10 h, or between 01:54 and 04:20 h, and instead called to one another occasionally from a variety of perches.

Both adults attempted to defend the nest from observers. On 28 October 2010 when we lifted the video camera to check the nest (around mid-day), the female flushed and repeatedly flew at the camera, striking it with her talons. On 3, 4, 10, and 13 November 2010, the adult stayed on the nest when we tried to check it by day, allowing us only poor views of the nestling. On 18 and 27 November 2010, we checked the nest before dawn, when the adults were absent; however, one adult flew in and struck the camera repeatedly with its talons both days. In 2012, when the nest contained an egg, we checked the nest after dusk and the adults were much less aggressive, sometimes swooping but only once striking the camera. The adults also often vocalized during nest checks.

We could observe ten food items brought to the nest; all were very large moths in the family Sphingidae (Lepidoptera), including *Manduca* spp. and *Neocoxytus* spp. One moth was captured in flight and three were taken from low plants or the forest floor. The adults often hunted near the base of the nest tree. We did not find any owl pellets despite searching around the base of the nest tree and under perches that the adults used frequently at night.

Vocalizations and wing-clapping. Around the nest, we heard and recorded a wide variety of vocalizations, many of which we have not heard at any other time (i.e., when there was no nest). During the incubation period (October 2010 before finding the nest, and October 2012) the first calls of the evening were six or

seven descending notes (Fig. 2A), heard 50–100 m northeast of the nest tree, and attributed to the male. Usually, but not always, the female would have already left the nest and would be perched on one of the *vyra pyta* (*Peltophorum dubium*) trees adjacent to the nest tree. From there, she would answer her mate with the same call or with a 1-, 2-, or 3-note call (Fig. 2C). The descending call was also used as the last vocalization before dawn during both the incubation and nestling stage. Sometimes it was shortened to three or four notes. We have heard 1-, 2-, and 3-note calls outside of the nesting context in Paraguay and Misiones, but we have not heard the descending call anywhere except near the nest site at Parque Provincial Cruce Caballero.

We noticed an increase in vocal activity in the few days before we found the nest in 2010, and we suspect this was related to the hatching of the nestling. At the end of October and beginning of November 2010, during the nestling period, vocal activity of the adults began around 19:10 h when there was still light, 8 min after sunset. During the nestling period, the female would leave the nest in silence, fly to a nearby perch, and emit the descending call. Her mate would answer with the same call, the typical song (Fig. 2B; Hardy *et al.* 1990, Straneck & Carrizo 1990) or a 1, 2, or 3-note call (Fig. 2C). During the night, the adults maintained contact with one another using 1-, 2-, and 3-note calls, and two types of screeches (Fig. 2F and G), rarely using the typical song (Fig. 2B). We never heard the Type I screech (Fig. 2F) outside the context of nesting. Adults emitted the two types of screeches mostly within 30 m of the nest, often from a perch in one of the *vyra pyta* trees and sometimes from the nest itself (Fig. 2B).

By 9 November 2010, the nestling could be heard calling when one of the adults arrived at the nest (Fig. 2D and 2I). It also vocalized frequently in the evenings when the

female was off the nest. For example, it vocalized constantly during 4 h of observation beginning at sunset on the night of 18 November 2010. The female also emitted a vocalization like the nestling when she received food from the male, whether on the nest or on a nearby perch. Outside of the nesting context, we have not heard adults emit nestling-like vocalizations. If one of the adults was on the nest when the other arrived at a nearby tree, the two adults and the nestling would often all vocalize (Fig. 2H).

We tried playback of the typical song (Straneck & Carrizo 1990) and descending call (Fig. 2A) within 100 m of the nest, on three nights. Each time, one of the adults came immediately from the nest toward the sound, vocalized, then flew away, vocalizing in different trees along the way, past the nest and about 300 m beyond. In one case, after almost an hour emitting 2- and 3-note calls (Fig. 2C) it emitted an unusual 2-note vocal display that we have not heard on any other occasion (Fig. 2E). Eventually, about an hour after playback, it returned to the nest area. The other adult did not respond to the playback in any way that we could detect.

The adults' flights were normally completely silent, and we usually heard nothing even when they passed within a few meters of us. However, on several occasions during the nesting period, we heard an adult flapping its wings loudly as it landed on a perch near the nest tree (Fig. 2J). We interpret the flapping noise as intentional wing-clapping. It was often accompanied by vocalizations.

Post-breeding period. We left the study area on 2 December 2010 when the nest was still active. On 17 February 2011, we returned to the study area and climbed the nest tree. The nest site was empty and the owls were not seen in the vicinity. Carlos Alderete photographed an adult at the campsite (100 m southeast of the nest site) on 8 March 2011. We observed a

juvenile at the campsite on 4 May 2005. It came with an adult in response to playback of the typical song (Straneck & Carrizo 1990), but only the adult vocalized (descending notes, Fig. 2A). Another adult answered from about 80 m away with the same descending notes. The juvenile had adult size and plumage, except for a larger amount of white and pale grey, especially on the head, neck, and breast. Its facial disk was black, like an adult.

Territoriality. We believe the breeding pair of Black-banded Owls excluded other large owls from the core area of their territory. Our work at Parque Provincial Cruce Caballero included multiple week-long visits per year from 2003 to 2012, and a nearly permanent presence at the campsite from September to December every year from 2006 to 2012. Prior to 2008, we recorded the Black-banded Owl only twice, despite searching with playback throughout the park. The records were in response to playback about 600 m north of the campsite on 3 and 4 May 2005. In contrast, we frequently detected Rusty-barred Owl and Tawny-browed Owl with or without playback during the same time period, and these species often responded to playback by coming to the campsite itself. At other sites, we have also recorded Tawny-browed and Rusty-barred Owls approaching playbacks at the same points on the same nights (i.e., apparently holding overlapping territories; e.g., at Parque Provincial Urugua-í, Establecimiento La Alegría, Parque Provincial Esmeralda, and Area Experimental Guaraní). In contrast, we have not detected Black-banded Owls during playbacks where these other two owls were detected.

