

The birds of Gunung Ambang Nature Reserve, North Sulawesi, Indonesia

JON RILEY and JORYS MOLE

Between 9 and 19 November 1999 we conducted ornithological surveys at Gunung [= Mount] Ambang, an 8,638 hectare nature reserve located on the northern peninsula of Sulawesi, Indonesia. The reserve supports a number of primary forest types between 700 m and 1,760 m. Surveys were also made in a 25,000 hectare area of primary lowland and hill forest, of uncertain official status, to the north of Ambang. We noted 108 species in these two areas, including the globally threatened Matinan Flycatcher *Cyornis sanfordi*, which is restricted to montane forests on the north peninsula of Sulawesi, and Cinnabar Hawk Owl *Ninox ios*, a recently described species previously known only from a single specimen collected from Bogani Nani Wartabone National Park, c. 30 km to the west. A total of 113 species has now been recorded in the reserve. Bird populations at Mt. Ambang are threatened primarily by loss of habitat caused by agricultural encroachment into the reserve and habitat degradation resulting from timber extraction. Hunting is a major threat to mammal species in the reserve and some birds are also affected. Clarification of the current status of the extension area, ideally followed by its designation as a reserve, would add an important site to the island's protected area network. This move, coupled with an increase in patrolling and monitoring by park authorities, and publicizing the reserve amongst local communities, would be important first steps towards ensuring the future of Mt. Ambang's forests and wildlife populations.

INTRODUCTION

The 159,000 km² island of Sulawesi is the largest island in the biogeographical subregion of Wallacea, the transition zone between Asian and Australian plants and animals. In part due to its size and geographic isolation, Sulawesi is characterized by high levels of species endemism and supports at least 88 species of endemic birds (White and Bruce 1986, Whitten *et al.* 1987). The island has been designated an Endemic Bird Area by BirdLife International, supporting c. 350 bird species, of which 54 are restricted to a particular range (Andrew 1992, Sujatnika *et al.* 1995, Coates and Bishop 1997, Stattersfield *et al.* 1998).

North Sulawesi lies just above the equator, and extends 50-100 km in width and approximately 450 km in length. The topography is characterized by steep mountains that were formed by recent volcanic events, with elevations reaching over 2,200 m. Whilst most remaining lowland forest areas in North Sulawesi are small, there are still large forest tracts in montane regions >1,000 m. These are important refuges for many

threatened bird species, including Minahasa Masked Owl *Tyto inexpectata*, Snoring Rail *Aramidopsis plateni*, and Maleo *Macrocephalon maleo*. In addition, two threatened species are currently known only from montane forests in the north peninsula: Matinan Flycatcher *Cyornis sanfordi* and the recently described Cinnabar Hawk Owl *Ninox ios* (White and Bruce 1986, BirdLife International 2000, Coates and Bishop 1997, Stattersfield *et al.* 1998, Rasmussen 1999).

In recent years, faunal populations in North Sulawesi have dramatically declined (O'Brien & Kinnaird 1996, Lee 1999, Lee *et al.* 1999). Wildlife is intensively hunted, and farming practices continue to raze and compromise the integrity of natural landscapes. Furthermore, trade in birds is common (F. R. Lambert verbally December 1999). Due to these increasing pressures on wildlife, protected areas have become even more critical than before to the conservation of Sulawesi's fauna.

We document the first systematic survey of bird populations at Gunung Ambang Nature Reserve between 9 and 19 November 1999, and discuss conservation implications.

STUDY AREA

The 8,638 hectare Gunung Ambang Strict Nature Reserve *Cagar Alam* was designated by the Indonesian government in 1978 and straddles two North Sulawesi districts, Minahasa and Bolaang Mongondow (Fig 1). The reserve is centred on the Ambang mountain ridge, including the peaks of Mt. Tudutalong (1,680 m), Mt. Moyayat (1,706 m), Mt. Molibut (1,565 m), and Mt. Ilantat (1,552 m) (KSDA 1998, *Peta Rupabumi Indonesia* series 1991) (Fig 2).

At present, there is conflicting information from different government agencies concerning the status of



Figure 1. Map of North Sulawesi showing the location of Gunung Ambang Nature Reserve

an area of forest, c. 25,000 ha in size, north of the nature reserve. In 1983, this forest was proposed as a production forest by the Nature Conservation and Forest Protection Office (KSDA), but the proposal was never formally accepted by the Forestry Department (PHPA). In 1994, a new proposal was submitted to PHPA to change the status of the expansion area to a Protection Forest *Hutan Suaka Alam*; the result of this proposal is unknown.

The Ambang forests are important for the protection of watersheds for surrounding areas in North Sulawesi, in addition to supporting a number of threatened endemic species. To date, however, very little research has been conducted at Ambang. In the late 1970s, J. and K. MacKinnon carried out a short survey on crested black macaque *Macaca nigra* and other mammal and bird species (brief details in Rodenberg and Paleta 1981, FAO 1982), followed by another survey of macaques in 1986 (Sugardjito *et al.* 1989). More detailed studies of mammals and vegetation were conducted by Robert Lee and the Wildlife Conservation Society (WCS) in 1998 but, unfortunately, no comprehensive ornithological notes were made (Lee 1998). To our knowledge few ornithologists have visited the reserve since MacKinnon; Frank Rozendaal and René Dekker provided some important records from the summit of Mt. Muajat [our Mt. Moyayat, following Peta Rupabumi Indonesia series 1991] (Rozendaal and Dekker 1989), whilst other records were noted in a Sulawesi Bird Report (Kukila 1990).

WCS-Indonesia Programme worked at Gunung Ambang for 12 days in November 1999; we were based at two sites (map 2). At Singsingon we surveyed three transects, each of 4.5 km, located in secondary, selectively logged, and primary forest between 1,250 m and 1,575 m; all transects were within the boundaries of the nature reserve. Surveys were also made in

agricultural areas *en route* to the reserve and around the village of Singsingon, down to altitudes of c. 1,000 m. At Lake Iloloi we surveyed a single transect of 4.5 km located in the proposed extension area. Habitat was a patchwork of secondary, selectively logged, and primary forest between 925 m and 1,250 m. Observations were also made around the marshy fringes of Lake Iloloi and surrounding agricultural land, down to an altitude of c. 800 m.

