

Non-breeding season records of warblers in the *Phylloscopus reguloides* lineage from Thailand and Myanmar

Authors: Round, Philip D., Promnun, Pattarapon, Pierce, Andrew J., Sankamethawee, Wangworn, Allen, Desmond N., et al.

Source: Bulletin of the British Ornithologists' Club, 143(2) : 265-272

Published By: British Ornithologists' Club

URL: <https://doi.org/10.25226/bboc.v143i2.2023.a11>

The BioOne Digital Library (<https://bioone.org/>) provides worldwide distribution for more than 580 journals and eBooks from BioOne's community of over 150 nonprofit societies, research institutions, and university presses in the biological, ecological, and environmental sciences. The BioOne Digital Library encompasses the flagship aggregation BioOne Complete (<https://bioone.org/subscribe>), the BioOne Complete Archive (<https://bioone.org/archive>), and the BioOne eBooks program offerings ESA eBook Collection (<https://bioone.org/esa-ebooks>) and CSIRO Publishing BioSelect Collection (<https://bioone.org/csiro-ebooks>).

Your use of this PDF, the BioOne Digital Library, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Digital Library content is strictly limited to personal, educational, and non-commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne is an innovative nonprofit that sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Non-breeding season records of warblers in the *Phylloscopus reguloides* lineage from Thailand and Myanmar

by Philip D. Round, Pattarapon Promnun, Andrew J. Pierce,
Wangworn Sankamethawee, Desmond N. Allen, Jérôme Fuchs, Ngwe Lwin
& Mongkol Safoowong

Received 16 December 2022; revised 10 March 2023; published 7 June 2023

<http://zoobank.org/urn:lsid:zoobank.org:pub:3EF9418D-F525-49CE-BE75-AB04850929BA>

SUMMARY.—A total of 20 individual *Phylloscopus* warblers in the ‘Blyth’s Leaf Warbler *P. reguloides* lineage’, caught for ringing in the non-breeding season in Thailand and Myanmar, were resolved via mtDNA assay as *P. reguloides* (seven individuals), Claudia’s Leaf Warbler *P. claudiae* (12) and Hartert’s Leaf Warbler *P. goodsoni* (one). As expected, *P. claudiae* proved to be the most widely distributed. The occurrence of four *P. claudiae* on an island in the Thai Gulf, alongside large numbers of typically Sundaic wintering species on northbound migration during late March–early April, indicates that its non-breeding season range probably extends further south than previously recognised, into that subregion.

The *Phylloscopus* warblers formerly united as Blyth’s Leaf Warbler *Phylloscopus reguloides* (*sensu lato*) have recently been shown by molecular analysis to represent three distinct lineages. *P. reguloides* is sister to the lineage comprising Claudia’s Leaf Warbler *P. claudiae* and Hartert’s Leaf Warbler *P. goodsoni* (Olsson *et al.* 2005, Alström *et al.* 2018). This arrangement is further supported by analyses of vocalisations (Päckert *et al.* 2009). Plumage differences among the three taxa are slight, however, all possessing a pale median crown-stripe, two wingbars and narrow white edges to the inner margins of the two or three outermost rectrices. *P. claudiae* and *P. goodsoni* differ from each other chiefly in the degree of yellow suffusion on their face and underparts, although this is difficult to judge under field conditions.

Monotypic *P. claudiae* is the most northerly distributed and widespread, its breeding range lying mostly north of the Changjiang (Yangtze) River in Gansu, Sichuan and Shaanxi, north to Hebei, in China (Cheng 1987, Dickinson & Christidis 2014). The distribution of *P. goodsoni* is more southerly, with nominate *goodsoni* in Guangxi and Guangdong, and *P. g. fokiensis* further north in Fujian, Jiangsu, Hubei and Shaanxi where it almost meets *P. claudiae* (Päckert *et al.* 2009, Dickinson & Christidis 2014). Four races of *P. reguloides* are distributed in the Himalayas from Kashmir in the west, east to north-west Vietnam and elsewhere in northern continental South-East Asia, including the montane outlier of the Langbian Plateau (Dickinson & Christidis 2014). In Thailand, breeding of *P. reguloides* [*assamensis*] was first proven on Thailand’s highest mountain, Doi Inthanon, 2,565 m (Alström & Olsson 1994), and it is also apparently resident on a few other 2,000 m-plus peaks in Thailand, including Doi Pha Hom Pok (2,285 m), and probably Doi Chiang Dao, Chiang Mai Province (2,175 m), and in the west on the ornithologically little-known peak of Doi Kajela, 2,152 m, Tak Province (16°10’N, 99°02’E) based on the evidence of birds singing during April (PDR pers. obs.). Further, *P. reguloides assamensis* ‘probably breeds throughout the mountains of

Burma, and has been recorded from Mt. Victoria, North East Burma, the Shan States and Karenni' (Smythies 1986).

