

PERSISTENCE OF BABBLER (TIMALIIDAE) COMMUNITIES IN SINGAPORE FORESTS

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INTRODUCTION

Babblers form the dominant family of insectivorous passerine birds in Malaysian lowland dipterocarp forests, often with large number of species co-occurring together (Lambert & Collar, 2002). As many as 22 species of babblers are known to occur in lowland forest in the Panti Forest Reserve in Southern Peninsular Malaysia alone (Yong, 2006). Furthermore, babblers also dominate in terms of overall abundance (Wong, 1986). For instance, Wong (1986) noted that babblers can constitute as much as up to half the individuals and 25% of banded species in mature tropical forests. In spite of their richness and abundance in the forests of Southeast Asia, babbler community ecology is relatively poorly known, with most studies in the region tending to focus on overall bird faunas or the large charismatic species (e.g., hornbills, woodpeckers). Gibson-Hill (1950) listed 13 species of babblers for Singapore, of which six were no longer present at the time of review and most probably extinct then (Chasen, 1923; Castelletta et al., 2000). Another species, the moustached babbler (*Malacopteron magnirostre*) was treated as a doubtfully occurring species by Gibson-Hill (1950), but subsequently confirmed to occur in Singapore (Lim & Gardner, 1997; Wang & Hails, 2007; Wells, 2007).

Currently, five babbler species continue to persist in Singapore's forest to varying extents. One, the moustached babbler is almost certainly nationally extinct as it was last recorded in 1987 and has not been found despite extensive survey efforts and observer coverage in the Central Catchment Area (CCA) forests for nearly two decades (Wells, 2007; Lim, 2009). Of the five extant species, two [the striped tit-babbler (*Macronous gularis*) and Abbott's babbler (*Malacocincla abbotti*)] are habitat generalists that are able to utilize disturbed habitats like regenerating secondary forest, plantations, and belukar (Lim & Gardner, 1997). The remaining three species [the short-tailed babbler (*Malacocincla malaccensis*), chestnut-winged babbler (*Stachyris erythroptera*), and white-chested babbler (*Trichastoma rostratum*)] are largely confined to mature secondary and primary forests in the CCA forests (Lim & Gardner, 1997; Wang & Hails, 2007; Lim, 2009) though the white-chested babbler has been periodically recorded in mangrove forests, back mangrove sites, and wooded marshland (Wells, 2007; Lim et al., 2008; Lim, 2009), implying less specialized habitat preferences.

With only five species still extant out of the total of 13 species that were known to have occurred historically, Singapore suffered an alarming 61.5% loss of known babbler diversity. Presently, all except for two species are predominantly confined to the highly fragmented forests of the CCA forests, which consist of a mosaic of primary forest patches amongst regenerating and mature secondary forest (see Corlett, 1997). The depauperate babbler diversity in Singapore is comparable to other studies in the region, which reported few babbler species and a virtual absence of terrestrial babblers in small degraded forest patches (e.g., Round, 1988; Ford & Davison, 1995). In this article, I review the status of presently extant species of babblers in Singapore's forests and the potential impacts of forest loss and degradation on their diversity.

MATERIAL AND METHODS

I sampled babbler diversity at three forest sites, namely the Nee Soon Swamp Forest, Sime Road-MacRitchie Reservoir Forest and Bukit Timah Nature Reserve. Together the three sites constitute the largest proportion of all remaining primary forest habitat (lowland dipterocarp forest and freshwater swamp forest) remaining on Singapore Island. All three sites were sampled between 0700 hours and 1100 hours for at least five times over the period of 2003–2009. Surveys were conducted along trails and walking paths which extensively traverse all the three sites. As most babbler species are generally vocal and respond readily to tape playback, detection of babbler species is relatively straightforward. A species was deemed to be present if it was visually recorded or heard during a survey. Furthermore, species identification was made easier as all babbler species have distinctive vocalizations. Field sampling at the three sites supplement published 'occurrence' data of babbler species, which are compiled from historical and recent reviews of Singapore's avifauna. This include Chasen (1923), Gibson-Hill (1950), Lim (1994), Lim & Gardner (1997), Wang & Hails (2007), Lim (2009), and Lim & Lim (2009).