HABITATS

The reserve covers a wide altitude range from 700 m to 1,760 m at the summit of Mt. Moyayat (FAO 1982, KSDA 1998) and is composed of a number of habitat types. The vegetation below c. 1,000 m consists of lowland evergreen rain forest with the canopy at c. 17–25 m, and some emergent trees. Characteristic medium to large (20–45 cm diameter at breast height) tree species recorded in 45 10 m x 50 m vegetation plots made along the Lake Iloloi transect included: *Calophyllum* spp., *Eugenia* sp., *Knema* sp., *Litsea* sp., *Sterculia insularis*, *Acalypha caturus*, and *Cryptocarya celebicum*. The most regularly recorded very large girth (generally >50 cm DBH) species were *Pometia pinnata*, *Endospermum peltatum* and *Canarium asperum*. Palms were generally uncommon; species recorded included *Areca vestiaria*, *Arenga pinnata*, *Pinanga celebica*, and *Caryota mitis*; *Livistona rotundiflora* a very common palm to the east (for example at Tangkoko-Duasudara Nature Reserve) and west (for example at Bogani Nani-Wartabone) is notably rare at Ambang. A total of 105 tree species with DBH >10 cm was recorded in these 45 plots.

Above c. 1,000 m trees are not as tall, there are fewer emergent trees, and there is a dense understory with many palms. No vegetation plots were surveyed in 1999, but research conducted in 1998 recorded a number of species characteristic of higher altitude forests on Sulawesi, for example *Eugenia* sp., *Lithocarpus celebicus*, *L. bancanus*, *Calophyllum treubii*, *C. soulattri*, *Derris dalbergoides* and *Vaccinium* sp. (Whitten *et al.* 1987, Lee 1998)

A characteristic feature of the landscape is the number of small lakes and marshes, including Lake Iloloi and Paya Swamp (N 00°46'295 E 124°23'442). Marshes and lake fringes are dominated by sedges and grasses, whilst shrubs and stunted trees grow on drier ground, forming a very dense understory.

Habitat disturbance caused by human activities, primarily selective logging, has created a patchwork of recently cleared open areas, secondary growth, and regenerating forest surrounded by primary forest. Such disturbed areas are characterised by pioneer species including *Trema orientalis*, *Macaranga hispida*, *Piper aduncum* and *Dendrocnide microstigma*. Towards the reserve's boundaries this secondary growth becomes more extensive and is eventually replaced by plantations and other agricultural land.

NOTES ON SELECTED SPECIES

MALEO *Macrocephalon maleo* (VU). A single record on 13 November, of a lone bird calling in primary forest at

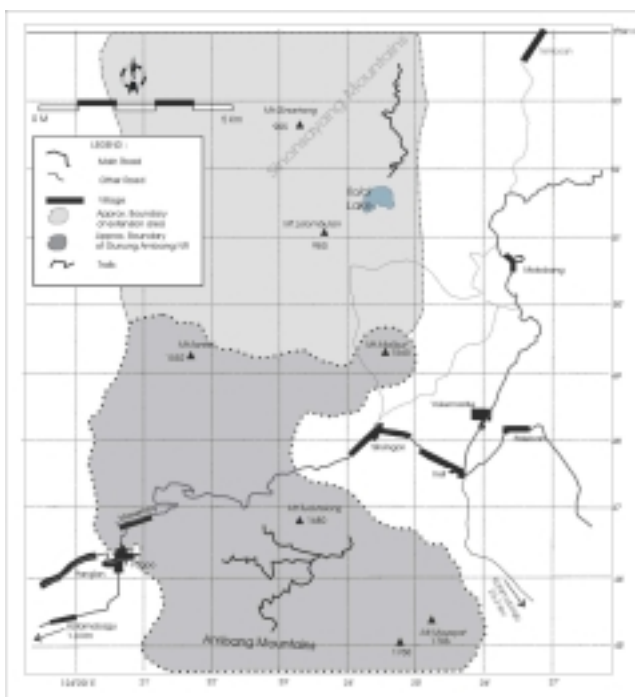


Figure 2. Map of Gunung Ambang Nature Reserve and extension area

1,375 m. This is above the species' reported altitudinal limit of 1,200 m (White and Bruce 1986, Coates and Bishop 1997).

SULAWESI PYGMY WOODPECKER *Dendrocopos temminckii*. Common, with four birds seen together at Lake Iloloi on 17 November.

ASHY WOODPECKER *Mulleripicus fulvus*. Common at Lake Iloloi.

SULAWESI HORNBILL *Penelopides exarhatus*. Common at Lake Iloloi up to an altitude of 1,000 m, but absent from forest at Singsingon. Sulawesi Hornbill is only occasionally recorded above *c.* 700 m (Coates and Bishop 1997).

KNOBBED HORNBILL *Aceros cassidix*. At Singsingon a single record of a female in primary forest at 1,325 m. Common in forested habitats at Lake Iloloi, with a maximum of eight birds – five males and three females – seen on 17 November in selectively logged forest.

PURPLE-WINGED ROLLER *Coracias temminckii*. A single sighting on 17 November of a single bird in secondary forest at 1,000 m at Lake Iloloi.

COMMON KINGFISHER *Alcedo atthis*. A single bird recorded at 800 m at Lake Iloloi on 13 November. This is well above the 225 m altitudinal limit for the species on Sulawesi (Coates and Bishop 1997).

SULAWESI DWARF KINGFISHER *Ceyx fallax*. A single bird seen in secondary forest at Lake Iloloi on 13 November.

SCALY KINGFISHER *Actenoides princeps*. Birds of the nominate subspecies endemic to NE Sulawesi (White and Bruce 1986) were recorded in primary forest between 1,050 m and 1,550 m at Singsingon. A female was observed eating a small lizard on 18 November. A female bird was mist-netted at 1,400 m on 17 November (weight 105 g, wing 117 mm, tail 91 mm).

PURPLE-BEARDED BEE-EATER *Meropogon forsteni*. Uncommon at Singsingon in more open areas of the forest – tree falls, open areas created by logging, and at the forest edge. On 11 November a nest hole was discovered which was attended by a single adult bee-eater. The burrow was located *c.* 30 cm from the ground in a low earth bank at the side of a footpath in primary forest at 1,475 m. The burrow ran horizontally *c.* 50 cm into the bank before opening out into the nest chamber that contained two young, estimated to be 10-15 days old. Invertebrate remains outside the nest hole include moths, butterflies, bees and – predominantly – beetles.

BLACK-BILLED KOEL *Eudynamys melanorhyncha*. Very common in all habitats up to 1,250 m.

YELLOW-BILLED MALKOHA *Phaenicophaeus calyborhynchus*. Common at both sites.

BAY COUCAL *Centropus celebensis*. Only recorded at Lake Iloloi, up to 1,100 m, in groups of up to five birds.

ORNATE LORIKEET *Trichoglossus ornatus*. Very common at Singsingon in flocks of up to 15 birds in forest edge and agricultural habitats. Less common at Lake Iloloi.

