A Mist-netting Study of Birds in Lunang Freshwater Swamp Forest, West Sumatra

WILSON NOVARINO[1], RICHARD NOSKE[2], ANAS SALSABILA[1], AND JARULIS[3]

[1]Jurusan Biologi FMIPA Universitas Andalas Padang, Sumatera Barat, PO Box 093, Indonesia.
[2]School of Science & Primary Industries, Charles Darwin University, Darwin, NT, 0909, Australia.
[3]Andalas Wildlife Study Club, Padang, Sumatera Barat, Indonesia.
[1]Corresponding author email: Wilson_n_id@yahoo.com

Summary. The diversity and guild composition of birds in Lunang freshwater swamp forest, 250 km south of Padang, West Sumatra, was investigated in April-June 2001 using mist nets over 15 days (1 368 net-h) and 20-species list censuses (120 h). A total of 154 individuals belonging to 40 species were captured. *Alcedo meninting* was the most frequently captured species, followed by *Trichastoma rostratum*, *Macronous gularis*, *Anthreptes singalensis*, and *Arachnothera longirostra*. Of the nine foraging guilds represented among captured birds, foliage-gleaning insectivores were overwhelmingly dominant in terms of both species and individuals. Of 14 families, Timaliidae and Nectariniidae contributed the most to the total number of captured individuals. Including the 70 species recorded only during censuses, 110 species were observed in Lunang swamp forest. Six species were encountered only in mist-nets, indicating the usefulness of this technique in obtaining comprehensive species inventories, especially when experience of calls is limited. Total capture rates were higher than those reported in Peninsular Malaysia and Sarawak, but inter-regional comparisons are constrained by differences in sampling effort, design and habitats.

Ringkasan. Investigasi keragaman dan komposisi *guild* burung-burung di hutan rawa air tawar Lunang (250 km selatan Padang, Sumatra Barat) telah dilakukan pada bulan April-Juni 2001 dengan menggunakan jala kabut, selama 15 hari (1 368 net-h) dan sensus dengan metoda daftar 20 jenis (120 h). Total 154 individu yang tergolong kedalam 40 spesies telah ditangkap. *Alcedo meninting* merupakan jenis yang paling sering tertangkap, diikuti oleh *Trichastoma rostratum*, *Macronous gularis*, *Anthreptes singalensis*, dan *Arachnothera longirostra*. Diantara delapan kategori *guild* yang mewakili spesies burung yang tertangkap, burung pemakan serangga didedaunan mendominasi baik dalam jumlah jenis maupun individu. Sedangkan dari 14 famili, Timaliidae dan Nectarinidae berkontribusi paling banyak terhadap jumlah total individu yang tertangkap. Termasuk 70 spesies yang tercatat selama pelaksanaan sensus, 110 spesies burung teramati di hutan rawa Lunang. Enam jenis hanya tercatat dengan menggunakan jala kabut, ini menunjukkan efektifnya cara ini dalam melakukan inventarisasi spesies secara menyeluruh. Perbandingan jumlah tangkapan seluruhnya lebih tinggi dibandingkan hasil yang dilaporkan dari Malaysia Barat dan Sarawak, tetapi perbandingan *inter-regional* dipengaruhi berbagai perbedaan dalam hal *sampling effort*, rancangan dan habitat.

Introduction

Despite the devastating destruction and degradation of Sumatran lowland forests in recent decades caused by illegal logging, wildfire and conversion to oil palm plantations (Verheugt *et al.* 1993; Holmes 2000; Jepson *et al.* 2001), and its likely disastrous effect on biodiversity

(Lambert & Collar 2002; Sodhi *et al.* 2004) we are still ignorant about the avifauna of many parts of the island. Since the Sumatra Bird Report compiled by Holmes (1996), there have been few publications concerning the avifauna of the Sumatran mainland (Parrott & Andrew 1996), although several papers have described the avifauna of the islands around Sumatra (Rajathurai 1996; Thiollay 1996; Kemp 2000). Holmes (2000) also predicted that if pre-1900 trends in deforestation continued, virtually all of the lowland plains forests in Sumatra would be gone by about 2005, and the alluvial (swamp) forests by about 2010.

The coastal wetland systems of South-east Asia, encompassing mangroves, peat swamp forest and freshwater swamp forest, are disappearing due to increasing population pressure (in Indonesia, resulting partly from transmigration), and by conversion to many land use forms, including agriculture and aquaculture (Davie & Sumardja 1997). Hosting up to 58% of resident land bird species occurring in Sumatra (Anon. 1996), freshwater swamp forest is an important, but poorly understood, habitat for birds. Normally forming on riverine alluvium, freshwater swamp forest differs from peat swamp forest in lacking deep peat, having soils richer in plant nutrients and higher pH, and being periodically inundated by fresh water from rivers and rainwater (Whitmore 1990; Whitten *et al.* 2000). The flora and fauna of Southeast Asian freshwater-swamp forests is thought to be richer than those of peat-swamp forest, and more similar to those of lowland dry-land forests, but detailed studies are lacking (Verheugt *et al.* 1993).