Nee Soon Swamp Forest was surveyed on 27 Jan.2003, 18 May 2003, 29 Jun.2003, 5 Jul.2003, 20 Jul.2003, 19 Mar.2004, 28 Mar.2004, 9 Apr.2004, 4 Jul.2004, 2 Jul.2006, 19 Mar.2008, 6 Jul.2008, 13 Sep.2008, 14 Sep.2008, 6 Feb.2009 and 12 Jul.2009.

Bukit Timah Nature Reserve (BTNR) was surveyed on 13 Jul.2003, 17 Aug.2003, 25 Dec.2003, 14 Feb.2004, 15 Feb.2004, 14 Nov.2004, 14 Jan.2005, 6 Nov.2008, 9 Nov.2008, 15 Nov.2008 and 19 May 2009.

Sime Road-MacRitchie Reservoir Forest was surveyed on 5 Oct.2003, 14 Dec.2003, 20 Dec.2003, 21 Oct.2006, 29 Oct.2006 and 5 Oct.2007.

RESULTS AND OBSERVATIONS

Fig. 1 indicates the extent and kinds of forest types in the CCA forest areas in Singapore. Fig. 2 indicates the decline of babbler diversity in Singapore between 1923 and 2009. Table 1 is the list of all Singapore babbler species, their current status and habitat preferences. Table 2 indicates the babbler diversity at the three study sites in the CCA forests.

It has been highlighted by Wang & Hails (2007) that the six species of babblers recorded by Chasen (1923) and not by Gibson-Hill (1950) were erroneously recorded, but this is virtually unlikely given that all six species are still found in similar forest habitats in Johor, Southern Peninsular Malaysia (see Yong, 2006) and there is no reason why it should not have occurred in pre-settlement Singapore's forests. Comparing past and present records, Singapore lost more than half of its known babbler diversity, with six species extinct by 1950 at least, as highlighted in Lim & Gardner (1997). This is not surprising, considering that most primary forests on the island was cleared for agriculture and timber extraction such that only Bukit Timah, Changi, Chan Chu Kang and a few other small areas of forest escaped clearance prior to 1900 (Corlett, 1992; Corlett, 1997). Subsequently, remaining primary forest cover was further reduced so that it is now confined to the BTNR and a few patches in the Central Catchment Nature Reserve (Ng & Lim, 1992). Sometime between 1950 to present day, the forest-dependant large wren-babbler *Napothera macrodactyla* became extirpated (Gibson-Hill, 1950; Lim & Gardner, 1997).

