Reappraisal of Koepcke's Screech Owl *Megascops koepckeae* and description of a new subspecies

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Summary.—Little empirical evidence has ever been presented to justify the taxonomic ranking of Koepcke's Screech Owl *Megascops koepckeae*. We summarise current knowledge of its distribution and ecology, and provide detailed information concerning its distinctive vocalisations. There is no evidence to support its asserted occurrence in Bolivia, but two distinctive populations can be recognised in Peru. A new subspecies is described here from the rainshadow valleys of south-central Peru.

Koepcke's Screech Owl *Megascops koepckeae* was described in 1982 (Hekstra 1982b) as a subspecies (*koepckei*, *sic*) of Tropical Screech Owl *Megascops* (*Otus*) *choliba*. Doubts were expressed regarding the assumed relationship with *M. choliba* (Marshall & King 1988, König & Straneck 1989, Marshall *et al*. 1991, König *et al*. 1999, 2008) and although little peer-reviewed empirical evidence has ever been presented, it has been treated as a species (e.g., Holt *et al*. 1999, Schulenberg *et al*. 2007).

Hekstra (1982b) based his description on 23 specimens from north-west Peru (Chachapoyas and Yanac and the type locality Quebrada Yanganuco in Cordillera Blanca, Ancash), south-central Peru (Ninabamba in Ayacucho) and La Paz (Chulumani, Irupana) and Cochabamba (Tin-tin), Bolivia. A description of this owl, with the proposed name *Otus roboratus alticola*, was drafted in 1969 by M. Koepcke, Peru's pre-eminent ornithologist, and this was forwarded via J. Weske to E. Eisenmann, who made Koepcke aware of Hekstra's ongoing project to revise the classification of New World screech owls (M. Koepcke *in litt*. 1969). Sadly, Koepcke was killed in a plane crash in 1971 and her text was never published, but Hekstra named the new taxon in her honour given that she was the first to recognise it as a distinct form.

In March 1987, JF & NKK encountered a road-kill *Megascops* near Abancay in Apurímac, south-central Peru, and immediately recognised it as being phenotypically distinct from specimens from north-west Peru examined few weeks earlier in Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos in Lima. Despite its poor condition, the bird was prepared as a specimen, but because of the lack of vocal data (of either population) nothing was concluded. In 1995 GE obtained another specimen near Abancay, and in 2001 a sound-recording. In January 2003 VY & RY obtained two additional specimens, the first video and additional sound-recordings from this area, documenting the distinctive vocalisations. Similar (but not identical) vocalisations were recorded from Lima in the 1990s (IFJ) and La Libertad in 2004 (DFL), south and north, respectively, of the type locality of *M. koepckeae* in Cordillera Blanca.

With several new specimens and sound-recordings available we are now able to describe more precisely how Koepcke's Screech Owl differs from other Andean screech owls, and to define differences between geographical populations within the species. Here we provide this new information and describe and name the population inhabiting the dry

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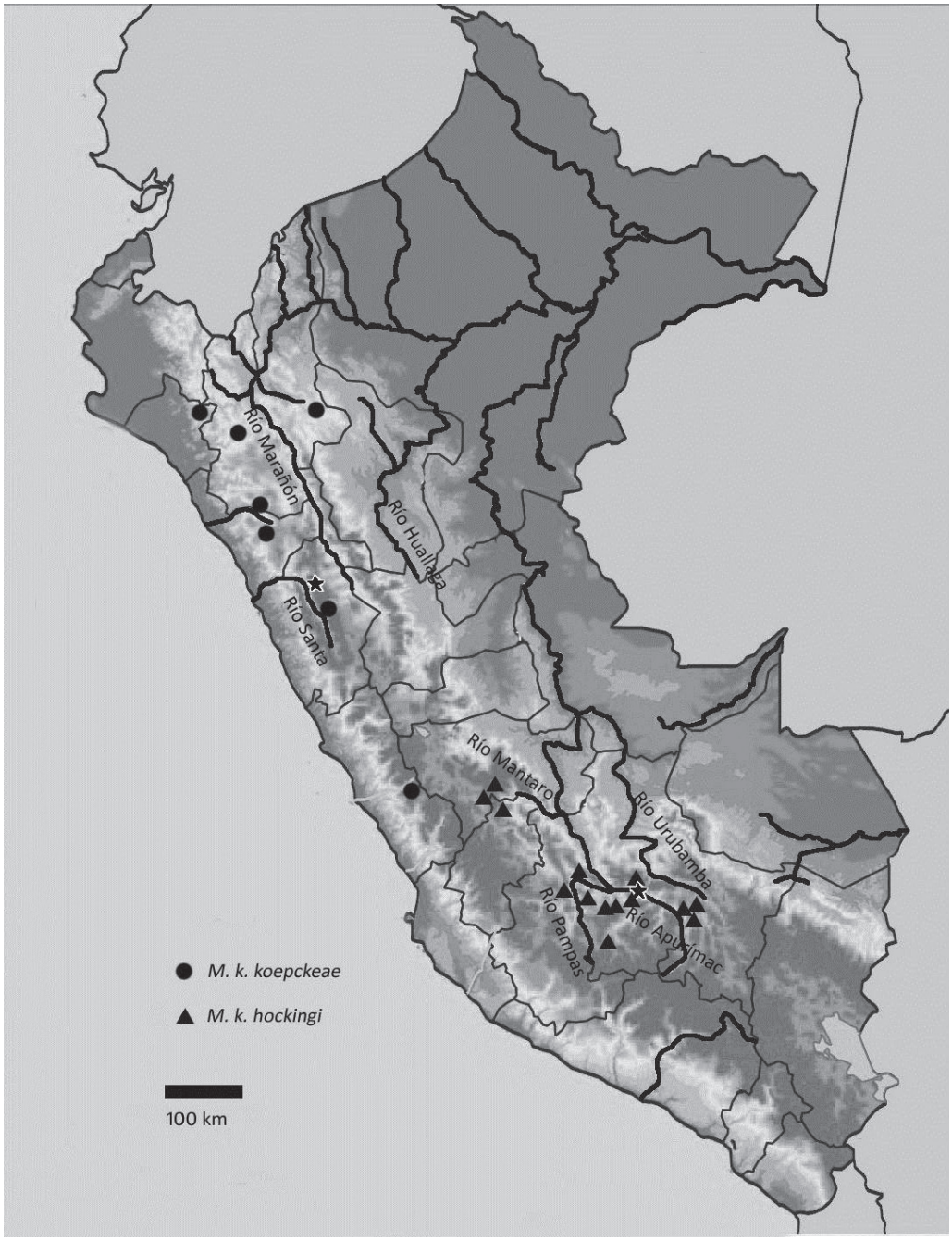

