Status of wintering waterbirds on Hainan Island: results of annual waterbird surveys between 2008–2020

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We conducted annual surveys on wintering waterbirds at a total of 81 wetland sites on China's Hainan Island from 2008 to 2020. These surveys recorded 82 waterbird species. Little Egret *Egretta garzetta*, Lesser Sand Plover *Charadrius mongolus* and Kentish Plover *C. alexandrinus* were the most abundant species, while Little Egret, Chinese Pond Heron *Ardeola bacchus* and Common Sandpiper *Actitis hypoleucos* were the most widespread. We discovered a new and important wintering site for the endangered Black-faced Spoonbill *Platalea minor* in Danzhou Bay. Our data also suggest that Hainan may be a regular wintering site for a small number of Great Knot *Calidris tenuirostris* and Nordmann's Greenshank *Tringa guttifer*. Sites of particular importance included Dongzhaigang, Houshui Bay, Danzhou Bay, Beili Bay, Changhuajiang River Estuary and Yinggehai Saltpans, but not all of them are formally protected at present. Our longitudinal data suggest an increasing trend in the total number of waterbirds counted, but this most likely reflects increased survey effort over the years, improving field skills of surveyors and a growing knowledge of important waterbird sites. The average annual count of waterbirds recorded during our 13-year survey period was relatively low compared with some nearby wetlands of importance on the mainland. Our surveys also detected continuous declines of waterbirds at some sites. To safeguard the future of Hainan's waterbirds and their habitats, we recommend establishing new or expanding existing protected areas at key sites, and enhancing management and enforcement efforts throughout the island.

INTRODUCTION

Hainan Island lies in the southernmost part of China, with a land area of 33,900 km^2; its south-eastern coastline faces the South China Sea and is bounded by the Gulf of Tonkin in the north-west. Hainan's numerous inland wetlands and extensive coastline harbour some 3,200 km^2 of wetlands (Jiang 2015). Visiting naturalists in the late nineteenth century reported a thriving waterbird community in Hainan, with records of present-day rarities such as Common Crane *Grus grus*, Lesser Adjutant *Leptoptilos javanicus* and Black-headed Ibis *Threskiornis melanocephalus*, some of which have not been seen locally for over half a century (Swinhoe 1870, Hartlaub 1892, Styan 1893, Hartert 1910, Xu *et al*. 1983).

Located midway along the East Asian–Australasian Flyway (EAAF), Hainan Island provides stopover and wintering grounds for a good number of migratory waterbirds, including some globally threatened species. It is therefore of value to conduct long-term monitoring to understand the conservation status of waterbirds and the habitat they depend on. Modern ornithologists began waterbird studies in Hainan in the 1980s (Guan & Deng 1990, Gao 1991, Zou *et al*. 2000, 2001), and in 2003 an annual island-wide scheme of wintering waterbird surveys was initiated and remains ongoing today. This annual survey scheme has been coordinated by the Hainan Wildlife Conservation and Management Bureau with financial and manpower support from several organisations. Zhang *et al*. (2005, 2006) reported the results of the 2003 and 2004 annual surveys, and Lee *et al*. (2007) summarised the results up to 2007, during which 74 waterbird species were recorded. We herein report the results of this long-term annual survey between 2008 and 2020, and make conservation recommendations which we consider as most crucial to conserve waterbirds and their habitats in Hainan.

STUDY SITES

We covered 81 wetland sites throughout the island between 2008–2020, of which 62 were intertidal (76.5%), 11 were reservoirs (13.6%), and eight were freshwater ponds and marshes (9.9%). Appendix 1 provides details of all surveyed wetland sites, and Figure 1 is a map showing locations of all sites. For extensive coastal bays, clusters of discrete survey sites were visited; in this article, where discussion refers to a whole cluster of sites within a bay, we refer to these sites collectively, such as in 'the Danzhou Bay'. We circle clusters of sites in Figure 1.

METHODS

As part of the International Black-faced Spoonbill *Platalea minor* Census organised by the Hong Kong Bird Watching Society (HKBWS, BirdLife Partner in Hong Kong), our annual survey was conducted by teams of surveyors over a period of 2–4 days every January to coincide with the spoonbill census. Due to a lack of manpower, surveying activity in 2010 was limited to the Black-faced Spoonbill. For the other 12 years, survey sites varied annually depending on manpower and the discovery of new waterbird sites, but 20 key sites were consistently surveyed post-2010 (sites 10, 11, 22, 23, 31, 34, 37, 40–45, 52, 56, 58, 65, 67, 74 and 77). Each team was led by an experienced surveyor familiar with the assigned survey sites, and the rest were volunteer birdwatchers and nature reserve staff with birdwatching skills.

During the surveys, teams tried to cover all parts of each site in different parts of the island within the assigned period. To maximise scan coverage and sighting accuracy, the best vantage points were selected based on local knowledge and prior experience. All waterbirds encountered were identified and counted using telescopes and binoculars. The point count method was used where concentrations of over 100 waterbirds were encountered, and for groups of fewer than 100 birds we counted the absolute number of birds. Larger or flying flocks were counted using the block-count method (Ma *et al*. 2006) and, whenever possible, photographs were taken to cross-check count accuracy. In extensive open habitats, surveyors also walked and used boats to cover grounds. Intertidal sites were visited during the best tidal condition as far as possible, which was determined by local bathymetry and terrain to maximise the chance of observing waterbird concentrations. For example, high tide presented the optimal condition in Danzhou Bay (sites 65–69) and Houshui Bay (sites 72–75) along the northern coast, while in Dongzhaigang (sites 10–18) and Huiwen Coastal Wetland (sites 21–22) along the north-eastern coast, ebbing or flooding tides were desirable.

From 2018, for better coverage of the 33 km^2 Dongzhaigang National Nature Reserve (NNR) in north-eastern Hainan, which is one of China's largest mangrove areas, we started to conduct a full-day (rather than half-day as in previous years) simultaneous survey in the reserve as part of our island-wide survey. In order not to divert manpower from the annual surveys, we scheduled the Dongzhaigang surveys prior to the island-wide survey. Our annual survey records show that the composition and abundance

Figure 1. Wetland sites visited during our annual surveys of wintering waterbirds in Hainan, China, 2008–2020. Circles denote clusters of sites within the same coastal bays. See Appendix 1 for detailed site information.