YELLOW-AND-GREEN LORIKEET *Trichoglossus flavoviridis*. Extremely common at Singsingon in flocks of up to 25 birds, often together with the previous species. On 25

November a group of 25 was feeding in a *Trema orientalis* tree in secondary forest. Also recorded from the foot of Mt. Moyayat (Rozenaal and Dekker 1989).

YELLOW-BREASTED RACQUET-TAIL *Prioniturus flavicans* (NT). Common at Lake Iloloi, but only recorded once at Singsingon – a single bird seen and heard in primary forest at 1,350 m on 16 November. This is a notable altitudinal range extension for the species, which is usually recorded to *c.* 1,000 m (White and Bruce 1986, Coates and Bishop 1997). Yellow-breasted Racquet-tail is endemic to the north peninsula of Sulawesi (White and Bruce 1986, Coates and Bishop 1997), although treated by Inskipp *et al.* (1996) as conspecific with Blue-crowned Racquet-tail *P. discurus* of the Philippines.

GOLDEN-MANTLED RACQUET-TAIL *Prioniturus platurus*. Common at both sites to altitudes of 1,550 m.

SULAWESI HANGING PARROT *Loriculus stigmatus*. Uncommon. A single in a clove plantation on 10 November, two records – both of two birds – at the forest edge at Singsingon on 11 and 16 November, and a single in selectively logged forest at Lake Iloloi on 19 November.

PYGMY HANGING PARROT *Loriculus exilis*. A single bird in selectively logged forest at 1,000 m at Lake Iloloi on 17 November. Pygmy Hanging Parrot has not been recorded above this altitude (Coates and Bishop 1997).

FORK-TAILED SWIFT *Apus pacificus*. One record of a flock of six birds at Singsingon on 13 November 1999. This species is either a scarce winter visitor or transient migrant in Wallacea (Coates and Bishop 1997).

SULAWESI OWL *Tyto rosenbergii*. Calls heard most nights at Lake Iloloi and Singsingon, but particularly common at the latter site. Owls were seen twice at Singsingon: a single in flight over potato fields, at 04h50 on 12 November, and a single in secondary forest on 15 November at 05h15.

SULAWESI SCOPS OWL *Otus manadensis*. Common, with birds heard calling every night in secondary habitat at both sites.

SPECKLED HAWK OWL *Ninox punctulata*. A sighting at 08h30 on 16 November in primary forest at 1,450 m. A single bird was flushed from the foot of a hollow tree trunk, flew a short distance and then perched, in full view, for 4-5 minutes. Also heard calling on the 10 November and 15-16 November from selectively logged forest between 1,100 m and 1,300 m at Singsingon. The call was noted to be a series of soft whistles repeated approximately once every second.

CINNABAR HAWK OWL *Ninox ios* (DD). A single bird was mist-netted at 19h00 on 14 November 1999 in primary forest at 1,420 m (Lee and Riley in prep.). The owl was caught in the lowest shelf of a mist-net set 1 m from the ground.

Description: The iris was yellow, the orbital skin of the eye was pink. The bill was pale horn. The tarsii were pink with light feathering on both surfaces, although on the extreme lower tarsii and toes this was replaced by fine rufous brown bristles; the claws were dark grey with lighter grey bases. The crown to the mantle was uniform chestnut brown with the supercilium and centre of the forecrown, down to the bill, a slightly paler chestnut

brown. The underparts were chestnut brown with the feathers showing light brown and buff barring. The vent and belly were paler rufous brown. The upper tail surface was finely barred with alternating bands of dark brown and pale cinnamon brown. The undertail coverts were pale rufous with white spots. The upperparts were uniform dark chestnut brown and appeared slightly darker than the underparts. The scapulars were rufous with large whitish spots with broad dark tips. On the upperwing, the median coverts were pale rufous brown, the secondary median coverts with two narrow white bars on the outer web, whilst the primary coverts were darker. The lesser upperwing coverts were pale ochre brown. The remiges had the inner webs dark brown, becoming barred on the secondaries and, in particular, on the tertials with pale rufous ochre; the outer webs were lighter chestnut brown. Measurements: Wing +/- 184 mm; tail 112 mm; weight 94 g.

This recently described species (Rasmussen 1999) was previously only known from a single specimen collected in 1985 from a forested valley at 1,120 m at Clark's Camp in the eastern section of Bogani Nani Wartabone National Park. The measurements and plumage of the Ambang specimen agree with those of the type (P. C. Rasmussen *in litt.* December 1999).

Cinnabar Hawk Owl remains a very little known species. The two known localities are only c. 60 km apart and, to date, the species is not recorded from outside this extremely restricted range. Clearly, further surveys are required to determine fully the species's status, but such efforts are currently hampered by the lack of information about the species's voice. We did not hear any calls at Ambang that could have been attributed to Cinnabar Hawk Owl.

STEPHAN'S DOVE *Chalcophaps stephani*. A single bird seen feeding on the forest floor at 1,375 m at Singsingon on 17 November, and a single bird flushed in secondary forest at 925 m at Lake Iloloi were the only records. Both sightings were made well above the known altitudinal limit of the species in Sulawesi, given as 500 m by Coates and Bishop (1997).

SULAWESI GROUND DOVE *Gallicolumba tristigmata*. Found in primary forest at both sites between 925 m and 1,525 m, but notably common at Singsingon.

RED-EARED FRUIT DOVE *Ptilinopus fischeri*. Common in primary and secondary forest above 1,000 m. On 17 November, a pair was observed constructing a nest in the canopy of a 10 m tall tree at 1,500 m in primary forest. The nest, a platform of dried twigs situated on an outer branch, was constructed by both birds; one bird collected nesting material from a nearby *Trema orientalis* tree whilst the second bird built the nest. Recorded at the summit of Mt. Moyayat in 1985 (Rozendaal and Dekker 1989).

MAROON-CHINNED FRUIT DOVE *Ptilinopus subgularis*. A single record of two birds on 10 November in selectively logged forest at 1,150 m above Singsingon. Recorded to c. 800 m on Mt. Moyayat by Rozendaal and Dekker (1989). Coates and Bishop (1997) give an upper altitudinal limit of 800 m for this species on Sulawesi.

WHITE-BELLIED IMPERIAL PIGEON *Ducula forsteni*. Common in forested habitat at both sites. A group of 10 birds was seen feeding on fruits of *Ficus altissima* on

13 November 1999, together with Grey-headed Imperial Pigeon.

GREY-HEADED IMPERIAL PIGEON *Ducula radiata*. Recorded singly or in pairs in forested habitats at both sites. A flock of three was seen on 13 November 1999 (see above).