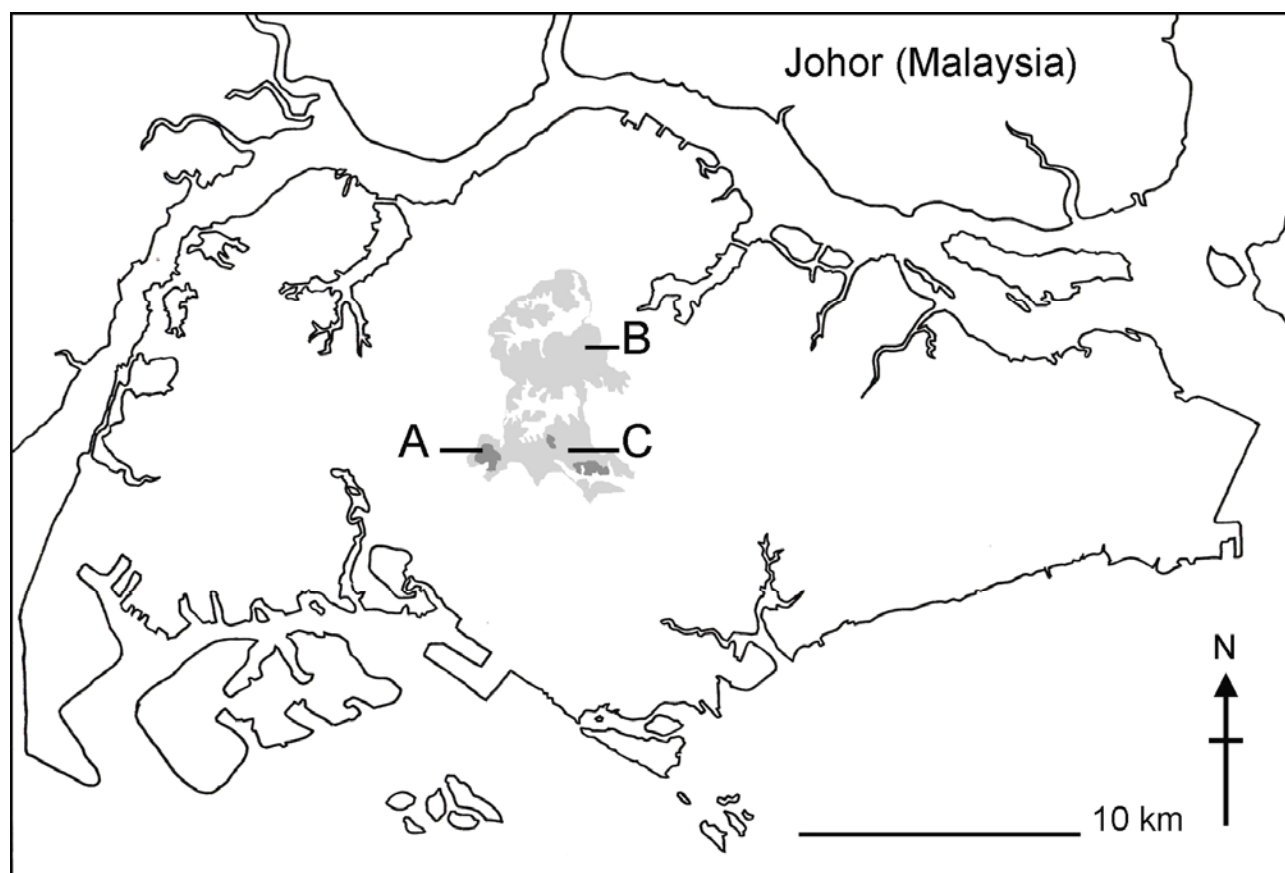


Fig. 1. Remaining dryland and swamp forest cover in the Central Catchment Area forests, Singapore. The light-shaded regions are covered with secondary forest at varying stages of regeneration while the dark-shaded regions are dryland primary forests. A, Bukit Timah Nature Reserve; B, Nee Soon Swamp Forest; C, Sime Road-MacRitchie Reservoir Forest.

