A five-year study of over-summering shorebirds on Sonadia Island, Cox's Bazar district, Bangladesh

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The behaviour of migratory birds which defer return migration to their breeding grounds and spend the boreal summer in their wintering areas is generally referred to as over-summering. Little information is available about the extent of this practice by shorebirds in Asia, including Bangladesh. To improve the understanding of this phenomenon in Bangladesh, we made a five-year survey of shorebirds on Sonadia Island, Cox's Bazar district, during both the winter (January–March) and summer (May–August) seasons. A total of 23 shorebird species were recorded over-summering at three sites on Sonadia Island in the period May–August between 2011 and 2015. Of these 23 species, nine were regarded as commonly or regularly over-summering, whilst nine were uncommon and five were rare. Based on the average annual counts over the five-year period, the most abundant over-summering species were Lesser Sandplover *Charadrius mongolus* (451), Greater Sandplover *C. leschenaultii* (68) and Eurasian Curlew *Numenius arquata* (46). In contrast, although 23–26 wintering Critically Endangered Spoon-billed Sandpiper *Calidris pygmaea* were recorded annually during the study, over-summering birds totalled only three—two birds in 2012 and one in 2015. In all we found a substantial number of globally threatened shorebirds over-summering on Sonadia Island, and we therefore recommend that conservation efforts should be undertaken there throughout the year.

INTRODUCTION

Migratory birds that remain on their wintering grounds throughout the year and do not return to their breeding grounds are typically known as over-summering birds (McNeil *et al.* 1994, Newton 2010). This behaviour is common in long-distance migrants and the birds involved are mostly young individuals of species that do not breed until they are two or more years old. The over-summering phenomenon separates age groups geographically during the breeding season, and allows young birds to avoid the physical costs and risks of an unnecessary return journey (Newton 2010). Over-summering is a regular phenomenon in some 15 bird families, particularly raptors, seabirds and shorebirds, and especially in the Charadriidae and Scolopacidae (McNeil *et al.* 1994, Newton 2010).

Understanding the numbers and occurrence of shorebirds during the over-summering period has important implications for conservation (Newton 2010, Zöckler *et al.* 2010a). However, little information is available about this behaviour in Asia, including Bangladesh (Li *et al.* 2009, Chowdhury 2012). Bangladesh hosts 130 species of migratory waterbirds, including 50 species of shorebird (Siddiqui *et al.* 2008, Chowdhury 2011). In 1999 the government of Bangladesh declared Cox's Bazar–Teknaf Peninsula and Sonadia Island an Ecologically Critical Area (ECA) in recognition of the locality's importance for nesting Vulnerable Olive Ridley *Lepidochelys olivacea* and Endangered Green *Chelonia mydas* Turtles (IUCN 2017); three species of endangered cetaceans—Finless Porpoise *Neophocaena phocaenoides*, Irrawaddy Dolphin *Orcaella brevirostris* and Bottlenose Dolphin *Tursiops aduncus*—also occur here (Chowdhury *et al.* 2011). Sonadia Island was listed as an Important Bird Area in 2013 (BirdLife International 2017a) and it is also one of five East Asian–Australasian Flyway Network sites in Bangladesh (East Asian–Australasian Flyway Partnership 2017). It is a key wintering site for three endangered shorebird species—Critically Endangered Spoon-billed Sandpiper *Calidris pygmaea*, Endangered Spotted Greenshank *Tringa guttifer* and Endangered Great Knot *C. tenuirostris* (Chowdhury *et al.* 2011, BirdLife International 2017b).

Hunting has been identified as a major cause of the sharp decline of the Spoon-billed Sandpiper. Zöckler *et al.* (2010a) suspected that immature birds are more susceptible to capture than adults because they do not return to the breeding grounds and thus are vulnerable to hunting for a longer period during the summer; shorebird hunting has been reported from Sonadia Island (Chowdhury 2010). However, the species is also known to be vulnerable at stopover sites during migration (Pain *et al.* 2011, Peng *et al.* 2017). Therefore, in order to better understand the over-summering behaviour of shorebirds, with a special focus on Spoon-billed Sandpiper, we carried out surveys at three sites on Sonadia Island between May and August over a five-year period and investigated the diversity and numbers of shorebirds present—those which are supposedly exposed to localised threats such as hunting for an extended period. We also examined the proportion of the wintering population which over-summers and compared our over-summering counts of each species with winter counts at the same three sites.

