Surveys at Bagan Percut, Sumatra, reveal its international importance to migratory shorebirds and breeding herons

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Summary: The Bagan Percut region of north-eastern Sumatra, Indonesia, is becoming well known for its large concentrations of migratory shorebirds. From January to June 2011 we made monthly counts of shorebirds and waterbirds at four mudflats and one heron rookery. Fifty-one species were recorded, including 35 migratory species, and eight breeding species in the rookery. We counted 20,114 migratory shorebirds (mudflats) and 45,648 breeding waterbirds (rookery) over six months of surveys. We observed >1% of the East Asian-Australasian flyway population of five species of migratory shorebirds: Nordmann's Greenshank *Tringa guttifer* (globally Endangered), Lesser Sand Plover *Charadrius mongolus*, Pacific Golden Plover *Pluvialis fulva*, Eurasian Curlew *Numenius arquata*, and Ruddy Turnstone *Arenaria interpres*. Our results support the work of others that indicate that Bagan Percut is an important habitat for wintering, migrating, and summering shorebirds. We recommend that Bagan Percut be added to the East Asian-Australasian Flyway Partnership list of internationally important wetlands because the area meets all three criteria for inclusion.

Ringkasan: Kawasan Bagan Percut di bagian timur laut Sumatera Indonesia menjadi terkenal karena adanya konsentrasi burung pantai bermigrasi yang besar. Dari Januari sampai Juni 2011 kami melaksanakan penghitungan bulanan burung air di di empat lokasi hamparan lumpur dan satu koloni burung air yang berbiak. Selama enam bulan survei kami melaporkan sebanyak lima puluh satu spesies burung, termasuk 35 spesies yang bermigrasi dan 8 spesies yang berbiak di tempat tersebut. Kami menghitung 20.114 burung pantai yang bermigrasi di hamparan lumpur dan 45.648 burung air yang juga berbiak di tempat itu. Kami mengamati >1% populasi di Jalur Timur Asia-Australia dari lima spesies burung pantai yang bermigrasi: Trinil Nordmann *Tringa guttifer* (secara global Genting), Cerekpasir Mongolia *Charadrius mongolus*, Cerek Kernyut *Pluvialis fulva*, Gajahan Erasia *Numenius arquata*, dan Trinil Pembalik-batu *Arenaria interpres*. Hasil survei kami mendukung upaya pihak lain yang mengindikaskan bahwa kawasan Bagan Percut merupakan habitat penting. Kami merekomendasikan kawasan Bagan Percut ditambahkan kepada daftar Kemitraan Jalur Timur Asia-Australia yang secara internasional merupakan lahan basah penting yang memenuhi semua kriteria.

Introduction

The eastern coast of Sumatra, Indonesia, is a critically important region for migratory shorebirds (Verheugt *et al.* 1993; Crossland *et al.* 2006; Iqbal *et al.* 2010, 2011, 2013a). Crossland *et al.* (2012) made eight visits of 1–7 days to the Bagan Percut area of North Sumatra province from 1995–2005 and found large numbers of shorebirds, including >1% of the East Asian-Australasian flyway (hereafter 'flyway') population (Delany & Scott 2006; Bamford *et al.* 2008; Li *et al.* 2009) of Lesser Sand Plover *Charadrius mongolus*, Greater Sand Plover *C. leschenaultii*, Bar-tailed Godwit *Limosa lapponica*, Asian Dowitcher *Limnodromus semipalmatus*, Eurasian Curlew *Numenius arquata*, Common Redshank *Tringa totanus*, Terek Sandpiper *Xenus cinereus*, and Curlew Sandpiper *Calidris ferruginea* in the region.

Iqbal *et al.* (2010) visited Bagan Percut and two nearby sites, Pantai Ancol and Tanjung Balai on 3–4 January 2009 and found an estimated 28,000 waterbirds, including >1% of the flyway population of Green Sandpiper *Tringa ochropus*, Terek Sandpiper, Lesser Sand Plover, Eurasian Curlew, Eastern Curlew *Numenius madagascariensis*, Bar-tailed Godwit, Black-tailed Godwit *Limosa limosa*, and an impressive 32% of the flyway population of Asian Dowitcher, which is globally Near Threatened (BirdLife International 2014). In addition, Crossland & Sitorus (2011) found >1% of the flyway population of Red Knot *Calidris canutus* in the area. The Bagan Percut region also hosts large waterbird rookeries that have been little studied (but see Jumilawaty 2012), and is important for the globally Vulnerable Lesser Adjutant *Leptoptilos javanicus*, although no breeding site for the species has been found locally (Shepherd & Giyanto 2009).