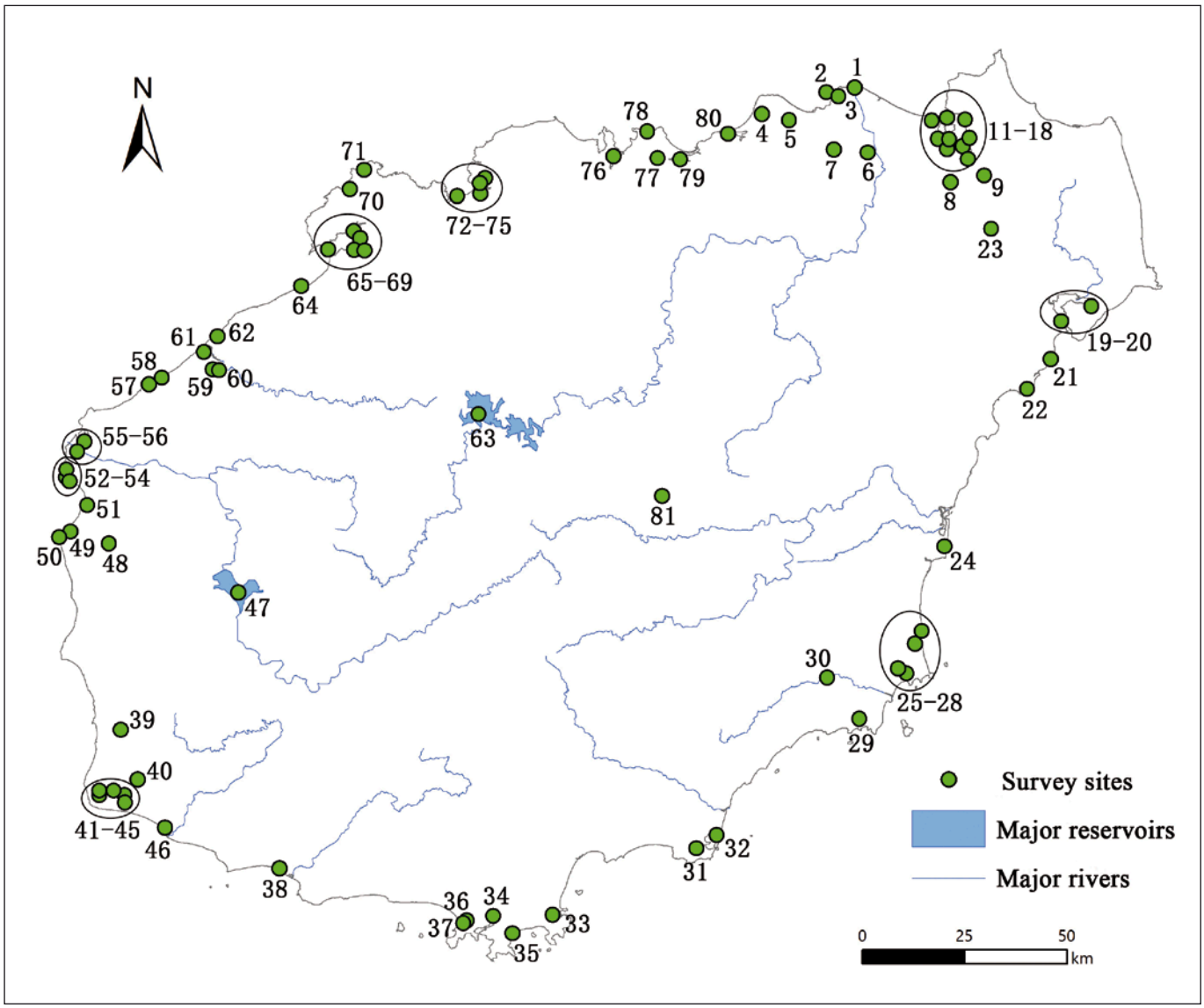


Table 1. Survey dates, effort and organiser information of our annual surveys in Hainan, China, 2008–2020.

Survey dates	No. of surveyed sites	Organiser[2]	Funder[2]
10–13 Jan 2008	16	KFBG	KFBG
8–12 Jan 2009	24	KFBG	KFBG
21–23 Jan 2011	23	KFBG	KFBG
13–17 Jan 2012	20	KFBG	KFBG
11–15 Jan 2013	25	KFBG	KFBG
17–21 Jan 2014	22	KFBG	KFBG
17–19 Jan 2015	31	KFBG\HBWS	KFBG
16–18 Jan 2016	33	KFBG\GEF\HBWS	KFBG\GEF
13–15 Jan 2017	46	KFBG\GEF\HBWS	KFBG\GEF
14[1], 20–21 Jan 2018	49	HDWI\GEF\HBWS\DZGNNR	GEF\ DZGNNR
20[1], 25–27 Jan 2019	46	HDWI\HBWS\ DZGNNR	KFBG\HDWI\ DZGNNR
12[1], 17–19 Jan 2020	51	HDWI\HBWS\ DZGNNR	KFBG\HDWI\ DZGNNR

[1] Dates of full-day Dongzhaigang wintering waterbird surveys since 2018.
[2] KFBG: Kadoorie Farm and Botanic Garden; HDWI: Haikou Duotan Wetlands Institute; GEF: UNDP-GEF Hainan Wetland Project; HBWS: Hainan Bird Watching Society; DZGNNR: Hainan Dongzhaigang National Nature Reserve.

of wintering waterbirds in Hainan was stable in January, suggesting that the slightly advanced date of the Dongzhaigang surveys would not bias the characterisation of the wintering waterbird community in Hainan. Therefore, we also included the Dongzhaigang data for the island-wide database for 2018–2020. For details of survey effort see Table 1. We follow Gill & Donsker (2020) for nomenclature.

RESULTS

A total of 82 waterbird species were recorded between 2008–2020, 15 of which are new additions compared to Lee *et al.* (2007): Greylag Goose *Anser anser*, Common Shelduck *Tadorna tadorna*, Falcated Duck *Mareca falcata*, Eastern Spot-billed Duck *Anas zonorhyncha*, Purple Heron *Ardea purpurea*, Grey-headed Swamphen *Porphyrio poliocephalus*, Eurasian Coot *Fulica atra*, Pheasant-tailed Jacana *Hydrophasianus chirurgus*, Nordmann's Greenshank *Tringa guttifer*, Grey-tailed Tattler *Tringa brevipes*, Sharp-tailed Sandpiper *Calidris acuminata*, Spoon-billed Sandpiper *Calidris pygmaea*, Oriental Pratincole *Glareola maldivarum*, Gull-billed Tern *Gelochelidon nilotica* and Common Tern *Sterna hirundo*. We failed to record seven species listed by Lee *et al.* (2007): Mandarin Duck *Aix galericulata*, Mallard *Anas platyrhynchos*, Von Schrenck's Bittern *Ixobrychus eurhythmus*, Ruddy-breasted Crake *Porzana fusca*,

Figure 2. Waterbird species richness and abundance recorded during the annual surveys in Hainan, 2008–2020.