The winter distributions of these taxa are imperfectly known, owing to their morphological similarity. Relatively few of the specimens in museums have been subjected to DNA assay. *P. reguloides* (*sensu stricto*) is presumed to be either resident or a short-distance or elevational migrant throughout its range (e.g., Ali & Ripley 1983). The co-occurrence of *P. claudiae*, wintering alongside *P. reguloides* in parts of South-East Asia, had long been recognised, based on the slightly longer, more pointed wing of the relatively long-distance migrant *claudiae* compared to *reguloides*. Nonetheless, although Deignan (1945) acknowledged Ticehurst's (1938) identification of ten March-collected individuals from the Doi Inthanon summit (Doi Ang Ka) as *P. reguloides assamensis*, his subsequent Thailand checklist (Deignan 1963) omitted these, and unaccountably only listed *P. [reguloides] claudiae* therein: from Thailand's northern plateau (Chiang Rai, Chiang Mai and Lamphun Provinces) and the extreme north of the north-eastern plateau (Loei Province). Wintering birds presumed to be *P. claudiae* have since been found much more widely in Thailand: at lower elevations in the north-east, especially in Khao Yai National Park; in the south-eastern provinces, in the western forest complex, around Bangkok (on passage), and in the north of the peninsula south to c.12°N (Lekagul & Round 1991, Treesucon & Limparungpathanakij 2018). However, the possibility that some of these birds might have included *P. goodsoni*, the winter distribution of which is poorly known, cannot be eliminated owing to the morphological similarity of the two.

The picture is further complicated by nomenclatural confusion, as nominate *P. g. goodsoni* was formerly placed as a subspecies of Sulphur-breasted Leaf Warbler *P. ricketti*, whilst *P. g. fokiensis* was subsumed under *P. reguloides* (Watson *et al.* 1986). There are relatively few unequivocal records remote from the Chinese breeding range of either, although *P. g. goodsoni* is known to winter on Hainan and *P. g. fokiensis* may be widespread in northern continental South-East Asia (Dickinson & Christidis 2014). The two *P. goodsoni* subspecies are thought to overwinter in roughly equal proportions in Hong Kong, where *P. claudiae* is, as yet, unrecorded (Carey & Pang in prep.).

Three individuals collected in Phongsali province, northern Laos, in March 2005, one from montane elevation (>1,000 m) and two from steep, submontane land, were determined by mtDNA assay as *P. goodsoni* (Fuchs *et al.* 2007). Although the subspecies was not determined, the specimens are deposited in Muséum national d'Histoire naturelle, Paris, and are available for scrutiny. Subsequently, a long-staying bird photographed in a Bangkok city park during 17 January to 11 February 2015 (Robson 2015, Bird Conservation Society of Thailand, unpubl.) was considered to be a nominate *P. g. goodsoni*, whilst two heard singing at c.1,200 m elevation, Khao Yai National Park, on 21 February 2021 were considered to be *P. goodsoni* ssp. (Bird Conservation Society of Thailand 2021, Roddis & Loseby 2021). Sound recordings archived on Xeno-canto indicate the non-breeding presence of *P. goodsoni* in non-montane elevations of both central Myanmar (A. Lastukhin & V. Sotnikov) and Cambodia (F. Lambert; www.xeno-canto.org).

We were primarily concerned to identify the winter ranges and relative abundance of *P. claudiae* and *P. goodsoni* ssp. in Thailand and Myanmar among 'P. reguloides lineage birds' that were captured and released during ringing activities.