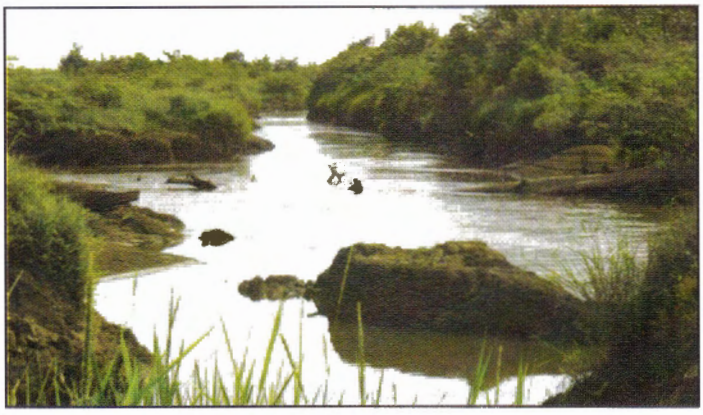
Lunang freshwater swamp forest (2°06'S, 101°14'E), 250 km south of Padang, in the province of West Sumatra, has been recognized as an Important Bird Area (Holmes & Rombang 2001), yet little information is available on its avifauna. The wetland is a part of a forested area of 17,000 ha for which protection was proposed (Anon. 1996), but not yet formally declared. Holmes & Rombang (2001) presumed that the wetland originally comprised freshwater and peat swamp forest in equal amounts (45% each), but noted that the area had undergone large-scale clearing and conversion to transmigration settlements and oil palm estates by 1999.

Mist-netting has proved an indispensible technique in studies of avian life history and migration, but it is also widely used to monitor populations (Remsen & Good 1996; Silkey & Geupel 1999), as well in surveys of tropical rainforest avifaunas (Karr 1980; Blake & Loiselle 2000; Prawiradilaga *et al.* 2002). Despite its obvious bias towards small to medium-sized species of the lower levels of forests (e.g. Jenni *et al.* 1996), mist-netting is being increasingly used to examine the effects of habitat and disturbance on the diversity and abundance of birds in several regions in South-east Asia, such as Peninsular Malaysia (Wong 1986), Singapore (Sodhi *et al.* 2002), Borneo (Gaither 1994; Sodhi *et al.* 2002), and Sulawesi (Waltert *et al.* 2004; Sodhi *et al.* 2005).

Using mist nets in Gunung Palung National Park (GPNP), West Kalimantan (Borneo), Gaither (1994) concluded that Southeast Asian peat swamp forests supported fewer bird species and individuals than lowland dipterocarp forest. This paper presents information on the diversity and guild composition of birds mist-netted at Lunang freshwater swamp forest, and is supplemented by data gathered from 20-species list censuses. The results are compared with those of the above-mentioned studies, and an ongoing study of the secondary lowland forest at Sipisang, approximately 50 km north of Padang and 300 km from Lunang (Salsabila *et al.* 1997; Novarino *et al.* 2002).

Methods

The study was conducted in swamp forest adjacent to the Batang Lunang River, Pesisir Selatan District, West Sumatra (2°06'07"S, 101°14'27"E). The study site was bordered by the PT Inkasi Raya oil palm plantation and traditional agricultural land. The forest was dominated by *Gluta rengas* and *Shorea* spp, but active selective logging and the presence of many pioneer tree species (e.g. *Macaranga* sp) demonstrated past and present disturbance. In accordance with oil palm plantation management, several canals had been dug within the forest, perpendicular to the river, to protect the plantation from periodic floods. The conditions at the study site were dramatically affected by tides. During high tides each day, brackish water flooded the forest, and the bunds between the canals became a refuge for many landbirds, which dispersed widely when the water receded.



© Iwan Setiawan

Plate 1. Batang Lunang River, Pesisir Selatan District, West Sumatra.