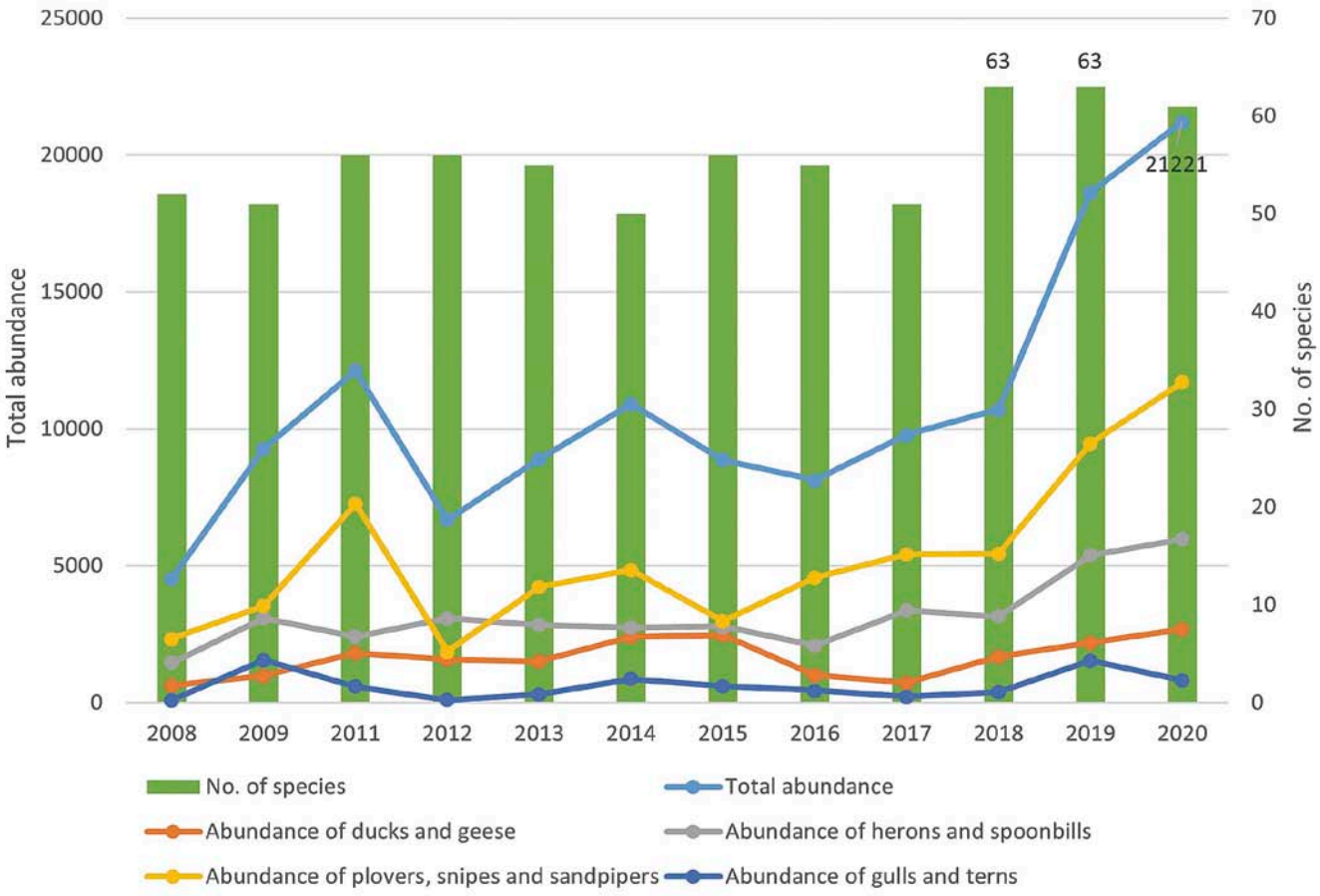


Figure 3. Survey sites with significant average annual abundance and richness of waterbirds recorded by our annual surveys in Hainan, 2008–2020. Site numbers are given for each cluster, while numbers in brackets denote the total species richness of each site. See Appendix 1 for detailed site information.

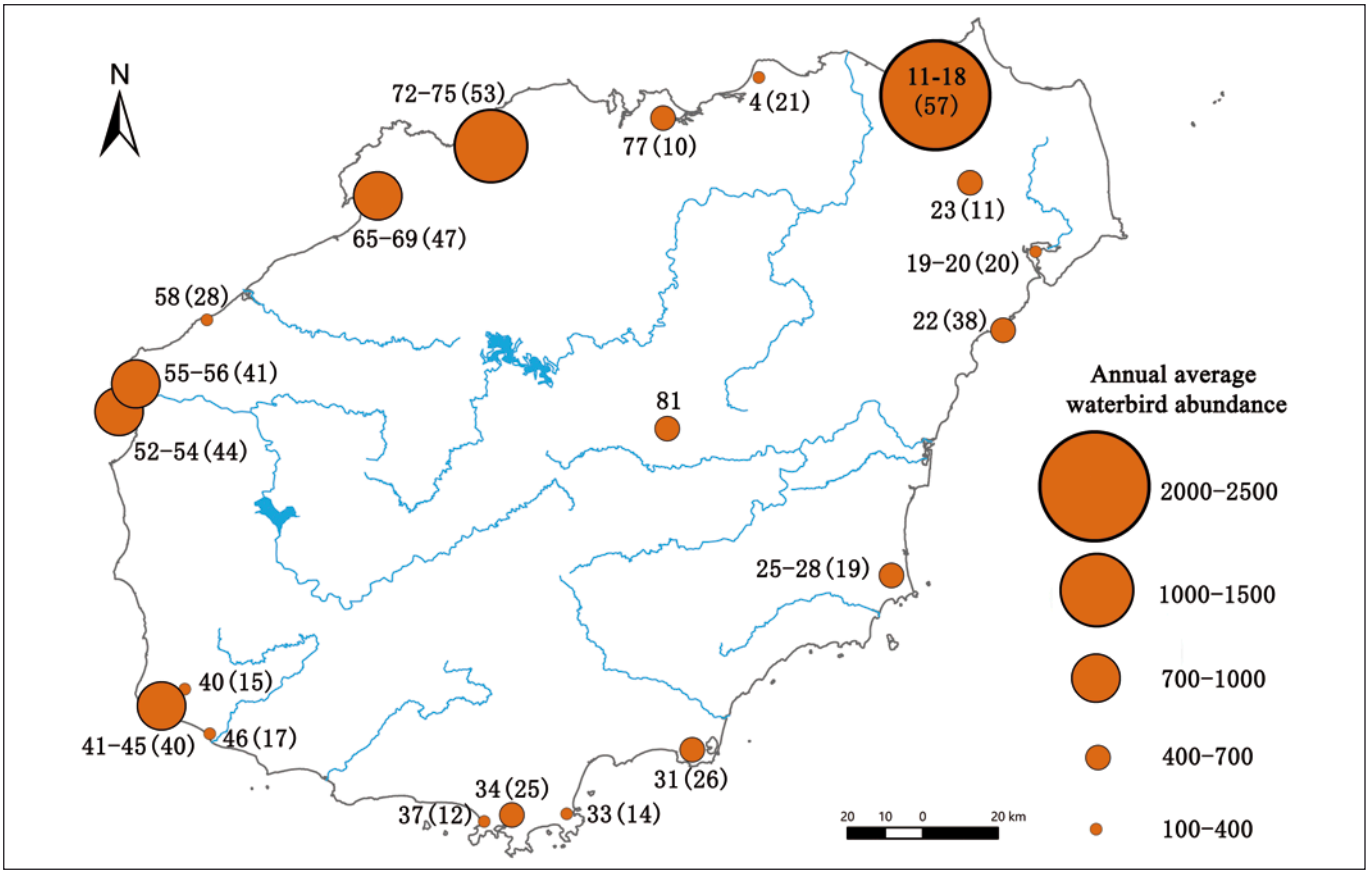


Figure 4. Trend of the numbers of Lesser Whistling-duck *Dendrocygna javanica* recorded at Mingrenshan (site 23) and Nanshan Reservoir (site 77), Hainan, 2011–2020.