Methods

We collected feathers for DNA assay from a total of 23 *P. reguloides* (*sensu lato*) mist-netted and ringed at five discrete localities (Table 1): Doi Chiang Dao and Doi Lang (the north-east ridge of Doi Pha Hom Pok), both montane, at elevations of 1,450 m and 1,900 m

TABLE 1
Locations where *Phylloscopus* spp. were sampled

Location	Coordinates	Elevation (m)
Indawgyi Lake, Kachin State, Myanmar	25°06'N, 96°17'E and 25°14'N, 96°22'E	180 m
Doi Lang, Mae Ai District, Thailand	20°06'57"N, 99°07'44"E	1,900 m
Khun Huai Mae Kok Substation, Doi Chiang Dao Wildlife Sanctuary, Chiang Mai Province, Thailand	19°22'27"N, 98°50'05"E	1,450 m
Khao Yai National Park headquarters area, Nakhon Nayok Province, Thailand	14°24'58"N, 101°22'43"E	750 m
Ko Man Nai (Man Nai Island), Rayong Province, Thailand	12°36'44"N, 101° 41'18"E	sea level

respectively, in Chiang Mai Province; Khao Yai National Park, Nakhon Nayok Province (c.750 m, where exclusively winter visitors); the island of Ko Man Nai, Rayong Province (four individuals, all apparently on northbound spring migration during March–April); and Indawgyi Wildlife Sanctuary, Kachin State, northern Myanmar (three apparently wintering birds in lowland secondary forest at c.180 m elevation; Table 1). All were measured and weighed and basic wing formula (position of the tip of the second outermost primary, p2, numbered ascendantly, in relation to the tips of the inner primaries) was noted for most. All individuals are referred to in subsequent text by ring number.

Laboratory protocols.—We extracted DNA from feather samples using NucleoSpin tissue kit (Macherey-Nagel), with 0.1% Dithiothreitol (DTT) added to increase the DNA yield (Olsson *et al.* 2005). Partial cytochrome-*b* (Cyt *b*) mitochondrial gene was amplified using primers: L14841 (5'-AAAAAGCTTCCATCCAACATCTCAGCATGATGAAA-3') and H15547 (5'-AATAGGAAGTATCATTCGGGTTTGATG-3'; Helbig *et al.* 1995). We performed Polymerase Chain Reaction (PCR) using AccuStart II GelTrack PCR SuperMix (Quanta BioSciences) with concentration of ingredients suggested by the manufacturer. The PCR reactions were performed using an Eppendorf Mastercycler gradient thermocycler under the following conditions: 94°C for three minutes followed by five cycles at 94°C for 30 seconds, 48°C for 30 seconds, 72°C for one minute, then 30 cycles at 94°C for 30 seconds, 51°C for 30 seconds, 72°C for one minute and a final 72°C for five minutes (Saitoh *et al.* 2015). The PCR products were visualised with 1.5% agarose gel electrophoresis and purified using NucleoSpin Gel and PCR Clean-up (Macherey-Nagel). The products were sent for sequence analyses using Applied Biosystems BigDye Terminator v3.1 Cycle Sequencing Kit protocol.

Genetic analyses.—Sequences of collected samples were deposited in GenBank (Table 2) and aligned with sequences of recognised *P. reguloides* (AY656231, AY656233, AY656238, and EU851077–EU851079), *P. claudiae* (EU851083 and MH079258), *P. goodsoni* (AY656225, EU851081, and the three individuals referred to by Fuchs *et al.* 2007) using ClustalW in MEGA7 v. 7.0.21 (Kumar *et al.* 2016). Yellow-vented Warbler *P. cantator* (AY606157) and *P. ricketti* (AY606172) served as outgroups. We used Kakusan4 (Tanabe 2007) to select the best-fit evolutionary model under the Akaike Information Criterion (AIC; Akaike 1974) and Bayesian Information Criterion (BIC; Schwarz 1978) for Maximum Likelihood (ML) and Bayesian Inference (BI) approaches, respectively. The selected model for the ML was GTR Gamma and for BI was HYK85 Gamma. The ML trees were constructed using RAxML v8.2.12 (Stamatakis 2014) on CIPRES Science Gateway V3.3 (Miller *et al.* 2010) with 1,000 bootstrapping iterations. We considered bootstrap values higher than 70% as significant support. The BI trees were performed in MrBayes v3.2.6 (Huelsenbeck & Ronquist 2001) under a Metropolis-coupled, Markov chain Monte Carlo (MC-MCMC) approach, started from random tree, run twice in parallel with a four-chain analysis for

five million generations. The trees were sampled every 100 generations and 25% of these were discarded as 'burn-in'. We then evaluated stationarity by checking Effective Sample Size (ESS > 200) using Tracer v1.7.1 (Rambaut *et al.* 2018). We considered 95% posterior probabilities or higher from the remaining trees as significant support. The ML and BI trees were visualised and edited in FigTree v1.4.3 (Rambaut 2009).