Despite the importance of the area to migratory shorebirds, Bagan Percut is not included on the Ramsar or East Asian-Australasian Flyway Partnership (EAAFP) lists of internationally important wetlands. Inclusion on one of these lists raises the profiles of wetlands in the public eye and encourages governments to prioritize the sites for conservation. Prospective wetlands to be added to the Ramsar list are evaluated against nine criteria that describe the wetland's uniqueness and importance for flora and fauna (Ramsar Convention Secretariat 2015). To be included on the EAAFP list, wetlands are evaluated based on the three Ramsar criteria that are most relevant to migratory shorebirds: criterion 2, supporting Vulnerable, Endangered, or Critically Endangered migratory bird species according to IUCN criteria; criterion 5, regularly supporting 20,000 or more migratory birds; and criterion 6, regularly supporting 1% of the individuals in a population of one species or subspecies of migratory bird (EAAFP 2015).

We extended previous studies by doing systematic surveys of migratory shorebirds on four mudflats and herons at a rookery across six months. We did these surveys in order to characterize the seasonal abundance of migratory species on mudflats and breeding species in the rookery. We also used our data and information from previously published studies to evaluate the evidence for including Bagan Percut on the EAAFP list of wetlands of international importance.

Methods

Four mudflats were surveyed (by CAP and DH) once per month from 6 January to 18 June 2011 in the Bagan Percut region of North Sumatra province, Sumatra (Fig. 1). The mudflat sites were spaced along c. 16 km of coastline: Tanjung Rejo (3.741° N, 98.769° E, Plate 1), Percut (3.723° N, 98.798° E), Sei Tuan / Pematang Lalang (3.711° N, 98.833° E), and Rugemuk / Pantai Labu (3.683° N, 98.891° E; Plate 2). The rookery, also surveyed

by CAP and DH, was at Tanjung Rejo (3.720° N, 98.760° E). The nests at the rookery were located in trees and mangroves above fish ponds. Surveys were done with Nikon binoculars (8 x) and a Nikon Fieldscope ED monocular.

