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Winter distribution, habitat and feeding behaviour of Nordmann's Greenshank *Tringa guttifer*

Christoph Zöckler[1], David Li[2], Sayam U. Chowdhury[3], Muhammad Iqbal[4] & Yu Chenxing[5]

[1]*Manfred-Hermsen-Stiftung, Goebenstrasse 1, D-28211 Bremen, Germany. christoph.zoeckler@m-h-s.org*
[2]*Sungei Buloh Wetland Reserve, National Parks Board, 301 Neo Tiew Crescent, 718925, Singapore*
[3]*Bangladesh Spoon-billed Sandpiper Conservation Project, House 16/C, Flat 501, Tallabag, Sobhanbag, 1207 Dhaka, Bangladesh*
[4]*Conservation Biology Program, Faculty of Science, Sriwijaya University, Jalan Padang Selasa 524, Palembang, South Sumatra, Indonesia*
[5]*Conservation Ecology Program, School of Bioresources and Technology, King Mongkut's University of Technology Thonburi, 49 Soi Thianthale 25, Bangkhuntien-Chaithaley Road, Tha Kham, Bangkhuntien, Bangkok 10150, Thailand*

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A recent increase in shorebird surveys and birdwatching activities in SE Asia has enabled the winter distribution of the globally-threatened Nordmann's Greenshank *Tringa guttifer* to be determined for the first time. We estimate that 850–950 birds winter in SE Asia, with most in Thailand and Malaysia and smaller numbers in Myanmar and Sumatra. Hardly any of the sites identified as important for the species are protected. We describe Nordmann's Greenshank's characteristic feeding behaviour and its wintering habitats. Hunting and coastal development threaten the remaining wintering population, and the protection of key sites is recommended for safeguarding the long-term future of this endangered shorebird. We recommend that the species' current Red List status as Endangered be maintained.

Keywords

Spotted Greenshank

Tringa guttifer

winter distribution

habitat

feeding behaviour

conservation

INTRODUCTION

Nordmann's Greenshank *Tringa guttifer* (or Spotted Greenshank; Fig. 1) is one of the rarest and most threatened shorebirds in the world. BirdLife International (2016) estimates the world population at 1,000–2,000, and it is classified as Globally Endangered. It breeds exclusively in coastal habitats around the Sea of Okhotsk in Russia (Dorogoi 1997, Doer 1998). It migrates through China, Korea and Japan and winters in SE Asia. Until the last few years, little was known about its non-breeding distribution (BirdLife International 2001), but recent surveys have increased our knowledge considerably. Its winter distribution in Thailand was described by Round (2006). Surveys of mudflats in SE Asia, mostly during searches for wintering Spoon-billed Sandpipers *Calidris pygmaea* (Zöckler *et al.* 2016), but also a general increase in interest in shorebird habitats and birdwatching across the region since 2008 (e.g. Abdillah & Iqbal 2012, Bakewell *et al.* 2017, A.P. Chairunas in prep.), have greatly improved knowledge of many coastal areas in SE Asia and this has enabled us to determine the Nordmann's Greenshank's winter distribution in detail for the first time. In addition, previously inaccessible coastal stretches, mostly in Myanmar and Cambodia but also in Vietnam, have become more accessible during the last ten years and better coverage has provided a more complete picture. We present a summary of our current understanding of the species' main winter distribution and our best estimate of population size. We also describe its winter habitat and observations of its characteristic feeding behaviour.

METHODS

We interviewed key country and regional shorebird experts from all countries in the East Asian–Australasian Flyway and requested data from them on Nordmann's Greenshank observations for the years 2010–2016. In addition, we encouraged surveys of poorly-known areas and helped secure funding for them (e.g. in Myanmar and North Sumatra). In a few cases for which recent information is not available, data going back to 2003 have been used to describe the species' distribution, as well as in making our estimate of the global population. For some sites, data from the 1990s or 1980s are available, but these are not included in our results as we consider them to be outdated. For many sites for which several years' data are available, we present a range of recent numbers. Totalling the maximum numbers recorded at

Fig. 1. Two Nordmann's Greenshanks in the Brahmaputra Delta, Bangladesh. Note the yellow legs and stout, two-toned and slightly recurved bill (photo: S.U. Chowdhury).

sites for which there are data from several years can lead to inaccuracies and overstating the population size. Hence, we provide data on the range of numbers recorded at such sites and also within sub-regions or countries to allow for shifts in the distribution between years. However, in many places we have noticed that populations are site-faithful and stable from year to year and assume that in such cases errors associated with using maxima are less pronounced.