METHODS

Study area

Sonadia Island (4,916 ha) is located in Maheshkhali Upazila subdistrict, Cox's Bazar district, on the south-east coast of Bangladesh (Figure 1), and comprises a wide variety of wetland habitats, including mudflats, sand-dunes, mangroves, sandbars, lagoons, saltpans and beaches (CWBMP 2006). The study was carried out at three sites, two high-tide roosts (Belekardia and Tajiakata) and a mudflat (Kaladia) (Figure 1).

Field survey

Speedboats were used to travel from Cox's Bazar and between sites during the surveys, which were carried out between January 2011 and August 2015. The surveys followed methods for counting non-breeding shorebirds outlined in Bibby *et al.* (2000) and Asian Waterbird Census (Li *et al.* 2009). Time spent surveying at each site varied depending on the number of birds present, and was typically between 3–8 hours per site, and two to three days every month were required to cover the three sites. Counts were made twice (the second count immediately after the first) on most occasions and the higher count is presented here. Counts were undertaken during both high and low tides, depending on the habitat type—mudflat or high tide roost. Birds were identified using Grimmett *et al.* (2011) and Chowdhury (2011). Observations were made using 10 × 42 binoculars and 25–50× spotting scopes. In addition, images of individuals which were difficult to identify were obtained (using a DSLR camera with a 300 mm lens) during the surveys for later analysis/identification.

Data analysis

Counts made between January and March are considered as winter counts, counts between May and August as over-summer counts, and annual peak counts of each species during these two periods are presented and compared in Table 1.