BARRED HONEY-BUZZARD *Pernis celebensis*. Three records at Singsingon; on 13 November a single bird soaring over primary forest, followed by singles seen on 16 and 17 November flying over agricultural land close to the forest edge.

WHITE-BELLIED SEA EAGLE *Haliaeetus leucogaster*. A single record of an adult flying over Lake Iloloi on 13 November. The species is occasionally recorded well inland on Sulawesi (Coates and Bishop 1997).

SULAWESI GOSHAWK *Accipiter griseiceps*. A single record on 14 November of an adult perched in secondary forest at Lake Iloloi.

SPOT-TAILED SPARROWHAWK *Accipiter trinotatus*. Uncommon in all forest habitats. A male seen in primary forest on 16 November was hunting for insects from a perch in a 4 m tall understorey tree.

GREY-FACED BUZZARD *Butastur indicus*. A single in agricultural land at Singsingon on 14 November. This species is a common winter migrant to Sulawesi from the east Palearctic (White and Bruce 1986).

BLACK EAGLE *Ictinaetus malayensis*. The most commonly encountered raptor at Ambang, and recorded almost daily at Singsingon. A group of three birds seen at Singsingon on 11 November included a single immature.

SCARLET MYZOMELA *Myzomela dibapha*. Uncommon with just three records. A single male in primary forest at 1,150 m at Lake Iloloi on 13 November; a single female in selectively logged forest at 1,000 m at Lake Iloloi on 18 November; and a single male in a mixed species flock in primary forest at 1,475 m at Singsingon on 17 November. This species is treated by most authors as *M. sanguinolenta* (White and Bruce 1986, Coates and Bishop 1997).

DARK-EARED MYZA *Myza celebensis*. Common at Singsingon in primary forest between 1,275 m and 1,575 m. Two male birds were mist-netted on 17 November followed by a single on 19 November (weight 19.5-22.5 g, wing 82-85 mm, tail 68-81 mm).

OLIVE-FLANKED WHISTLER *Hylocitrea bonensis*. Noted twice in primary forest at Singsingon. A single female was noted at 1,400 m on 16 November, followed by a single male on the edge of a large mixed species flock at 1,500 m on 17 November.

SULPHUR-BELLIED WHISTLER *Pachycephala sulfuriventer*. One of the commonest species at both sites. A single adult was mist-netted in primary forest at 1,475 m on 19 November (weight 22 g, wing 85 mm, tail 69 mm).

CERULEAN CUCKOO-SHRIKE *Coracina temminckii*. Common at both sites.

SULAWESI CICADABIRD *Coracina morio*. Common at both sites; also observed on Mt. Moyayat in 1985 (Rozendaal and Dekker 1989).

RUSTY-BELLIED FANTAIL *Rhipidura teysmanni*. Common at Singsingon in primary and selectively logged forest above 1,275 m. An adult bird was mist-netted in primary forest at 1,400 m on 17 November (weight 10 g, wing 69 mm, tail 80 mm).

SULAWESI DRONGO *Dicrurus montanus*. Common but recorded only at Singsingon between 1,150 m and 1,525 m. Observed at the summit of Mt. Moyayat in 1985 (Rozendaal and Dekker 1989).

GREY-STREAKED FLYCATCHER *Muscicapa griseisticta*. Two records, a single in forest edge scrub at Singsingon on 11 November, and a single at Mokobang village on 19 November.

SNOWY-BROWED FLYCATCHER *Ficedula hyperythra*. The subspecies *annalisa*, endemic to north Sulawesi (White and Bruce 1986), was common in primary forest above 1,175 m at Singsingon. A male and female were mist-netted in primary forest at 1,400 m on 17 November (male: weight 9 g, wing 60 mm, tail 31 mm; female: weight 9.5 g, wing 58 mm, tail 40 mm).

LITTLE PIED FLYCATCHER *Ficedula westermanni*. Common at Singsingon. A pair was seen feeding young on 11 November. An immature male seen on the same date had broad brown fringes to the feathers of the back, mantle and nape.

MATINAN FLYCATCHER *Cyornis sanfordi* (VU). The previous record from the reserve was made by Rozendaal and Dekker (1989) who mist-netted a single bird on Mt. Moyayat in 1985. We recorded Matinan Flycatcher in primary hill forest between 1,450 m and 1,500 m on three occasions between 17 and 19 November 1999. The first observation, on 17 November, was of two birds on the edge of a large mixed flock with ten other species including Sulphur-bellied Whistler, Malia, Sulawesi Leaf Warbler and Sulawesi Drongo. There were two observations on 19 November: the first of a single bird, followed by a loose group of three birds seen *c.* 400 m away.

A nest site was located at 1,300 m in selectively logged hill forest with dense undergrowth, within 400 m of agricultural land. Over a period of four days between 15 and 19 November, a single bird was observed repeatedly entering a cavity in the trunk of a dead tree. It was not possible to examine the nest cavity which was some 3 m from the ground.

Matinan Flycatchers are robust birds with generally ponderous movements. Flycatchers will sit motionless for long periods, surveying the foliage with careful, deliberate twists of the head, before dashing after prey. This is a nondescript species with brown upperparts, slightly darker on the wings, and uniform ash-grey underparts. The only striking feature is the buff-ochre vent. The eye is large and appears black in the field, whilst the bill is pink-horn with a fine tip, very broad base, and is surrounded by rictal bristles.

These are the first published observations of Matinan Flycatcher for 15 years, and it remains a little known species. For example, the calls of the flycatcher remain undescribed (Coates and Bishop 1997), and recent field guides have produced inaccurate paintings. Whilst

Matinan Flycatcher is currently regarded as a threatened species (BirdLife International 2000) the observation of a bird at a presumed nest site in disturbed habitat suggest that it is able to tolerate some habitat alteration.

SULAWESI MYNA *Basilornis celebensis*. Common at Lake Iloloi up to 1,150 m.

WHITE-NECKED MYNA *Streptocitta albicollis*. Common at Lake Iloloi.

FIERY-BROWED MYNA *Enodes erythrophris*. Common at both sites, in large flocks of up to 60 birds. At Singsingon, birds were seen feeding in a fruiting fig in selectively logged forest on four consecutive days from 14 November; up to 55 birds were present in the tree at a single time. Fiery-browed Myna was less frequent at Lake Iloloi, with most records of small flocks of 2-3 birds.

PACIFIC SWALLOW *Hirundo tahitica*. A pair feeding two young at Singsingon on 10 November 1999.

