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Site use by non-breeding Black-tailed Godwits at Nijhum Dweep National Park, Bangladesh

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The Black-tailed Godwit *Limosa limosa* is a globally Near Threatened species but a common winter visitor to Bangladesh. Although the total wintering population size and trend are unknown, we suspect it is declining due to habitat degradation. Nijhum Dweep National Park is one of the most important sites for Black-tailed Godwits in Bangladesh. Here we report on the site use of Black-tailed Godwits in this national park and adjacent Char Birbira. From October to March 2016–2017 to 2019–2020, we performed 17 winter counts. High tide roosts were counted from vantage points in these tidal areas, whereas foraging activities were observed from boats during low tide. Black-tailed Godwits were always present, with counts ranging from 735 in January 2020 to 8,269 in December 2017 with a mean of 3,304. It is possible that we counted certain individuals or flocks twice. The uncertainty of these counts and population estimates for this area in general suggest that better assessment methods, such as simultaneous high tide counts undertaken at the same time each year, are needed. Our study area met the Ramsar 1% threshold population criterion for the species for 13 of the 17 counts, demonstrating the international importance of this area for Black-tailed Godwits. A more than 80% local decline from 9,000 to 1,707 birds over the last decade was apparent on Damar Char West. Over the decades, the landscape of Damar Char has changed, with increased numbers of households, more land converted to agricultural fields and increased fishing effort. These changes call for better assessments of bird movements and disturbance and more effective conservation actions to help birds and people coexist. We suggest that there should be a monitoring and protection scheme in the Nijhum Dweep management plan that focuses on waterbirds and restricts and regulates access to Damar Char West, East and Char Birbira. An urgent attempt to create awareness among the main stakeholders, fishers and crab hunters, to provide context and engage them in conservation action, should be a priority.

Keywords: *Limosa limosa*, East Asian-Australasian Flyway, Central Asian Flyway, Ganges-Brahmaputra-Meghna delta, Bay of Bengal, Meghna Estuary, Important Bird and Biodiversity Area, Marine Protected Area,

INTRODUCTION

Bangladesh, offering key non-breeding and staging sites for thousands of migratory waders, lies at the overlap between the Central Asian and East Asian-Australasian flyways (Chowdhury *et al.* 2011). Black-tailed Godwits *Limosa limosa* are a common winter visitor to Bangladesh (Siddiqui *et al.* 2008). The global population of Black-tailed Godwits has been classified as Near Threatened (IUCN 2020) and local population declines of up to 50%, have been observed across the globe (Watkins 1993, Garnett *et al.* 2011, BirdLife International 2015). The wintering population in Bangladesh is also suspected to be declining due to habitat degradation (Chowdhury 2015, Mundkur *et al.* 2017). However, due to logistical difficulties only the key sites in Bangladesh are counted and coverage may therefore be incomplete (Mundkur *et al.* 2017).

In Bangladesh, Black-tailed Godwits are mainly found in wetlands, particularly on the central coast and in *haors*, bowl-shaped large floodplain wetlands in the northeast of the country (Khan 2018). Two subspecies of Black-tailed Godwits *limosa* and *melanuroides* are thought to visit Bangladesh (Rasmussen & Anderton 2005, Wetlands International 2012). Within Bangladesh, the Asian Waterbird Census found seven sites that met the 1% Ramsar-site criterion (Li *et al.* 2009), Nijhum Dweep National Park being one of them. Nijhum Dweep is a hotspot for coastal biodiversity and harbours thousands of migratory waders from October to March (Islam 2001, Islam & Khan 2005a, b, Das *et al.* 2018, Thompson *et al.* 2018). A count of 9,000 Black-tailed Godwits in March 2010 (Bird *et al.* 2010), established it as one of the most important sites for the species in Bangladesh. Based on high-tide counts and low-tide surveys performed over four winters, we report on the seasonal changes in Black-tailed Godwits and their foraging distribution within the Nijhum Dweep National Park and adjacent Char Birbira.