The study took place over 15 days during two sampling periods: (1) from 18 to 23 April 2001 (six days) and (2) from 31 May to 8 June 2001 (nine days). During the first (April) sampling period, seven mist-nets (12 m x 2.4 m high) were erected in a continuous line (total length, 84 m) along the wall of a 2 m-wide canal running perpendicular to the 3 m-wide river. Mist-nets were opened at 06:00 hrs and closed at 18:00 hrs each day, and checked every hour. During the second (June) sampling period, ten mist-nets (total length, 120 m) were used during the first three days, but thereafter, 3 mist-nets were closed due to their direct exposure to solar radiation, which endangered the lives of captured birds. The total sampling effort was 504 net-hours in April and 864 net-hours in June. Captured birds were identified, ringed (using rings provided by Yamashina Institute for Ornithology), measured, weighed, photographed and released near the place of capture. For analysis of recapture rates, only individuals captured during April and re-captured during June were considered; individuals re-captured within the month of capture were ignored.

Bird censuses were conducted during both sampling periods by the first author using the 20-species list method of MacKinnon & Phillips (1993), in which listing ceases after 20 species have been recorded. Species were listed only if seen. Only one list was made each day, except on the last day in June, when no census was conducted. Birds were listed in the early morning (06:00-10:00) and late afternoon (14:00-18:00) while walking along a 500 m section of the bund on the plantation side of the river. Censuses were conducted between

checks of mist nets and processing of captured birds, and if 20 species had not been listed after an hour since the release of captured birds, the census would resume from the last location on the transect. The total time spent censusing was 120 h.

We assumed that birds captured in mist nets largely represented species typical of the understorey, and characterize the guild structure and taxonomic composition accordingly. Guild categories were assigned according to Smythies (1981), Wong (1986) and Lambert (1991, 1992), verified by field observations. Rare species were defined as species whose cumulative number of individuals captured was less than 2% of the total number of individuals captured for all species (Wong, 1986; Karim-Dakog *et al.* 1997).

Results

In total, 110 bird species were observed in Lunang swamp forest, of which 40 species (36.4%) belonging to 14 families were captured in mist-nets (Table 1). In April, a total of 56 individuals of 28 species were caught and banded, while in June, 109 individuals of 33 species were caught, including 11 recaptured individuals of nine species that had been banded in April. Seven species captured in April were not captured in June, and twelve species captured in June were not captured in April. The recapture rate of individuals banded in April was 20%. There was little difference between sampling months in the number of individuals banded (11.1 and 11.3 birds per 100 net-h, respectively), but more species were banded in April than June (5.56 and 3.82 per 100 net-h, respectively). The number of species caught (including recaptures) over the first six days of April and last six days of June (when net-hours were comparable) did not differ significantly between sample months (Wilcoxen Matched Pairs test, $T = 9.5$, $P > 0.05$). The five most frequently captured species were Blue-eared Kingfisher *Alcedo meninting* (14 individuals banded), followed by White-chested Babbler *Trichastoma rostratum* and Striped Tit-Babbler *Macronous gularis* (13 each), Ruby-cheeked Sunbird *Anthreptes singalensis* (8) and Little Spiderhunter *Arachnothera longirostra* (8).

Plate 2. Blue-eared Kingfisher *Alcedo meninting*.

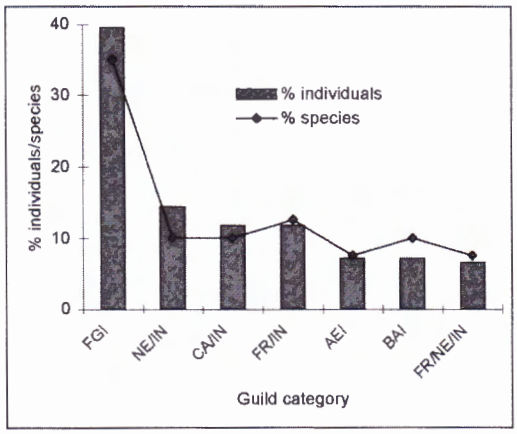


Figure 1. Guild composition of birds mist-netted at Lunang in April/June 2001. Guilds defined in Table 1, but granivores (2 individuals) and obligate frugivores (1 individual) excluded.

Of the nine foraging guilds recognised, foliage-gleaning insectivores were overwhelmingly dominant in terms of both species richness (14 species, 35% of all species captured) and numbers of individuals (40% of all captured birds, excluding recaptures)(Fig. 1). The three omnivorous categories (partial frugivores and/or nectarivores) constituted 30% of the species captured, and 32% of individuals captured There was no significant change in the contribution of the major guilds between April and June, in terms of individuals captured ($\chi^2 = 0.89$, df = 3, $P > 0.05$).

Of the 14 families represented among captured birds, Timaliidae dominated both in terms of individuals and species richness (39 and 6, respectively), followed by Nectariniidae (29; 5) and Pycnonotidae (18; 5) (Fig. 2). At the other extreme, Columbids, Dicrurids and Chloropseids were each represented by a single individual only.