RESULTS

Winter distribution

We summarise data from Nordmann's Greenshank wintering sites from Bangladesh in the west and Indonesia and the Philippines in the east in Table 1. The core wintering area supporting the largest numbers is in Thailand and Malaysia on the Malaysian and Tenessarim Peninsulas (Fig. 2). The total wintering population is estimated to be in the range 850–950 birds.

Habitat

Our data show that Nordmann's Greenshanks are almost entirely coastal in winter and inland records are exceptional. The latter include one bird on the banks of the Mekong River in Thailand in 2012 (Bird Conservation Society of Thailand (BCST) Data records), which might hint at overland migration across Indochina, as revealed by satellite tracking of Spoon-billed Sandpipers *Calidris pygmaea* (Clark 2017).

Almost all wintering habitats were on the estuarine intertidal mudflats of large rivers but also on softer mudflats sheltered by mangrove stands adjacent to sandier substrates and shared with the Spoon-billed Sandpiper. Often, Nordmann's Greenshanks show a preference for feeding in areas of deeper mud. In Thailand the largest concentrations are usually found where sand and mud are mixed. At high-tide roosts and also when feeding on a receding tide they often join with other waders, particularly with Grey Plovers *Pluvialis squatarola* and Great Knots *Calidris tenuirostris*, but also with larger waders such as godwits *Limosa* spp. and curlews *Numenius* spp. and also loosely with smaller waders such as sandplovers *Charadrius* spp. and small Calidrids, such as stints and Spoon-billed Sandpipers (Nordmann's Greenshanks also occur at 16 of 26 known Spoon-billed Sandpiper wintering sites). The close association with Grey Plovers and Great Knots has also been observed at key stopover sites in China (CZ & SUC pers. obs.).

Feeding behaviour

Nordmann's Greenshanks normally forage on fine-grain, soft sediments, where they are recorded as feeding predominantly on larger prey, such as mudskippers, crabs and shrimps. Their feeding behaviour is very active, running swiftly like other *Tringa* species, but they are even more vigorously active in chasing after prey items visible on the surface rather than only probing for buried invertebrates like many other shorebirds. It was Bijlsma & De Roder (1986) who first described Nordmann's Greenshanks' active pursuit of large visible prey and considered their foraging behaviour to be similar to that of Terek Sandpipers *Xenus cinereus*. However, unlike similar shorebirds, Nordmann's Greenshanks have also been observed locating and pursuing prey while flying. This

Table 1. Range of yearly maximum numbers of wintering Nordmann's Greenshanks at regularly visited sites in S and SE Asia. Counts from 2003–2009 are only included in the regional estimates when no recent data are available. Older figures in parenthesis are for comparison with more recent counts and reflect possible trends. BCST = Bird Conservation Society of Thailand data.