METHODS

Study area

Nijhum Dweep National Park (22°03'30" N, 91°00'10" E) and Char Birbira (22°05'59" N, 91°08'18" E) are situated in the Bay of Bengal on the central coast of Bangladesh (Fig. 1). The study area is part of the Ganges-Brahmaputra-Meghna delta, which has been recognized as an Important Bird and Biodiversity Area (IBA; BirdLife International 2021). Nijhum Dweep National Park covers 16,352 ha, including offshore islands. In the north, the park is partially delimited by the Mokhtaria Channel, in the west by the Shahabaj River and in the south and the east by the Bay of Bengal.

The area has a semidiurnal tidal regime and is dynamic, with sediment accretion and erosion constantly reshaping and resizing the islands (Hossain *et al.* 2016). For this reason, the topography of the park is changing too. The government gazette mentions 11 islands that make up the area of the park and describes their position by stating which landmarks lie to the east, west, north and south of each island. Based on this gazette, literature (Islam 2001, Islam & Khan 2005a,b, MoEF & BFD 2014) and field experience, we believe that Nijhum Dweep island was previously four islands that have merged into one (Char Osman, corner of Char Osman, Char

Kamala & Char Aftab) and that Char Bahauddin (locally known as Damar Char) also consists of four merged islands (Char Johan, Khajar Char, Char Rawshon & Char Bahauddin), together encompassing eight of the 11 islands in the official gazette in 2001. Char Kalam, Char Yunus and Char Muid (locally known as Char Kabira) are still separated and recognizable as individual islands (Fig.1). Majher Char, an important roosting and foraging area for birds, appeared between Char Bahauddin and Char Kalam, but it probably did not exist when the National Park was established. We failed to find a demarcated map of Nijhum Dweep National Park by the Forest Department.

Creeks drain the water from the islands into the surrounding rivers and the Bay of Bengal; during incoming tides the water fills the creeks (Fig. S1). The meadows near the river are dominated by the grasses *Porteresia coarctata*, *Zoysia matrella* and *Paspalum vaginatum* (Uddin *et al.* 2015). During ebb tide, vast areas of mudflats open up around each island and each island has a sand bar, usually to the south. These peripheral sand bars and mudflats form the major roosting and foraging areas for the waders that winter in the Park. This area is an important site for many globally threatened bird species including Spoon-billed Sandpiper *Calidris pygmaea*, Great Knot *Calidris tenuirostris* and Indian Skimmer *Rhynchops albicollis*, as well as mammals such as Irrawaddy Dolphin *Orcaella brevirostris*, Indo-Pacific Humpback Dolphin *Susa chinensis*, Finless Porpoise *Neophocaena phocaenoides*, Fishing Cat *Prionailurus viverrinus*, and Smooth-coated Otter *Lutrogale perspicillata* (PDO-ICZMP 2004, Islam & Khan 2005a, Li *et al.* 2009, Mundkur *et al.* 2017, Das *et al.* 2018, Thompson *et al.* 2018, Das *et al.* 2020a, b). There were already people living on Nijhum Dweep at the time it was declared a protected area, but since then Damar Char has also become inhabited. The grassy coastal meadows are grazed by Water Buffalo *Bubalus bubalis* (Fig. S2).

We divided our study site into five subsites: Nijhum Dweep, Damar Char West, Damar Char East, Majher Char and Char Birbira (Fig. 1). We made counts at these subsites over four-day periods, spending most of a day at a single site (except in the case of Majher Char, which we covered in less time on the same day as either Damar Char West, Damar Char East, or Char Birbira). However, we sometimes had to skip a site due to lack of time and funding (Table 1). During high tides, we surveyed all round Nijhum Dweep by boat, Damar Char West and Char Birbira were surveyed partially by boat and partially on foot and Damar Char East was surveyed mainly on foot. Char Birbira, covering *ca.* 700 ha, is located 10 km north-east of Damar Char and has two sand dunes, in the east and south where birds roost during peak high tides (Das *et al.* 2018). The east side of Damar Char is dynamic, with big changes between 2016–2017 and 2017–2018 when an area of *ca.* 200 ha, previously over knee-deep soft mud, became a walkable sandy substrate.