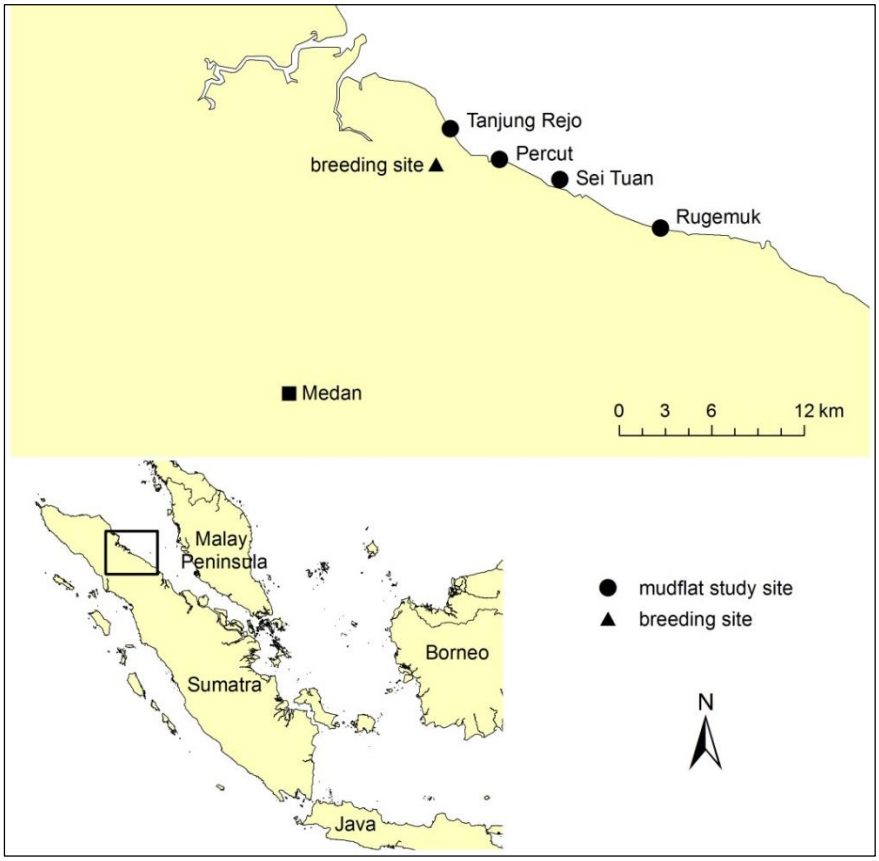

Figure 1. Study area in North Sumatra, Indonesia. Breeding site denotes location of rookery.

Mudflat counts were done for two hours, starting at low tide. Each site was visited on a different day within a particular month. We cannot rule out movement of birds between sites, although the four mudflats were widely spaced along the 16 km of coastline we sampled. To sample mudflats we counted from a single point, either from a small boat or on the mudflat. We approached bird aggregations to within 50 m and then began a 200 m radius point count, starting at low tide. We stayed at the site for 60 minutes so that the tide would push the birds closer to the observers and promote easier identification and a more complete sample. Our total counts should be considered to be subsamples of the population of the total mudflat. We did not have access to sufficient geographic information systems data to estimate the proportion of the mudflats we sampled. When re-sampling sites (in the following month) we selected bird aggregations within 300 m of the previous sample point. Logistics of accessing sites made roost counts infeasible. For the breeding site surveys we walked around the rookery along dikes to census birds in all areas of the rookery.

We compared our counts to Bamford *et al.* (2008) to judge the approximate percentage of the East Asian-Australasian flyway population found in our study sites. We followed the taxonomy of Gill & Donsker (2015).

Results

We found 51 species of shorebirds and waterbirds in the Percut region, including 30 migratory shorebird species and eight breeding waterbird species in the rookery. Combining mudflat counts from January to June gave an estimated 23,871 birds, including 20,114 migratory shorebirds (Charadriidae and Scolopacidae) and 3,757 other waterbirds. The Sei Tuan mudflat had the greatest abundance of birds among the four mudflat sites (Table 1; Appendices 1-4). It appears that Lesser Sand Plover, Curlew Sandpiper, Bar-tailed Godwit, and Grey Plover decreased in abundance from January to June (Table 2). In contrast, abundance of Eurasian Curlew and Whimbrel appeared not to change substantially during the study period.

We observed one Endangered migrant (Nordmann's Greenshank *Tringa guttifer*), two Vulnerable residents (Lesser Adjutant and Milky Stork *Mycteria cinerea*), and a Near Threatened migrant (Asian Dowitcher). Our counts of migratory shorebirds represent more than 1% of the flyway population for five species: Nordmann's Greenshank, Lesser Sand Plover, Pacific Golden Plover, Eurasian Curlew *N. a. orientalis*, and Ruddy Turnstone *Arenaria interpres*. Of particular note were large counts of Eurasian Curlew, making up 1–3% of the East Asian Australian flyway population of this uncommon subspecies (Bamford *et al.* 2008) across all months of the study (Tables 1, 2). Additional records of interest (from Tanjung Rejo in February) were of 8 Common Snipe *Gallinago gallinago*, 25 Ruff *Philomachus pugnax*, and 6 Greater Painted-snipe *Rostratula benghalensis.* The first two species are rare or scarce winter visitors and the latter is an uncommon and inconspicuous resident in Sumatra (Iqbal *et al.* 2013a). Two species were observed opportunistically during the study period (not on the standardized surveys): 12 Nordmann's Greenshanks were observed on 29 March 2012 at the Sei Tuan mudflat, and 25 Wood Sandpipers *Tringa glareola* were seen in a rice paddy near the village of Sei Tuan on 15 February 2011. Photographs of all species are available in Putra (2011).

Plate 1. View of mudflat and mangrove forest around Tanjung Rejo Village.

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Plate 2. Large flocks of shorebirds on mudflat of Rugemuk village.

Table 1. Mean (and maximum) number of shorebirds and waterbirds observed at four mudlfats across the six monthly samples. Values in parentheses are maxima. Bold values indicate sites with highest counts. TR, Tanjung Rejo; PC, Percut; ST, Sei Tuan; RG, Rugemuk.