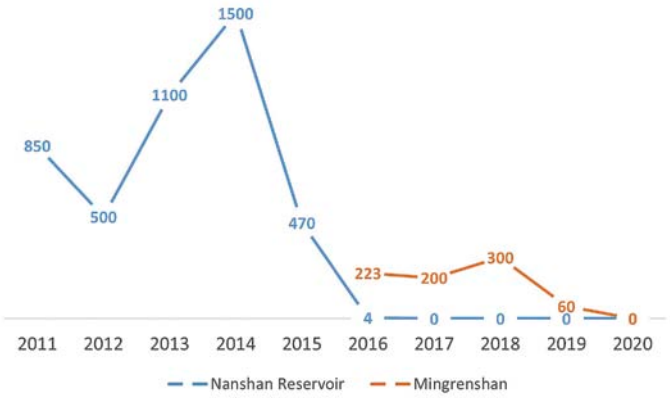
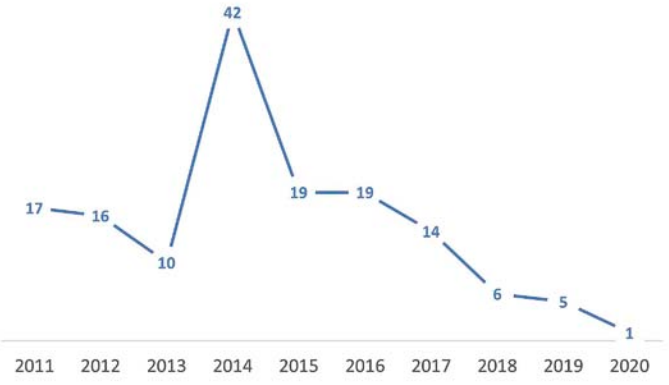


Figure 5. Trend of the numbers of Grey-headed Swamphen *Porphyrio poliocephalus* recorded at Changjiang Haiwei Wetland (site 58), Hainan, 2011–2020.



Watercock *Gallicrex cinerea*, Long-billed Dowitcher *Limnodromus scolopaceus* and Little Tern *Sternula albifrons* (Appendix 2). With the increased survey coverage and effort, we recorded the highest species richness in 2018 and 2019, both years yielding 63 species. Similarly, the number of waterbirds recorded also increased over the years to exceed 20,000 birds in the surveys since 2018 (Figure 2). Our data suggest that the northern and western coasts facing the Gulf of Tonkin supported higher waterbird abundance and diversity than the rest of the island (Figure 3).

Composition of wintering waterbirds in Hainan

During our surveys the most abundant taxonomic groups recorded, in descending order, were: shorebirds, egrets and herons, ducks, geese and grebes. The most common species were, in descending sequence: Little Egret *Egretta garzetta* (13,740 birds counted between 2008–2020), Lesser Sand Plover *Charadrius mongolus* (12,094), Kentish Plover *C. alexandrinus* (9,547), Lesser Whistling-duck *Dendrocygna javanica* (9,285) and Great White Egret *Ardea alba* (8,719). The most widespread waterbird species in Hainan were Little Egret (recorded at 49% of the 81 surveyed sites), Chinese Pond Heron *Ardeola bacchus* (46%), Common Sandpiper *Actitis hypoleucos* (40%), Great White Egret (38%), Common Greenshank *Tringa nebularia* (33%) and Grey Heron *Ardea cinerea* (33%). Appendix 2 summarises detailed annual records of waterbirds counted during the surveys. Wetland sites ranked as the highest in average annual species richness and abundance were: Dongzhaigang (sites 10–18), Houshui Bay (sites 72–75), Danzhou Bay (sites 65–69), Beili Bay (sites 52–54), Changhuajiang River Estuary (sites 55–56) and Yinggehai Saltpans (sites 41–45). See Figure 3 for species richness and abundance of wintering waterbirds across surveyed sites.

Species accounts

The following accounts, which present detailed occurrence data collected by our surveys, cover species that are either listed as globally threatened by the IUCN (2020) or Nationally Threatened (Jiang *et al*. 2016), or are rare on Hainan Island.

Lesser Whistling-duck *Dendrocygna javanica*

Listed as nationally Vulnerable on the China Red List. Hainan is considered the species's stronghold in China (Lee *et al*. 2007). Between 2008–2020 we recorded the species from six sites, but the most important site (Guyue Villa, site 81) reported by Lee *et al*. (2007) has been developed into a housing estate and the population has vanished since 2008. It also disappeared from two other sites (Mingrenshan and Nanshan Reservoir, sites 23 and 77, respectively) in recent years (Figure 4).

Greylag Goose *Anser anser*

Rare winter visitor to Hainan. Eleven individuals were recorded on 10 January 2008 and two on 8 January 2009 at the brackish Xiatang Wetland (site 10) abutting Dongzhaigang NNR.

Common Shelduck *Tadorna tadorna*

One individual was recorded at Wanglougang (site 46) on 18 January 2020. In view of the rarity of Common Shelduck in South China and the proliferation of 'wild duck farms' in nearby Guangdong Province, it cannot be ruled out that this represents an individual of captive origin (Richard Lewthwaite *in litt*. February 2020).

Falcated Duck *Mareca falcata*

Rare winter visitor to Hainan. The record of one male and one female at Sanqugou Reservoir (site 40) represents the third record for Hainan.

Eastern Spot-billed Duck *Anas zonorhyncha*

Rare winter visitor to Hainan. Zheng (2017) listed it for Hainan without any detailed information. A single duck seen mixed with a flock of Lesser Whistling-ducks at Haiwei Wetland (site 58) on 17 January 2015 represents the first Hainan record with locality data. One individual was subsequently seen at Haidian Island (site 3) on 20 January 2018.

Grey-headed Swamphen *Porphyrio poliocephalus*

Listed as nationally Vulnerable on the China Red List and rare in Hainan. The first unequivocal Hainan record was of a bird recorded at Danzhou Bay during the 2008 survey, which is believed to have been caught locally (He *et al*. 2013, Lu *et al*. 2015). Our results indicate that Haiwei Wetland (site 58) is the only reliable site for the species in Hainan, with all records during our surveys coming from this site, with a highest count of 42 individuals at this site in 2014. The population is decreasing, however, and only one bird was recorded in 2020 (Figure 5).

Far Eastern Curlew *Numenius madagascariensis*

Listed as globally Endangered by IUCN while the China Red List considers it Vulnerable. We recorded two individuals on 17 January 2014 at Huiwen Coastal Wetland (site 22) and three on 21 January 2018 at Houshui Bay (site 73).