A boat was always required for accessing count sites and used as a hide wherever possible. High tide roosts were counted from vantage points (Sutherland 1996, Bibby *et al.* 2000). Observations were made using 60 and 80 mm spotting scopes and a GPS unit was used to record locations. Black-tailed Godwits can move during or in between counts and between subsites. While we noted their movements, it is still possible that we counted the same bird or flock twice, or missed them entirely, particularly if the site they used differed between count days.

In total, we made 17 high tide counts from 2016–2017 to 2019–2020 in the winter season (October–March). We only counted once in 2016–2017 and four times in 2017–2018 due to a lack of funding (Table 1). However, we counted six times in 2018–19 and 2019–20 (Table 1). During low tide we observed the foraging activities of Black-tailed Godwits and marked the outlines of flocks and their size on printed maps. Most counts were simultaneously made by multiple observers (mostly three people) and we then took the mean (\pm standard deviation) to reduce personal bias.

RESULTS

We found Black-tailed Godwits during all 17 counts, with 8,269 individuals in December 2017 the highest count and 735 in January 2020 the lowest. The mean count was 3,304 (Table 1). When data from all years are combined by season, early (Oct–Nov), mid (Dec–Jan) and late (Feb–Mar), the median count was highest during early winter (3,603) and the lowest in mid-winter (2,160; Fig. 2). Among the subsites of our study area, the highest number of Black-tailed Godwits was counted at Char Birbira (mean 1,320, highest 3,500) and the lowest at Majher Char (mean 207, highest 1,405). As March was the only month which we counted in all four years, we compared them between the four years showing that overall numbers in March have been largely stable, with a low of 1,888 in 2018 and a maximum of 3,055 in 2017. The March count was incomplete in 2017 and 2020.

Black-tailed Godwits roosted in open areas during the daytime (Fig. S2). Although mangroves are available in all subsites, we did not see them fly to or come from mangroves. Black-tailed Godwits preferentially foraged on soft mud patches and roosted on nearby open high ground, often the sandy bars. The general movement pattern between high-tide roosting and low-tide foraging areas is shown in Fig. 1.

Black-tailed Godwits were present in all subsites and used all existing mudflats to varying degrees. Char Birbira and Damar Char were used most (Fig. 3). On Nijhum Dweep, there was a major roosting area in the south-west (near Namar Bazaar Khal) and these roosting Black-tailed Godwits foraged over a vast intertidal mudflat to the south of the island (Fig. 3). On Damar Char, the intertidal mudflats on the west side (north corner to Khyear Khal mainly) were mostly used for foraging (Fig. 3). In Char Birbira, the east and west side were mainly used for foraging during low water (Fig. 3). During spring tides, we observed Black-tailed Godwits fly *ca.* 3 km from the sand dune to the west of Char Birbira to the sand dune to the east of Char Birbira to roost. In Majher Char, the mudflat on the west corner was used to forage during low water and nearby open high ground to roost during high water (Fig. 3). Black-tailed Godwits roosting at Majher Char often flew to the west side of Damar Char to forage.

DISCUSSION

Bangladesh has participated in the Asian Waterbird Census organized by Wetlands International since 1987 and has counted waterbirds each boreal winter since then. Li *et al.* (2009) summarized the Waterbird counts for Asia from 1987–2007. They reported seven sites in Bangladesh to hold 1% of the flyway population of Black-tailed Godwits and a maximum of 3,000 Black-tailed Godwits at Nijhum Dweep island in 1992. Islam (2001) reported 2,524 Black-tailed Godwits in October 2000 from Nijhum Dweep. However, since 2011 the Asian Waterbird

Census counts in Nijhum Dweep recorded less than 1,000 Black-tailed Godwits and Thompson *et al.* (2018) reported 1,157 Black-tailed Godwits in February 2018. Likewise, our maximum count of Black-tailed Godwits in Nijhum Dweep was 1,453 in February 2019. Chowdhury *et al.* (2020) reported 622 Black-tailed Godwits from Nijhum Dweep island in February 2020. Our maximum counts in January and October were 1,134 and 101 respectively. Compared to available previous counts in January 1992 and October 2000 (Li *et al.* 2009, Islam 2001), these suggest that there may have been large decreases in numbers in these months.