English name	**Scientific name**	TR	PC	ST	RG
Grey Heron	*Ardea cinerea*		1 (1)	2.8 (8)	
Purple Heron	*Ardea purpurea*	2.8 (4)	2 (2)		3 (3)
Eastern Cattle Egret	*Bubulcus cormandus*	1.6 (3)		11 (13)	
Striated Heron	*Butorides striata*	1 (1)	1 (1)	1.3 (2)	1.3 (2)
Great Egret	*Ardea alba*	17 (25)	41 (83)	25 (46)	19 (26)
Little Egret	*Egretta garzetta*	2 (4)	3 (6)	7 (12)	2.6 (4)
Intermediate Egret	*Egretta intermedia*		4.5 (13)		1 (1)
Lesser Whistling Duck	*Dendrocygna javanica*				118 (118)
Little Ringed Plover	*Charadrius dubius*	1 (1)			
Kentish Plover	*Charadrius alexandrinus*			5 (5)	1 (1)
Greater Sand Plover	*Charadrius leschenaultii*				58 (107)
Lesser Sand Plover	*Charadrius mongolus*	190 (326)	116 (247)	370 (844)	209 (594)
Pacific Golden Plover	*Pluvialis fulva*	27 (48)	74 (159)	305 (811)	78 (180)
Grey Plover	*Pluvialis squatarola*	34 (67)	37 (117)	45 (167)	41 (66)
Lesser Adjutant	*Leptoptilos javanicus*		1.5 (2)		
Milky Stork	*Mycteria cinerea*	16 (36)	23 (33)	28 (45)	9.4 (17)
White-winged Tern	*Chlidonias leucopterus*		64 (64)		20 (36)
Little Tern	*Sternula albifrons*		3.3 (5)		18 (42)
Lesser Crested Tern	*Thalasseus bengalensis*				11 (27)
Common Tern	*Sterna hirundo*		142 (251)	108 (276)	106 (166)
Gull-billed Tern	*Gelochelidon nilotica*		15 (38)	24 (24)	9 (18)
White-breasted Waterhen	*Amaurornis phoenicurus*			1 (1)	1 (1)
Common Moorhen	*Gallinula chloropus*				1 (1)
Greater Painted-snipe	*Rostratula benghalensis*	6 (6)			
Black-winged Stilt	*Himantopus himantopus*			68 (73)	
White-headed Stilt	*Himantopus leucocephalus*			3 (3)	
Common Sandpiper	*Actitis hypoleucos*	1 (1)	2.8 (5)	3.4 (10)	2 (2)
Ruddy Turnstone	*Arenaria interpres*		1 (1)	4 (4)	127 (458)
Red Knot	*Calidris canutus*			3 (3)	
Sanderling	*Calidris alba*				23 (60)
Curlew Sandpiper	*Calidris ferruginea*	163 (321)	20 (43)	83 (237)	23 (41)
Red-necked Stint	*Calidris ruficollis*				116 (116)
Great Knot	*Calidris tenuirostris*		61 (117)	136 (423)	29 (44)
Broad-billed Sandpiper	*Limicola falcinellus*		7 (12)	25 (38)	7.5 (14)
Common Snipe	*Gallinago gallinago*	8 (8)			
Asian Dowitcher	*Limnodromus semipalmatus*	17 (33)	22 (52)	18 (48)	3 (3)
Bar-tailed Godwit	*Limosa lapponica*	31 (59)	44 (96)	81 (271)	104 (202)
Black-tailed Godwit	*Limosa limosa*		29 (67)	63 (117)	65 (187)
Eurasian Curlew	*Numenius arquata*	236 (341)	150 (322)	351 (732)	45 (62)
Eastern Curlew	*Numenius madagascariensis*	3 (3)		54 (84)	1.5 (2)
Whimbrel	*Numenius phaeopus*	83 (124)	104 (164)	28 (74)	18 (60)
Ruff	*Philomachus pugnax*	25 (25)			
Common Greenshank	*Tringa nebularia*		19 (33)	14 (14)	1 (1)
Marsh Sandpiper	*Tringa stagnatilis*	11 (17)		3 (3)	23 (32)
Common Redshank	*Tringa totanus*	44 (112)	3 (3)	25 (52)	1 (1)
Terek Sandpiper	*Xenus cinereus*	13 (28)	10 (10)	41 (146)	104 (245)

Table 2. Total number of shorebirds and waterbirds estimated each month from four mudflats (combined) at Percut, Sumatra.