Results

The samples from 20 individuals were successfully amplified but in three further individuals, from Khao Yai, the sequences were unrecoverable, apparently due to contamination. The final alignments from collected samples and downloaded sequences revealed 670 bp (130 variable sites and 115 parsimony informative sites). As ML and BI approaches provided similar topology, only the BI tree is shown (Fig. 1).

Of these 20 birds, seven were resolved as *P. reguloides* with high statistical support (100% bootstrap value and 100% posterior probability; Table 2). The clade of *P. reguloides* was further divided into two subclades. Our three Myanmar individuals, A34517, A34516 and A34567, caught in lowlands of Indawgyi Wildlife Sanctuary, were closely related to birds from montane elevations elsewhere in the same country (AY656231 and EU851078 from Mt. Victoria (Natmataung National Park)), and from Nepal (AY656238 and EU851077) with 100% bootstrap and posterior probability. The relationship of the same three to additional Myanmar birds from Mt. Victoria (AY656233 and EU851079) received lower statistical support (70% bootstrap and <90% posterior probability, Fig. 1). Four northern Thai montane-trapped birds, 1A03637 (Doi Lang), 1A23428, 1A23030 and 1A01942 (Doi Chiang Dao, Table 2) were more closely related to *P. reguloides* from Yunnan, China (EU851079) and northern Tonkin, Vietnam (AY656233) with high statistical support (100% bootstrap value and 100% posterior probability). Another Doi Chiang Dao bird, 1A01944, clustered with *P. goodsoni* from Jiangxi (EU851081) and Guangdong, China (AY656225) and with three Fuchs *et al.* (2007) *P. goodsoni* from northern Laos, OP90367, OP90368 and OP90369 (100% bootstrap value and 100% posterior probability; Fig. 1).

A further 12 individuals (two from Doi Chiang Dao, 1A01729 and 1A01730, six from Khao Yai, 1A03127, 1A03104, 1A03137, 1A03138, 1A03177 and 1A03200, and four from Man Nai Island, A35381, A35387, A35388 and A34420) nested with *P. claudiae* from Gansu (EU851083) and Shaanxi, China (MH079258), with 100% bootstrap value and posterior probability; Fig. 1, Table 2).

Six of the seven *P. reguloides* were tentatively identified as that taxon before release based on wing formula (p2 falling between p9 and the tips of the secondaries, Table 2). Seven of the 12 *P. claudiae* were likewise correctly attributed to taxon on the basis of their longer p2 (= p7, one individual; = p8, four individuals; and = p8/9, two individuals; primaries numbered ascendantly). A further *P. claudiae* could not be reliably assigned on wing formula (p2 = 9/10), and wing formula was not noted for the four remaining birds (Table 2). While *P. goodsoni* could not be excluded for any of these *claudiae* based on wing formula, the relative weakness of any yellow suffusion on the supercilium and throat observed at time of capture was then judged to more likely indicate *P. claudiae*. Neither plumage details nor wing formula were specifically noted for the single *P. goodsoni* that was sampled.

Discussion

Although *P. reguloides* (*sensu stricto*) is known as an elevational migrant that winters in the Himalayan foothills and plains of northern India (Ali & Ripley 1983, Rasmussen &

TABLE 2
Biometrics, wing formula, body mass, ring numbers and accession numbers of sampled *Phylloscopus* (wp = wing point; nr = not recorded). Primaries are numbered ascendantly.