Country/Region	Maximum No.	Years	Source	Latitude/Longitude
Bangladesh	**38–53**			
Jahajja Char, Meghna Estuary	2	2015–2016	Chowdhury *et al.* 2017	22°28'53"N 91°12'40 E
Damar Char, Meghna Estuary	4–19	2010–2016	Bird *et al.* 2010, S. Chowdhury pers. obs.	22° 2'06"N 91° 3'51"E
Sonadia Island, Cox's Bazar	28	2010–2016	Chowdhury & Foysal 2016	21°33'02"N 91°50'33"E
Jahajja Char North	2	2015–2016	Chowdhury *et al.* 2017	22°30'36"N 1°12'48"E
Foillatoli, Chittagong	2	2015	S. Raju pers. comm.	22°19'57"N 91°45'26"E
Myanmar	**99–112**			
Nan Thar Island	5	2010–2015	Zöckler *et al.* 2014, Ren Nou Soe pers. comm.	20°12'28"N 92°44'15"E
Nga Man Thaung, Ayeyarwaddy Delta	46–48	2013–2016	Zöckler 2016	15°41'37"N 95°21'07"E
Let kot Kon, Gulf of Mottama	8–10	2010–2012	Zöckler *et al.* 2014	17° 3'43"N 96°57'43"E
N Myeik Archipelago	14	2014–2017	Zöckler *et al.* 2014, S. Moses pers. comm.	12°35'14"N 98°37'37"E
Yay Ngan & Bokpyin, S Myeik Archipelago	26–35	2016–2017	Zöckler pers. obs.	11°14'43"N 98°44'09"E
Thailand	**334–361**			
Gulf of Thailand	***311–332***			
Laem Phak Bia-Pak Thale , Ban Laem District, Phetchaburi Province	179	2018	A. Jearwattanakanok (BCST)	13°04'02"N 100°04'42"E
Mahachai Mangrove Research Station - Samut Maneerat - Khok Kham, Samut Sakhon Province	32–36 (60)	2016–2018 (2005)	Round *et al.* 2007, S. Daengphayon & W. Narungrsi (BCST), Yu Chenxing pers. obs.	13°30'07"N 100°16'24"E
Khao Sam Roi Yot National Park, Prachuap Khiri Khan Province	3 (7)	2018 (2004)	L. Evans (BCST), Yu Chenxing pers. obs.	12°08'05"N 99°58'11"E
Thung Kha, Chumphon Province	1	2003	BCST	10°21'19"N 99°13'45"E
Khlong Tamru, Chon Buri Province	1	2017	Yu Chenxing pers. obs.	13°26'36"N 100°58'04"E
Mouth of Prasae River, Klaeng District, Rayong Province	75–87	2013–2017	BCST	12°42'09"N 101°43'21"E
Khlong Yai, Trat Province	20–25	2018	A. Jearwattanakanok (BCST)	11°46'45"N 102°52'38"E
Andaman Coast	***23–29***			
Koh Libong NHA -Had Chao Mai NP, Trang Province	15 (26)	2014 (2000)	BCST, Yu Chenxing pers. obs.	07°15'18"N 99°27'01"E
Krabi river mouth, Muang District, Krabi province	6–12	2018	BCST, Yu Chenxing pers. obs., S. Buckell pers. comm.	08°02'33"N 98°55'01"E
La-ngu beach, Satun Province	2	2016–2018	A. Jearwattanakanok (BCST), Yu Chenxing pers. obs.	06°47'52"N 99°48'01"E
Cambodia	**7**			
Koh Kapik	7 (13)	2014 (1997)	F. Lambert & S. Visal pers. comm.	11°19'33"N 103°04'08"E

Table 1 continued

Country/Region	Maximum No.	Years	Source	Latitude/Longitude
Malaysia	**240**			
Selangor state	***129***			
Sungai Burung	14	2005–2007	Li *et al.* 2007	03°41'N 100°56'E
Sungai Nibong	75	2005–2007	Li *et al.* 2007	03°36'N 101°04'E
Kapar Power Station Ash ponds	40	2017	Malayan Nature Society data	03°08'N 101°20'E
Penang State	***90***			
Teluk Air Tawar-Kuala Muda Coast	90	2016	D. Bakewell pers. comm.	05°30'N 100°22'E
Sarawak State	***21***			
Bako-Buntal Bay	14	2010–2012	Bakewell *et al.* 2017	01°42'N 110°21'E
Pulau Lakei to Muara Tebas	3	2010–2012	Bakewell *et al.* 2017	01°41'N 110°30'E
Kuala Samarahan to Kuala Sadong	1	2010–2012	Bakewell *et al.* 2017	01°35'N 110°37'E
Kuala Saribas to Kuala Kabong	2	2010–2012	Bakewell *et al.* 2017	01°46'N 111°05'E
Kuala Belawai to Kuala Paloh	1	2010–2012	Bakewell *et al.*. 2017	02°22'N 111°11'E
Singapore	**0–2**			
Sungei Buloh Wetland Reserve	2	2008	Gan *et al.* 2017	01°26'N 103°43'E
Indonesia	**114**			
Sumatra	***106***			
Tanjung Reio Mudflat	12	2018	A. Chairunas in prep.	3°44'57"N 98°45'54"E
Kresek Beach	69	2018	A. Chairunas in prep.	3°24'18"N 99°22'57"E
Cemara	21	2008–2010	Noni & Londo 2008, 2010, Tirtaningtyas & Philippa 2009	01°32'25"S 104°27'"E
Sembilang NP	4	2012	M. Iqbal pers. obs.	02°00'43"S 104°50'15"E
Java	***8***			
Kulon Progo	4	2013–2014	I. Londo pers. comm.	07°54'46"S 110°04'02"E
Pantai Trisik	4	2013–2015	I. Taufiqurrahman & Waskito Kukuh Wibowo pers. comm.	07°58'27"S 110°11'32"E
Philippines	**15**			
Negros Occidental Wetland Conservation area	15	2015	Biodiversity Management Bureau data	10°23'13"N 122°52'35"E
Vietnam	**8**			
Red River Delta	1 (14)	2014 (1996)	Trai Le Long & J. Eames pers. comm.	20°49'53"N 107°10'46"E
Mekong Delta	7	2011	V. Morozov pers. comm	08°46'23"N 105°17'03"E
Australia	**0–1**			
Broome	1	2004	Boyle & Slaymaker 2010	
Total	**855–919**			