English name	Jan	Feb	Mar	Apr	May	Jun
Grey Heron	1	8	4	0	2	1
Purple Heron	4	0	4	0	4	4
Eastern Cattle Egret	2	9	1	14	1	3
Striated Heron	5	2	2	4	3	3
Great Egret	64	158	61	123	116	69
Little Egret	9	25	3	0	6	6
Intermediate Egret	2	13	0	3	0	1
Lesser Whistling Duck	118	0	0	0	0	0
Little Ringed Plover	0	1	0	0	0	0
Kentish Plover	0	6	1	0	0	0
Greater Sand Plover	0	107	8	0	0	0
Lesser Sand Plover	1412	1369	1182	421	423	299
Pacific Golden Plover	212	1152	189	53	0	23
Grey Plover	306	109	152	95	24	18
Lesser Adjutant	0	2	0	0	1	0
Milky Stork	48	114	47	87	71	78
White-winged Tern	36	64	28	9	5	0
Little Tern	42	2	44	7	4	1
Lesser Crested Tern	27	0	15	2	0	1
Common Tern	237	527	441	309	246	266
Gull-billed Tern	53	38	7	18	2	8
White-breasted Waterhen	0	1	0	1	0	0
Common Moorhen	1	0	0	0	0	0
Greater Painted-snipe	0	6	0	0	0	0
Black-winged Stilt	0	73	63	0	0	0
White-headed Stilt	0	0	3	0	0	0
Common Sandpiper	336	121	213	120	0	57
Ruddy Turnstone	5	458	48	0	1	0
Red Knot	0	0	3	0	0	0
Sanderling	3	60	7	0	0	0
Curlew Sandpiper	606	121	381	195	16	80
Red-necked Stint	0	116	0	0	0	0
Great Knot	142	117	436	21	0	6
Broad-billed Sandpiper	51	14	14	0	0	0
Common Snipe	0	8	0	0	0	0
Asian Dowitcher	96	52	44	6	18	34
Bar-tailed Godwit	303	364	390	174	130	170
Black-tailed Godwit	88	254	32	0	43	117
Eurasian Curlew	163	951	567	538	389	533
Eastern Curlew	58	43	3	84	12	78
Whimbrel	321	194	143	226	218	207
Ruff	0	25	0	0	0	0
Common Greenshank	5	48	22	33	14	14
Marsh Sandpiper	5	3	49	26	12	0
Common Redshank	116	1	67	12	30	36
Terek Sandpiper	201	246	77	28	17	13
Total	**5078**	**6982**	**4751**	**2609**	**1808**	**2126**

At the Tanjung Rejo rookery we counted between 45,664 and 55,511 birds each month (Appendix 5). At least seven heron species nested at the site, the most numerous being the Eastern Cattle Egret *Bubulcus coromandus*, Little Egret *Egretta garzetta*, and Great Egret *Ardea alba* with maximum counts of 29,970, 7,920, and 6,670, respectively. Notable for Sumatra, we also found Glossy Ibis *Plegadis falcinellus* (4 seen in January and February) and breeding Little Cormorants *Phalacrocorax niger* (up to 4,720 seen in a visit), both of which were recently discovered at the site (Iqbal *et al.* 2013b; Putra *et al.* 2013).

Discussion

Our data confirm the importance of the Bagan Percut region of North Sumatra for migratory shorebirds. Furthermore, our findings show that large numbers of shorebirds remain in north-eastern Sumatra until the late passage period, especially Eurasian Curlew and Whimbrel. Our data suggest that Eurasian Curlew should be added to the list (Iqbal *et al.* 2013a) of migratory shorebirds that are non-breeding boreal summer residents in Sumatra. In contrast to Eurasian Curlew and Whimbrel, abundance of Lesser Sand Plover, Curlew Sandpiper, Bar-tailed Godwit, and Grey Plover appeared to decrease from January to June. Decreased abundance of the latter four species corresponds to their return to breeding grounds. Near constant abundance of the curlews suggests many individuals do not migrate until late into the season, or some birds remain in the area over the boreal summer. We suspect that many of the birds that remain are first year birds (e.g. Watkins 1993).