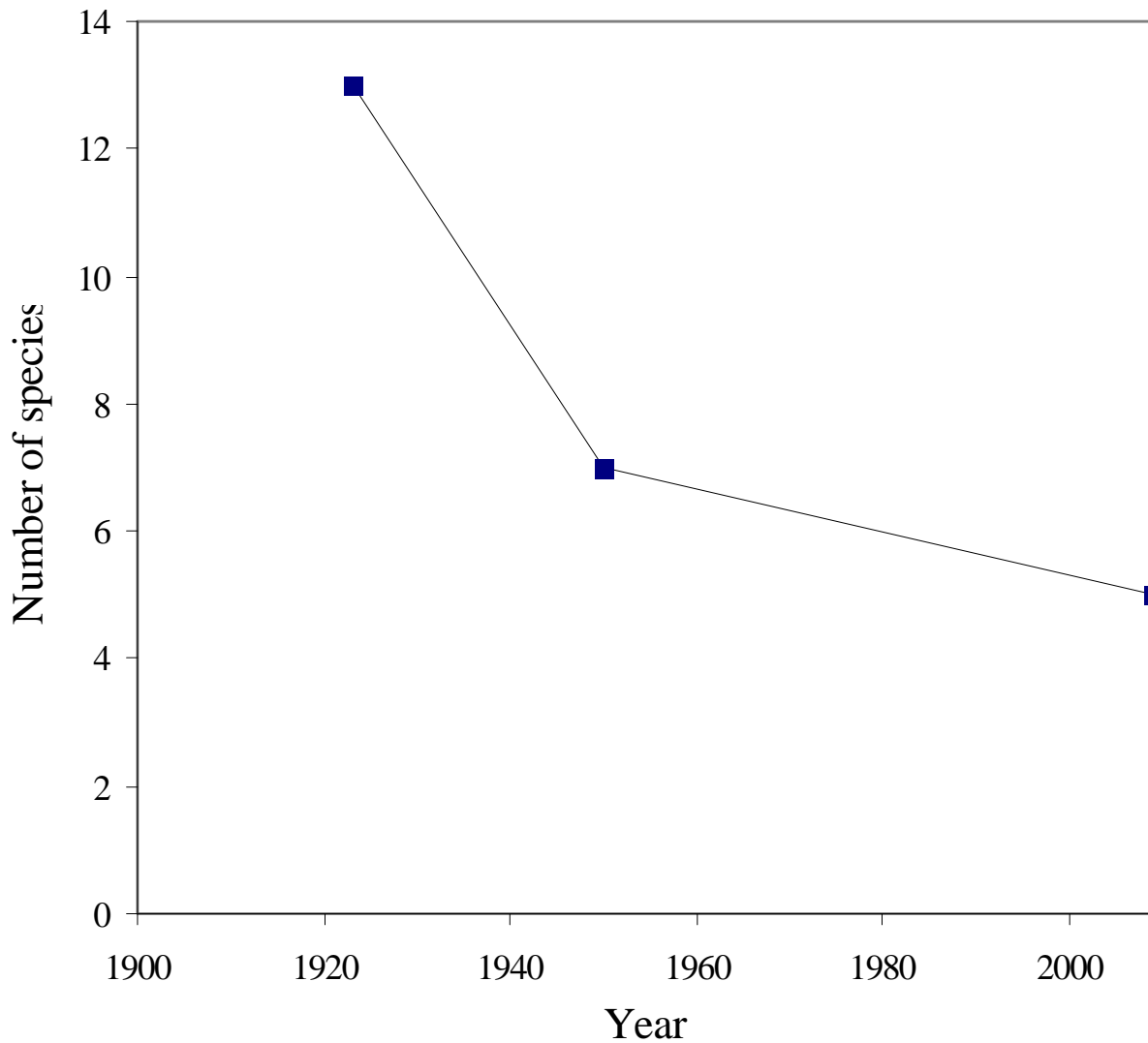


Fig. 2. Line graph showing estimated decline of babbler diversity in Singapore between 1923 and 2009. The graph shows that more babbler species were lost before 1950 than subsequent years and also a corresponding higher rate of species loss (data from Chasen, 2003; Gibson-Hill, 1950; Lim, 2009). This can be attributed to extensive deforestation experienced in Singapore over the period 1819-1900 (Corlett, 1997), as compared to the latter century.

Table 1. Table of all babbler species known to occur in Singapore, their current status and corresponding habitat preferences (Chasen, 1923; Gibson-Hill, 1950; Wells, 2007; Lim, 2009).

Common Name	Zoological Name	Status	Habitat	Source(s)
Black-capped babbler	<i>Pellorneum capistratum</i>	Extinct	Forest	Chasen (1923)
Grey-breasted babbler	<i>Malacopteron albogulare</i>	Extinct	Forest, Swamp Forest	Chasen (1923)
Moustached babbler	<i>Malacopteron magnirostre</i>	Possibly extinct	Forest	Gibson-Hill (1950), Lim (2009)
Short-tailed babbler	<i>Malacocincla malaccensis</i>	Extant	Forest	Gibson-Hill (1950),
Abbott's babbler	<i>Malacocincla abbotti</i>	Extant	Forest, Scrub, Plantations	Gibson-Hill (1950)
White-chested babbler	<i>Trichastoma rostratum</i>	Extant	Forest, Swamp Forest	Gibson-Hill (1950)
			Mangroves	Lim (2009)
Striped wren-babbler	<i>Kenopia striata</i>	Extinct	Forest	Chasen (1923)
Large wren-babbler	<i>Napothera macrodactyla</i>	Extinct	Forest	Gibson-Hill (1950)
Chestnut-rumped babbler	<i>Stachyris maculata</i>	Extinct	Forest	Chasen (1923)
Chestnut-winged babbler	<i>Stachyris erythroptera</i>	Extant	Forest	Chasen (1923)
Black-throated babbler	<i>Stachyris nigricollis</i>	Extinct	Forest	Chasen (1923)
Striped tit-babbler	<i>Macronous gularis</i>	Extant	Forest, Forest edge, Scrub, Plantations	Gibson-Hill (1950), Lim (2009)
Fluffy-backed tit-babbler	<i>Macronous ptilosus</i>	Extinct	Forest	Chasen (1923)