Ring no	Date	Location	mtDNA determination	wing	tail	bill	tarsus	wp	p2	mass (g)	GenBank no.
A34516	29 Jan 18	Indawgyi,	<i>reguloides</i>	61	44	13.5	18.2	p5 (p4)	=p10	7.3	MT921120
A34517	29 Jan 18	Indawgyi,	<i>reguloides</i>	62	46	12.8	19.0	p5 (p4)	=p10	7.0	MT921122
A34567	06 Feb 18	Indawgyi,	<i>reguloides</i>	57	43	12.5	17.7	p4=p5	=p9/ss	nr	MT921121
1A03637	28 Mar 08	Doi Lang	<i>reguloides</i>	56	42	12.0	13.9	p4=p5	=ss	7.3	MT921119
1A01942	3 Dec 09	Doi Chiang Dao	<i>reguloides</i>	61	47	13.0	17.8	nr	nr	7.6	OP381448
1A23030	24 Jan 15	Doi Chiang Dao	<i>reguloides</i>	58	45	13.5	18.2	p4=p5	=p9	10.1	MT921131
1A23428	16 Dec 15	Doi Chiang Dao	<i>reguloides</i>	61.5	47	13.7	19.9	p4=p5	=10/ss	7.2	MT921123
1A01944	3 Dec 09	Doi Chiang Dao	<i>goodsoni</i>	60	46	13.7	16.8	nr	nr	7.4	MT921116
1A01729	30 Jan 09	Doi Chiang Dao	<i>claudiae</i>	63	47	13.6	nr	nr	nr	8.1	MT921118
1A01730	30 Jan 09	Doi Chiang Dao	<i>claudiae</i>	61.5	46	13.5	17.4	nr	nr	7.5	MT921117
1A03104	19 Nov 06	Khao Yai	<i>claudiae</i>	62	46	nr	nr	nr	nr	7.3	MT921130
1A03127	28 Oct 07	Khao Yai	<i>claudiae</i>	61	46	nr	nr	p4=p5	=p7	7.0	MT921129
1A03137	10 Nov 07	Khao Yai	<i>claudiae</i>	61	45	nr	nr	p4=p5	=p8	7.3	MT921128
1A03138	11 Nov 07	Khao Yai	<i>claudiae</i>	62	43	nr	nr	p4=p5	=p9/10	7.6	MT921127
1A03177	20 Jan 08	Khao Yai	<i>claudiae</i>	60	45	nr	nr	p4=p5	=p8	7.2	MT921126
1A03200	5 Mar 08	Khao Yai	<i>claudiae</i>	58	44	nr	nr	nr	nr		MT921125
A35381	19 Mar 21	Ko Man Nai	<i>claudiae</i>	62	45	13.0	16.7	p4	=p8	8.3	MZ404594
A35387	20 Mar 21	Ko Man Nai	<i>claudiae</i>	57	41	12.3	16.8	p4 (p5)	=p8/p9	7.4	MZ404595
A35388	20 Mar 21	Ko Man Nai	<i>claudiae</i>	61	44	13.9	17.6	p5 (p4)	=p8/p9	6.8	MZ404596
A35420	6 Apr 21	Ko Man Nai	<i>claudiae</i>	60	42	14.3	16.5	p4	=p8	9.3	MZ404597

Anderton 2005) our three Indawgyi individuals may be the first confirmed records from comparable lowland elevations in Myanmar or South-East Asia.

P. claudiae was confirmed, as expected, to be a widespread winter visitor in forested habitats of both lowland and montane elevations in Thailand. While the *P. claudiae* from Doi Chiang Dao and Khao Yai were apparently over-wintering birds, four others from the island of Ko Man Nai during late March–early April were almost certainly northbound passage migrants. The island, which lies 5.5 km off the eastern Thai coast, is a noted hotspot for migration during March to May (Round *et al.* 2015, Round & Dymond 2022). Almost all migrants caught on the island during those months were judged to be Sundaic winterers, probably making landfall following a c.600 km sea-crossing from Pattani Province, southern Thailand, which is c.600 km due south, on the extreme northern edge of the Peninsular Malayan bulge. Our captures might suggest, therefore, that small numbers of *P. claudiae* winter, as yet undetected, in the Sunda subregion, perhaps alongside the relatively common wintering Eastern Crowned Leaf Warbler *P. coronatus*.