The large numbers of migratory shorebirds we observed (totaling c. 20,114) are in accordance with previous studies (Crossland *et al.* 2012). While it is difficult to compare our results to those of Crossland *et al.* (2012) because of differing sampling methods, it appears that overall numbers of migratory shorebirds may be declining (see Wilson *et al.* 2011). One species that appears to be in decline is the Asian Dowitcher (Plate 3). Surveys from 1995 to 2009 yielded an average of 904 dowitchers (Iqbal *et al.* 2010; Crossland *et al.* 2012) while the maximum that we observed on the four mudflats in a given month was 96.

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Plate 3. Asian Dowitcher (*Limnodromus semipalmatus*) used mudflats in Percut village as a foraging area.

We found >1% of the flyway population of five species of shorebirds in the area. Two of these species, Nordmann's Greenshank (Plate 4) and Pacific Golden Plover, had not previously been observed in globally important numbers in Bagan Percut (Iqbal *et al.* 2010; Crossland & Sitorus 2011; Crossland *et al.* 2012). Combining our data with previous studies, 16 shorebird species have now been observed at >1% of their flyway populations in the Bagan Percut region: Pacific Golden Plover, Lesser and Greater Sand Plovers, Asian Dowitcher, Bar-tailed Godwit, Black-tailed Godwit, Common Redshank, Nordmann's Greenshank, Green Sandpiper, Terek Sandpiper, Red Knot, Curlew Sandpiper, Eastern Curlew, Eurasian Curlew, Whimbrel, and Ruddy Turnstone.

Plate 4. Nordmann's Greenshank (*Tringa guttifer*), Sei Tuan mudflat.

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Plate 5. Egrets flock at rookery in Tanjung Rejo Village.

Our assumption that birds did not move between the mudflat sites during the four days that comprised a month's sample could under- or over-estimate the true total. Our cumulative totals also assume that there was 100% turnover of birds in between consecutive month samples, which likely overestimates the true number of birds as many shorebirds are faithful to wintering sites (Warnock & Takekawa 1996; Coleman & Milton 2012). In contrast, our 200 m radius count method did not estimate bird abundance in the entire mudflat so our totals necessarily underestimate true abundance at a site in a particular month.

Our results, combined with previous studies (Iqbal *et al.* 2010; Crossland & Sitorus 2011; Crossland *et al.* 2012) demonstrate that the Bagan Percut area meets all three criteria for inclusion on the EEAFP list: (1) supporting greater than 1% of the flyway population of migratory shorebirds; (2) regularly hosting >20,000 migratory waterbirds; and (3) hosting IUCN-listed migratory waterbirds. Therefore we recommend that the site be added to the EAAFP list and possibly be included on the Ramsar list in the future. A systematic analysis of count data from the region (Iqbal *et al.* 2010; Crossland *et al.* 2012; results herein) is needed to estimate population trends and optimize conservation actions.

Our data show that large numbers of egrets, herons, and Little Cormorants use the Tanjung Rejo rookery for nesting (Plate 5). The abundance and diversity of waterbirds at Tanjung Rejo rivals that of Pulau Rambut and Pulau Dua, Java, proving that this site must rank as one of Indonesia's major heron rookeries (Milton & Marhadi 1985; Mardiastuti 1992). Our data do not cover a sufficiently long period to test for changes in population sizes over time, but future studies (D.H. in prep.) plan to address this.

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Plate 6. Disturbance of curlews at Sei Tuan, North Sumatra, by oil palm company, 28 October 2012.

As is the case across much of Southeast Asia, large areas of estuarine mangroves in Sumatra are being converted to human land uses, and shorebird and waterbird populations are likely to decline as a result (Verheugt *et al.* 1993; Mardiastuti 2000; Sandilyan *et al.* 2010; Spalding *et al.* 2010). Shorebirds use mudflats in the area for foraging and mangroves for roosting (Jumilawaty 2012). Mangroves are especially important roosting sites, for while long-legged waders are able to roost in deeper pools and mudflats, short-legged waders rely on mangroves for roosting during high tides (C.A. Putra, pers. obs.). None of the mudflats or mangroves in the region are protected, and mangroves in some areas, including our Sei Tuan study site, are being rapidly converted into oil palm plantations and fish ponds. While the Tanjung Rejo rookery is currently tolerated by resident fish farmers, the surrounding mangroves are under threat of conversion. Open ground in young oil palm plantations may serve as roosting sites, but planting and harvesting operations flush birds, and plantations may provide less cover from predators than other habitats (Plate 6). Fish ponds in the region are usually too deep to provide foraging or roosting habitat for shorebirds (C.A. Putra, pers. obs.). Conservation action is urgently required to secure roost sites for the globally important concentrations of shorebirds found in the Bagan Percut region.