The Ramsar 1% threshold population criterion is used to identify internationally important sites for waterbird species (Ramsar Convention Secretariat 2013). The 1% thresholds for the two populations of Black-tailed Godwits known to occur in Bangladesh, *limosa* and *melanuroides* are 1,500 and 1,400 respectively (from WPE5 in Wetlands International 2021). In our study, >1,400 Black-tailed Godwits were counted at least once at each subsite; > 1,500 Black-tailed Godwits were counted at Damar Char and Char Birbira only. At Char Birbira we counted >1,500 individuals six times out of the 15 counts (Table 1). In total, our study area met the 1% population criterion for the species in 13 of 17 counts, clearly demonstrating the international importance of the area for this population.

Chowdhury *et al.* (2020) reported around 1,700 Black-tailed Godwits at the same study site, which is less than half the number of Black-tailed Godwits we observed. It is possible that we counted certain individuals or flocks twice. For example, in December 2017 we might have counted the same flock of ~3,500 Black-tailed Godwits on separate days on both Damar Char East and Char Bibira, resulting in our highest total count for the area (Table 1). However, we think that the discrepancy between the studies is not due to double-counting, but methodological differences between the studies. Our Results are based on roost counts performed during high water (\pm 3 hrs peak high tide) only and we sub-divided our sites and spent a day in each site focusing only on counting the high tide roosts. We also covered more areas than Chowdhury *et al.* (2020), i.e. the mudflats to the east of Char Birbira. Unfortunately, we cannot resolve whether the discrepancy in counts is due to biological or methodological differences between the studies. Therefore, we propose that simultaneous high tide counts should be carried out in future to avoid the possibility of double-counting.

Within the national park of Nijhum Dweep, Damar Char is recognized as an important roosting and foraging site for migratory waterbirds (Islam & Khan 2005a, Thompson *et al.* 2018). Past waterbird counts were made on the west side of Damar Char and maximum counts of Black-tailed Godwits from this area were 1,560 in October 2000 (Islam 2001), 600 in Feb 2004 (Islam & Khan 2005b), 9,000 in March 2010 (Bird *et al.* 2010) and 2,515 in December 2015 (Thompson *et al.* 2018). We counted a maximum of 1,661 Black-tailed Godwits on the west side in February 2019. However, we also counted birds on the east side of Damar Char and the maximum combined count on the east and west side of Damar Char was 4,016 in December 2017 and 1,707 in March 2020. Compared to the 9,000 Black-tailed Godwits counted in March by Bird *et al.* (2010), our 1,707 count in March 2020 might suggest a population decline of more than 80% over the last decade. During the same period, the landscape of Damar Char has changed, the number of households increased, more land has been converted to agriculture and fishing effort has increased (D. Das, pers. obs.). These changes could have contributed to the apparent decline in March counts, which may be a result of redistribution or population decline.

Char Birbira is a newly identified wintering site for migratory birds in Bangladesh discovered in 2016 (Das *et al.* 2018). Here, we recorded the highest godwit numbers (mean count 1,320). Thompson *et al.* (2018) also surveyed the area in February 2018 and found 826 Black-tailed Godwits during a single low tide. Char Birbira is not part of the Nijhum Dweep National Park but is located adjacent to it. With our maximum count of 3,500 Black-tailed Godwits during high tide, the importance of this subsite may have increased and we recommend that Char Birbira should be included in the protected area.

