



An undescribed *Ninox* hawk owl from the highlands of Central Sulawesi, Indonesia?

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SUMMARY.—The Indonesian island of Sulawesi is a globally important hotspot of avian endemism, yet its birds are little studied and new species are still being discovered in the region. We present observations and photographs of an apparently undescribed taxon of *Ninox* hawk owl from 2,250 m on Gunung Rorekatimbu, Central Sulawesi. We reviewed specimens of all known South-East Asian *Ninox* owls and concluded that this bird's white-spotted underparts and pale supercilia are not shared by any other *Ninox* hawk owl in the region. Recordings attributed to it are strikingly similar to *Ninox ios*, but consistently have a longer inter-note interval between the paired main notes, and may be slightly lower in frequency. We believe it either represents a new subspecies of *N. ios* in Central Sulawesi, or it is a new species closely related to *N. ios*. If shown to be of species rank, we suggest the common name White-spotted Hawk Owl for it. Photographs of the unknown owl were taken in 1999 and a published photograph from 2007 likely pertains to it, but the bird's taxonomic status remains unresolved, and no specimens are known. Montane forest at the site is relatively intact and we are planning further work to address this problem.

Sulawesi, the largest landmass within the biodiversity hotspot of Wallacea, is a globally important centre of avian endemism with 42 endemic bird species. This is more than one-third of all species endemic to the Sulawesi region (Coates & Bishop 1997, Stattersfield *et al.* 1998, Mittermeier *et al.* 2004) and about one-sixth of its resident avifauna. Despite its biological richness, Sulawesi is ornithologically one of the most unfamiliar regions on Earth, and new species are still being described from the island and its satellites (Coates & Bishop 1997). Recently described species include Cinnabar Hawk Owl *Ninox ios* from mainland Sulawesi (Rasmussen 1999), Sangihe Scops Owl *Otus collaris* from Sangihe Island (Lambert & Rasmussen 1998) and Togian Hawk Owl *Ninox burhani* and Togian White-eye *Zosterops somadikartai* from the Togian Islands in the Gulf of Tomini (Indrawan & Somadikarta 2004, Indrawan *et al.* 2008). Avian rediscoveries are also relatively frequent; for example, Banggai Crow *Corvus unicolor*, previously known only from two specimens of uncertain provenance, was recently rediscovered on Peleng Island in the Banggai archipelago (Mallo *et al.* 2010). Much of Sulawesi is mountainous, with an estimated 20% of its land area over 1,000 m elevation. Unsurprisingly, many of the island's endemic birds (e.g. Geomalia *geomalia heinrichi*, Sombre Pigeon *Cryptophaps poecilorrhoa*) are restricted to the highlands (Whitten *et al.* 2002). Although Sulawesi's mountains have been explored to varying extents in the past century, few high-elevation areas have been visited recently and thus the montane avifauna is still poorly known (White & Bruce 1986, Collar 2009). Disconcertingly, accelerating habitat loss both outside and inside protected areas is threatening Sulawesi's avian diversity even before all of its species are described (King *et al.* 1999, Sodhi *et al.* 2005, Waltert *et al.* 2005, Cannon *et al.* 2007).



Wallacea supports an exceptionally diverse owl community with six *Tyto* barn owls, at least nine *Ninox* hawk owls and six *Otus* scops owls (Coates & Bishop 1997, BirdLife International 2009a). These nocturnal birds are even more poorly known than the region's diurnal avifauna. At least four new owl species have been described from Wallacea in the last two decades, namely two hawk owls and a scops owl from the Sulawesi region (Lambert & Rasmussen 1998, Rasmussen 1999, Indrawan & Somadikarta 2004) and a hawk owl in the Lesser Sundas (Olsen *et al.* 2002). The taxonomy and distribution of many Wallacean owl taxa is not well known and subject to revision. For example, recent evidence shows that the geographically variable Moluccan Hawk Owl *Ninox squamipila* probably involves a complex of three morphologically, vocally and genetically distinct species (Norman *et al.* 1998, Rasmussen 1999), yet their taxonomy remains unresolved. In the case of *N. ios*, the species is still known from only a single specimen, although there are now many photographs and sound-recordings from North Sulawesi, and putative records from Central Sulawesi (e.g., Lee & Riley 2001, Mauro 2001).