Figure 1. Records of the two subspecies of Koepcke's Screech Owl *Megascops koepckeae* in Peru. Bold lines mark major rivers and thin lines mark departmental borders. Stars mark the type localities of the two taxa (map prepared by Daniel F. Lane)

montane valleys of central Peru. However, it falls outside the scope of this paper to present molecular data that places the bird in a phylogenetic context.

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Materials and Methods

Morphological evidence has been assembled over a long period of time, mainly by JF, through visits to various museums: American Museum of Natural History, New York (AMNH), Academy of Natural Sciences of Philadelphia (ANSP), the Natural History Museum, Tring (BMNH; specimen loan); Field Museum of Natural History, Chicago (FMNH), Louisiana State University Museum of Zoology, Baton Rouge (LSUMZ; JF & DFL), Museo Nacional de Historia Natural de la Universidad Nacional Mayor de San Marcos, Lima (MUSM; JF, DFL & RW), Swedish Museum of Natural History, Stockholm (SMNH), the United States National Museum of Natural History, Smithsonian Institution, Washington DC (USNM), Museo de la Universidad Nacional de San Antonio Abad, Cuzco (MUSAAC; DFL), Museo de Historia Natural de la Universidad Nacional de San Agustín de Arequipa (MUSA) and Centro de Ornitología y Biodiversidad, Lima (CORBIDI; JF, JB & DFL). However, because of heterogeneous measurement protocol, we used below only the measurements taken by JF: bill length (to skull), tarsus, wing (flattened against the ruler) and tail (from base of central rectrices). Total length, wingspan and mass were in some cases noted from specimen labels.

For defining plumage characteristics, comparison was made with Andean screech owls with yellow eyes, firstly the widespread *Megascops choliba*, West Peruvian Screech Owl *M. roboratus* of the drier forests of north-west Peru and adjacent Ecuador, Montane Forest Screech Owl *M. hoyi* of the Boliviano-Tucumano forest zone, and to a lesser extent the very dark White-throated Screech Owl *M. albogularis*. Colour terminology is from Ridgway (1912). Sound-recordings were obtained by us over many years of field surveys and from published or online sound archives (Krabbe & Nilsson 2003, Coopmans *et al*. 2004, Lysinger *et al*. 2005, Boesman 2006, Jahn *et al*. 2008; Macaulay Library of Natural Sounds and xeno-canto); altogether 11 recordings of 13–14 *M. koepckeae* individuals from north-west Peru and 41 recordings of 23–24 individuals from south-central Peru (recorded by DFL, JB, RW & RY). These were compared with 76 recordings of *M. choliba* (of seven subspecies), 13 *M. roboratus pacificus*, seven *M. r. roboratus*, nine *M. hoyi*, 11 *M.* (*guatemalae*) *napensis*, six *M.* (*guatemalae*) *centralis* and 28 *M. albogularis*.

Results

Geographical distribution of M. koepckeae.—*M. koepckeae* occurs in two separate areas of Peru (*contra* the distribution map in König *et al*. 1999, 2008), in north-west Peru and in the east-draining valley systems of south-central Peru.

In northern Peru it is found in evergreen forests of the western Andes from Lambayeque (Bosque de Chiñama, at 2,250 m and Corral Grande in Laquipampa reserve, 1,840 m) to La Libertad (Sinsicap, *c*.2,500 m) and Cajamarca (La Granja, 2,200 m and Bosque Cachíl, 2,470 m) and around the Utcubamba Valley in Amazonas (San Pedro Chachapoyas, 2,620–2,870 m and ACP San Antonio-Chachapoyas; F. León photo). Other populations occur at high elevation in Cordillera Blanca, Ancash (río Santa valley, Yanac and Quebrada Yanganuco above Yungay, 2,458–4,500 m) and on the Pacific slope of Lima (Bosque Zarate, 2,850 m; Bosque Linday, 2,730 m). In general, the habitats are oligothermic and often mist-dependent forests and evergreen high-elevation *Polylepis* forests. Thus, the species could potentially occur at many additional sites in the Cordillera Blanca to adjacent northern Lima, as well as more widely along the upper slopes of the Marañón Valley, and perhaps into the drier upper Huallaga Valley.

In northern Peru *M. koepckeae* is broadly sympatric with *M. roboratus*, which has been recorded south to San Damien on Peru's Pacific slope (GE), usually in dry forest at

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Figure 2. *Megascops koepckei hockingi*, two birds showing different facial expressions (Jon Fjeldså)

lower elevation than *M. koepckeae*. The altitude of the replacement zone may vary locally. In Laquipampa reserve on the Pacific slope in Lambayeque the two species have been found only 2 km apart, *roboratus* at 1,400 m (sound-recording XC41268), *koepckeae* at 1,840 m (XC8649). In Ancash *roboratus* has been recorded to 2,100 m (Schulenberg *et al*. 2007), *koepckeae* not below 2,458 m. East of the continental divide their distributions are less well known, the two closest records >100 km apart, the highest *roboratus* record at 1,340 m, the lowest *koepckeae* at 2,200 m. On the most humid cloud-forest ridges, *M. koepckeae* is replaced by *M. albogularis*.

In south-central Peru, *M. koepckeae* was first collected in 1939 at Ninabamba in Ayacucho (Morrison 1948; identified by him as *Otus choliba crucigerus*) and recently at several other sites, especially in Apurímac (see Fig. 1 and below). Unlike in north-west Peru, it frequents rainshadow valleys with dry woodland, primarily *Prosopis*, but often with many large deciduous *Eriotheca vargasii* ('pati') trees (*Bombax sensu lato*, Malvaceae) with many epiphytic bromeliads (*Tillandsia*), mainly around 2,000 m (Baiker 2011). In the Mantaro, it appears not

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TABLE 1
Some characteristics of typical songs of selected taxa of *Megascops*. Values for pitch are for first harmonic although sometimes the loudest pitch is on second harmonic.