Great Knot *Calidris tenuirostris*

Listed as globally Endangered by IUCN and Vulnerable on the China Red List. First recorded in 2008 in our surveys, and has been recorded at seven sites so far. A fair number have been recorded in Hainan annually since 2013, with a peak count of 95 at Huiwen Coastal Wetland (site 22) in 2014.

FENG ERHUI

Plate 1. Black-faced Spoonbills *Platalea minor*, with a single Eurasian Spoonbill *P. leucorodia*, Houshui Bay (site 74), Hainan, China, 16 December 2016.

Red Knot *Calidris canutus*

Listed as globally Near Threatened by IUCN and Vulnerable on the China Red List. Recorded at five sites during our surveys, with the highest count of 80 birds at Huiwen Coastal Wetland (site 22) in 2012.

Spoon-billed Sandpiper *Calidris pygmaea*

Listed as Critically Endangered by both the IUCN and the China Red List. Very rare in Hainan, with only two birds recorded at Beili Bay (site 54) on 23 January 2018 during our surveys. The Leizhou Peninsula of Guangdong province, which is the continental landmass closest to Hainan at only 20 km to the north, is a newly discovered key wintering site for this species (Martinez & Allcock 2016). Additional sightings may be obtained from more targeted survey efforts along the northern coast of Hainan that aim to identify potential occurrence areas and the best tide conditions during peak migration periods.

Nordmann's Greenshank *Tringa guttifer*

Listed as Endangered by both the IUCN and the China Red List. Previously only known from Hainan by two very old specimens collected in the capital Haikou (Styan 1894). It reappeared on 19 January 2015 when one bird was seen at Huiwen Coastal Wetland (site 22), and we recorded one, three and three individuals, respectively, at the same site in three consecutive years between 2018–2020.

Black-faced Spoonbill *Platalea minor*

Listed as globally Endangered by IUCN and the China Red List. In the past two decades, Sigeng Provincial Nature Reserve (which is part of Beili Bay) and Houshui Bay (sites 73 and 74) have been known as wintering sites for the species in Hainan (Lee *et al*. 2007). However, there has been a continuous decline in its numbers at Sigeng since 2009, causing a general decline in the wintering number in Hainan, with a low count of 44 in 2012. Luckily the wintering population in Houshui Bay has been increasing and a new wintering population was discovered in nearby Danzhou Bay (sites 66–69) in 2017, resulting in a modern high count of 108 individuals for Hainan in 2020 (Figure 6, Plate 1). All our records have been submitted to the EAAFP Black-faced Spoonbill Working Group, and Hainan remains a major wintering site of global importance, regularly holding more than 1% of the global population (Yu Yat Tung *in litt*. 2020).

DISCUSSION

While our surveys did not rely on a consistent survey effort or cover a consistent group of sites throughout the study period, we believe that our results provide an adequate general overview of the status of wintering waterbirds in Hainan. By covering the majority of coastal and inland wetlands of Hainan and by consistently surveying traditionally important sites, we recorded a total of 82 waterbird species, 15 of which were new additions compared to Lee *et al*. (2007), but we also failed to record seven species noted prior to 2007. The northern and western coasts of Hainan facing the Gulf of Tonkin supported higher waterbird abundance and diversity during our surveys compared with elsewhere on the island. We believe the lack of sizeable estuaries and mudflats as well as a higher human population density along the south-eastern coast are the most probable explanations for this finding.

Figure 6. Trend of the numbers of Black-faced Spoonbill *Platalea minor* recorded in Hainan, 2008–2020.

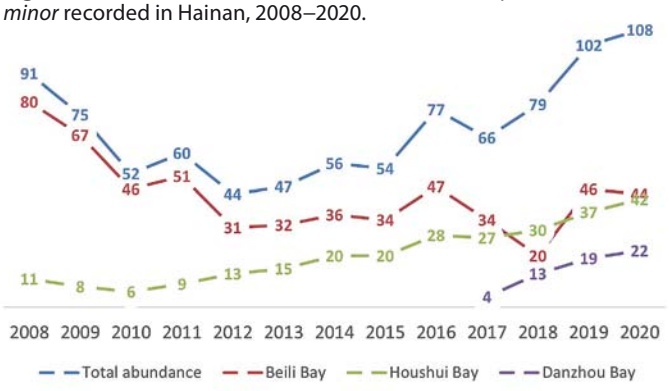
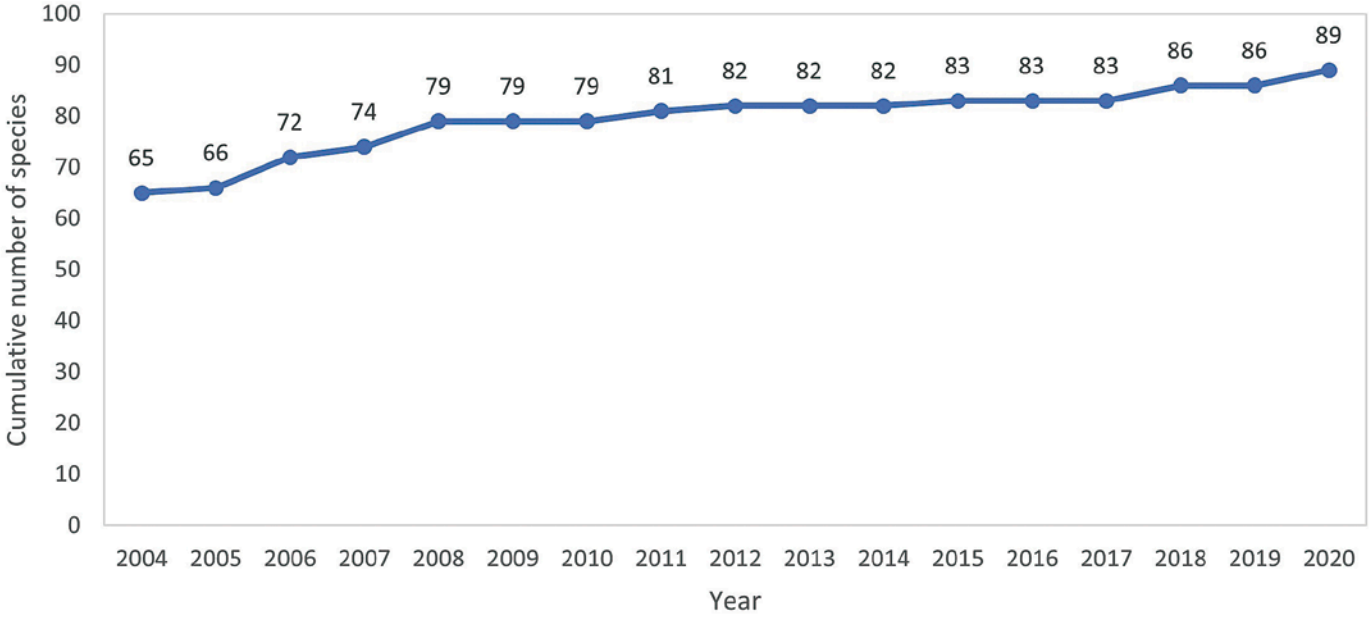


Figure 7. Species accumulation curve of island-wide annual surveys of wintering waterbirds in Hainan, 2004–2020 (data for 2004–2007 from Lee *et al.* 2007).