A new *Ninox*

Here we present observations and photographs of a distinctive medium-sized *Ninox* owl, which differs markedly in plumage from all other known Indonesian owls and is thus likely to represent an undescribed taxon. The owl was photographed by BM in July 1999 during the day, on the Anaso track on the east slope of Gunung Rorekatimbu (c.01°16.07'S, 120°19.02'E; c.2,250 m) in Central Sulawesi (Fig. 1). Tebb *et al.* (2008) also photographed and discussed a bird at c.1,700 m on Rorekatimbu that appears to be the same taxon.

Much of Gunung Rorekatimbu lies within Lore Lindu National Park (LLNP), a 217,991-ha protected area that supports c.78% of Sulawesi's endemic birds, as well as important populations of threatened endemic mammals (Coates & Bishop 1997, Prawiradilaga *et al.* 2006, Lee *et al.* 2007). LLNP is a key area for the conservation of threatened and range-restricted birds such as Maleo *Macrocephalon maleo* (Endangered), Snoring Rail *Aramidopsis plateni* (Vulnerable), Blue-faced Rail *Gymnocrex rosenbergii* (Vulnerable), Minahassa Owl *Tyto inexpectata* (Vulnerable), Cinnabar Hawk Owl (Vulnerable; see comments below concerning status in LLNP), Heinrich's Nightjar *Eurostopodus diabolicus* (Vulnerable) and Geomalia (Near Threatened) (Mauro 2001, Mauro & Drijvers 2000, Riley & Wardill 2003, BirdLife International 2009a,b).

Most of LLNP is mountainous and habitats and rainfall are variable (TNC 2004); annual rainfall in the north of the park, where Gunung Rorekatimbu is located, is 2,000–3,000 mm (SNRI 2008). The national park is under considerable pressure from increasing human population due to transmigration, expansion of cacao agriculture and illegal logging (Weber *et al.* 2007, Clough *et al.* 2009, Lee *et al.* 2009). In the early 1990s a logging company constructed a road and selectively logged montane forest from the Palu–Wuasa road to Puncak Dingin and Anaso. There are still many open areas along the road (now called the Anaso track), but the canopy is starting to close in places. In addition, most areas of the mountain away from the road are primary and mature secondary forest, from c.1,250 m to the summit of Gunung Rorekatimbu at 2,520 m. Forest on the mountain at c.1,500–2,000 m is up to 25 m tall and dominated by oaks such as *Castanopsis acuminatissima* (Fagaceae) and dammar (*Agathis* sp., Araucariaceae; Whitten *et al.* 2002). At c.2,250 m where the owl was photographed, the forest is lower in stature with abundant epiphytes. Dominant trees in this area include *Leptospermum* sp. (Myrtaceae) and *Dacrycarpus* sp. (Podocarpaceae), while *Rhododendron* and *Vaccinium* (Ericaceae) are common in the understorey (Whitten *et al.* 2002).