Taxon	*n*	Length of song mean ± SD (range) (s)	Pace at start of song mean ± SD (range) (notes/s)	Change in pace	Average pitch mean ± SD (range) (Hz)	Special characteristics
M. koepckeae (north-west Peru)	6	2.0 ± 0.2 (1.6–2.2)	7.6 ± 1.0 (5.8–8.6)	Slowing, especially towards end	968 ± 112 (850–1,160)	Second last 1–2 notes accentuated
M. koepckeae (south-central Peru)	5	2.6 ± 0.5 (2.0–3.1)	6.9 ± 0.9 (5.5–7.7)	Slowing, especially towards end	1,246 ± 111 (1,070–1,360)	Second last 1–2 notes accentuated
M. choliba	59	1.2 ± 0.2 (0.9–1.7)	14.5 ± 1.5 (12–17)	Constant except for pauses between last 1–2 notes	711 ± 75 (460–870)	Last 1–2 notes accentuated and higher pitched
M. roboratus roboratus	5	2.6 ± 0.3 (2.3–3.1)	25.0 ± 2.4 (21–27)	Constant	602 ± 13 (580–610)	
M. r. pacificus	12	2.6 ± 0.9 (2.3–3.1)	21.8 ± 2.1 (19–25)	Constant	564 ± 60 (510–670)	

to reach above 2,000 m and is found down to 1,400 m, but in Apurímac it can occasionally be found to 3,400 m. Thus, habitat selection here seems more similar to that of *M. roboratus* in the middle Marañón Valley in north-west Peru. The species should be looked for also in other arid intermontane valleys.

Characteristics and plumage variation.—*M. koepckeae* resembles *M. roboratus* in having small gracile feet, similar plumage and golden-buff under-down visible through the body plumage. However, *M. koepckeae* is apparently monomorphic, but varies from chocolate-brown in northern Peru to more greyish brown in south-central Peru. *M. roboratus* has, on the other hand, distinct greyish and rufous-brown colour morphs. Both species have a distinct black border to the pale facial disk, the 'herringbone' pattern on the underparts is often broken, as missing bars cause large white patches, and the shaft stripes are often expanded or bifurcate near the feather tip (as in *M. hoyi*). *M. koepckeae* has a very poorly developed or missing collar of whitish mottles on the hindneck, unlike *M. roboratus*, in which a whitish collar separating the dark cap from a paler nape is well visible in the field. Furthermore, *M. roboratus* has more uniform dark distal inner webs to the outer primaries and more vermiculated underparts, as the 'herringbone' marks are dominated by double bars, which are often irregular or disintegrated as stippled lines (see Johnson & Jones 1990, Fjeldså & Krabbe 1990: Pl. XXV 5b, Schulenberg *et al.* 2007: Pl. 80). In *M. koepckeae* the transverse bars on the underparts are usually prominent, with four per feather, or two bars below the breast, and little tendency towards vermiculation. *M. koepckeae* further differs by being less vermiculated dorsally, with narrower black streaks on the forehead and crown. Unlike *M. roboratus* (Johnson & Jones 1990), all known populations of *M. koepckeae* are fairly uniform in size (110–130 g, see Table 2).

Whereas birds from north-west Peru are quite brown above (warm sepia-brown with darker chocolate-brown or blackish markings) with a significant ochre-brown to cinnamon wash over the neck-sides and breast, and some ochre on the legs and vent (Schulenberg *et al*. 2007: Pl. 80), those of the east-draining valleys of south-central Peru are the greyest of all *Megascops* populations in Peru. They have very little brown in the plumage (except for mostly hidden ochraceous bars in the wings), and generally much whiter underparts below the breast. Thus, the underparts show a marked contrast between a mottled breast and white lower parts with a well-spaced grid of vertical and horizontal black lines (Fig. 2).

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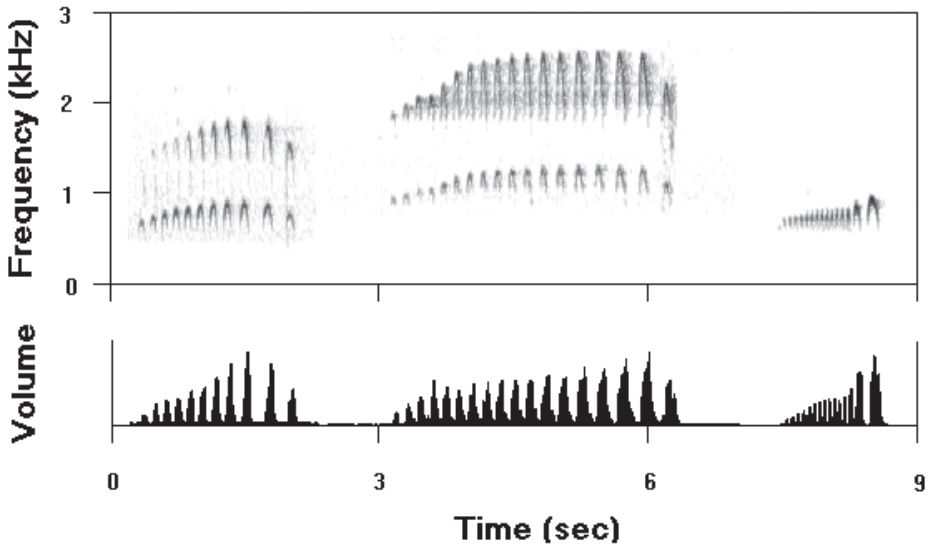

Figure 3. Songs of *Megascops koekckeae* (left, from La Libertad, middle, from Apurímac) and *M. choliba* (right, from Tucumán). Notice the lower pitch and the constant, fast pace of *M. choliba*, and differences in accentuation and change of pitch.