Compared to surveys conducted in 2003–2007, we surveyed 43 new sites and discarded 31 previous sites. While inland wetlands in subtropical China, especially along the Yangtze River, are the most important wintering sites for ducks and geese (Tao *et al.* 2017), the tropical island of Hainan is situated south of the southern limits for most wintering ducks and geese, and those species which reach Hainan tend to spend their winters along coastal wetlands. As such the inland wetlands of Hainan, mostly steep-shore reservoirs and small rocky rivers, are characterised by low numbers of a few resident egrets, herons, the Lesser Whistling-duck and the Little Grebe *Tachybaptus ruficollis* (Lee *et al.* 2007). To maximise the cost-effectiveness of our surveys with limited resources, we decided to drop many of the inland reservoirs and riverine sites after 2008 as they were consistently species- and abundance-poor for migratory waterbirds (Lee *et al.* 2007, authors' unpubl. data).

With the increased survey effort, improved survey skill and familiarity with wetland sites of Hainan, we have been recording higher waterbird diversity and abundance in recent years, reaching record high counts of 63 species in 2018 and 2019, and 21,221 individuals in 2020. A species accumulation curve of our survey between 2004–2020 shows a continuously rising trend over the last 16 years, suggesting that more species could potentially be added to the survey checklist in the future (Figure 7). Despite the higher counts in recent years, the abundance of wintering waterbirds in Hainan falls far below its real potential. As an illustration, six teams simultaneously surveyed the 33 km^2 Dongzhaigang in 2019 and recorded 5,377 waterbirds in a day, which represents the only high count of over 5,000 waterbirds of any site over the years. In contrast, on the nearby Leizhou Peninsula, Sayam *et al.* (2019) counted 12,031 waterbirds at five sites over four days. Similarly, the 15 km^2 Mai Po and Inner Deep Bay Ramsar Site in Hong Kong regularly holds around 50,000 waterbirds each winter, and a surveyor can easily count 5,000–6,000 waterbirds during a day in the winter (Yu Yat Tung *in litt.* 2020).

Conservation

Hainan is undergoing a rapid phase of urbanisation; it is therefore important to identify key sites for the protection of wintering waterbirds and their habitats. Beili Bay (sites 52–54) and Houshui Bay (sites 73–75) regularly supported 1% of the global population of Black-faced Spoonbill during our surveys, thus meeting the Ramsar criteria for wetlands of international importance. The number of Caspian Tern *Hydroprogne caspia* recorded at site 72 of Houshui Bay in 2019 also exceeded 1% of the non-breeding EAAF population, and it remained high in 2020. Additionally, Danzhou Bay (sites 65–69) held more than 1% of the non-breeding EAAF population of Caspian Tern in 2019 and more than 1% of the global population of Black-faced Spoonbill in 2020. Yinggehai Saltpans (sites 41–45) supported over 1% of the non-breeding EAAF population of Spotted Redshank *Tringa erythropus* in 2017 (Wetlands International 2020).

Some species previously recorded in Hainan were absent in our surveys, and there is no indication that they persist anywhere in Hainan. These species include Bean Goose *Anser fabalis*, Cotton Pygmy-goose *Nettapus coromandelianus*, Baikal Teal *Sibirionetta formosa*, Great Thick-knee *Esacus recurvirostris*, Common Crane, Spot-billed Pelican *Pelecanus philippensis*, Lesser Adjutant, Painted Stork *Mycteria leucocephala* and Black-headed Ibis. Rampant poaching and habitat loss are likely to be the major drivers of their local extirpation (Liang *et al.* 2013, Jiang 2015). Luckily, waterbird poaching with rifles has largely stopped, extractive mist-netting and trapping have been reduced substantially, and many nature reserves are improving their management efforts and effectiveness. For example, in 2012–2014, Dongzhaigang NNR invested great efforts to halt illegal aquaculture and duck-farming activities and carried out mangrove restoration, which effectively expanded usable habitats and reduced human disturbance for waterbirds.

Nonetheless, the size and quality of wetlands island-wide are deteriorating. According to a national wetland study conducted in 2013, Hainan has lost 36.1% of its intertidal mudflats, and in total lost 13.1% of its wetlands. Of the remaining wetlands, 40% are suffering from overharvesting of marine animals for human consumption, and 25% are threatened by pollution (Jiang 2015). In addition to the threats listed by Lee *et al.* (2007), a recent, and potentially detrimental, threat is the designation of Hainan Island as 'International Tourism Destination' and a special economic zone by the Central Government, with ensuing large-scale development especially along the island's coastlines and lowland countryside. The negative impacts of habitat loss are obvious: in 2014, we recorded nearly a thousand waterbirds at Sanya Yulingang (site 34), but the wetlands were subsequently filled for housing development and the waterbird numbers dropped dramatically in recent years, with less than a hundred individuals recorded in 2019.