We suggest the increase in the number of Black-tailed Godwits in early and late winter may reflect influxes during south and northbound migrations (Islam 2001, Islam & Khan 2005b) and could account for the lower numbers in mid-winter. Although numbers have declined at Damar Char and Char Birbira during our study, they have become important foraging and roosting sites having large intertidal areas and being relatively less disturbed by human activities. However, human disturbance is increasing here (D. Das, pers. obs.). We observed hunting activities and the initiation recreational activities such as group picnics during our study. We recommend that measures should be taken to reduce disturbance.

Based on the available literature (Islam 2001, Islam & Islam 2002, Islam & Khan 2005a,b, Bird *et al.* 2010, Thompson *et al.* 2018, Chowdhury *et al.* 2020) and the results of the annual Asian Waterbird Census data (Li *et al.* 2009, Mundkur *et al.* 2017), Nijhum Dweep National Park together with Char Birbira harbour holds the largest aggregation of Black-tailed Godwits in Bangladesh. When Nijhum Dweep National Park was declared a legally protected area in 2001 people lived on Nijhum Dweep island. By 2014, 13,000 people were living on Nijhum Dweep island (BBS 2014) but current numbers are unknown. The legal status of the National Park prohibits all human activities including disturbance, hunting or killing animals and plants within the protected area. However, in practice, the entire Nijhum Dweep National Park including important areas for migratory birds is used extensively by people for their livelihood, mainly fish-based and the population is highly dependent on the wetland. Fishing activities in the channels and on the mudflats frequently disturb foraging and roosting migratory birds (D. Das, pers. obs.). Hunting also poses a threat (Khan 2012, Thompson *et al.* 2018). Contrary to Chowdhury *et al.* 2020, we observed a direct incident of poison baiting and the demise of a Black-headed Ibis *Threskiornis melanocephalus* in Nijhum Dweep. We encountered multiple hunters and hunting efforts using noose traps (locally called Jangi) targeting ducks *Anas sp.*, curlews *Numenius sp.* and storks *Ciconia sp.* (Fig. S3). In addition, we believe that the loss of foraging and roosting habitat within the national park through land claim and due to human settlement, intensification of agriculture (e.g. cattle grazing, Fig. S2) and tourism, increase the threats for birds using the site.

Clearly, the existing protection and management of the park is insufficient. The custodian of the park, Bangladesh Forest Department, has limited resources, knowledge and skills and is understaffed (MoEF & BFD 2014). Moreover, the present administration is focused only on planting mangroves. Therefore, there is no regulation of disturbance or monitoring of waterbirds. However, from a management point of view, solutions will be complex and challenging to achieve due to the poor socio-economic situation of the local people, their lack of awareness, yet high dependence, on the wetlands and the lack of recognition of the value of this ecosystem.

We recommend modifying and strengthening the existing management plan by developing and implementing a conservation action plan with policies that emphasize waterbirds and ways for birds and people to coexist. This modification should include a waterbird monitoring and protection scheme designed to be consistent with the dynamic nature of this area (Kabir *et al.* 2020). The action plan should also have an annual assessment of the status and composition of the waterbird assemblage, site use and threats within the national park and surrounding islands by simultaneous high tide counts. It will also be important to create awareness among stakeholders, mainly fishers and crab hunters, to engage them in conservation action. We recommend making a buffer zone, with restricted human activity, around the roosting and foraging areas. Access to Damar Char West, East and Char Birbira should be restricted and regulated. We recommend reevaluating the Forest Department policy of planting mangrove seedlings on mudflats, conducting more ecological studies to fill the knowledge gap of migration ecology, and formulating a science-based conservation action plan.