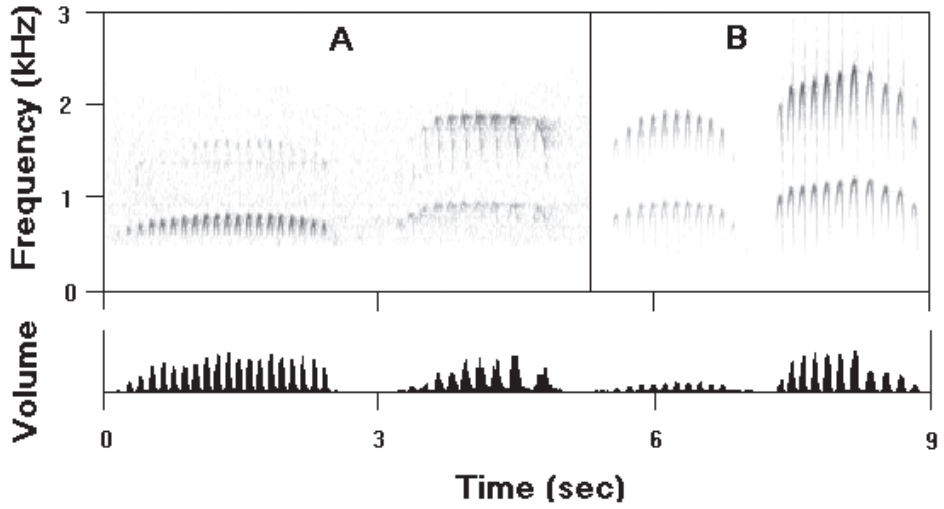

Figure 4. Duets of *Megascops koepckeae*. A: La Libertad, B: Apurímac. The lower pitched birds are males. In A the male gives an aggressive song rather than typical song.

Hekstra (1982a,b) referred 13 specimens from La Paz and Cochabamba to his *Otus choliba koepckei*, although he noted that they averaged smaller and more rufous, intermediate with his *O. c. alilicuco* of the Andean foothills of northern Argentina. JF found that specimens collected in the Andean valleys of Bolivia, below 2,500 m, varied much by plumage, some of them being very dark and heavily streaked, generally with 4–5 bars per 'herringbone' mark and a rather ochraceous appearance (Fjeldså & Krabbe 1990, and photographs and notes on specimens in AMNH, ANSP and SMNH). Although some

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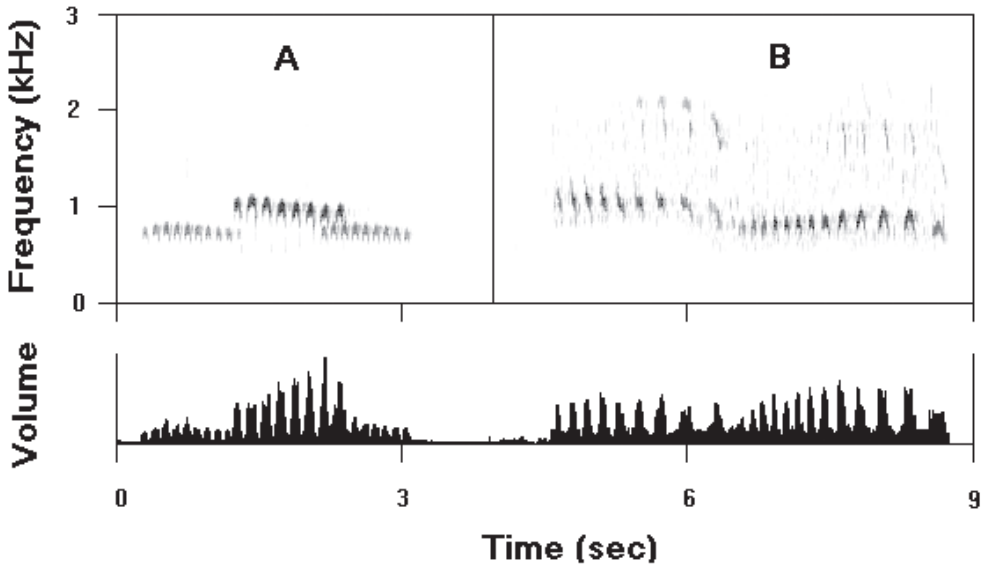

Figure 5. Duets of *Megascops albogularis* (A; Mérida, Venezuela) and *M. koepckeae* (B; Lambayeque, Peru). Note that the pace slows down in *M. koepckeae*.

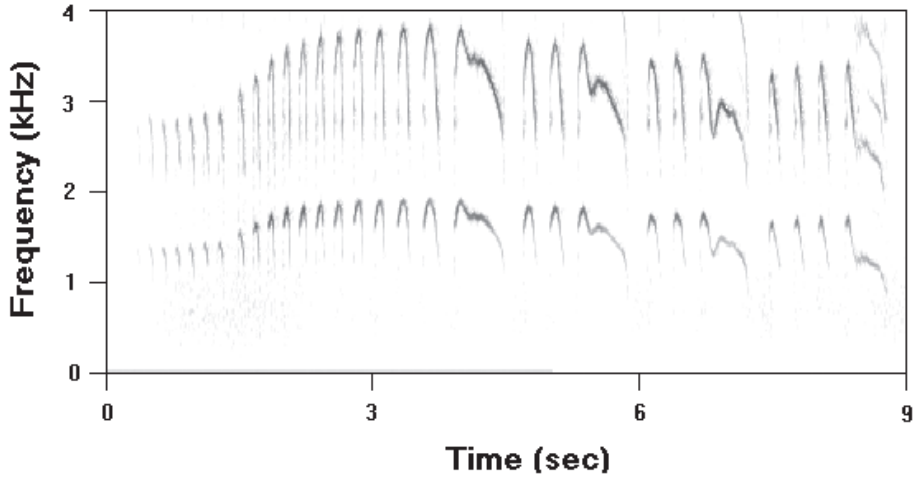

Figure 6. Long high-pitched call given by female *Megascops koepckeae* after repeated playback.