has been recorded at several different sites in Myanmar, where birds have been observed flying low over large areas of mudflat, taking abrupt turns, and suddenly dropping to the surface to stab prey that had apparently been detected visually while flying. On several occasions, CZ has seen Nordmann's Greenshanks successfully take 8–10 cm long mudskippers, and also similarly sized crabs. At sites in Myanmar, birds have sometimes been seen flying and briefly hovering 10–20 m above ground (see also Zöckler & Frew 2011) but also much lower at a maximum height of 1–2 m.

While foraging in flight, Nordmann's Greenshanks call regularly, and especially when dropping to the ground they utter their distinctive '*kwag*' calls (Zöckler *et al.* 2017). This feeding behaviour has been observed most commonly during the receding tide, when prey seem to be more abundant on the surface of the mud. Similar feeding behaviour has been observed in Malaysia (A. Long pers. comm.) and Bangladesh. The behaviour is so distinctive that birds can often be identified as Nordmann's Greenshanks from a great distance. Aside from these active feeding behaviours, Nordmann's Greenshanks have been recorded searching for prey while standing motionless, as they have in Thailand and at a stopover site in China; mainly this has been seen after an initial bout of active foraging (Byrkjedal & Lislevand 2011). The birds stand motionless, apparently attempting to ambush crabs as they emerge from their burrows.

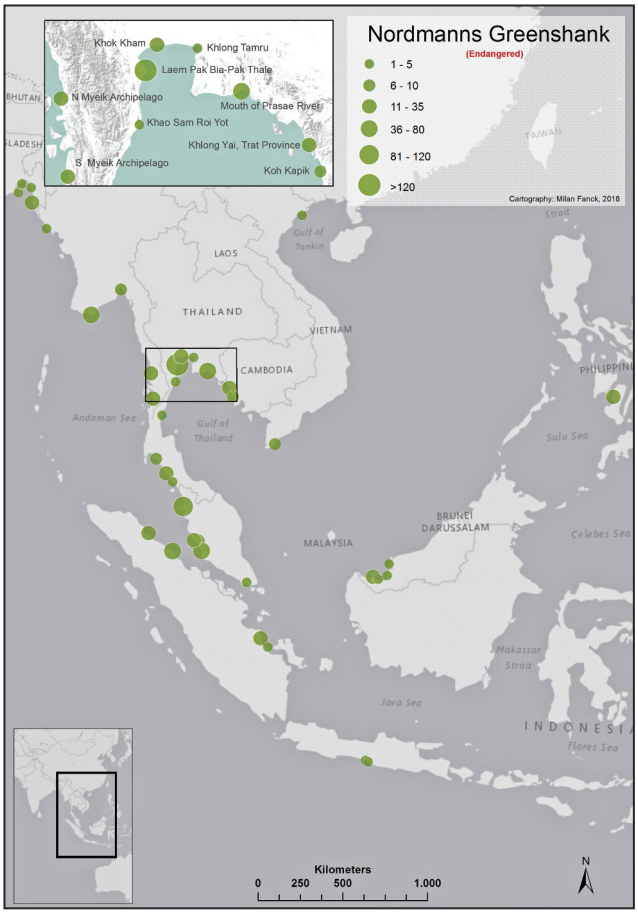

Fig. 2. Winter Distribution of Nordmann's Greenshank *Tringa guttifer* based on counts and surveys from 2010–2018 and in some cases from earlier years (see text).