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Appendix 1. Waterbirds and shorebirds counted at the Tanjung Rejo mudflat, North Sumatra, from January to June 2011.

English name	Jan	Feb	Mar	Apr	May	Jun	Total
Purple Heron	1		2		4	4	**11**
Eastern Cattle Egret	2		1	1	1	3	**8**
Striated Heron	1			1	1	1	**4**
Great Egret		21	9	25	17	11	**83**
Little Egret	4	3	1		1	1	**10**
Little Ringed Plover		1					**1**
Lesser Sand Plover	264	187	326	123	143	98	**1141**
Pacific Golden Plover		2	48	36		21	**107**
Grey Plover	11		57	67	23	12	**170**
Milky Stork	7	36	6	19	10	16	**94**
Greater Painted-snipe		6					**6**
Common Sandpiper	1		1				**2**
Curlew Sandpiper	321	115	210	117		54	**817**
Common Snipe		8					**8**
Asian Dowitcher	21		33	3		11	**68**
Bar-tailed Godwit	47	59	33		12	4	**155**
Eurasian Curlew	288	341	267	211	142	165	**1414**
Eastern Curlew			3				**3**
Whimbrel	88		69	124	56	76	**413**
Ruff		25					**25**
Marsh Sandpiper	5		17				**22**
Common Redshank	112		14		7		**133**
Terek Sandpiper	13		6	28		7	**54**
Total	**1186**	**804**	**1103**	**755**	**417**	**484**	**4749**

Appendix 2. Waterbirds and shorebirds observed at the Percut mudflat, North Sumatra from January to June 2011.

English name	Jan	Feb	Mar	Apr	May	Jun	Total
Grey Heron			1		1		**2**
Purple Heron			2				**2**
Striated Heron	1			1		1	**3**
Great Egret	16	83	24	51	46	26	**246**
Little Egret	3	6			1	2	**12**
Intermediate Egret	1	13		3		1	**18**

Lesser Sand Plover	175	247	231	20	22	3	**698**
Pacific Golden Plover	81	159	112	17		2	**371**
Grey Plover	117	60	2		1	5	**185**
Lesser Adjutant		2			1		**3**
Milky Stork	24	33	26	21	13	18	**135**
White-winged Tern		64					**64**
Little Tern		2	3	5			**10**
Common Tern	120	251	42	189	96	154	**852**
Gull-billed Tern	28	38	7		2	1	**76**
Common Sandpiper	5	3	2	1			**11**
Ruddy Turnstone	1		1				**2**
Curlew Sandpiper	43	6	16	35	9	12	**121**
Great Knot	5	117					**122**
Broad-billed Sandpiper	12	2					**14**
Asian Dowitcher	27	52	2		7		**88**
Bar-tailed Godwit	96	86	13	48	17	6	**266**
Black-tailed Godwit	14	67	7				**88**
Eurasian Curlew	65	177	322	154	67	112	**897**
Whimbrel	99	164	16	87	134	121	**621**
Common Greenshank	4	33					**37**
Common Redshank	3						**3**
Terek Sandpiper	10						**10**
Total	**950**	**1665**	**829**	**632**	**417**	**464**	**4957**

Appendix 3. Waterbirds and shorebirds observed at the Sei Tuan / Pantai Lalang mudflat, North Sumatra from January to June 2011.