resemble *M. koepckeae* specimens from north-west Peru in plumage, no specimen could be referred to that taxon with any confidence. More noteworthy, all screech owls (except *M. albogularis* and *marshalli*) in the Andean valleys of La Paz and Cochabamba are vocally typical of *O. choliba* and voices corresponding to those of *M. koepckeae* have never been heard in Bolivia (JF pers. obs., S. Arias pers. comm., S. K. Herzog *in litt*. 2009; Mayer 1996). The semi-evergreen Boliviano-Tucumano forests further south are inhabited by the vocally distinct *M. hoyi* (Fjeldså & Mayer 1996). This species, overlooked by Hekstra (1982a,b), has distinct colour morphs, including grey birds resembling *M. koepckeae* in south-central Peru. We conclude that Hekstra was probably confused by the significant phenotypic variation

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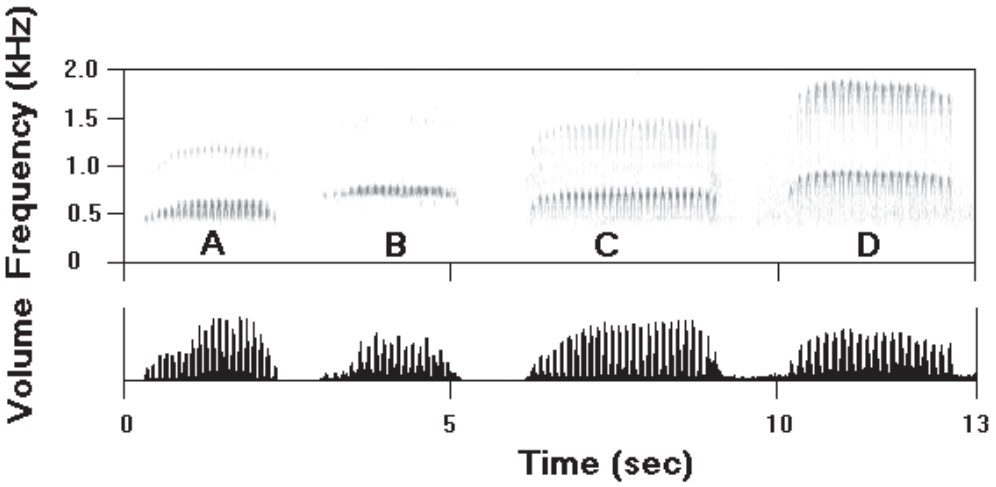

Figure 7. Aggressive songs of *Megascops* spp. A: *M. choliba* (Norte de Santander, Colombia). B: *M. hoyi* (Jujuy, Argentina). C–D: *M. koepckeae* (La Libertad and Apurímac, Peru). Note the similarity.

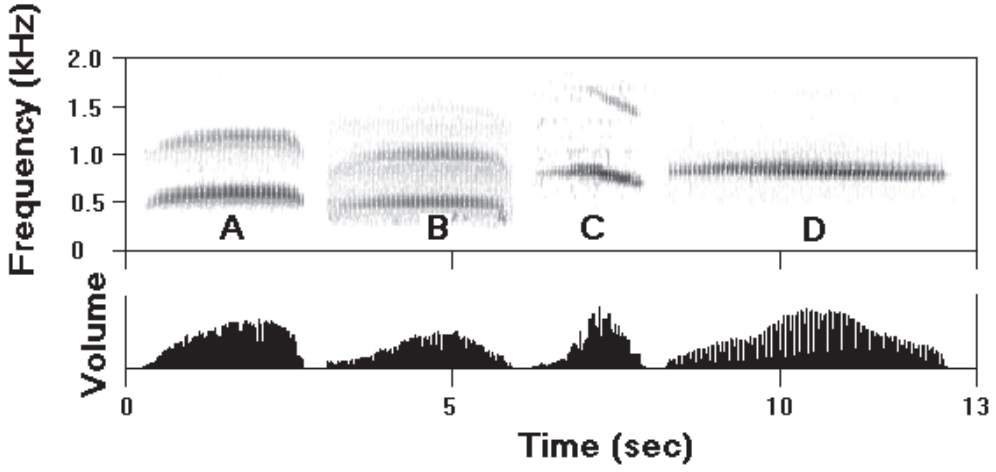

Figure 8. Male songs of some species of *Megascops*. A: *M. r. roboratus* (Zamora-Chinchipe, Ecuador). B: *M. r. pacificus* (Lambayeque, Peru). C: *M.* [*guatemalae*] *centralis* (El Oro, Ecuador). D: *M.* [*g.*] napensis (Napo, Ecuador). Notice that *pacificus* is lower pitched than *roboratus* despite its significantly smaller body size (70–90 g vs. 144–162 g: Marks *et al*. 1999). In D only the first harmonic shows in this example.

among Bolivian specimens of *M. choliba* and *hoyi*, and erroneously referred some of them to his *Otus choliba koepckei*.

Vocalisations of M. koepckeae.—The song of *M. koepckeae* consists of a loud, rising and falling series of 'hysterical' shrill notes that slows down, especially at the end, with accentuated second or third to last notes: *ko-ko-ko-ko-ko-ko-ka Ká Ka Kah* or *ko-ko-ko-ko-ko-ko-ka Ká Kah* (Fig. 2). This is quite unlike any other *Megascops*. Thus, *M. roboratus*, including *pacificus*, produces very fast, low-pitched trills, like many other congeners (Fig. 5), but well outside the range of variation documented for *M. koepckae*.

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TABLE 2
Measurements of specimens per subspecies.