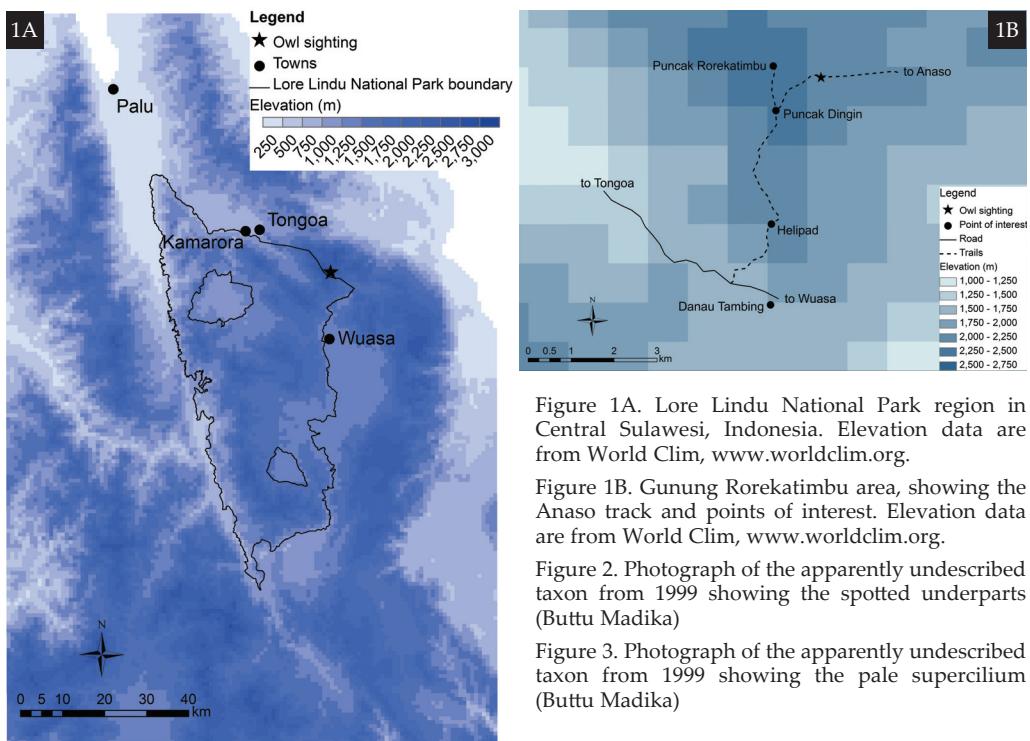


Figure 1A. Lore Lindu National Park region in Central Sulawesi, Indonesia. Elevation data are from World Clim, www.worldclim.org.

Figure 1B. Gunung Rorekatimbu area, showing the Anaso track and points of interest. Elevation data are from World Clim, www.worldclim.org.

Figure 2. Photograph of the apparently undescribed taxon from 1999 showing the spotted underparts (Buttu Madika)

Figure 3. Photograph of the apparently undescribed taxon from 1999 showing the pale supercilium (Buttu Madika)



In July 1999 BM & FNM (hereafter 'we') spent c.14 days on the Anaso track observing and photographing birds. Between one and two km from Puncak Dingin towards Anaso, we encountered an owl roosting in a c.6 m tall tree. We were able to approach it to within 5 m and take several photographs (Figs. 2–3). The owl displayed plumage characteristics that differed from other *Ninox* species found on Sulawesi with which we are familiar (Ochre-bellied *N. ochracea*, Speckled *N. punctulata* and Cinnabar Hawk Owls). The bird showed a



unique combination of two characteristics: large white spots on the underparts, and bold white supercilia.

Four *Ninox* hawk owls (three endemic residents and one winter visitor) are already known from LLNP. The endemics are Ochre-bellied Hawk Owl, found from the lowlands to 800 m (Coates & Bishop 1997, Rasmussen 1999), Speckled Hawk Owl found from the lowlands to 1,100 m (rarely to 2,300 m; Coates & Bishop 1997), and Cinnabar Hawk Owl found on Gunung Rorekatimbu, Gunung Rano Rano, Gunung Nokilalaki and Gunung Dali at 1,630–2,260 m (pers. obs.). The migratory Brown Hawk Owl has been recorded from sea level to 800 m (Coates & Bishop 1997). Two species from adjacent islands must also be considered: Togian Hawk Owl, recorded to 400 m in the Togian Islands (Indrawan & Somadikarta 2004) and the highly polytypic Moluccan Hawk Owl which is found from sea level to 1,750 m in the Moluccas (Coates & Bishop 1997). If confirmed as a new species, the undescribed taxon would increase the known resident *Ninox* species of Sulawesi to four, making the island home to the richest hawk owl assemblage in the world.