MALIA *Malia grata*. At Singsingon the distinctive subspecies *recondita* – olive-green wings, tail olive-green or reddish-brown (birds at Ambang the latter) – endemic to north Sulawesi (White and Bruce 1986), was noted only in primary forest above 1,350 m. Usually encountered in small, noisy parties of 2-4 birds accompanied by Sulawesi Drongo, Rusty-bellied Fantail, Yellow-billed Malkoha, and Sulawesi Leaf Warbler. Malia were occasionally observed feeding close to Sulawesi Dwarf Squirrels *Prosciurillus murinus* and *P. leucomus*, possibly on invertebrates disturbed by them.

BLACK-CROWNED WHITE-EYE *Zosterops atrifrons*. Very common at both sites in secondary and selectively logged forest. At Singsingon, three birds of the nominate subspecies endemic to north Sulawesi (Rasmussen *et al.* 2000), were mist-netted in secondary scrub on November (weight 9.5-10.5 g, wing 54.5-56 mm, tail 42.5-44.5 mm).

STREAK-HEADED DARKEYE *Lophozosterops squamiceps*. The subspecies *L. s. stresemanni*, endemic to north-east Sulawesi (White and Bruce 1986) was very common in all habitats at Singsingon. Commonly observed in single species flocks of 2-10 birds, but often formed mixed species flocks with Black-crowned White-eye, Grey-sided Flowerpecker, and Yellow-sided Flowerpecker. Three birds were mist-netted: two birds in primary forest at 1,425 m on 14 November and a single bird in secondary scrub at 1,250 m on 16 November (weight 14-15 g, wing 60 mm, tail 43-46 mm).

CHESTNUT-BACKED BUSH WARBLER *Bradypterus castaneus*. Very common at Singsingon; also common below the summit of Mt. Moyayat in 1985 (Rozendaal and Dekker 1989).

MOUNTAIN TAILORBIRD *Orthotomus cuculatus*. Common in all habitats and also recorded by Rozendaal and Dekker (1989) on Mt. Moyayat. A single bird was mist-netted in secondary scrub at Singsingon on 16 November (weight 7.5 g, wing 45 mm, tail 46 mm).

ARCTIC WARBLER *Phylloscopus borealis*. Two records from Lake Iloloi: two birds on 15 November in selectively logged forest at 1,050 m, and a single in primary forest at 1,250 m on 16 November.

SULAWESI LEAF WARBLER *Phylloscopus sarasinorum*. Extremely common at Singsingon in all forested habitats. A single bird was mist-netted in primary forest at 1,400 m on 17 November (weight 10 g, wing 59 mm, tail 36 mm).

SULAWESI BABBLER *Trichastoma celebense*. Very common in all habitats.

YELLOW-SIDED FLOWERPECKER *Dicaeum aureolimbatum*. Common at both sites and recorded up to 1,375 m at Singsingon. The upper altitudinal limit on Sulawesi is given as 1,140 m (Coates and Bishop 1997).

CRIMSON-CROWNED FLOWERPECKER *Dicaeum nehrkorni*. Uncommon at both survey sites.

GREY-SIDED FLOWERPECKER *Dicaeum celebicum*. Common up to 1,250 m at both sites. Coates and Bishop (1997) stated that Grey-sided Flowerpecker is recorded up to 1,000 m on Sulawesi.

BROWN-THROATED SUNBIRD *Anthreptes malacensis*. Uncommon in secondary habitats above Singsingon to 1,100 m, a slight altitudinal range extension above the c. 1,000 m given by Coates and Bishop (1997).

BLACK SUNBIRD *Nectarinia aspasia*. Uncommon in secondary habitats above Singsingon to 1,150 m, a significant altitudinal range extension above the 800 m given by Coates and Bishop (1997).

OLIVE-BACKED SUNBIRD *Nectarinia jugularis*. Common in secondary habitats above Singsingon to 1,200 m, a significant altitudinal range extension above the 800 m given by Coates and Bishop (1997).

PECHORA PIPIT *Anthus gustavi*. Seen twice on 11 November at Singsingon; a single in ploughed fields and a single in secondary scrub at the forest edge. An under-recorded species in Sulawesi (Coates and Bishop 1997).

BLACK-FACED MUNIA *Lonchura molucca*. Uncommon in agricultural land around Singsingon village to 1,150 m, a slight altitudinal range extension above the c. 1,000 m limit given by Coates and Bishop (1997).

BLACK-HEADED MUNIA *Lonchura malacca*. Uncommon in agricultural land around Singsingon village to 1,150 m. This is a significant altitudinal range extension above the 800 m limit given by Coates and Bishop (1997).

DISCUSSION

The results of our survey show that Gunung Ambang is a small but extremely important reserve. Whilst the total number of species recorded [113] is lower than at the adjacent Bogani-Nani Wartabone National Park [195] (Rozendaal and Dekker 1989, Lee *et al.* in prep), this difference can in part be attributed to the number (23) of waterbirds (herons, waders and ducks) recorded from the National Park. A further contributing factor is the paucity of ornithological research at Ambang.

Of particular significance is the presence of two threatened species currently only known from the north peninsula of Sulawesi – Matinan Flycatcher and Cinnabar Hawk Owl, and a third threatened species endemic to Sulawesi – Maleo. The first two species

remain little known across their restricted ranges, whilst Maleo is increasingly threatened throughout Sulawesi (BirdLife International 2001).

The small size of the Gunung Ambang reserve accentuates land-use pressures also felt in the much larger national park. The most immediate threat to the reserve's integrity is habitat loss and forest degradation. Ambang is fringed by a large human population and access to the reserve and its hinterlands is made easy by a good road system, one road cutting through the centre of the park. This has led to much of the land abutting the reserve being converted to agricultural production. However, the reserve's boundaries are largely acknowledged by local people (despite it being unmarked) and farmers around Singsingon have cleared land to the boundary but not, at present, beyond. This results in the flatter terrain around the village being used for agriculture whilst the steep slopes within the reserve still retain some forest cover. It seems unlikely that this *status quo* will persist for much longer and in recent years protected forest along the Kotamobagu-Singsingon road has been cleared for farming (KSDA verbally November 1999).

Large areas within the reserve have already been affected by non-commercial selective logging. Currently these activities are restricted largely to the flatter, more accessible areas of the reserve, but some logging was noted in the remote central forests and on steep slopes. Undoubtedly much timber is used locally, demand encouraged by the presence of a large number of "traditional" workshops making wooden houses in Mokobang village.