All babbler species that are now extinct in Singapore are forest-dependant (see Wells, 2007), implying high sensitivity and correspondingly, low tolerance to loss and degradation of forest habitat. In one sector of the Pantii Forest Reserve, south Johor which has been selectively logged in the past and now fragmented by agriculture, the same species as those

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Table 2. Babbler diversity for three selected key forest sites in the Central Catchment Area forests in Singapore sampled by me from 2003–2009. An asterisk (*) indicates possible local extinction, as suggested by the absence of recent records (over the last 10 years) despite extensive and regular observer coverage (see Wang & Hails, 2007; Lim, 2009).

Species	Latin Name	Site Surveyed		
		Bukit Timah Nature Reserve	Nee Soon Swamp Forest	Sime Road-MacRitchie Reservoir Forest
Moustached babbler	<i>Malacopteron magnirostre</i>		X*	X*
Short-tailed babbler	<i>Malacocincla malaccensis</i>	X	X	X
Abbott's babbler	<i>Malacocincla abbotti</i>	X	X	X
White-chested babbler	<i>Trichastoma rostratum</i>		X	
Chestnut-winged babbler	<i>Stachyris erythroptera</i>	X*	X	X
Striped tit-babbler	<i>Macronous gularis</i>	X	X	X
Total Extant Babbler Species		4	5	4

extinct in Singapore: the striped wren-babbler, large wren-babbler and grey-breasted babbler are all now extremely rare (Yong, 2006) despite the presence of extensive disturbed forest habitat (pers. obs.) and must be highly susceptible to extinction. Another extinct babbler in Singapore, the moustached babbler is still a common babbler of disturbed and primary lowland dipterocarp forests on Peninsular Malaysia (Gibson-Hill, 1949; Wells, 2007). While initially recorded by Chasen (1923) and collected by W. L. Abbott (Lim, 2009), Gibson-Hill (1950) strangely found no evidence for its occurrence in Singapore. A small breeding population was subsequently discovered in the CCA forests at the Seletar and Sime Road area in the 1980s (Wang & Hails, 2007; Wells, 2008; Lim, 2009). However, the dearth of confirmed records of this normally vocal species anywhere in the CCA forest for nearly two decades since the last record in MacRitchie Reservoir forest in 1993 (Lim, 1994) despite intensive and regular survey efforts throughout the CCA forests suggest that this species is either persisting at ultra-low densities or is now locally extirpated (Lim, 2009).

Of the remaining five extant babbler species, two are widespread and distributed in suitable habitats throughout Singapore Island and some of the offshore islands. The striped tit-babbler, undoubtedly the most successful and abundant babbler, continues to persist in a myriad of habitats ranging from degraded scrub, young secondary forest, plantations and even in primary forests (Lim & Gardner, 1997; Wells, 2007). Lim (2009) lists the status of the Abbott's babbler as uncommon, as is supported by field observations throughout Singapore Island and some of the offshore islands (e.g., Sentosa, Pulau Ubin). Formerly common, this species is on the decline and has disappeared from some areas (e.g., Bukit Batok Nature Park), possibly owing to competition with the introduced white-crested laughing-thrush (*Garrulax leucolophus*) which is now common in western and southern Singapore (R. Subaraj, in litt, 2009). On the other hand, Abbott's babbler is known to be able to persist in very small fragments of scrub and forests (Sodhi et al., 2005; Lim, 2009).

The remaining three babbler species are all forest specialists, being largely confined to the CCA forests with the exception of the white-chested babbler which is also known to inhabit mangroves (Lim et al., 2008). The fact that these three forest babblers are still extant in the CCA forests implies some level of tolerance to forest disturbance and degradation and is consistent with observations elsewhere in Panti Forest Reserve, Johore and forested islands in Kenyir Lake, Terengganu in Peninsular Malaysia (Yong, 2006; Yong, 2008). One species, the white-chested babbler is known to occur in Singapore in the CCA forests as well as a number of mangrove sites on the mainland and the offshore islands of Ubin and Tekong. In recent years, remnant populations have been lost from a few sites like Senoko, Loyang and Pasir Ris (Lim et al., 2008) while the population in its present stronghold in Nee Soon Swamp Forest appears to have declined as implied by lower encounter rates recently (pers. obs.); the species is currently considered as critically-endangered (Lim et al., 2008).