Table 1. Bird species (n = 40) mist-netted in Lunang swamp forest in decreasing order of total individuals captured. Captured birds in June exclude recaptures from April. Guilds: AEI, aerial insectivore; BAI, bark-foraging insectivore; CA/IN, carnivore/insectivore; FGI, foliage-gleaning insectivore; FRU, frugivore; FR/IN, frugivore/insectivore; FR/NE/IN, frugivore/nectarivore/ insectivore; GRA, granivore; NE/IN, nectarivore/insectivore.

Scientific name	Captured in: April	June	Recaptures	Guild
Alcedo Meninting	5	9	1	CA/IN
Macronous gularis	2	11		FGI
Anthreptes singalensis	6	2		NE/IN
Arachnothera longirostra		8		NE/IN
Sasia abnormis	2	5	1	BAI
Orthotomus ruficeps	3	4		FGI
Hypogramma hypogrammicum	4	3		FR/NE/IN
Cyornis turcosus	3	3	1	AEI
Pycnonotus atriceps		5		FR/IN
Pycnonotus erythropthalmus	1	4		FR/IN
Macronous ptilosus	3	2	2	FGI

Cymbirhynchus macrorhynchos	1	3		FGI
Pycnonotus brunneus	1	3	1	FR/IN
Stachyris erythroptera	1	3	1	FGI
Anthreptes malacensis	1	3		NE/IN
Cacomantis merulinus	1	2		FGI
Eurylaimus ochromalus	1	2		FGI
Pycnonotus simplex	2	1		FR/IN
Rhipidura javanica		3		AEI
Meiglyptes tukki	2			BAI
Stachyris maculata		2		FGI
Stachyris nigricollis	1	1	1	FGI
Orthotomus sericeus	1	1	1	FGI
Hypothymis azurea		2		AEI
Aethopyga siparaja		2		NE/IN
Dicaeum trigonostigma	1	1		FR/NE/IN
Chalcophaps indica		1		FRU
Chrysococcyx xanthorhynchus		1		FGI
Centropus sinensis	1			CA/IN
Ceyx erithacus	1	1		CA/IN
Pelargopsis capensis		1		CA/IN
Celeus brachyurus	1			BAI
Meiglyptes tristis	1			BAI
Chloropsis cyanopogon	1			FR/NE/IN
Pycnonotus plumosus		1		FR/IN
Dicrurus paradiseus		1		FGI
Orthotomus atrogularis		1		FGI
Lonchura striata	1			GRA
Ploceus hypoxanthus	1			GRA
Trichastoma rostratum	7	6	2	FGI
Total individuals	56	98	11	
No. species	28	33	9	
Net-hours	504	864		
No. indivuduals 100 net-h^{-1}	11.1	11.3		

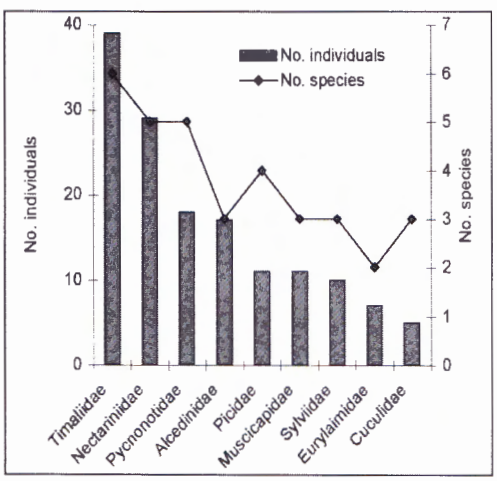


Figure 2. Number of species and individuals caught for all families in which more than 2 individuals were caught. Other families: Ploceidae (2 individuals; 2 species); Dicaeidae (2; 1); Columbidae, Chloropseidae, Dicruridae (each 1, 1).

A total of 104 species were observed during censuses and incidental observations, of which 34 species (33%) were also captured in mist-nets (Appendix 1). Six species captured in mist-nets were not observed during censuses (Violet Cuckoo *Chrysococcyx xanthorhynchus*, Black-headed Bulbul *Pycnonotus atriceps*, Olive-winged Bulbul *P. plumosus*, Chestnut-rumped Babbler *Stachyris maculata*, Dark-necked Tailorbird *Orthotomus atrogularis* and Crimson Sunbird *Aethopyga siparaja*). The cumulative number of species recorded during 20 species-lists rose steadily during the 14 days of censusing, and did not reach an asymptote (Fig. 3). The five most frequently listed species (on 8-10 lists) during the censuses were (in order of decreasing frequency): Whiskered Tree-swift *Hemiprocne comata*, Raffles's Malkoha *Rhinortha chlorophaea*, Blue-eared Kingfisher *Alcedo meninting*, Fluffy-backed Tit-babbler *Macronous ptilosus* and Ashy Tailorbird *Orthotomus ruficeps*. The last three species were also among the 12 most frequently captured species (Table 1).