Whilst such degraded habitat can still support many bird species, for example Matinan Flycatcher, the removal of large trees encourages farmers to clear the remaining vegetation and plant crops, a process already taking place outside the reserve at Singsingon. Once forest cover is lost, forest specialists can no longer persist and are replaced by ecological generalists such as flowerpeckers, white-eyes and sunbirds.

Hunting is a third major pressure at Gunung Ambang. The larger mammal species are favoured prey of local hunters – for example Sulawesi pig *Sus celebensis*, anoa *Bubalus* sp., Sulawesi dwarf cuscus *Stigocuscus celebensis* and crested black macaque – but as these populations dwindle small mammals are increasingly trapped using trip-wire snares. Whilst they are set primarily to catch forest rats and squirrels, the traps also kill birds and we noted the remains of Malia and Sulawesi Ground Dove. Given the intensity of trapping – snares set every 10 m for 200 m in some locations – the overall pressure on animal populations must be great.

A contributory factor to all these pressures is the weak management of the reserve. Whilst nominally under the control of the National Park office in Kotamobagu, there is little evidence of field activities by reserve guards who are poorly equipped, unsupervised, and largely untrained and unmotivated. With the huge Bogani-Nani Wartabone National Park to supervise it is perhaps not surprising that Ambang is, to some extent, ignored; reserve guards in Singsingon noted it was over two years since any patrols or monitoring were conducted inside the reserve. Institutional weaknesses are also highlighted by the confusion over the status of the 25,000 ha extension

area north of the nature reserve. This land is variously described as a potential protected area or as production forest (i.e. ear-marked for timber extraction). Weaknesses in the management of protected areas have been identified as major problems facing conservation efforts throughout Indonesia (Wells *et al.* 1999).

In conclusion, the Gunung Ambang reserve protects an important watershed and supports a high diversity of bird species, including a number of threatened endemics. The reserve is small and faces a number of pressures, above all habitat alteration, which threaten both the reserve's future and those of its animal populations. To ensure the integrity of the reserve these problems must be addressed. Clarification of the current status of the extension area to the north, ideally followed by its designation as a protected area, would make a valuable addition to the protected area network in the province. Whether or not this status change is carried out, there is a clear need for an increase in patrolling and monitoring of the existing reserve by park authorities, intensive training of park guards, and an extensive community awareness and education programme to familiarize local people with the function of the reserve and its boundaries.

We wish to thank the Sub-Balai Konservasi Sumber Daya Alam (KSDA) for granting permission to work in Gunung Ambang Nature Reserve, and Yulius Domingus (KSDA Singingon) for his great kindness and help. Many thanks to Yusman Hunowu, Michael Wangko, Meyner Nuslawo, Feliks Tanglamin, Iwan Hunowu, Edies Maneasa, Raymond Bororing, Yoppy Manderos and Rob Lee for assisting with data collection. Renee Manoppo helped to prepare the maps. Jim Wardill and Rob Lee commented on an earlier version of this manuscript. This work was supported by the Natural Resources Management Program (NRM/EPIQ), a program supported by USAID, Margot Marsh Biodiversity Conservation Fund, and the Wildlife Conservation Society.

REFERENCES

- Andrew, P. (1992) *The birds of Indonesia: a checklist (Peters' sequence)*. Jakarta: Indonesian Ornithological Society (Checklist No. 1).
- BirdLife International (2001) *Threatened birds of the world*. Barcelona and Cambridge, U.K.: Lynx Edicions and BirdLife International.
- Coates, B. J. and Bishop, K. D. (1997) *A guide to the birds of Wallacea: Sulawesi, the Moluccas and Lesser Sunda islands, Indonesia*. Alderley, Queensland: Dove Publications.
- FAO (1982) *National conservation plan for Indonesia. Volume 6. Sulawesi*. Bogor: UNDP/FAO.
- Holmes, D. (1990) Sulawesi bird report. *Kukila* 5 (1): 4-26.
- Inskipp, T., Lindsey, N. and Duckworth, W. (1996) *An annotated checklist of the birds of the Oriental region*. Sandy: Oriental Bird Club.
- KSDA (1998) *Informasi kawasan konservasi di propinsi Sulawesi Utara*. Manado: Unpublished Report.
- Lee, R. J. (1998) A report on biological surveys at Gunung Ambang Nature Reserve. Wildlife Conservation Society: Unpublished Report to Department of Forest Protection and Nature Conservation.
- Lee, R. J. (1999) Impact of subsistence hunting in North Sulawesi, Indonesia and conservation options in J. G. Robinson and Bennett, E. L., eds. *Hunting for sustainability in tropical forests*. New York: Columbia University Press.
- Lee, R. J., O'Brien, T. G., Kinnaird, M. F. and Dwiyahreni, A. (1999) *The impact of hunting in Sulawesi with conservation recommendations*. Bogor: WCS (Technical Memorandum No. 4).
- O'Brien, T. G., and Kinnaird, M. F. (1996) Changing populations of birds and mammals in North Sulawesi. *Oryx* 30: 50-156.
- Rasmussen, P. C. (1999) A new species of hawk-owl *Ninox* from North Sulawesi, Indonesia. *Wilson Bull.* 111 (4): 457-464.
- Rasmussen, P. C., Wardill, J. C., Lambert, F. R. and Riley, J. (2000) On the specific status of the Sangihe White-eye *Zosterops nehrkorni* and a taxonomic review of the Black-fronted White-eye *Zosterops atrifrons*. *Forktail* 16: 69-81.
- Rodenberg, W. F. and Paleta R. (1981) Proposed Dumoga-Bone National Park, North Sulawesi, Indonesia: Management Plan 1982-1983. Unpublished WWF Report for the Directorate of Nature Conservation, Republic of Indonesia.
- Rozendaal, F. G. and Dekker, R. W. R. J. (1989) Annotated checklist of the birds of the Dumoga-Bone National Park, North Sulawesi. *Kukila* 4 (2): 85-109.
- Stattersfield, A. J., Crosby, M. J., Long, A. J. and Wege, D. C. (1998) *Endemic Bird Areas of the world: priorities for biodiversity conservation*. Cambridge: BirdLife International.
- Sugardjito, J., Southwick, C. H., Supriatna, J., Kohlhaas, A., Baker, S., Erwin, J., Froelich, J. and Lerche, N. (1989) Population survey of macaques in northern Sulawesi. *American Journal of Primatology* 18: 285-301.
- Sujatnika, Jepson, P., Soehartono, T. R., Crosby, M. J. and Mardiasuti, A. (1995) *Conserving Indonesia biodiversity: The Endemic Bird Area approach*. Jakarta: PHPA/BirdLife International-Indonesia Programme.
- Wells, M., Guggenheim, S., Khan, A., Wardojo, W. and Jepson, P. (1999) *Investing in Biodiversity: A Review of Indonesia's integrated conservation and development projects*. Washington D. C.: The World Bank, East Asia Region.
- White, C. M. N. and Bruce, M. D. (1986) *The birds of Wallacea (Sulawesi, The Moluccas and Lesser Sunda Islands)*. London: British Ornithologists' Union (Checklist No. 7).
- Whitten, A. J., Mustafa, M. and Henderson, G. (1987) *The ecology of Sulawesi*. Yogyakarta: University Gaja Madah Press.