Diagnosis

For the unknown owl, the following diagnosis is based solely on three available photographs of the same individual showing the front of the bird, and therefore specimen material will be required to validate some of the taxon's characteristics, particularly those involving size and structure. Comparative material of other taxa used was primarily an extensive reference collection of specimen photographs taken at many museums, as well as photographs of several taxa available on Oriental Bird Images (OBI; <http://orientalbirdimages.org/>, accessed 6 April 2010) and elsewhere.

Our photographs show an earless, rufous owl almost certainly belonging to the genus *Ninox*, with boldly spotted underparts and prominent whitish supercilia extending from the base of the bill and ending above the eyes.

The crown appears dark, but resolution of the photographs is insufficient to determine whether patterning is present on the crown. The feathers of the pale supercilium appear to be somewhat upstanding, above the plane of the crown feathers. The supercilia form a shallow 'V' shape with the forecrown, and are bordered below (above the eye) by distinct zones of dark russet-brown feathers narrowest medially and broadest laterally. The irides appear to be pale yellow, lacking a narrow black ring on the exterior edge of the iris itself, but with a variably narrow dark eye-ring of bare skin, broadest and darkest over the anterior lateral half of the eye. The bill and cere are pale, and the nares are prominent. The ear-coverts are fairly uniform dark russet-brown, although they are palest below and behind the eye, and darkest to the sides of the bill, and they terminate in thin extensions beyond the rim of the facial disk. The feathers of the entire underparts from the lower breast to vent have large white or whitish spots, prominent white shaft-streaks, and strongly contrasting dark brown chevron-shaped tips. It appears probable from the photographs that the feathers of the upper breast have only small whitish spots and are mostly dark. The photographs do not show the dorsal surface.

In comparison with *N. ios* from North Sulawesi, our photographs appear to show that the putative new owl is more heavily built, with a relatively smaller head; a longer bill with relatively larger more prominent nares and with the cere more exposed; a relatively longer body; a relatively squarer tail; and heavier toes. It is possible that postural differences play a role in some of these perceived differences, but the overall shape of the unknown bird appears quite distinct from *N. ios*. In soft parts, the unknown owl appears to have paler yellow irides without the surrounding black iris ring or (as far as can be determined from photographs) narrow pinkish bare eye-ring, both present in *N. ios*, while being similar in the



colour of bill, toes and claws. Given that the photographs of the unknown bird were taken in daylight, while those of *N. ios* we have seen were taken with flash in darkness, these putative distinctions require substantiation. In ventral plumage, the unknown owl differs strikingly from North Sulawesi *N. ios* in its strong face pattern (vs. no apparent pattern in *N. ios*); the large white-spotted feathers over the entire underparts from breast to vent; and its less narrowly banded tail (hence with fewer visible tail bands). In addition, its feathering appears more compact, less full and fluffy, with the exception of the apparent ear-covert tufts. Note that there is only a single specimen of *N. ios*, the holotype held in Naturalis (Leiden), and the above comparisons were made with photographs of it and several photographs from Gunung Ambang, North Sulawesi on OBI and avocet.zoology.msu.edu. Most of the above-noted differences, which are based on comparisons of photographs, require further substantiation.

The type specimen and all photographs available in the above-mentioned photo archives of *N. ios* from North Sulawesi show fairly uniform rufous underparts, with at most subtle barring and / or speckling. However, a bird photographed in Lore Lindu in September 2007 and identified as *N. ios* appears very similar to our photographs (Tebb *et al.* 2008). The bird's voice was said to be similar to *N. ios* from North Sulawesi but its plumage shows the same bold, pale spots below and pale supercilium. Tebb *et al.* (2008) observed similarly marked birds in Lore Lindu in September 2004 and October 2006, although no photographs of these birds were published.