English name	Jan	Feb	Mar	Apr	May	Jun	Total
Grey Heron	1	8	3		1	1	**14**
Eastern Cattle Egret		9		13			**22**
Striated Heron	1	2	1	2	1	1	**8**
Great Egret	25	46	12	21	35	10	**149**
Little Egret		12				2	**14**
Kentish Plover		5					**5**
Lesser Sand Plover	844	341	361	247	231	198	**2222**
Pacific Golden Plover	88	811	17				**916**
Grey Plover	167	3	27	28		1	**226**
Milky Stork	10	28	15	33	45	38	**169**
Common Tern	46	276	233	23	37	31	**646**
Gull-billed Tern	24						**24**
White-breasted Waterhen				1			**1**
Black-winged Stilt		73	63				**136**
White-headed Stilt			3				**3**
Common Sandpiper	10	1	1	2		3	**17**
Ruddy Turnstone			4				**4**
Red Knot			3				**3**
Curlew Sandpiper	237		114	43	7	14	**415**
Great Knot	93		423	21		6	**543**
Broad-billed Sandpiper	38	12					**50**
Asian Dowitcher	48		6	3	11	23	**91**
Bar-tailed Godwit	102	17	271	41	34	22	**487**

Black-tailed Godwit	67		24		43	117	**251**
Eurasian Curlew	36	732	211	384	322	421	**2106**
Eastern Curlew	56	42		84	12	78	**272**
Whimbrel	74	13	54	9	17	3	**170**
Common Greenshank		14					**14**
Marsh Sandpiper		3					**3**
Common Redshank	1		52	12	23	36	**124**
Terek Sandpiper	146	1	37		17	6	**207**
Total	**2114**	**2449**	**1935**	**967**	**836**	**1011**	**9312**

Appendix 4. Waterbirds and shorebirds observed at the Rugemuk / Pantai Labu mudflat, North Sumatra from January to June 2011.

English name	Jan	Feb	Mar	Apr	May	Jun	Total
Purple Heron	3						**3**
Striated Heron	2		1		1		**4**
Great Egret	23	8	16	26	18	22	**113**
Little Egret	2	4	2		4	1	**13**
Intermediate Egret	1						**1**
Lesser Whistling Duck	118						**118**
Kentish Plover		1	1				**2**
Greater Sand Plover		107	8				**115**
Lesser Sand Plover	129	594	264	31	27		**1045**
Pacific Golden Plover	43	180	12				**235**
Grey Plover	11	46	66				**123**
Milky Stork	7	17		14	3	6	**47**
White-winged Tern	36		28	9	5		**78**
Little Tern	42		41	2	4	1	**90**
Lesser Crested Tern	27		15	2		1	**45**
Common Tern	71		166	97	113	81	**528**
Gull-billed Tern	1			18		7	**26**
White-breasted Waterhen		1					**1**
Common Moorhen	1						**1**
Common Sandpiper		2					**2**
Ruddy Turnstone	4	458	43		1		**506**
Sanderling	3	60	7				**70**
Curlew Sandpiper	5		41				**46**
Red-necked Stint		116					**116**
Great Knot	44		13				**57**
Broad-billed Sandpiper	1		14				**15**
Asian Dowitcher			3				**3**
Bar-tailed Godwit	58	202	73	85	67	138	**623**
Black-tailed Godwit	7	187	1				**195**
Eurasian Curlew	62	42	31				**135**
Eastern Curlew	2	1					**3**
Whimbrel	60	17	4	6	11	7	**105**
Common Greenshank	1	1	4				**6**
Marsh Sandpiper			32	26	12		**70**
Common Redshank		1	1				**2**
Terek Sandpiper	32	245	34				**311**
Total	**796**	**2290**	**921**	**316**	**266**	**264**	**4853**

Appendix 5. Waterbirds counted at the Tanjung Rejo rookery, North Sumatra.

English name	Jan	Feb	Mar	Apr	May	Jun	Total
Grey Heron	990	1110	944	975	821	1028	**5868**
Purple Heron	990	1665	1416	1134	955	1127	**7287**
Eastern Cattle Egret	28710	29970	25960	27236	25111	23445	**160432**
Great Egret	3465	4995	4248	6358	4932	6670	**30668**
Little Egret	7920	7215	6136	6512	7426	7130	**42339**
Intermediate Egret	990	1665	944	1324	1180	976	**7079**
Black-crowned Night Heron	3960	4440	2832	4255	3672	2664	**21823**
Little Cormorant	2475	4440	4720	2945	2675	2624	**19879**
Common Sandpiper	1	7					**8**
Glossy Ibis	4	4					**8**
Total	**49505**	**55511**	**47200**	**50739**	**46772**	**45664**	**295391**