Appendix Checklist of birds recorded at Gunung Ambang Nature Reserve

		Habitat	Altitudinal range (m)	Status
MALEO <i>Macrocephalon maleo</i>	(VU)	P	1375	E
BLUE-BREASTED QUAIL <i>Coturnix chinensis</i>				KUKILA 1990
RED JUNGLEFOWL <i>Gallus gallus</i>		Slf	950	
SULAWESI PYGMY WOODPECKER <i>Dendrocopos temminckii</i>		S, Slf, P	825-1375	E
ASHY WOODPECKER <i>Mulleripicus fulvus</i>		S	825-950	E
SULAWESI HORNBILL <i>Penelopides exarhatus</i>		S	825-1000	E
KNOBBED HORNBILL <i>Aceros cassidix</i>		S, P	800-1125	E
PURPLE-WINGED ROLLER <i>Coracias temminckii</i>		S	1000	E
COMMON KINGFISHER <i>Alcedo atthis</i>		L	800	
SULAWESI DWARF KINGFISHER <i>Ceyx fallax</i>		S	825	E
COLLARED KINGFISHER <i>Todiramphus chloris</i>		A	800-1350	
SCALY KINGFISHER <i>Actenoides princeps</i>		P	1050-1550	E
PURPLE-BEARDED BEE-EATER <i>Meropogon forsteni</i>		Slf, P	1300-1400	E
PLAINTIVE CUCKOO <i>Cacomantis merulinus</i>		P	1250-1325	
RUSTY-BREASTED CUCKOO <i>Cacomantis sepulcralis</i>		P	1350-1525	
BLACK-BILLED KOEL <i>Eudynamis melanorhyncha</i>		A, S, Slf	850-1250	E
YELLOW-BILLED MALKOHA <i>Phaenicophaeus calyborhynchus</i>		A, S, Slf, P	800-1500	E
LESSER COUCAL <i>Centropus bengalensis</i>		A, S	800-1250	
BAY COUCAL <i>Centropus celebensis</i>		S, Slf, P	850-1100	E
ORNATE LORIKEET <i>Trichoglossus ornatus</i>		A, S	800-1250	E
YELLOW-AND-GREEN LORIKEET <i>Trichoglossus flavoviridis</i>		A, S, Slf	1000-1250	E
YELLOW-BREASTED RACQUET-TAIL <i>Prioniturus flavicans</i>	(NT)	S, P	850-1350	E
GOLDEN-MANTLED RACQUET-TAIL <i>Prioniturus platurus</i>		A, S, P	850-1450	
AZURE-RUMPED PARROT <i>Tanygnathus sumatranus</i>		S	850-1000	
SULAWESI HANGING PARROT <i>Loriculus stigmatus</i>		A, S, Slf	850-1200	E
PYGMY HANGING PARROT <i>Loriculus exilis</i>		S	1000	E
GLOSSY SWIFLET <i>Collocalia esculenta</i>		A, S, Slf, P	800-1450	
FORK-TAILED SWIFT <i>Apus pacificus</i>		A	1200	M
GREY-RUMPED TREE-SWIFT <i>Hemiprocne longipennis</i>		A, S, Slf	800-1200	
SULAWESI OWL <i>Tyto rosenbergii</i>		A, S	1000-1300	E
SULAWESI SCOPS OWL <i>Otus manadensis</i>		A, S	800-1250	E
OCHRE-BELLIED HAWK OWL <i>Ninox ochracea</i>				Rodenburg & Palete 1981
SPECKLED HAWK OWL <i>Ninox punctulata</i>		Slf, P	1250-1450	E
CINNABAR HAWK OWL <i>Ninox ios</i>	(DD)	P	1480	E
GREAT EARED NIGHTJAR <i>Eurostopodus macrotis</i>		A	800-1100	
SPOTTED DOVE <i>Streptopelia chinensis</i>		A	825-1250	
BROWN CUCKOO DOVE <i>Macropygia amboinensis</i>		S, Slf, P	925-1500	
STEPHAN'S DOVE <i>Chalcophaps stephani</i>		S, P	925-1375	
SULAWESI GROUND DOVE <i>Gallicolumba tristigmata</i>		S, P	925-1525	E
RED-EARED FRUIT DOVE <i>Ptilinopus fischeri</i>		S, P	1000-1760	E
MAROON-CHINNED FRUIT DOVE <i>Ptilinopus subularis</i>		Slf	1050-1150	E
SUPERB FRUIT DOVE <i>Ptilinopus superbus</i>		S, Slf, P	825-1425	
BLACK-NAPED FRUIT DOVE <i>Ptilinopus melanospila</i>		A, S, Slf, P	825-1350	
WHITE-BELLIED IMPERIAL PIGEON <i>Ducula forsteni</i>		S, Slf, P	925-1350	E
GREY-HEADED IMPERIAL PIGEON <i>Ducula radiata</i>		S, Slf, P	1000-1500	E
GREEN IMPERIAL PIGEON <i>Ducula aenea</i>		S, Slf, P	800-950	
SOMBRE PIGEON <i>Cryptophaps poecilorrhhoa</i>	(NT)	P	1760	E Rozendaal & Dekker 1989
BARRED RAIL <i>Gallirallus torquatus</i>		A, S, L	800-1200	
BUFF-BANDED RAIL <i>Gallirallus philippensis</i>		A, S	1000-1200	
ISABELLINE BUSH HEN <i>Amaurornis isabellinus</i>		A, S	1000-1100	E
WHITE-BREASTED WATERHEN <i>Amaurornis phoenicurus</i>		L	800	
WHITE-BROWED CRAKE <i>Porzana cinerea</i>		L	800	
BARRED HONEY-BUZZARD <i>Pernis celebensis</i>		A	1000-1200	