A photograph of putative *N. ios* from Lore Lindu on OBI (taken by E. Collaerts on 18 August 2008) has large pale (but not white) spots below, with dark brown chevron-like borders on the feather edges, and there appear to be fewer tail bands than in the North Sulawesi form of *N. ios*. Unfortunately the face of this individual is tilted away in the photograph, as it was taken from below, making it impossible to determine the degree of face patterning. Another photograph of putative *N. ios* from LLNP (by T. Sawbridge, September 2009, available at www.birdtourasia.com/sulawesireportsept09.html), shows a bird with similar, although more subtle, markings on the underparts. The face is partially obscured in the photograph but the supercilium appears pale, although not bright whitish as in our photographs. More tail bands are visible in the Sawbridge bird than in the Collaerts bird or our unknown owl, but this could be an artefact of the photograph. The birds photographed by Collaerts and Sawbridge are more subtly marked than our unknown owl, but it is still possible that these photographs represent the same taxon. It now appears that the Central Sulawesi population previously assumed to be *N. ios* is actually the unknown owl, in which case it must be highly variable in plumage (unlike *N. ios* from North Sulawesi).

We have considered the possibility that the unknown owl represents juvenile *Ninox ios*. Although, as far as we are aware, no data are available on the juvenile plumage of *N. ios*, this seems unlikely given the apparent difference in tail banding, the fact that the unknown owl appears no more and probably less fluffy and with more distinct markings (exactly the opposite of what would be expected based on juveniles of other *Ninox* species; PCR unpubl.), and the apparent differences in structure.

The unknown owl differs strongly from Ochre-bellied Hawk Owl *N. ochracea* in coloration, being largely russet with strong white spots below (vs. brown with an entirely or nearly unmarked ochraceous-buff belly in *N. ochracea*). Note also that although *N. ochracea* has a prominent white supercilium, it is narrow and runs into the pale feathering at the sides of the bill, forming an 'X' shape. It also has a mostly dark bill and its tail has very narrow pale bands and very broad dark ones. Juveniles of *N. ochracea* are similar to adults but fluffier and slightly duller below.



Compared to Brown Hawk Owl *N. scutulata* (all forms except the almost all dark *N. [s.] obscura* of the Andamans, considered a distinct species by Rasmussen & Anderton (2005), and including forms *randi* and *japonica* sometimes split on the basis of vocalisations), the unknown owl has much more extensive pale supercilia (vs. a small white triangle between the eyes, not extending above the eye in *N. scutulata*); an entirely pale (vs. largely dark) bill; dark bristles surrounding the bill (vs. whitish); a more russet-brown face (vs. largely dark grey in most *N. scutulata*); a very different underparts pattern with each feather primarily white surrounded by dark (vs. distinct large dark brown or rufescent heart- or chevron-shaped marks surrounded by white and forming stripes on the lower underparts, and more typical dark central feather streaking on the breast); and much narrower tail banding. In addition, the unknown bird appears to be distinct in shape from *N. scutulata*, having a less markedly small head and less compact plumage.

Compared to Andaman Hawk Owl *N. affinis*, the unknown bird differs in much the same ways as for *N. scutulata*, except that *N. affinis* has even paler feathering around the bill and typical dark central feather streaking on the lower underparts. In comparison to Hume's Hawk Owl *N. [scutulata] obscura*, the unknown bird is much paler and more russet overall, with very different markings and aspect.

The recently described Togian Hawk Owl *N. burhani* of the Togian Islands has a very different plumage pattern and colour to that of the unknown Lore Lindu owl. It is largely drab brown with a narrow white 'X' on the face, small white speckles on the brown crown and breast, and white lower underparts with dark brown streaking.

There are three poorly known large *Ninox* taxa in the Moluccas generally united under the name Moluccan Hawk Owl *N. squamipila*. However, these taxa are all so markedly different from each other that their taxonomy clearly requires revision (Rasmussen 1999, Rheindt & Hutchinson 2007). Nominate *N. s. squamipila* from Seram has a dark brown head with a whitish 'X' facial pattern; rufous-brown underparts, the lower underparts narrowly dark-banded, with broader white bands; and a strongly banded tail with narrow dark and broader pale bands. The form on Halmahera, *N. s. hypogramma*, is rather similar in plumage to *N. s. squamipila* but is darker especially on the head and has equal-width, narrow dark and light bands below, and the undertail is at most obscurely banded. The Buru form *N. s. hantu* appears much more similar to the unknown owl because it is largely rufescent, but it has narrowly dark-banded underparts with slightly broader rufescent bands, and a rather faintly banded undertail. None of the heterogeneous taxa currently comprising *N. squamipila* are at all similar to the unknown *Ninox*.