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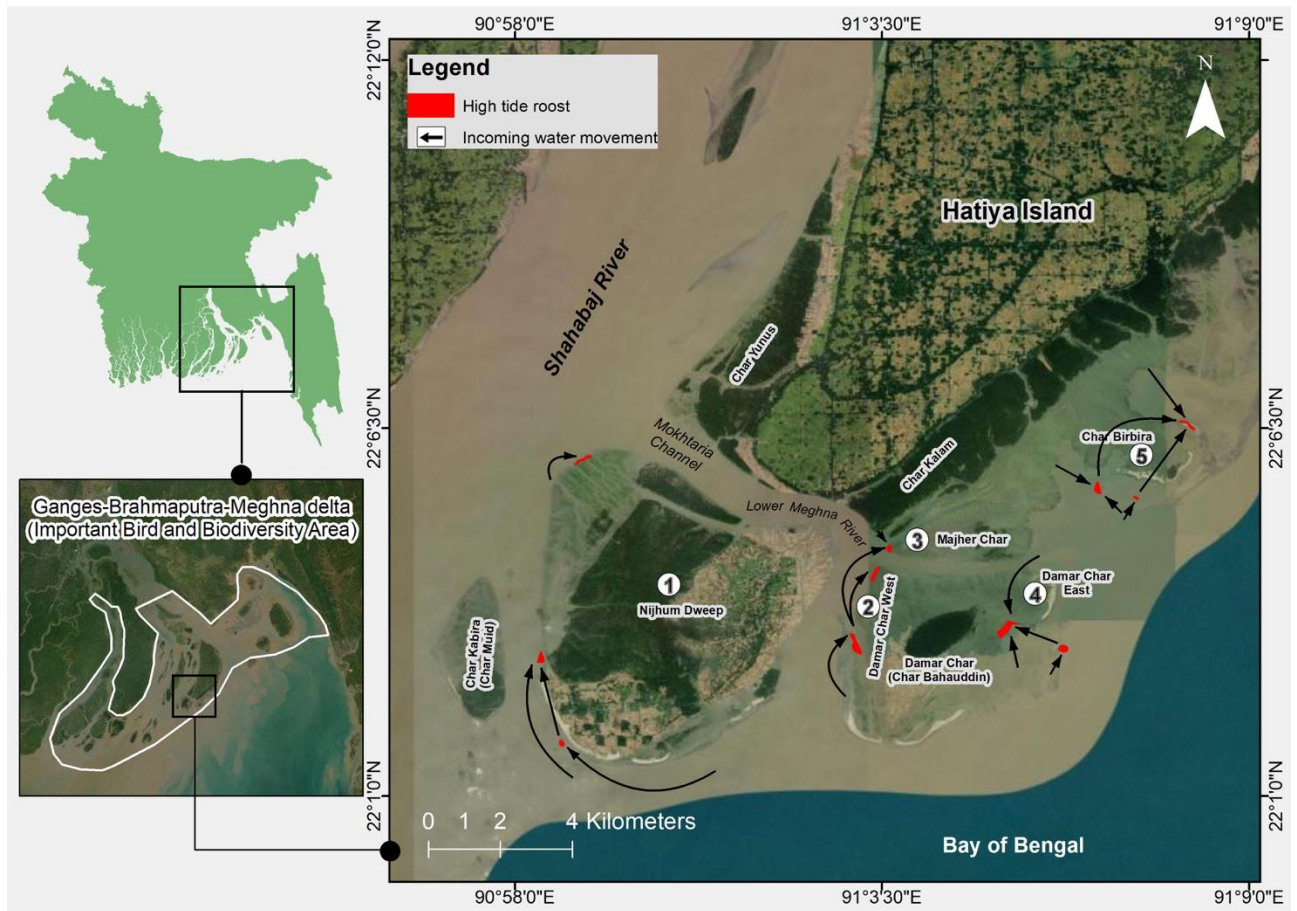


Figure 1. Map of the study area showing our division of Nijhum Dweep National Park and Char Birbira into five subsites. The arrows depict Black-tailed Godwits movement from foraging areas to roost sites during incoming tide.