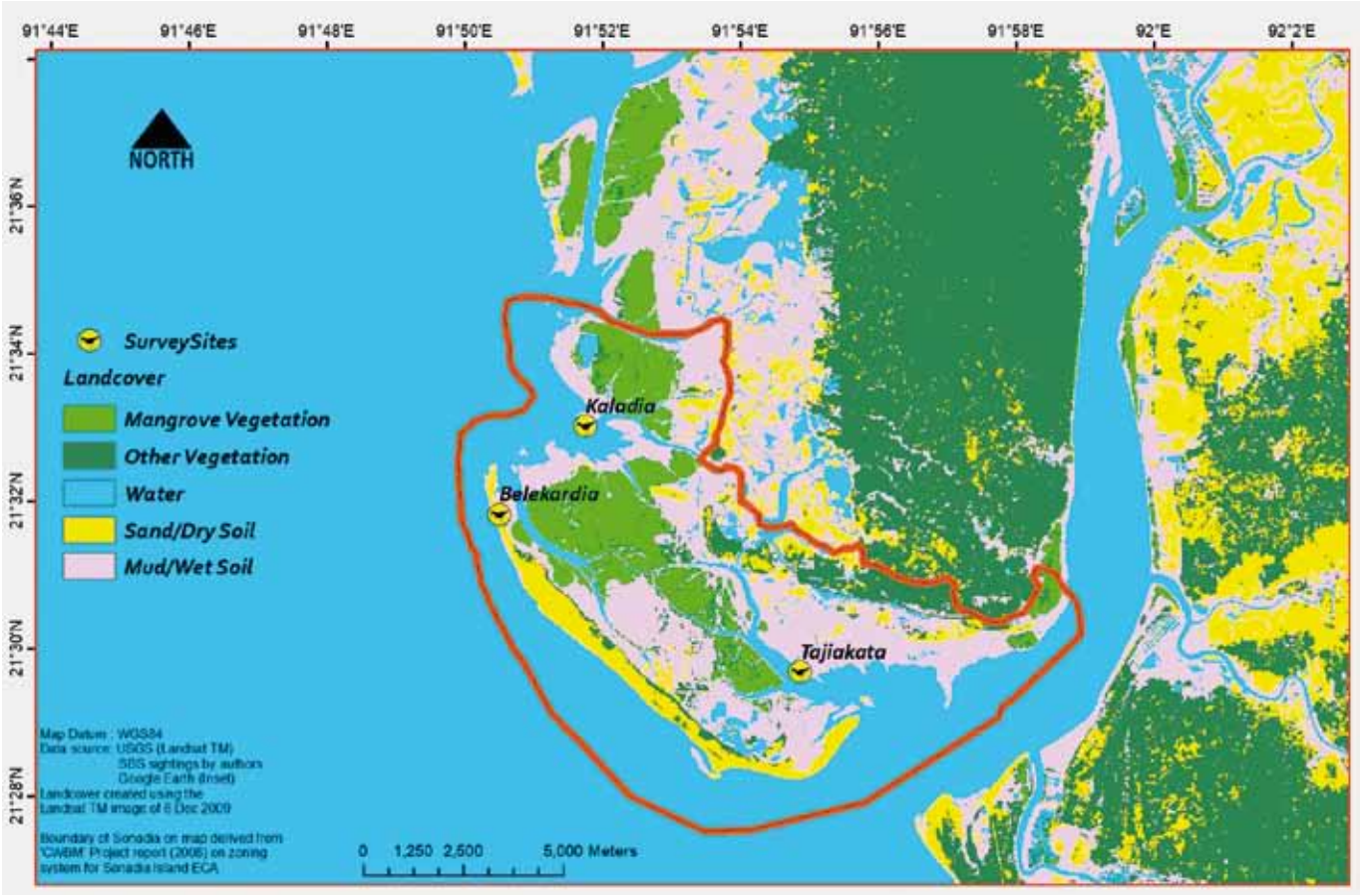

Figure 1. Map of Sonadia Island showing the three sites surveyed during the over-summering periods.

Although we were confident that both Red-necked Stint *Calidris ruficollis* and Little Stint *C. minuta* were present, at times we found it difficult and time-consuming to separate them, therefore they were lumped together as 'Little & Red-necked Stint'. We classified over-summering shorebirds which were seen 15–20 times out of 20 visits (four visits per year during the summer months) as 'common', 5–15 times as 'uncommon' and 1–5 times as 'rare', following the guidelines of Javed & Kaul (2002).

RESULTS

A total of 23 shorebird species were recorded over-summering at the three sites on Sonadia Island between May and August in 2011 to 2015 (Table 1). The maximum over-summering count was 1,127 individuals in 2014 and the minimum was 554 individuals in 2011.

Abundance of over-summering shorebirds

The most abundant over-summering species was Lesser Sandplover *Charadrius mongolus* (mean 451), followed by Greater Sandplover *C. leschenaultii* (mean 68). These two species were observed during all 20 summer visits over the five years and were classified as common over-summering shorebirds on Sonadia Island. Of the 23 over-summering species recorded, nine were classified as common, nine as uncommon and five as rare (see Table 1).

Endangered shorebirds during the over-summering period

We recorded three globally endangered species in summer—two Spoon-billed Sandpipers in June 2011 and one in May–June 2015 and one Spotted Greenshank in June 2011, whilst Great Knot was recorded during the summer months of 2011 (7), 2014 (80) and 2015 (43). The Near Threatened species Eurasian Curlew *Numenius arquata*, Bar-tailed Godwit *Limosa lapponica*, Black-tailed Godwit *L. limosa*, Curlew Sandpiper *Calidris ferruginea* and Red-necked Stint *C. ruficollis* were also observed.

Comparison of summer and winter counts

All shorebirds species recorded during the summer months between 2011 and 2015 were also recorded during the winter months. Wood Sandpiper *Tringa glareola*, Red Knot *Calidris canutus*, Long-toed Stint *C. subminuta*, Oriental Pratincole *Glareola maldivarum* and Small Pratincole *G. lacteal* (Chowdhury & Foysal 2016) were recorded during the winter months of 2011–2015 (although in small numbers) but were not observed during summer counts and are therefore not included in our analysis.