Population	*n*	Bill length to skull (mm)	Tarsus (mm)	Flattened wing (mm)	Tail (mm)	Mass (g)
M. koepckeae, north-west Peru	6	21.7 ± 0.73 (20.8–22.3)	28.7 ± 0.70 (28–30)	177.2 ± 4.29 (173–185)	99.3 ± 1.71 (98–102)	119.9 ± 4.8 (112–127)
M. koepckeae, south-central Peru	8	21.5 ± 1.73 (19.0–23.7)	30.7 ± 2.63 (25.3–37.0?)	172.3 ± 2.45 (169–174)	94.6 ± 5.16 (86–103)	121, 122, 130

Most similar to the song of *M. koepckeae*, perhaps, *M. choliba* also gives trills at lower pitch, slightly rising at constant pace and succeeded by one or two (rarely three) higher pitched and accentuated notes: *popopopopopopopopo-pú*, *popopopopopo-pú-pú* (Fig. 3, Table 1). Songs from throughout the vast geographical range of *M. choliba* (59 recordings) are remarkably uniform. Songs of five individuals from eastern Peru are no different from the rest, showing no intermediacy towards *M. koepckeae*, just as none of the songs of 11 presumed males of *M. koepckeae* shows any tendency towards that of *M. choliba*. The two differ consistently from each other in pace, change of pace, pitch, change of pitch and accentuation. Additionally, *M. choliba* does not normally duet, whereas *M. koepckeae* apparently does so commonly. Very few (at most two of 59) recordings of *M. choliba* are duets, vs. nine of 23 (39%) of *M. koepckeae* recordings. Among South American screech owls, duetting is most frequent in *M. albogularis*, with 19 of 28 songs (68%) (Fig. 2b), but is also common in *M. roboratus* (11 of 20 songs, 55%) and *M. sanctaecatarinae* (four of nine songs, 44%).

During duets of *M. koepckeae*, the presumed male song is answered by a similar, but slightly shorter and slower paced, 5–40% higher pitched song, presumably the female (Fig. 2). In response to playback, songs of both sexes become slightly higher pitched and longer (pitch of an excited presumed male is thus much like a relaxed presumed female), or sometimes more dissonant ('hoarse'). Following repeated playback, the female (alone?) may give a high-pitched long series, up to 1,700 Hz and nine seconds long (Fig. 3). Some presumed male songs may be incomplete, given with notes at constant pace and without accentuation. The 'aggressive song' (*sensu* Schulengerg *et al*. 2007; 'type B song' of many authors), an alternate type often given by more agitated birds, is similar but slightly longer and faster paced, approaching the 'aggressive songs' of *M. choliba* and *M. hoyi* (Fig. 4), but with a slower pace than in *M. robotatus*, *centralis* and *napensis* (Fig. 5). Other vocalisations of *M. koepckeae* include a hiss (female only?) given in response to male song (Schulenberg *et al*. 2007).

There are constant differences between songs of the two geographical populations of *M. koepckeae*. Those from the Marañón and Pacific drainages (Cajamarca, Lambayeque, La Libertad) are shorter and lower pitched than those from central Peru (Junín, Apurímac, Cuzco), with little overlap (Fig. 1, Table 1).

New taxon.—Plumage colours are, in general, of little use in screech owl systematics, but differences in vocalisations and habitat are usually more reliable (Holt *et al*. 1999, König *et al*. 2008). The differences in song and habitat choice between *M. koepckeae* populations of north-west and south-central Peru may suggest their long isolation. This would make sense biogeographically, as the north-western and central Peruvian Andes possess separate aggregates of endemic species (Fjeldså 1992, García-Moreno & Fjeldså 1999, García-Moreno *et al*. 1999, Fjeldså & Irestedt 2009). However, we adopt here the conservative approach that species rank should not be proposed unless thorough molecular studies, with adequate sampling and modeling of coalescence and gene flow, confirm the existence of separate

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evolutionary lineages. Lacking such data, we propose to recognise the central Peruvian population as a subspecies, which we formally name:

Megascops koepckeae hockingi, subsp. nov.

Holotype.—Museo Nacional de Historia Natural de la Universidad Nacional Mayor de San Marcos, Lima, no. 24278. Adult male collected 8 May 2002 by J. Mattos, preparatory no. 400, at 1,925 m, C'onoq [=Cconoc] at río Apurímac, Apurímac, Peru.

Description of the holotype.—Upperparts from forehead to rump Drab (Ridgway 1912 for colours) with 2–3 mm-wide fuscous streaks, somewhat irregular and often expanded near feather tips, the lateral parts of feathers finely mottled and often with roundish spots of pale ochre to whitish, and only faint indication of a pale ochraceous nuchal collar. Humerals with large white patch on outer webs, on most feathers separated by black line from pale ochraceous base. Wing-coverts like back but outer greater coverts with large white subterminal spots; greater coverts black with ochraceous notches and white border on outer web; carpal joint white and wing linings mostly pale ochraceous; remiges and rectrices Dusky Drab with indistinct ochraceous to pale pinkish-buff bars and mottles including on terminal parts. Facial disk Pallid Mouse Grey with faint Drab mottles, partly as concentric rings, and whitish border towards forehead and bill, and black lateral border continuing on side of throat, which is white with Dark Mouse Grey herringbone marks. Breast greyish white with some Cinnamon-buff and Fuscous-black herringbone marks of variable structure: shaft stripes mostly 1–2 mm but up to 5 mm wide; most feathers with 4–5 bars, but often asymmetrical with many gaps creating white spots; belly and sides white with distinctive black lines (shaft stripe and generally two transverse bars) creating distinctive 'grid' pattern; vent white, most feathers with small black arrow-shaped mark; feathered tarsi buff with small fuscous streaks. Label data: irides yellow, bill greyish green, and feet greyish brown; 'regular' fat; no moult; left testis 6 × 4 mm.

Measurements of the type.—Bill (to skull) 22.3 mm, tarsus 28.0 mm, flattened wing 174 mm, tail 97.5 mm.

Other specimens examined.—*M. k. hockingi*: ZMUC 103.504–505; BMNH 1946.49.130 from Ninabamba, Ayacucho; MUSA (JUN10-100) from Patibamba, Ayacucho, and MUSA 2150 from Apurímac; MUSAAC TO-01 from Alfapata south-west of Abancay, 2,500 m, Apurímac; MUSM 24279, 24293 and 25300; LSUMZ 179642–643; CORBIDI AV-08618–619. Specimens of *M. k. koepckeae*: MUSM 2202, 7298–99, 8428–29, 8824, 12790–791, 15462, 16798, 19433–435, 20020, 25058; LSUMZ 179540 (and examined by JF in 1980s: AMNH 235429, 235431–432, 476729, 802425 [holotype]; Paris CJ1903 u.87). Several photos and videos of live birds of both subspecies also examined see http://www.youtube.com/watch?v=xArRBU02Pys and http://www.youtube.com/watch?v=9J8IRkztFnQ.