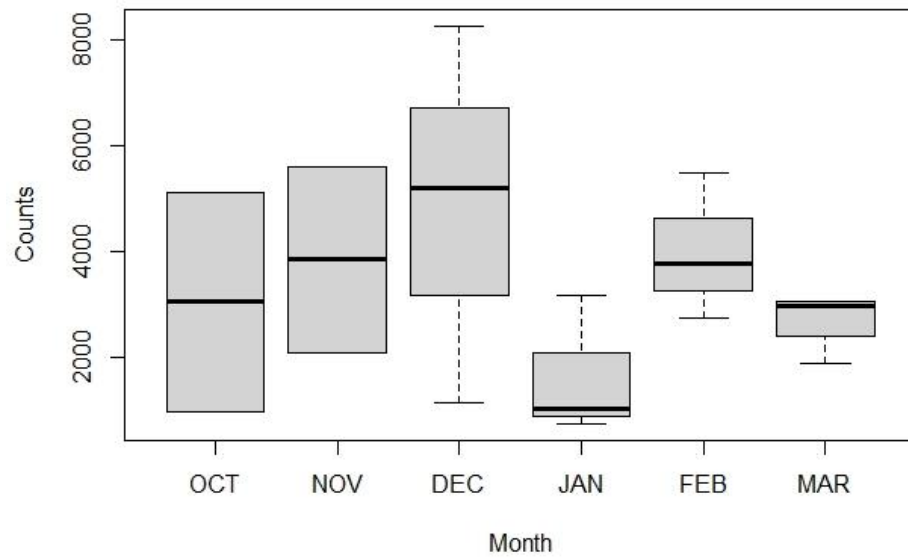


Figure 2. Monthly counts of Black-tailed Godwits (2016–2017 to 2019–2020) in the Nijhum Dweep National Park and the Char Birbira.