DISCUSSION

All the shorebird species recorded during our study had previously been reported to over-summer in their winter quarters, except for Pacific Golden Plover *Pluvialis fulva*, Spotted Greenshank and Broad-billed Sandpiper *Limicola falcinellus* (Hockey *et al.* 1998, Newton 2010). Our results for the winter and summer populations of some large waders (e.g. Whimbrel, Eurasian Curlew) suggest that a high proportion of those larger species visiting Sonadia Island are first-year birds (Hockey *et al.* 1998) which either may not breed at the end of their first year or are species that undertake the longest migratory flights and hence show a greater tendency to over-summer in winter quarters than other species (Summers *et al.* 1995, Newton 2010). Generally, larger shorebirds tend to live longer than smaller species and may not breed every year after reaching maturity, and therefore over-summer in those non-breeding years. Our results indicate that small shorebird species, with the specific exception of Lesser and Greater Sandplovers, do not over-summer

Table 1. Maximum seasonal shorebird numbers combining the three Sonadia Island sites in summer (May–August) and winter (January–March) from 2011 to 2015, with mean winter and summer counts and percentage of the winter population which apparently over-summers. Over-summering status (C = common, U = uncommon, R = rare) of each species is indicated in brackets; global threat status is shown in italics.

Species	Winter 2011	Summer 2011	Winter 2012	Summer 2012	Winter 2013	Summer 2013	Winter 2014	Summer 2014	Winter 2015	Summer 2015	Winter Mean	Summer Mean	Percentage
Pacific Golden Plover *Pluvialis fulva* (R)	0	5	40	0	2	0	0	0	0	0	8.4	1.0	11.9%
Grey Plover *Pluvialis squatarola* (C)	15	41	210	21	400	33	280	10	130	17	207.0	24.4	11.8%
Kentish Plover *Charadrius alexandrinus* (U)	119	22	380	25	742	21	22	2	26	3	257.8	14.6	5.7%
Lesser Sandplover *Charadrius mongolus* (C)	732	311	1,160	526	1,290	300	2,770	800	1,800	320	1,550.4	451.4	29.1%
Greater Sandplover *Charadrius leschenaultii* (C)	620	79	700	56	277	100	500	50	250	55	469.4	68.0	14.5%
Whimbrel *Numenius phaeopus* (C)	1	2	92	17	35	62	40	62	22	13	38.0	31.2	82.1%
Black-tailed Godwit *Limosa limosa* (R) *NT*	0	0	6	6	10	0	0	0	0	0	3.2	1.2	37.5%
Bar-tailed Godwit *Limosa lapponica* (U) *NT*	0	0	110	43	100	0	60	15	25	0	59.0	11.6	19.7%
Eurasian Curlew *Numenius arquata* (C) *NT*	65	29	117	127	77	0	166	60	107	14	106.4	46.0	43.2%
Common Redshank *Tringa totanus* (U)	50	10	77	0	190	84	45	9	36	22	79.6	25.0	31.4%
Marsh Sandpiper *Tringa stagnatilis* (U)	11	1	101	6	54	0	31	0	25	3	44.4	2.0	4.5%
Common Greenshank *Tringa nebularia* (C)	110	10	92	3	86	60	25	4	20	13	66.6	18.0	27.0%
Spotted Greenshank *Tringa guttifer* (R) *EN*	28	1	3	0	1	0	0	0	3	0	7.0	0.2	2.9%
Terek Sandpiper *Xenus cinereus* (U)	90	9	65	7	80	0	30	4	10	12	55.0	6.4	11.6%
Great Knot *Calidris tenuirostris* (U) *EN*	172	7	120	0	160	0	155	80	120	43	145.4	26.0	17.9%
Little Stint *Calidris minuta* (C) & Red-necked Stint *Calidris ruficollis* (C) *NT*	80	4	660	60	1,550	13	1,123	10	500	17	782.6	20.8	2.7%
Ruddy Turnstone *Arenaria interpres* (U)	27	0	32	0	17	5	45	1	17	13	27.6	3.8	13.8%
Sanderling *Calidris alba* (R)	0	0	0	0	0	1	32	10	4	0	7.2	2.2	30.6%
Temminck's Stint *Calidris temminckii* (R)	0	0	0	1	141	30	30	0	35	0	41.2	6.2	15.0%
Curlew Sandpiper *Calidris ferruginea* (C) *NT*	605	14	400	1	226	12	400	10	120	22	350.2	11.8	3.4%
Spoon-billed Sandpiper *Calidris pygmaea* (R) *CR*	25	0	24	2	26	0	26	0	23	1	24.8	0.6	2.4%
Broad-billed Sandpiper *Limicola falcinellus* (U)	80	9	513	0	190	0	450	0	250	3	296.6	2.4	0.8%
Total	**2,830**	**554**	**4,902**	**901**	**5,654**	**721**	**6,230**	**1,127**	**3,523**	**571**			