Diagnosis.—Differs from *M. k. koepckeae* by generally more drab grey (rather than Chocolate- to Snuff Brown) appearance and more sparsely marked rear underparts, contrasting with densely barred breast and throat. Very little brown in plumage, except ochraceous hue to greater primary-coverts, and only a little ochraceous underdown or tinge on legs and vent, as seen in nominate subspecies. Feathers of underparts below breast white, typically with 1.0–1.5 mm-broad shaft-streaks that extend laterally into bars, occasionally with an expanded bifurcation near tip of feather, and only two transverse bars, affording general impression of white rear underparts with 'grid' of black lines (Fig. 2). Generally some distinct short black shaft-streaks or arrow-shaped marks on feathered tarsi. *M. k. koepckeae*, in contrast, is more richly hued, with ochre-brown to cinnamon patches in plumage, and more gradual transition between densely barred breast and whiter belly, which often has some stippled bars and several narrow bars spaced 1.5 mm apart.

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Individual variation.—All specimens of *M. k. hockingi* very greyish but some variation in pattern, as certain individuals have dense pale speckles and spots, and conspicuous dark streaks dorsally, while others are more uniform dark brownish grey with indistinct mottling; some have virtually no indication of nuchal collar. Similarly, boldness of shaft-streaks on ventral side varies, as in females some dark stripes on breast up to 6 mm broad, thus much heavier than those illustrated in Fig. 2, with white parts of feathers rather peppered with small dark spots or indications of double bars. Some specimens have more ochraceous down on upper flanks and some pinkish cinnamon on the feathered tarsi. Measurements overlap with northern populations, albeit with slightly lower mean values, except the tarsus (Table 2).

Eyes (based on label data supplemented with photos of live birds) deep yellow, darkest near pupil; cere greenish, bill greenish (or blue-grey) with greenish-yellow cere and distal part; feet greenish-grey (with variation, as specimens from La Libertad had pale tan feet with olive soles, and a photo from Cordillera Blanca, Ancash, suggests pink feet).

Distribution.—Dry intermontane valleys of Apurímac, Ayacucho, Huancavelica and southern Junín, in central Peru (Fig. 1). Localities in Junín: below Pariahuanca, 12°02′41″S, 74°50′31″W, 1,950 m (sound-recordings DFL, T. S. Schulenberg) and north-east of Pariahuanca, 12°01′26″S, 74°50′56″W, 2,150 m (sound-recordings DFL); Acobamba near Estancia Chillo, 11°46′22″S, 74°47′28″W, 2,320 m (tape-recordings by FS). Huancavelica: Mantaro Valley, right bank on Surcubamba–Huachucollpa road, 12°05′28″S, 74°41′56″W, 1,400 m (sound-recordings DFL). Ayacucho: Ninabamba in lower río Pampas Valley (BMNH); Patibamba on río Torobamba (near Río Pampas), 13°07′S, 73°54′W, 2,253 m; near Huanta on río Huarpa (Mantaro Valley), 12°56′S, 73°07′W, 2,450 m; Chinchipata, 13°13′S, 73°52′W, 2,900 m, between Chilcas and Rosaspampa, and río Pampas Valley near Rosaspampa, 13°16′S, 73°49′W, 1,700 m (JB). Apurímac: Alfapata at 13°35′S, 73°07′W, between Andahuaylas and Abancay (collected, T. Aucca), Villa Los Loros Choquequirao lodge, near Huanipaca, beside río Tambobamba; Pachachaca Valley and ascent towards Abancay town, 1,550–2,100 m, 13°40′S, 72°55′W (two collected, many observations, Colcapata, Pachachaca, Pomachaca); Chalhuanca Valley south to Tampumayu 14°11′S, 73°19′W and Atunhuaijo north to Mutca, at 14°12′S, 73°17′W, 3,320 m; Apurímac Valley, including dpto. Cuzco (two collected at Tincocc, 13°50′S, 71°56′W at 2,626 m, Cocha, Pumachaca, San Ignacio, Cocamasana at 2,276 m, Baños de Cconoc [='C'onoq', type locality], Curahuasi, Huallpachaca, Colcapata, Huanipaca, Pachachaca, Tocto Huaylla and Río Yaurisque on río Molle Molle, and towards Choquequirao 13°25′55″S, 72°49′55″W, at 1,500–1,900 m, Ayusbamba 13°48′S, 71°57′W and Yaurisque 13°40′S, 71°55′W, at 3,400 m).

Etymology.—We name this owl for Pedro Hocking, in honour of his life-long efforts to document the Peruvian avifauna, notably the poorly explored forests of the central Peruvian Andes.

Ecology and biology.—The east-draining basins of the central Peruvian Andes are erroneously classified as humid montane forest by many ecological atlases (e.g., Dinerstein *et al*. 1995). In fact, these valleys are mostly a rainshadow area with dry forest and scrub, and relict patches of various types of evergreen mist vegetation only locally on the upper slopes towards the puna (*Podocarpus*, *Myrcianthes*, *Escallonia*, *Hesperomeles* etc., and *Polylepis* highest up). The only small owl reported from these evergreen forests is Andean Pygmy Owl *Glaucidium* (*jardinii*) *bolivianum*. In Lima and Ancash, however, the evergreen forests have *M. k. koepckeae*, whereas *G. peruanum* is mainly found in mist-dependent woodlots lower down, but in Apurímac, e.g., the latter occurs syntopically with *M. k. hockingi* (Baiker 2011). The rainshadow valleys of central Peru are mostly severely degraded, as deciduous forests have been turned into open land with spiny scrubs through most of Ayacucho, and

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few wooded patches are left, other than numerous *Eucalyptus* plantations. However, there are still large tracts of mature dry forest in the Mantaro, Pampas, Pachachaca, Apurímac and Chalhuanca valleys, at 1,400–2,000 m. *M. k. hockingi* is locally fairly common in woodland dominated by *Eriotheca vargasii*, *Ficus cuatrecasasiana* and *Schinus molle* along the río Apurímac. However, it also occurs in scrubby areas with groves of tall *Eucalyptus* trees at 3,400 m at Ayusbamba, Mutca and Yaurisque.