The first time we heard Black-banded Owls at the campsite was 20 July 2008, when two individuals began vocalizing (typical song) without playback. From then on, we frequently recorded Black-banded Owls but

we never again heard Rusty-barred Owls or Tawny-browed Owls at the campsite, although we sometimes heard them more than 200 m away, outside the area where the Black-banded Owls vocalized. We interpret that the Black-banded Owl pair, whose nest we discovered in 2010, displaced the other two species at the PP Cruce Caballero campsite in 2008.

DISCUSSION

The previously unpublished records reported here more than double the number of localities of Black-banded Owl in the Atlantic forest of Argentina. The recent records from Reserva de Biósfera Yaboty and the historical record from Jardín América extend the distribution southward. Nevertheless, our records are few when considering the number of field days and localities visited, and the Black-banded Owl must be considered an uncommon species in Misiones.

The Black-banded Owl is the least abundant of the large forest owls in Misiones. In the mixed forest with laurel, guatambú, and Paraná pine, and in the mixed forest with laurel and guatambú (e.g. Reserva de Biósfera Yaboty), the most common large owl is Rusty-barred Owl, followed by Tawny-browed Owl. In the mixed forest with laurel, guatambú, and palo rosa in the northern part of the province, the most common large owl is Mottled Owl, followed by Tawny-browed Owl (Bodrati *et al.* 2012).

To our knowledge, our description of nesting is the first for the Black-banded Owl. Egg-laying in September coincided with the main breeding season for birds in Misiones (including Ferruginous Pygmy-Owl *Glaucidium brasilianum*, Tropical Screech-Owl *Megascops choliba*, and Barn Owl *Tyto alba*; pers. observ.) and the breeding-condition Black-banded Owl collected in Paraguay (Ericson & Amrillia 1997).

Several aspects of breeding biology can be compared with other *Ciccaba* and *Strix* owls. In particular, a clutch size of one and nest placement among epiphytes (rather than a cavity or stick nest) is quite consistent with all four described nests of the other member of the superspecies, Black-and-white Owl, and differs from other *Ciccaba* and *Strix* owls. Black-and-white Owls in Guatemala laid a single egg directly on epiphytic vegetation (Gerhardt *et al.* 1994). At the same site in Guatemala, nine nests of Mottled Owls were all in tree cavities and contained 2–3 eggs (Gerhardt *et al.* 1994). *Strix* owls usually lay 2 or more eggs in tree cavities, hollow tree stubs or abandoned platform-style stick nests made by other birds or squirrels (Holt *et al.* 1999, Mazur & James 2000, Wallace 2010, Beaudoin & Ojeda 2011) although nests have also been found on the ground, in sheds, and in earthen banks (Estades 1998, Mazur & James 2000).

Only one adult Black-banded Owl appeared to incubate the egg or brood the nestling, consistent with all other species of owls that have been studied, in which females perform all incubation and brooding duties (Holt *et al.* 1999). We found the same tree fork used in two years by Black-banded Owls, separated by a year in which the birds were present near the nest site but vocalized much less often. Although we cannot reject the hypothesis that this pair nested in another part of their territory in 2011, the infrequency of their vocalizations suggests that they did not breed that year. In contrast, a pair of Black-and-white Owls nested every year for three years, but always in a different nest site (Gerhardt *et al.* 1994).

The only prey items we observed for the Black-banded Owl were large moths in the family Sphingidae, which were captured by adults and fed to the nestling or other adult. All of these observations were during the (Austral) spring of 2010, when we also noticed an unusual abundance of these moths

around the lights in our camp kitchen. In contrast, Ericson & Amarilla (1997) and Bornschein & Reinert (2000) found bats in the stomachs of adult Black-banded Owls. We did not find regurgitated pellets in the nest or under the nest tree, consistent with nests of Black-and-white Owl (Gerhardt *et al.* 1994) but in contrast to Rufous-legged Owl (*Strix rufipes*; Beaudoin & Ojeda 2011) and Barred Owl (*Strix varia*; T. Whiklo *in litt.*). Insects are also important in the diet of Black-and-white Owls, with 100% of pellets containing insect parts and 26% comprised only of insect matter (Gerhardt *et al.* 1994).

Our observation that adults visited the nest mostly in the hours after sunset and the hour before sunrise is consistent with Elderkin's (1987 per Mazur & James 2000) observations for female but not male Barred Owls. However, male Barred Owls also delivered prey during the day (Elderkin 1987 per Mazur & James 2000), a behavior we did not see with Black-banded Owls, even though their nest was on a main trail where we and our field assistants passed many times each day.

We report a wide range of vocalizations for the Black-banded Owl and what appears to be the first observation of wing clapping for any *Ciccaba* owl. Whereas some of the vocalizations we heard during nesting overlapped with vocalizations heard at other sites and times, several types of vocalizations and wing clapping appear to be associated with nesting activity. Wing clapping (beating wings in an exaggerated manner against one another, against the body, or against another object) has been observed for nine species of owls, including two in the genus *Strix*, usually in conjunction with courtship or aggressive displays (Whiklo & Duncan 2012).

Our study contributes new information about the distribution and abundance of Black-banded Owls in the Atlantic forest, the first description of nesting, and several associated vocalizations. More in-depth field studies

of this and other *Ciccaba* owls are needed to shed light on their ecology and phylogeny.

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