Both the chestnut-winged babbler and short-tailed babbler are still relatively widespread and well-distributed throughout the CCA forests but certainly not at high densities. Presently listed as nationally endangered (Lim et al. 2008), the chestnut-winged babbler currently persists at two main areas in the CCA forests, the Nee Soon Swamp Forest and the Sime Road-MacRitchie Reservoir Forest where it has been regularly recorded (Lim, 1994, Sodhi, 2002; Wang & Hails, 2007; Lim, 2009). A small population at BTNR has not been recorded since 1999 (Subaraj, R. pers. comm.) and might have died out. The short-tailed babbler bears the distinction of being the only stenotypic forest babbler that is not locally threatened and while its range in Singapore is confined to the CCA forests, it is locally common and still widely distributed throughout. In fact the population in BTNR where it continues to persist has been long documented (Gibson-Hill, 1950), and it appears to be fairly common in a number of surveyed localities in the CCA forest like the Nee Soon Swamp Forest and MacRitchie-Sime Forest (Lim, 1994; Sodhi 2002; Wang & Hails, 2007; Lim, 2009). However, it is now extinct in the 4 ha (0.04 km²) Singapore Botanic Garden forest where it formerly occurred (Sodhi et al., 2005; Lim, 2009).

Thus far, the results presented here are limited in sampling time and space and should therefore be cautiously interpreted. One limitation in sampling effort is the low number of surveys conducted in the CCA forests, especially surveys conducted over the months March-July for MacRitchie-Sime Forest which overlap with the breeding season of

many birds species (Lim, 2009). As this is the period when babblers are especially vocal, it is possible that non-calling birds might not be detected in a survey, leading to the conclusion of it being absent. Furthermore, a lack of vocalization may not necessarily indicate absence of a species, as exemplified in the case of the Malaysian eared-nightjar *Eurostopodus temminckii* (birds observed in Singapore are non-vocal, implying some behavioral differences from individuals observed elsewhere). However, as field sampling is meant to supplement a review of published records, the bulk of records here are drawn extensively from the literature and correspondences with experienced field surveyors, and thus adequately show trends in decline of various babbler species. All three sampling sites covered are also surveyed a few times annually in regular bird censuses (e.g., Lim & Lim, 2009); addition complementation by various independent surveyors provides regular and relatively intensive sampling of babbler diversity at sites.

DISCUSSION

Deforestation in Singapore, much of which was prior to 1900, resulted in the eventual extinction of a large number of forest birds. Pheasants, woodpeckers, barbets, trogons and babblers were the hardest hit, with half or more of the recorded diversity now extinct (Lim & Gardner, 1997; Castelletta et al., 2000). All eight locally extinct babbler species are known to be largely dependant on lowland dipterocarp forests and one species, the grey-breasted babbler, *M. albogularis*, on freshwater swamp forest (Wells, 2007). If only strictly forest babbler species are considered, then almost three-quarters of this family have been extirpated from Singapore. Presently, a startling 99.7% of Singapore's primary dryland forest has been lost, leaving only small fragments totaling 192 ha (1.92 km²) distributed throughout the CCA forests, with the largest fragments at the BTNR [= 52 ha (0.52 km²)] and near MacRitchie Reservoir (Corlett, 1997). Likewise, freshwater swamp forests, a significant habitat for babblers and currently supporting all extant forest babblers, have also been greatly reduced, leaving an estimated 87 Ha in the Nee Soon Swamp Forest as the last major remnant of this once extensive habitat in Singapore (Corlett, 1991; Ng & Lim, 1992; Turner et al., 1996).