The owls appear in pairs, maintaining frequent vocal contact. They are noisy and audible at long distance, and respond readily to playback. The small feet suggest that the diet is mainly insects, as also noted on several specimen labels. Breeding is in February–March (rainy season), based on the gonadal state of specimens. Roosting may be in holes in trees or cavities in large masses of epiphytic bromeliads. On 3 March 2010 DG, with J. Ccahuana & H. Clyman, observed a pair of *M. k. hockingi*, in a cultivated landscape with rows of trees and scrubs below Abancay, of which one bird flew into an apparently naturally eroded hole in a 4 m-high north-facing roadcut. On 29 March the site was visited again by DG & ML, and an adult and two nestlings were photographed in the hole. The hole was *c*.3 m above ground, oval-shaped, *c*.30 cm high, 70 cm wide and 1 m deep, tapering to *c*.20 cm high and 40 cm wide at its end, where the nest chamber was placed. The nestlings, probably a few days old, had pale grey down, the eyes closed, bill bluish grey.

This taxon is common in many places, even in rather degraded habitat. Provided some trees remain for roosting and perching, and holes in trees or banks for nesting, it seems to survive well. Thus, no particular conservation concern should exist for this owl. Yet, further work is much needed to clarify the apparent geographical variation in environmental requirements of Koepcke's Screech Owl, and there is also a need for genetic sampling to model the history of gene flow between its populations.

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Appendix 1: sound-recordings examined

LNS = Macaulay Library of Natural Sounds (http://macaulaylibrary.org), XC = Xeno-Canto (http://www.xeno-canto.org).

Megascops choliba: *M. c. margaritae* song 7 (LNS 59303, 59305–306, 59308–311, 105908, 59307, XC 45400), alarm 3 (LNS 59304, 105908, XC 45400), calls 3 (LNS 59300, 59304, 59308). *M. c. crucigerus* song 27 (LNS 4476–77, 59301, 59312, 59314–316, 59318–319, 59321, 89811, 90479, 95027, 134790, XC 6577, 7877, 8389, 10844, 12931–932, 12934, 13530, 14643, 27842, 28142, 30811–812), alarm 8 (LNS 4476–77, 59312, 59314, 59316–317, 87585, XC 12933), calls 3 (LNS 59302, 59313, 59321). *M. c. decussatus* song 8 (LNS 113387, XC 1225, 4369, 6604, 6890, 7416, 18921, 24732), calls 2 (XC 6420, 16809). *M. c. choliba* song 5 (XC 10240, 15944, 23848, 30363, 33444), alarm 1 (XC 8109). *M. c. uruguaiensis* song 5 (LNS 59320, XC 16289, 22566, 24378, 30450), alarm 1 (XC 22565). *M. c. suturutus* song 7 (LNS 110727, 120858, 120992, XC 2162, 2824, 3016, 4378), alarm 2 (LNS 120992, XC 3017), call 2 (LNS 120993, XC 3016). *M. c. wetmorei* song 3 (LNS 116068, 139170, XC 45228).

Megascops koepckeae: **North-west Peru** (11 recordings of 13–14 individuals): **Cajamarca** ('La Granja', 06°21'S, 79°07'W, 2,200 m) duet 1 (DFL), **Lambayeque** ('Corral Grande', 06°17'S, 79°27'W, 1,840 m) songs of two birds (females?) 1 (XC 8649), duet 1 (XC 5526), **La Libertad** (Sinsicap, 07°51'S, 78°45'W, 2,500–2,550 m) song 3 (GE, DFL), duet 3 (XC 14127, LNS 129552, DFL). **South-central Peru** (41 recordings of 23–24 individuals): **Junín** (Acobamba, 11°46'S, 74°47'W, 2,318 m) song 1 and alarm 1 (XC 23646–647), (below Pariahuanca, 12°03'S, 74°50'W, 1,950 m) song 2 and duet 1 (DFL) (north-east of Pariahuanca, 2,150 m) duet 1 (DFL), **Apurímac** ('San Ignacio', 13°25'S, 72°52'W, 1,784 m) song 1 (JB), (Cocamasana, 13°26'S, 72°50'W, 2,276 m) song 1 (JB), (Cconoc, 13°33'S, 72°35'W, 1,850–1,900 m) song 2, duet and call 2 (RY, JB), (Pacchani, 13°34'S, 73°04'W, 2,457 m) song 1 (JB), (3.5 km south-west of Abancay, 13°39'S, 72°56, 2,000 m) song 1 (DFL), (Pachachaca bridge, 13°40'S, 72°56'W, 1,775 m) song 1, call 1 (RY, RW), (6 km south-west of Abancay, 13°41'S, 72°57'W, 2,200 m) duet 1 (DFL), (Huallpachaca, 13°41'S, 72°20'W, 2,100 m) song 1 (RY), **Cuzco** (Molle Molle, 13°41'S, 71°57'W, 3,000 m) call and song 1 (RY), (Tocto Huaylla, 13°44'S, 71°59, 2,750 m) call 1 (RY), (Colcapata, 13°47'S, 71°58'W, 2,900 m), (Cocha, 13°50'S, 71°56'W, 2,626 m) duet 1 (RY).

Also analysed were the following recordings deposited in Macaulay Library, xeno-canto.org, or published by Hardy *et al*. (1989), Jahn *et al*. (2002), Krabbe & Nilsson 2003, Coopmans *et al*. (2004), Lysinger *et al*. (2005) and Boesman (2006); also an unpublished recording of *pacificus* from Loja by Anonymous (© Ginkgo) and two unpublished recordings of *roboratus* and three of *albogularis* by NKK: ***Megascops roboratus pacificus***: songs from 13 individuals or pairs, calls from five, from Ecuador and Peru. ***M. r. roboratus***: songs from seven individuals, calls from two, from Ecuador and Peru. ***M. hoyi***: songs from 16 individuals from Bolivia and Argentina. ***M. [guatemalae] napensis***: songs from 13 individuals from Ecuador and Peru. ***M. [g.] centralis***: songs from nine individuals from Panama, Colombia and Ecuador. ***M. albogularis***: songs or duets from 28 individuals or pairs from Venezuela, Colombia, Ecuador, Peru and Bolivia. ***M. sanctaecatarinae***: songs or duets from nine individuals or pairs.

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