	Habitat	Altitudinal range (m)	Status
BRAHMINY KITE <i>Haliastur indus</i>	A, S, Slf, P	800-1600	
WHITE-BELLIED SEA EAGLE <i>Haliaeetus leucogaster</i>	L	800	
SULAWESI GOSHAWK <i>Accipiter griseiceps</i>	S	925	E
SPOT-TAILED SPARROWHAWK <i>Accipiter trinitatus</i>	S, Slf	1000-1275	E
GREY-FACED BUZZARD <i>Butastur indicus</i>	A	1050	M
BLACK EAGLE <i>Ictinaetus malayensis</i>	A, S, Slf, P	1000-1600	
SPOTTED KESTREL <i>Falco moluccensis</i>	A	1000-1100	
PEREGRINE FALCON <i>Falco peregrinus</i>			Rodenburg & Palete 1981
CATTLE EGRET <i>Bubulcus ibis</i>	A, L	800-1100	
JAVAN POND HERON <i>Ardeola speciosa</i>	A, L	800-1100	
SCARLET MYZOMELA <i>Myzomela dibapha</i>	Slf, P	1000-1760	
DARK-EARED MYZA <i>Myza celebensis</i>	Slf, P	1275-1760	E
GOLDEN-BELLIED GERYGONE <i>Gerygone sulphurea</i>	A, S	1000-1250	
OLIVE-FLANKED WHISTLER <i>Hylocitrea bonensis</i>	P	1400-1500	E
SULPHUR-BELLIED WHISTLER <i>Pachycephala sulfuriventer</i>	S, Slf, P	925-1760	E
SLENDER-BILLED CROW <i>Corvus enca</i>	A	800-1200	
WHITE-BREASTED WOODSWALLOW <i>Artamus leucorhynchus</i>	A, S, Slf	800-1250	
BLACK-NAPED ORIOLE <i>Oriolus chinensis</i>	S, Slf, P	925-975	
CERULEAN CUCKOOSHRIKE <i>Coracina temminckii</i>	Slf, P	925-1425	E
SULAWESI CICADABIRD <i>Coracina morio</i>	S, Slf, P	825-1760	E
RUSTY-BELLIED FANTAIL <i>Rhipidura teysmanni</i>	Slf, P	1275-1760	E
SPANGLED DRONGO <i>Dicrurus hottentottus</i>	S, Slf, P	850-1150	
SULAWESI DRONGO <i>Dicrurus montanus</i>	Slf, P	1150-1760	E
BLACK-NAPED MONARCH <i>Hypothymis azurea</i>	S, Slf, P	825-1150	
GREY-STREAKED FLYCATCHER <i>Muscicapa griseisticta</i>	A, Slf	850-1250	M
SNOWY-BROWED FLYCATCHER <i>Ficedula hyperythra</i>	Slf, P	1175-1540	
RUFIOUS-THROATED FLYCATCHER <i>Ficedula rufigula</i>	(NT)		E Rodenburg & Palete 1981
LITTLE PIED FLYCATCHER <i>Ficedula westermanni</i>	S, Slf, P	1250-1350	
ISLAND FLYCATCHER <i>Eumyias panayensis</i>	S, Slf, P	1250-1475	
MATANAN FLYCATCHER <i>Cyornis sanfordi</i>	(VU)	Slf, P	1300-1760
MANGROVE BLUE FLYCATCHER <i>Cyornis rufigastra</i>	S, Slf, P	850-1300	
CITRINE CANARY FLYCATCHER <i>Culicicapa helianthea</i>	S, Slf, P	825-1500	
ASIAN GLOSSY STARLING <i>Aplonis panayensis</i>	A, S, Slf	825-1150	
SULAWESI MYNA <i>Basilornis celebensis</i>	S, P	825-1150	E
WHITE-NECKED MYNA <i>Streptocitta albigollis</i>	S, P	825-1075	E
FIERY-BROWED MYNA <i>Enodes erythroprhis</i>	A, S, Slf, P	825-1760	E
BARN SWALLOW <i>Hirundo rustica</i>	A, S	800-1300	M
PACIFIC SWALLOW <i>Hirundo tahitica</i>	A, S, Slf, P	800-1450	
MALIA <i>Malia grata</i>	P	1350-1540	E
MOUNTAIN WHITE-EYE <i>Zosterops montanus</i>	A, S, Slf, P	1200-1500	
BLACK-CROWNED WHITE-EYE <i>Zosterops atrifrons</i>	A, S, Slf, P	850-1325	E
STREAK-HEADED DARKEYE <i>Lophozosterops squamiceps</i>	A, S, Slf, P	1250-1760	E
CHESTNUT-BACKED BUSH WARBLER <i>Bradypterus castaneus</i>	S, Slf, P	1250-1700	
MOUNTAIN TAILORBIRD <i>Orthotomus cuculatus</i>	A, S, Slf, P	1200-1540	
ARCTIC WARBLER <i>Phylloscopus borealis</i>	Slf, P	1050-1250	M
SULAWESI LEAF WARBLER <i>Phylloscopus sarasinorum</i>	Slf, P	1275-1525	E
SULAWESI BABBLER <i>Trichastoma celebense</i>	A, S, Slf, P	825-1450	E
YELLOW-SIDED FLOWERPECKER <i>Dicaeum aureolimbatum</i>	A, S, Slf, P	825-1375	E
CRIMSON-CROWNED FLOWERPECKER <i>Dicaeum nehrkorni</i>	S, Slf, P	825-1525	E
GREY-SIDED FLOWERPECKER <i>Dicaeum celebicum</i>	A, S	800-1250	E
BROWN-THROATED SUNBIRD <i>Anthreptes malacensis</i>	A, S	800-1100	
BLACK SUNBIRD <i>Nectarinia aspasia</i>	A, S, P	800-1150	
OLIVE-BACKED SUNBIRD <i>Nectarinia jugularis</i>	A	1000-1200	
EURASIAN TREE SPARROW <i>Passer montanus</i>	A	1000-1100	

	Habitat	Altitudinal range (m)	Status
YELLOW WAGTAIL <i>Motacilla flava</i>	L, A	800-1150	M
GREY WAGTAIL <i>Motacilla cinerea</i>	A	1000-1150	M
PECHORA PIPIT <i>Anthus gustavi</i>	A	1000-1150	M
BLACK-FACED MUNIA <i>Lonchura molucca</i>	A	1000-1150	
BLACK-HEADED MUNIA <i>Lonchura malacca</i>	A	800-1150	

KEY

Threat category

VU = Vulnerable
 DD = Data Deficient
 NT = Near-threatened

Status

E = endemic to Sulawesi
 M = migrant species
 Reference = details where record published if species not recorded by WCS

Habitat

L = Lake Illoloi and surrounding marshy areas
 A = Agricultural lands
 S = Secondary forest
 Slf = Selectively logged forest
 P = Primary forest