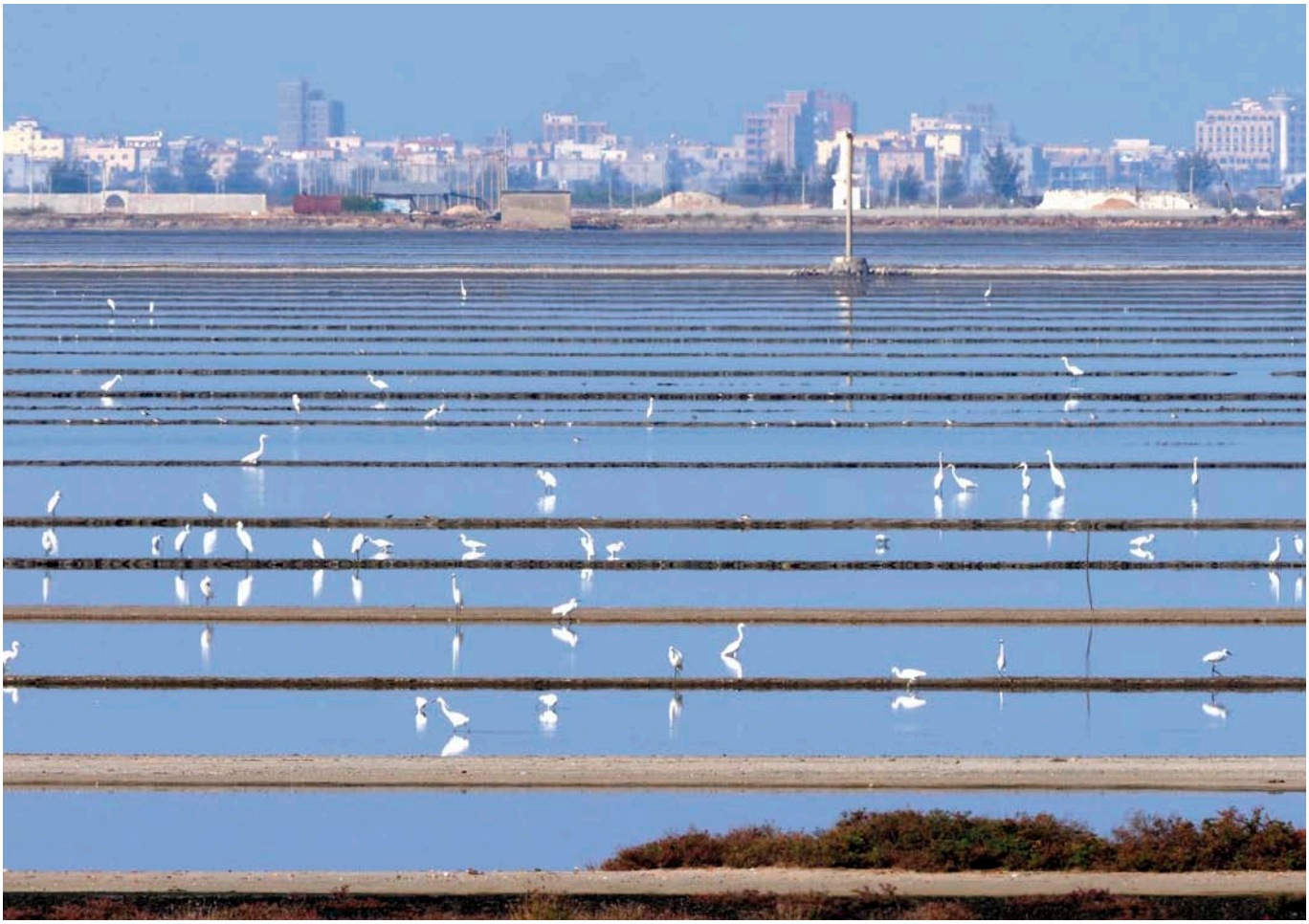


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Plate 2. Yinggehai Saltpans (site 43), western Hainan, 21 January 2018.

Recommendations

To mitigate the threats of wetland loss and degradation on an island undergoing rapid economic development is a big challenge. We believe the following conservation measures are pragmatic and can bring about marked positive impacts to the waterbirds and wetlands in Hainan:

(1) Expansion and establishment of key wetland reserves: sites of particular importance for waterbird conservation include Dongzhaigang (sites 10–18), Houshui Bay (sites 72–75), Danzhou Bay (sites 65–69), Beili Bay (sites 52–54), Changhuajiang River Estuary (sites 55–56) and Yinggehai Saltpans (sites 41–45). Dongzhaigang, as a national nature reserve, receives adequate resources for proper management, but much of the waterbird habitats at Houshui Bay, Danzhou Bay and Beili Bay are not formally protected at present. The Changhuajiang River Estuary and Yinggehai Saltpans of western Hainan, with extensive and under-surveyed habitats, are completely unprotected and under development pressures. It is of paramount importance that these important sites are safeguarded.

(2) Funding and staffing of neglected protected wetland areas: many municipal/county-level nature reserves, wetland parks and mini-reserves in Hainan lack administration structure, staffing and funding (Jiang 2015; see Appendix 1 for site details). Proper management of these protected areas is crucial so that they continue to provide ecosystem services and rural livelihood opportunities.

(3) Enforcement and education against waterfowl poaching: poaching, although reduced in frequency and scale, is still a problem and we witnessed this illegal activity most frequently at Xiaohai (sites 25–28) and Yinggehai Saltpans (sites 41–45); the latter is one of the most important waterbird sites for Hainan. Anti-poaching education campaigns and enforcement efforts should be enhanced, especially in the migration season.

(4) Conservation of key saltpans: saltpans have emerged to be important stopover sites for shorebirds worldwide and international efforts to revive saltpan production are on the rise (Warnock *et al*. 2002, Dias 2009, Siriya *et al*. 2011, BirdLife International 2016, Jackson *et al*. 2020). Hainan, with its numerous shallow bays and ample sunshine, has traditionally been an important salt production base in China. However, the local salt production industry is diminishing and only a few functional saltpans remain (Zhi & Wang 2019). Yinggehai Saltpans (Plate 2) were Hainan's biggest salt production bay and support one of the largest waterbird concentrations. Salt production has stopped and the abandoned saltpans are destined for other land uses. We call for the preservation of crucial waterbird areas at Yinggehai by restoring traditional salt production under a management scheme that caters to migrant waterbirds.

(5) Mudflat conservation: intertidal mudflats are critical foraging and resting grounds for waders (Li *et al*. 2019). In Hainan, many coastal wetland protection or restoration projects focus on mangrove coverage as an indicator for project success. It is imperative to maintain and restore mudflats in coastal wetland protection programmes.

(6) Conservation of freshwater wetlands: the dramatic declines in waterbird numbers at some freshwater sites, such as sites 23, 58, 77 and 81, are of national/regional concern as they supported China's largest Lesser Whistling-duck population and the nationally Vulnerable Grey-headed Swamphen. It is important to understand the drivers for waterbird abandonment of these sites, and mitigate the threats to reverse the declining trend.

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REFERENCES

BirdLife International (2016) Saving saltpans, a crucial habitat for migratory birds. Accessed at https://www.birdlife.org/saltpan-recovery-project.

Dias, M. P. (2009) Use of salt ponds by wintering shorebirds throughout the tidal cycle. *Waterbirds* 32: 531–537.

Gao, Y. R. (1991) The distribution of Charadriformes in the Guangdong Region, China. *The Stilt* 18: 25–28.

Gill, F. & Donsker, D. (eds.) (2020) IOC World Bird List (v 10.1). Doi 10.14344/IOC.ML.10.1. Accessed at http://www.worldbirdnames.org/.

Guan, G. X. & Deng, J. X. (1990) Birds in the area of mangroves tide-flats in South China. *Supplement to the Acta Scientiarum Naturalium Universitatis Sunyatseni* 9(2): 66–73. (In Chinese.)

Hartert, E. (1910) The birds of Hainan. *Novitates Zoologicae* 27: 189–254.

Hartlaub, G. (1892) Ein Beitrag zur Ornithologie Chinas. *Abhandlungen herausgegeben vom Naturwissenschaftlichen Verein zu Bremen* 12(2): 295–335.

He, F. Q., Lin, Z. & Jiang, H. D. (2013) The Purple Gallinule in China – a review on its distribution and the subspecies. *Chinese Journal of Zoology* 48(3): 490–496. (In Chinese.)

IUCN (2020) The IUCN Red List of Threatened Species. Version 2020-2. Accessed at http://www.iucnredlist.org. Downloaded on 10 July 2020.

Jackson, M. V., Choi, C.-Y., Amano, T., Estrella, S. M., Lei, W., Moores, N., Mundkur, T., Rogers, D. I. & Fuller, R. A. (2020) Navigating coasts of concrete: pervasive use of artificial habitats by shorebirds in the Asia-Pacific. *Biol. Conserv.* 247: 108591. Accessed at https://doi.org/10.1016/j.biocon.2020.108591.