The status of *P. goodsoni* remains to be further elucidated, however. Judged on the few Thai and other South-East Asian records, it is either scarce or overlooked, and is possibly

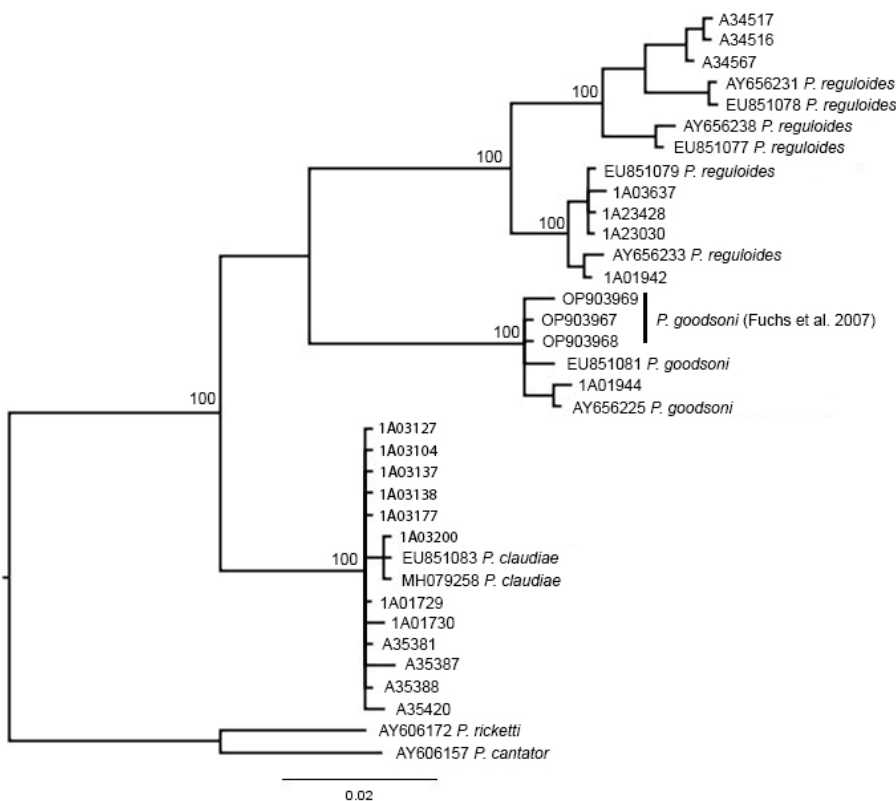


Figure 1. Bayesian Inference phylogenetic tree based on partial Cyt-b (B) gene of collected samples and those downloaded from GenBank, with Sulphur-breasted Warbler *P. ricketti* and Yellow-vented Warbler *P. cantator* serving as outgroups. Numbers on each node represent posterior probabilities. (All samples collected in this study are represented by ring numbers with either A or 1A preceding the five-digit number.)

more frequent in the east of the region. Separation of *P. goodsoni* and *P. claudiae* in field observations is problematical, and their similarity extends to behavioural traits. Nuthatch-like clambering on tree trunks and larger branches is frequently observed in birds identified both as *P. claudiae* (Treesucon & Limparungpatthanakij 2018) and *P. goodsoni* (Carey & Pang in prep.) but so far may not have been recorded in *P. reguloides*. Further sampling, whether by mist-netting and examination in the hand, or from sound-recordings of winter-singing birds, across a range of habitats and elevations in mainland South-East Asia, may improve our knowledge of the non-breeding season distribution and status of *P. claudiae* and *P. goodsoni* alongside *P. reguloides*.

Acknowledgements

Woraphot Bunkhwamdi, Bill Jones, Stephen Samworth, Kevin Thornton and Jan Visser helped in the field. Geoff Carey read and commented on this manuscript, and Will Duckworth and James Eaton kindly provided peer review. Per Alström, Urban Olsson and Martin Päckert provided information on the provenance of their Myanmar specimens. We thank the former head of Chiang Dao Wildlife Research Station, Mr Prateep Rojanadilok, for his cooperation and support. We also thank the Myanmar Forest Department for permission to implement field work at Indawgyi during 2018 and 2019, and are especially grateful to U Maung Win, Park Warden of Indawgyi Wildlife Sanctuary, for his collaboration during ringing activities. The Helmsley Charitable Trust contributed financial support for field work at Indawgyi. Ringing activities at Khao Yai National Park were performed with permission from the Department of National Parks, Wildlife and Plants Conservation and were funded by the Thailand Biodiversity Research and Training Program Grant BRT_346004 under the National Science and Technology Development Agency. On Ko Man Nai we worked

in collaboration with the Eastern Marine and Coastal Resources Research Center (EMCOR), Department of Marine and Coastal Resources. We are especially grateful to the Director of EMCOR, Mr Suthep Jualaong, for his support and encouragement. PR also wishes to thank Stephen Rumsey of The Wetland Trust, UK, for making his work possible.