on Sonadia Island in large numbers. For example, although the Spoon-billed Sandpiper has one of the longest migration routes within Asia (Zöckler *et al.* 2010a)—and recent re-sightings of leg-flagged individuals (the birds designated Lime 09, Lime 28, Lime 31, Lime A2 and Lime V4) confirmed that they had travelled about 7,640 km from Meinypilgyno, South Chukotka, Far East Russia (Lee *et al.* 2015, Chowdhury & Foysal 2016)—only three Spoon-billed Sandpipers were recorded over-summering during the five years of the study period. In contrast, the same sites on Sonadia regularly held an average of 24–25 Spoon-billed Sandpipers during the winter months (Chowdhury & Foysal 2016).

A higher proportion of larger waders were present at Sonadia Island during the summer than small waders, corresponding with accounts by several authors that deferred migration or breeding is a physiological response and more common in large, longer-lived birds than small birds (Summers *et al.* 1995, Hockey *et al.* 1998, Newton 2010). Zöckler *et al.* (2010a,b) assumed that many immature Spoon-billed Sandpipers remained on their wintering grounds and were therefore exposed to greater threats (e.g. hunting) compared with the adults on the breeding grounds, and considered that this had played a key role in the species's drastic decline. However, our study on one of the main wintering grounds of this species indicates low occurrence of small waders during summer, including Spoon-billed Sandpiper, which raises the question whether these immature birds are exposed to a wider range of threats (e.g. habitat loss, poaching) during migration, away from the main wintering grounds and especially at hostile stopover sites (Pain *et al.* 2011, Peng *et al.* 2017), or simply spend their first summer elsewhere along the flyway.

Conservation implications

Sonadia Island is not currently recognised under the Ramsar Convention; however, the island as a whole clearly meets three Ramsar criteria and probably meets a fourth. Moreover, the three sites that we surveyed meet the 1% threshold of Criterion 6 by themselves (Ramsar Convention Secretariat 2007, Chowdhury *et al.* 2011). Various industrial development projects are underway or being planned in and around Sonadia Island, including a 1,200 MW coal-fired power plant at Matarbari, Maheshkhali Upazila, Cox's Bazar district, about 15 km north of the key shorebird site (Khan 2014), liquefied natural gas terminals at Maheshkhali (Rasel 2017) and tourism development by Bangladesh Economic Zone Authority (Patwary 2017). These projects will require the acquisition of 3,831 ha (78%) of the Sonadia Island ECA, of which 20% is intended to be for infrastructure development, despite promises that development will be 'eco-friendly' (Patwary 2017).

Shorebird hunting was reported from Sonadia Island (Chowdhury 2010) but subsequently addressed by providing alternative livelihood support to 25 bird-trappers (Chowdhury & Foysal 2012). The ex-hunters mainly targeted larger waders but Spoon-billed Sandpipers were also trapped as by-catch (Chowdhury 2010). Hunting of shorebirds during the over-summering period may have been a regular practice before the agreement with hunters was reached. Since substantial numbers of globally threatened shorebirds over-summer on Sonadia Island, conservation efforts should continue year-round and not be focused only on the winter period.

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