Baseline studies on faunal communities in small forest fragments elsewhere in the humid tropics show that forest fragmentation leads to gradual extinction of persisting communities of fauna, notably birds (Karr, 1982; Turner, 1996). Reduction of species diversity in habitat fragments caused by a gradual 'fallout' of species due to extinctions results in a lowering of species richness in a phenomenon known as faunal relaxation (Sodhi, 2002). This can take as many over 100 years and brings species diversity to a lower and relatively more stable state (Brooks et al., 1999; Sodhi, 2002). In general, published compilations of Singapore's bird fauna suggest forest babbler communities here have shown considerable relaxation with extinction of majority of Singapore's known babbler species since published data first become available (see Chasen, 1923). Furthermore, the absence of large contiguous patches of forests in Singapore and in southernmost Johor, Peninsular Malaysia means that it is unlikely any of the extinct babbler species would ever recolonise existing forest fragments.

Presently, it is too early to tell if pre-existing babbler diversity in our forests has reached the lower equilibrium as predicted in Brooks et al. (1999). While threats faced by primary lowland forests in neighbouring countries such as logging and monoculture does not affect primary forests and to a large extent, secondary forests in Singapore, it is unclear how degradation of the forests by other factors such treefalls and human disturbance (due to heavy recreational usage) will affect the residual avifauna. Empirical evidence gathered, however, shows that faunal relaxation is still an ongoing process in the CCA forests, with the recent possible extinction of the moustached babbler. Records of the white-chested babbler, whose existing stronghold on mainland Singapore in the CCA forests is the Nee Soon Swamp forest has dwindled recently and may be condemned to local extinction in a few years (pers. obs.). The species has already disappeared from most of its known localities on mainland Singapore, leaving the only viable population on the offshore island of Pulau Tekong (R. Subaraj, in litt, 2009).

The BTNR, a small forest fragment [area = 163 ha (1.63 km²)] of which less than half is primary has been completely isolated from the CCA forest reserve for over two decades with the construction of the Bukit Timah Expressway (Lum & Sharp, 1996). Of the four species of babblers known to have occurred there, three has been recently recorded (as per 2009 data). However, the lack of records of the chestnut-winged babbler despite extensive observer coverage (see Lim & Lim, 2009) suggests that this species may also have gone extinct there in recent years (K. C. Lim, in litt. 2009).

Poor persistence of babbler species in Singapore's forest has not be investigated at length in recent reviews of the island's avifauna (e.g., Wang & Hails, 2007; Lim, 2009), but probably arises a result of specialised ecological/physiological traits coupled with continued degradation and fragmentation of the Singapore's Central forests. A guild-based classification places all extant babblers in three predominantly insectivorous foraging guilds: arboreal-insectivore/understorey foliage-gleaning insectivore and terrestrial insectivore (see Wong 1985). Studies drawn from the Neotropics have shown that insectivorous birds are particularly sensitive to fragmentation and habitat disturbances (Stratford & Stouffer, 1999; Sekercioglu et al., 2002). Babblers are the dominant and also most successful group of insectivorous birds in most Southeast Asian forests, but have been highlighted in studies (e.g., Ford & Davison, 1995) to respond poorly to fragmentation, which agrees with observed poor persistence of the family in Singapore's forest. Although this pattern is not well investigated, it could arise as a consequence of lowered insect abundances in degraded

or highly fragmented forest patches or more directly, fragment-associated microclimate changes in the lower storey of the forest (Lambert & Collar, 2002), where most babbler species inhabit.

While not fully explaining persistence within the patch itself, poor dispersal abilities across non-forest habitats implies that tiny populations of babbler persisting in forest fragments isolated by a myriad of anthropogenic factors can no longer be buffered by populations dispersing from surrounding contiguous or large forests (Lum & Sharp, 1996; Sodhi et al., 2004). BTNR, with its depauperate avifauna exemplifies this. Isolation of the reserve has probably hindered a number of birds with poor-dispersal abilities, notably babblers (e.g., chestnut-winged babbler) to re-invade from the CCA forests. Ultimately, combinatorial effects of stochastic factors like increased nest predation, lowered food resources and availability of nesting sites would be highly detrimental to species already plagued by low population density, pushing it nearer to extirpation (Sodhi et al., 2004). Our current knowledge of persistence patterns of babbler species in Singapore's forests is relatively limited even though forest degradation has been identified as a major cause. Much speculation remains over how babbler species become extinct or continue to persist, and this would require extensive field work (e.g. long-term mist-netting studies) to confirm.

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