The recently described Little Sumba Boobook *N. sumbaensis* (Olsen *et al.* 2002) is also very different in plumage from our unknown owl, being generally dull brown with fine wavy black lines over the underparts. It does have well-marked white supercilia, but these are smaller and less distinct than in the Lore Lindu owl.

Ninox philippensis is another heterogeneous grouping of taxa, which fall into three major groups on plumage type, none of which resemble our Lore Lindu owl. The unknown owl also differs greatly from the following species, which will therefore not be considered here: Speckled Boobook *N. punctulata*, Sumba Boobook *N. rudolfi*, the several forms of Southern Boobook *N. boobook* and Barking Boobook *N. connivens*. Finally, none of the *Ninox* species from outside the Oriental region are similar to the unknown Lore Lindu owl.

Discussion

The photographs described above and our preliminary diagnosis suggests that there is a probable new taxon of *Ninox* hawk owl in Lore Lindu National Park (LLNP). The status of *Ninox* species in LLNP is confused and it now appears likely that some or all birds assumed



to be *N. ios* in Central Sulawesi pertain to the new taxon. Alternatively, the strongly marked unknown owl could be an undescribed species, even though its voice is apparently similar to North Sulawesi *N. ios*. If the owl is shown to be of species rank, we propose the English name White-spotted Hawk Owl to highlight its unique, boldly spotted underparts. The two records come from montane forest (at c.1,700 m: Tebb *et al.* 2008, and c.2,250: this paper). We are unable to speculate further on possible habitat preferences.

We compared nine recordings (by JBCH, YDL on AVoCet, www.avocet.zoology.msu.edu, and by R. Hutchinson) believed to be *N. ios* from Lore Lindu with recordings and vocal descriptions of *N. ios* from Gunung Ambang, North Sulawesi (two recordings on www.xeno-canto.org, five on AVoCet, and one by R. Hutchinson; King 2005, Hutchinson *et al.* 2006). Although Lore Lindu birds possess vocalisations strikingly similar in quality and pattern to Gunung Ambang birds, inter-note intervals between the couplets that comprise each song strophe are consistently longer in Lore Lindu birds. In addition, the apparent frequency is slightly lower in each of the available samples from AVoCet and xeno-canto of Lore Lindu birds than in those from Gunung Ambang. The vocal evidence strengthens the case for the occurrence of *N. ios* in Central Sulawesi. One published paper also suggests, based on a sight record without photographic documentation, that *N. ios* (with North Sulawesi-like plumage) occurs in LLNP (Mauro 2001). Clearly, more research is needed to clarify the systematics, distribution and ecology of Sulawesi's *Ninox* owls.

On several occasions since 1999, we have unsuccessfully searched the area at 660–2,520 m for any owl differing from those already known in the LLNP. In 2006 we listened for owls at Danau Tambing (01°19.06'S, 120°18.05'E; 1,675 m) and Kamarora (01°11.05'S, 120°08.02'E; 660 m) (Fig. 1). In 2007 we conducted nocturnal searches from Danau Tambing, to Puncak Dingin, to Anaso at 1,675–2,315 m. In 2009 we performed night surveys and daylight searches for roosting birds from 2–5 November and 4–8 December in the same areas as 2007, and continued to Puncak Rorekatimbu at 2,520 m. The forest in these areas is maturing since the selective logging of the early 1990s and the habitat appears to be improving over time with the current levels of minimal disturbance. We are planning further surveys targeted towards resolving the mystery concerning the identity and status of this bird, and invite anyone with relevant data to contact us.

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