References:

- Akaike, H. 1974. A new look at the statistical model identification. *IEEE Trans. Automatic Control* 19: 716–723.
- Ali, S. & Ripley, S. D. 1983. *Compact handbook of the birds of India and Pakistan*. Oxford Univ. Press, Delhi.
- Alström, P. & Olsson, U. 1994. Blyth's Leaf Warbler *Phylloscopus reguloides* found breeding in Thailand. *Forktail* 9: 150–152.
- Alström, P., Rheindt, F. E., Zhang, R., Zhao, M., Wang, J. Zhu, X., Gwee, C-Y., Hao, Y., Ohlson, J., Jia, C., Prawiradilaga, D. M., Ericson, P. G. P., Lei, F. & Olsson, U. 2018. Complete species-level phylogeny of the leaf warbler (Aves: Phylloscopidae) radiation. *Mol. Phylo. & Evol.* 126: 141–152.
- Bird Conservation Society of Thailand. 2021. Records roundup (Dec 2020–Mar 2021). *Robin* (Bird Conservation Society of Thailand Bulletin) 38: 62–76.
- Carey, G. J. & Pang, C. C. in prep. Hartert's Leaf Warbler *Phylloscopus goodsoni*, version 1.0. In Carey, G. J. (ed.) *The avifauna of Hong Kong*. Hong Kong Bird Watching Society, Hong Kong.
- Cheng, Tso-hsin. 1987 *A synopsis of the avifauna of China*. Science Press, Beijing.
- Deignan, H. G. 1945. The birds of northern Thailand. *US Natl. Mus. Bull.* 186.
- Deignan, H. G. 1963. Checklist of the birds of Thailand. *US Natl. Mus. Bull.* 226.
- Dickinson, E. C. & Christidis, L. (eds.) 2014. *The Howard and Moore complete checklist of the birds of the world*, vol. 2. Fourth edn. Aves Press, Eastbourne.
- Fuchs, J., Cibois, A., Duckworth, J. W., Eve, R., Robichaud, W. G., Tizard, T. & van Gansberghe, D. 2007. Birds of Phongsaly province and the Nam Ou river, Laos. *Forktail* 22: 23–86.
- Helbig, A. J., Seibold, I., Martens, J. & Wink, M. 1995. Genetic differentiation and phylogenetic relationships of Bonelli's Warbler *Phylloscopus bonelli* and Green Warbler *P. nitidus*. *J. Avian Biol.* 26: 139–153.
- Huelsenbeck, J. P. & Ronquist, F. 2001. MrBayes: Bayesian inference of phylogenetic trees. *Bioinformatics* 17: 754–755.
- Kumar, S., Stecher, G. & Tamura, K. 2016. MEGA7: molecular evolutionary genetics analysis version 7.0 for bigger datasets. *Mol. Biol. Evol.* 33: 1870–1874.
- Lekagul, B. & Round, P. D. 1991. *A guide to the birds of Thailand*. Saha Karn Bhaet, Bangkok.
- Miller, M. A., Pfeiffer, W. & Schwartz, T. 2010. Creating the CIPRES Science Gateway for inference of large phylogenetic trees. Proc. Gateway Computing Environments Workshop (GCE). 14 Nov. 2010, New Orleans, LA: 1–8.
- Olsson, U., Alström, P., Ericson, P. G. P. & Sundberg, P. 2005. Non-monophyletic taxa and cryptic species—evidence from a molecular phylogeny of leaf-warblers (*Phylloscopus*, Aves). *Mol. Phylo. & Evol.* 36: 261–276.
- Päckert, M., Blume, C., Sun, Y.-H., Wei, L. & Martens, J. 2009. Acoustic differentiation reflects mitochondrial lineages in Blyth's leaf warbler and white-tailed leaf warbler complexes (Aves: *Phylloscopus reguloides*, *Phylloscopus davisoni*). *Biol. J. Linn. Soc.* 96: 584–600.
- Rambaut, A. 2009. FigTree v1.4.3. <http://www.tree.bio.ed.ac.uk/software/figtree>.
- Rambaut, A., Drummond, A. J., Xie, D., Baele, G. & Suchard, M. A. 2018. Posterior summarisation in Bayesian phylogenetics using Tracer 1.7. *Syst. Biol.* 67: 901–904.
- Rasmussen, P. C. & Anderton, J. C. 2005. *Birds of South Asia: the Ripley guide*, 2 vols. Smithsonian Institution, Washington DC & Lynx Edicions, Barcelona.
- Robson, C. 2015. From the field, late December 2014 to early November 2015. *BirdingASIA* 24: 144–148.
- Roddie, S. & Loseby, T. 2021. From the field, October 2020 to April 2021. *BirdingASIA* 35: 117–128.
- Round, P. D. & Dymond, J. N. 2022. Records of Northern Hawk-cuckoo *Hierococcyx hyperythrus* in Thailand and notes on their identification. *BirdingASIA* 37: 69–73.
- Round, P. D., Pierce, A. J., Nualsri, C. & Sankamethawee, W. 2015. A record of Japanese Leaf Warbler *Phylloscopus xanthodryas* in Thailand. *BirdingASIA* 23: 133–134.
- Saitoh, T., Sugita, N., Someya, S., Iwami, Y., Kobayashi, S., Kamigaichi, H., Higuchi, A., Asai, S., Yamamoto, Y. & Nishiumi, I. 2015. DNA barcoding reveals 24 distinct lineages as cryptic bird species candidates in and around the Japanese archipelago. *Mol. Ecol. Res.* 15: 177–186.
- Schwarz, G. E. 1978. Estimating the dimension of a model. *Ann. Stat.* 6: 461–464.
- Smythies, B. 1986. *The birds of Burma*. Third edn. Nimrod Press, Liss.
- Stamatakis, A. 2014. RAXML version 8: a tool for phylogenetic analysis and post-analysis of large phylogenies. *Bioinformatics* 30: 1312–1313.
- Tanabe, A. S. 2007. KAKUSAN: a computer program to automate the selection of a nucleotide substitution model and the configuration of a mixed model on multilocus data. *Mol. Ecol. Notes* 7: 962–964.
- Ticehurst, C. B. 1938. *A systematic review of the genus Phylloscopus*. Trustees of the Brit. Mus., London.
- Treesucon, U. & Limparungpatthanakij, W. 2018. *Birds of Thailand*. Lynx Edicions, Barcelona.