DISCUSSION

Winter distribution

Our results show that the core of the winter distribution of Nordmann's Greenshank is in the Malaysian peninsula, with Thailand and Malaysia holding over 60% of the entire population, and just two sites in Thailand supporting over 250 birds. Next in importance are Sumatra and Myanmar, where six wintering sites have been discovered in recent years. Myanmar was not previously known to host significant numbers and former distribution maps left the country blank (BirdLife International 2016). The coasts of Indonesia, especially the north-east coast of Sumatra, are also shown to support significant populations. In February 2018, after our survey period, even larger numbers were counted in Sumatra and it would seem likely that further surveys of potential areas will reveal even higher numbers. Although only 50 birds were found in Bangladesh, its vast mudflats were not surveyed completely so it is possible that larger numbers occur than were recorded. The Philippines, Vietnam and Cambodia only seem to be marginal in the species' distribution and unlikely to host much higher numbers of regularly wintering birds. Also, no significant numbers of wintering birds have been found in India or China (S. Balachandran & Tong Menxiu pers. comm.). China is only known for passage migrants (e.g. Peng *et al.* 2017). Large parts of Borneo have not been surveyed, so there might be important sites there that have not yet been discovered.

Total population size

The total wintering population located to date is estimated to be in the range of 850–950 individuals (Table 1, Fig. 2). As this estimate is based on observed maxima at several wintering sites, the actual number could be lower. Nordmann's Greenshanks often occur in mixed flocks alongside Common Greenshanks *T. nebularia*, and many people find the two species difficult to differentiate (Fig. 3). In some cases, this might have led to over-counting, while in others Nordmann's Greenshanks might have been overlooked. The winter counts we report from the entire known wintering range are roughly equal to the annual numbers observed at key stopover sites on the Jiangsu coast of China (Bai *et al.* 2015, Peng *et al.* 2017) and close to the lower end of the range of 1,000–2,000 birds estimated by BirdLife International (2016). BirdLife's wide range suggests that it is a rather crude estimate and our data indicate that the actual population is closer to the lower end than the upper end. Our precise numbers of 855–919 individuals suggest an even lower population, but they are very likely an underestimate, bearing in mind that unsurveyed areas of Bangladesh, Myanmar and Thailand could well host 10–20% more birds and Sumatra even higher numbers. However, this is not likely to amount to

Fig. 3. Nine Nordmann's Greenshanks and six Common Greenshanks roosting at high tide at Nga Man Thaung, Ayeyarwady Delta, Myanmar (photo: C. Zöckler).

more than 20–30% more birds. Therefore, unless important hitherto undiscovered sites are found in unsurveyed areas of Borneo or elsewhere, the total population of the species might not be greater than 900–1,200 birds.

Comparison with numbers at stopover sites

A major Nordmann's Greenshank stopover site was discovered in the Rudong/Dongtai area of Jiangsu province China in 2011 (Menxiu *et al.* 2012), and a link between this site and wintering areas in Thailand was confirmed by resightings of colour-marked birds and by satellite tracking (Yu & Gale 2017). In view of the numbers recorded at the Chinese site, it is likely that it hosts the entire global population during autumn migration and possibly also during spring migration. Maximum counts there were in excess of 1,200 in October 2013 (Bai *et al.* 2015) and 1,000 in 2014 (Peng *et al.* 2017). These counts exceed the global estimate derived from the wintering grounds by 20–30%, indicating that a similar number of birds must have been overlooked in the wintering areas. However, autumn stopover counts in China during 2015–2017 fell short of those recorded in 2013–2014, with only 800–900 birds in 2015 and 2016 (Z. Lin, G. Anderson & N. Clark pers. comm.). These figures correspond more closely with our counts from the wintering area. Therefore, the higher counts in 2013–2014 might be explained by greater numbers of juveniles following particularly successful breeding seasons. Another possibility is that the recent lower counts on the Jiangsu coast and at other stopover sites in China simply reflect the ongoing decline of the species (Piersma *et al.* 2017).