Plate 3. Violet Cuckoo *Chrysococcyx xanthorhynchus*.

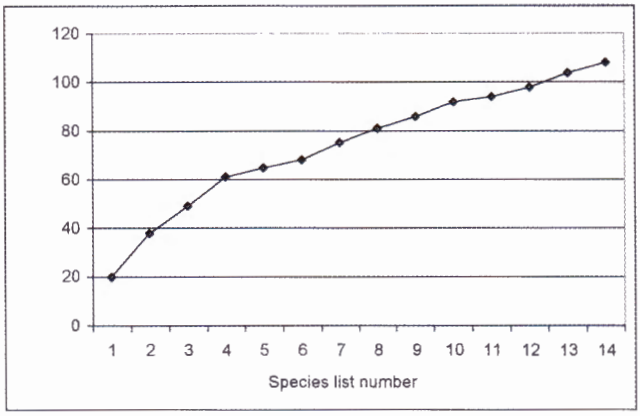


Figure 3. Cumulative number of species seen during 20 species list censuses (April and June sampling periods combined)

Discussion

Unlike most censusing techniques, mist-netting permits comparisons of data from different researchers with varying abilities and experience in detecting rainforest understory birds, and minimizes misidentifications (Waltert *et al.* 2005). The robustness of such comparisons depends on the extent to which sampling design and effort are replicated between study sites, and recent studies by Waltert (pers. comm.) and colleagues in Sulawesi, West Papua and Kalimantan use a standardized grid system for that reason. Inconsistencies in sampling

design and habitat, on the other hand, compromise this comparability between sites. The capture rate of birds (per 100 h of mist-netting) at Lunang is remarkably close to that experienced at another Sumatran site, Sipisang (Novarino *et al.* 2002), despite the different habitat, much higher species richness, and greater sampling effort at the latter site (Table 2). These Sumatran studies show higher capture rates than studies in Sarawak (West Borneo) and West Malaysia (Wong 1985; Karim-Dakog *et al.* 1997; Sodhi 2002), but lower capture rates than the two habitats sampled in GDNP, West Kalimantan (Gaither 1994).

In West Malaysia, Wong (1995) placed 30 mist nets systematically along 64 netting lanes, and operated them for two days in each of 24 consecutive months (total, 96 net-days for each of her two sites), yet her study shows the lowest capture rates of all studies in the region. Also in West Malaysia, Karim-Dakog *et al.* (1997) sampled over a shorter period (only four consecutive months in each of two years, totalling 80 net-days), and used fewer (10-20) nets, placed randomly along an unspecified number of trails, yet their capture rate was more than three times that of Wong (1995). Karim-Dakog *et al.* (1997) attributed their higher capture rates to a greater number of forest edge species, or a shift in foraging height of middle storey species to the understorey, due to a reduction in canopy cover or height. Sodhi's (2002) study in Sarawak yielded very similar capture rates to Karim-Dakog *et al.* (1997), despite a much lower sampling effort (c. 1,600 net-hours at both sites, or 18 net-days in total). However, the capture rates in Gaither's (1994) study, also in southwest Borneo, were double those of Sodhi (2002), despite a very similar total sampling effort (c. 1,500 net-hours at each of two sites). Both authors mist-netted for 2-3 days in each of their two sites, but Sodhi (2002) sampled his (widely separated) sites during 5 months, spread over 1.5 years, whereas Gaither mist-netted over 8 consecutive months.

In contrast to the present study, none of the above-mentioned studies operated mist nets in one location for more than three consecutive days, yet only Gaither's (1994) Bornean sites and our other Sumatran site (Sipisang) show higher rates of capture than the present study. Indeed, Wong (1985) explicitly avoided netting in the same area for more than two days because her preliminary fieldwork at Pasoh indicated a drastic reduction in the number of captures and increase in the number of recaptures, suggesting that birds had learned the position of nets. Nevertheless, her capture rates were lower than in any of the other studies. No such effects were evident at Lunang, where the number of captured individuals fluctuated from day to day, and showed no obvious decline for at least the first six days in either sampling month. On the other hand, all recaptured individuals from April were caught in the first four days of mist-netting in June, perhaps suggesting that these trap-prone resident individuals had learned the position of, and were avoiding, mist nets.