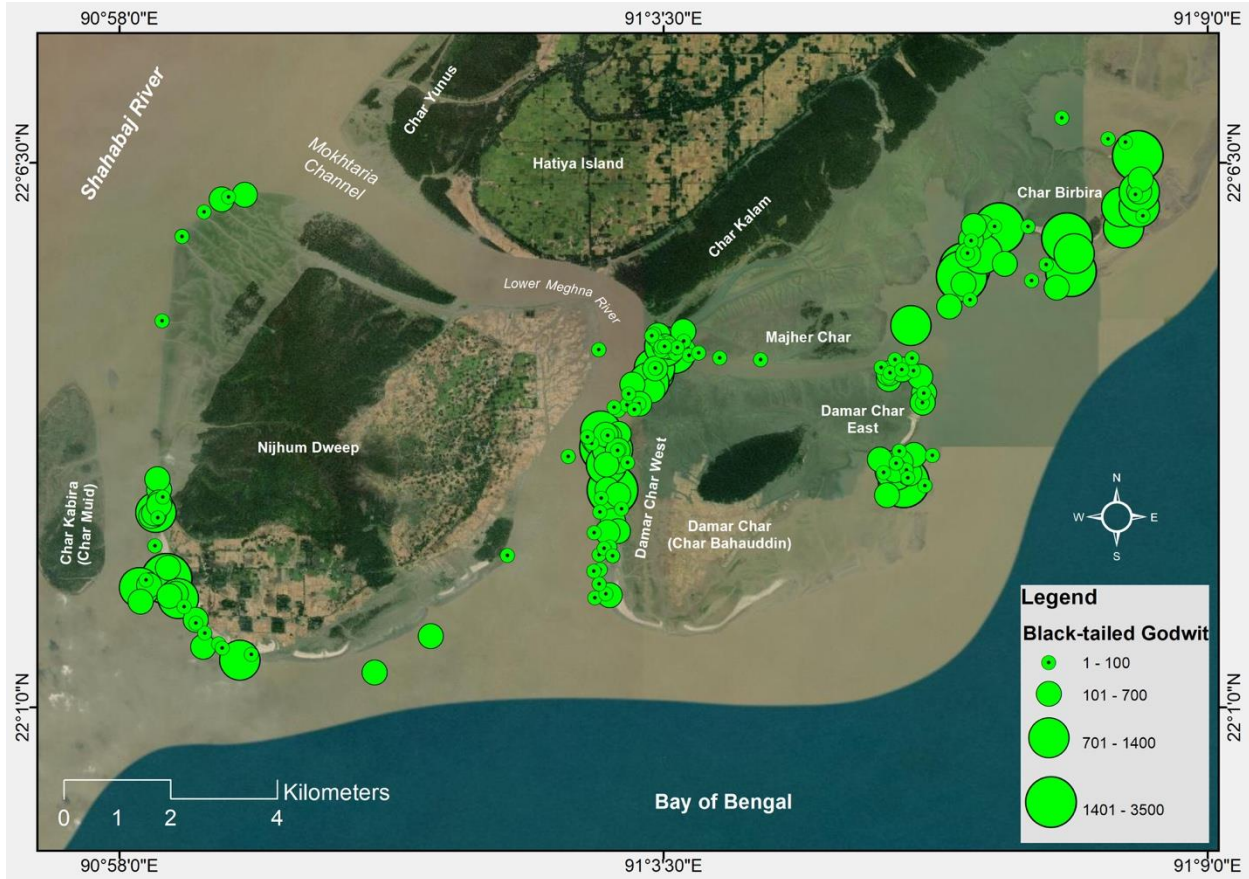


Figure 3. Low water distribution of all the Black-tailed Godwits flocks during 17 surveys (results combined) between 2016–2017 and 2019–2020.

Table 1. Counts of Black-tailed Godwits in Nijhum Dweep National Park and the Char Birbira highlight the maximum counts in each season and across all seasons and the mean count at each site in four seasons. Survey dates and range of peak high tide time during the survey dates are given. Counting was conducted during the ± 3 hrs around peak high tide.

Sites	2016–2017	2017–2018					2018–2019							2019–2020					Peak of all seasons	Mean	1% population count (>1400)		
	15–16 Mar–17 Peak High tide: 14:36–15:11	18–21 Dec–17 Peak High tide: 12:49–14:03	19–22 Jan–18 Peak High Tide: 14:24–16:20	18–21 Feb–18 Peak High tide: 14:21–16:37	26–29 Mar–18 Peak High tide: 8:30–11:38	Max	23–26 Oct–18 Peak High tide: 12:40–14:26	23–26 Nov–18 High tide: 13:30–15:38	19–22 Dec–18 Peak High tide: 11:06–13:15	14–17 Jan–19 Peak High tide: 7:20–10:40	15–18 Feb–19 Peak High tide: 9:11–12:06	29 Mar–1 Apr–19 Peak High tide: 8:53–11:30	Max	25–28 Oct–19 Peak High tide: 10:40–12:47	22–25 Nov–19 Peak High tide: 9:19–11:46	18–28 Dec–19 Peak High tide: 7:25–9:18; 14:03	19–21 Jan–20 Peak High tide: 8:03–10:19	7–11 Feb–20 Peak High tide: 11:42–14:34	10–13 Mar–20 Peak High tide: 13:35–15:37	Max			
Majher Char	373	265	55	10	10	265	1405	700	470	4	75	12	1405	4	132	0	0	0	0	132	1405	207	1
Nijhum Dweep	X	488	235	448	457	488	101	278	605	1134	1453	1367	1453	99	0	9	130	1110	1320	1320	1453	577	1
Damar Char West	800	416	13	244	150	416	1401	1300	1594	715	1661	1179	1661	0	1339	539	272	1570	1332	1570	1661	854	4
Damar Char East	X	3600	519	338	114	3600	4	336	1400	850	325	23	1400	76	405	172	333	227	375	405	3600	567	2
Char Birbira	1882	3500	190	1700	1157	3500	2205	3000	1123	469	1962	321	3000	800	214	428	X	856	X	856	3500	1320	6
Total	3055	8269	1012	2740	1888	8269	5116	5614	5192	3172	5476	2902	8919	979	2090	1148	735	3763	3027	4283	8269	3303	13