Watson, G. E., Traylor, M. A. & Mayr, E. 1986. Family Sylviidae, Old World warblers. Pp. 3–294 in Mayr, E. & Cottrell, G. W. (eds.) *Checklist of birds of the world*, vol. 11. Mus. Comp. Zool., Cambridge, MA.

Addresses: Philip D. Round, Animal Systematics and Molecular Ecology Laboratory, Dept. of Biology, Faculty of Science, Mahidol University, Rama 6 Road, Bangkok 10400, Thailand, e-mail: philip.rou@mahidol.ac.th. Pattarapon Promnun, Natural History Museum, National Science Museum (Thailand), Technopolis, Khlong 5, Khlong Luang, Pathumthani, 12120, Thailand, e-mail: pattarapon.prm@gmail.com. Andrew J. Pierce, Conservation Ecology Program, School of Bioresources and Technology, King Mongkut's University of Technology Thonburi, Bangkhunthien, Bangkok 10150, Thailand, e-mail: andyp67@gmail.com. Wangworn Sankamethawee Dept. of Environmental Science, Faculty of Science, Khon Kaen University, Mueang, Khon Kaen 40002, Thailand, e-mail: wangsakku.ac.th. Desmond N. Allen, 97 Sussex Way, London N7 6RU, UK, e-mail: rhabdornis@gmail.com. Jérôme Fuchs, UMR5202, Origine, Structure et Evolution de la Biodiversité, Département Systématique et Evolution, Muséum national d'Histoire naturelle, Case postale 51, 55 Rue Buffon, 75005 Paris, France, e-mail: jerome.fuchs@mnhn.fr. Ngwe Lwin, Fauna & Flora International, Myanmar Programme, No. 34 D/9 San Yae Twin Street, Kaba Aye Pagoda Road, Bahan Township, Yangon, 11201, Myanmar, e-mail: ngwe.lwin@fauna-flora.org. Mongkol Safoowong, Chiang Dao Wildlife Research Station, PO Box 11, Chiang Dao District, Chiang Mai 50170, Thailand, e-mail: moo_mongkol62@hotmail.com