The core breeding area of Nordmann's Greenshank is on Sakhalin Island and adjacent parts of the Russian mainland where the population has declined sharply and is still subject to various threats (E. Lappo pers. comm.). These declines are not reflected by counts in the wintering sites that have been monitored regularly. However, higher counts made in some areas in the 1980s and 1990s suggest an overall decline of all waders over the past 20–30 years (e.g. Tantipisanuh *et al.* 2016). Trend data for more recent years are not available for the most frequently visited sites, but some of them show an apparently increasing population; e.g. numbers wintering on the Ayeyarwady delta in Myanmar increased from 28 in 2013 to 46 in 2015 and 48 in 2016. There also seems to be an increase in numbers at Laem Phak Bia-Pak Thale, Thailand with a maximum of 179 birds recorded in 2018 (Table 1), although this could be a reflection of increased site monitoring or birds moving in from nearby sites in response to disturbance or habitat loss.

Elsewhere wintering numbers appear to have been stable in recent years. This suggests that there is high site-fidelity in wintering areas, and indicates that a viable strategy for monitoring population trends will be to carry out regular winter counts at a selection of wintering sites, as well as monitoring the main stopover site in Dongtai/Rudong, China.

Conservation

Nordmann's Greenshank has greatly benefitted from reduced shorebird hunting in many wintering areas in Bangladesh, Myanmar and China, arising mainly from measures taken to protect Spoon-billed Sandpipers (Zöckler *et al.* 2010, Chowdhury 2010, Martinez & Lewthwaite 2013). However, hunting is still an issue in Sumatra where it has a major detrimental impact on wintering shorebird

populations (A. Chairunas in litt.), and this is also the case in certain parts of Myanmar. In both regions there is an urgent need for further mitigation measures. Two new large Ramsar sites were designated in Myanmar in 2017, covering most of the country's key Nordmann's Greenshank wintering sites, but the species' stronghold in the south of the country remains unprotected. Sites in Bangladesh are also unprotected and are threatened by coastal development (Chowdhury *et al.* 2017).

The Inner Gulf of Thailand is one of the most important areas for non-breeding Nordmann's Greenshanks. However, it remains largely unprotected, despite the fact that Phak Bia Pak Thale and Khok Kham are recognised as Flyway Network sites within the East Asian–Australasian Flyway Partnership. All sites in the region are subject to unregulated onshore development pressures. Some areas that supported many thousands of shorebirds 25–30 years ago no longer do so due to development and fragmentation of onshore roosting habitats (Tantipisanuh *et al.* 2016). It is likely that ongoing human modification of coastal habitats in the Inner Gulf will have a major detrimental effect on the survival of Nordmann's Greenshanks and other shorebirds.

Despite the protection measures described above, hunting in most relevant countries in winter remains a major threat to the Nordmann's Greenshank. Moreover the coasts of Northern Selangor and Teluk Air Tawar-Kuala Muda in Penang, Malaysia, where a large number of Nordmann's Greenshanks are recorded, are not protected and these important sites could face development threats in the future.

Hardly any Nordmann's Greenshank wintering sites that support ten or more birds are currently under any form of site protection. Only 18% of key sites (4/17) are formally protected. Yet, some of the protected areas do not have adequate management plans in place, and hunting and other threats still occur despite the formal protection. Addressing these issues and protecting all key wintering sites remain the prime objectives for conserving the wintering population of the species.

Revised Red List status

Currently Nordmann's Greenshank is classified as 'Endangered' by BirdLife International due to its low overall population size and restricted range. Further monitoring is required to establish the species' recent population trend, specifically whether it has sharply decreased, as some evidence suggests, or has become more stable. An update of the situation on the breeding grounds is also highly desirable. For now, we recommend that the current classification of Nordmann's Greenshank as Endangered be retained, that numbers at its main wintering sites and stopover sites should be closely monitored, and its Red List status revised as appropriate.

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