Jiang, H. S. (ed.) (2015) *China Wetlands Resources: Hainan Volume*. Beijing: China Forestry Publishing House. (In Chinese.)

Jiang, J.-G., Jiang, J.-P., Wang, Y.-Z., Zhang, E., Zhang, Y.-Y., Li, L.-L., Xie, F., Cai, B., Cao, L., Zheng, G.-M., Dong, L., Zhang, Z.-W., Ding, P., Luo, Z.-H., Ding, C.-Q., Ma, Z.-J., Tang, S.-H., Cao, W.-X., Li, C.-W., Hu, H.-J., Ma, Y., Wu, Y., Wang, Y.-X., Zhou, K.-Y., Liu, S.-Y., Chen, Y.-Y., Li, J.-T., Feng, Z.-J., Wang, Y., Wang, B., Li, C., Song, X.-L., Cai, L., Zang, C.-X., Zeng, Y., Meng, Z.-B., Fang, H.-X. & Ping, X.-G. (2016) Red List of China's Vertebrates. *Biodiversity Science* 24(5): 500–551. (In Chinese with English abstract.)

Lee, K.-S., Chan, B. P. L., Lu, G. & Su, W.-B. (2007) Wetland birds of Hainan Island, China: results from winter waterbird surveys 2003–2007. *Forktail* 23: 92–101.

Li, J., Hughes, A. C. & Dudgeon, D. (2019) Mapping wader biodiversity along the East Asian–Australasian flyway. *PLoS ONE* 14(1): e0210552.

Liang, W., Cai, Y. & Yang, C. (2013) Extreme levels of hunting of birds in a remote village of Hainan Island, China. *Bird Conserv. Int.* 23(1): 45-52. doi:10.1017/S0959270911000499.

Lu, G., Li, F., Lee, K. S., Chan, B. P. L. & Sun, Y. H. (2015) New avifaunal records for Hainan island, China 2003–2013. *BirdingASIA* 23: 122–123.

Ma, J.-H., Liu, Y. & Lei, J.-Y. (2006) *Methods for bird surveys – a practical handbook*. Hong Kong: Hong Kong Bird Watching Society. (In Chinese.)

Martinez, J. & Allcock, J. A. (2016) China's Spoon-billed Sandpiper highest winter count in Leizhou peninsular, Guangdong province. *Spoon-billed Sandpiper Task Force - News Bulletin* 15: 23–27.

Chowdhury, S. C., Lai, N.-Y., Martinez, J., Li, F., Clark, N., Lappo, E., Syroechkovskiy, E. & Zöckler, C. (2019) Winter observations at Leizhou Peninsula, South China by SBS TF. *Spoon-billed Sandpiper Task Force - News Bulletin* 20: 7–10.

Siriya, S., Round, P. D., Savini, T., Trisurat, Y. & Gale, G. A. (2011) Traditional salt-pans hold major concentrations of overwintering shorebirds in Southeast Asia. *Biol. Conserv.* 144: 526–537.

Styan, F. W. (1893) On the birds of Hainan. *Ibis* 6(5): 424–437.

Styan, F. W. (1894) *Totanus guttiferus* in Hainan. *Ibis* 6(6): 337.

Swinhoe, R. (1870) On the ornithology of Hainan. *Ibis* 2(6): 77–367.

Tao, X.-D., Lei, J.-Y., Hearn, R. & Lei, G. (2017) *Report on the coordinated survey for wintering waterbird of the Central and Lower Yangtze in 2015*. Beijing: China Forestry Publishing House. (In Chinese.)

Warnock, N., Page, G. W., Ruhlen, T. D., Nur, N., Takekawa, J. Y. & Hanson, J. T. (2002) Management and conservation of San Francisco Bay salt ponds: effects of pond salinity, area, tide, and season on Pacific flyway waterbirds. *Waterbirds* 25: 79–92.

Wetlands International (2020) Waterbird population estimates. Accessed at http://wpe.wetlands.org/ on 23 July 2020.

Xu, L., Liu, Z., Liao, W., Li, X., Yu, S., Zhou, Y., Deng, J. & Guan, G. (1983) *Birds and mammals of Hainan Island*. Beijing: Science Press. (In Chinese.)

Zhang, G.-G., Liang, W., Liu, D.-P., Chu, G.-Z., Su, W.-B. & Kilburn, M. (2005) Survey on the wintering waterbirds of Hainan Island. *Chinese Journal of Zoology* 40(2): 80–85. (In Chinese with English abstract.)

Zhang, G.-G., Liang, W., Liu, D.-P., Chu, G.-Z., Su, W.-B. & Kilburn, M. (2006) Assessing biodiversity of wintering waterbirds and conservation priorities in Hainan Island. *Scientia Silvae Sinicae* 42(2): 78–82. (In Chinese with English abstract.)

Zheng, G.-M. (2017) *A checklist on the classification and distribution of the birds of China*. (Third edition). Beijing: Science Press. (In Chinese.)

Zhi, Y.-J. & Wang, Y.-L. (2019) The history of Hainan sea salt industry. *Relicts from the South* 3: 222–229. (In Chinese with English abstract.)

Zou, F.-S., Song, X.-J., Chen, K., Chen, W. & Zheng, X.-R. (2001) Avian diversity in mangrove wetland of Dongzhaigang. *Chinese Journal of Ecology* 20(3): 21-23. (In Chinese with English abstract.)

Zou, F.-S., Song, X.-J., Chen, K., Liang, Y. & Xu, D.-H. (2000) A preliminary study on avian ecology in mangrove wetland of Qinglangang, Hainan. *Chinese Biodiversity* 8(3): 307–311. (In Chinese with English abstract.)

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Appendix 1. Wetland sites visited during our annual wintering waterbird surveys in Hainan, China, 2008–2020.

Number	Site	Wetland type	Coordinates	Legal status*
1	Haikou Xinfu Island	Intertidal wetland	20.078°N 110.371°E	
2	Haikou Haidian Island	Intertidal wetland	20.067°N 110.309°E	
3	Haikou Haidian Island	Intertidal wetland	20.059°N 110.336°E	
4	Haikou Railway Station Wetland	Freshwater ponds and marsh	20.019°N 110.168°E	
5	Haikou Wuyuan River	Freshwater ponds and marsh	20.007°N 110.228°E	NWP
6	Haikou Nayang Wetland	Freshwater ponds and marsh	19.935°N 110.400°E	WMR**
7	Haikou Yangshan Reservoir	Reservoir	19.942°N 110.325°E	
8	Haikou Dingrong Reservoir	Reservoir	19.870°N 110.582°E	
9	Haikou Nanyang Reservoir	Reservoir	19.884°N 110.656°E	
10	Haikou Xiatang Wetland	Intertidal wetland	19.965°N 110.579°E	WMR**
11	Haikou Dongzhaigang	Intertidal wetland	20.005°N 110.541°E	NNR
12	Haikou Dongzhaigang	Intertidal wetland	Transect (midpoint at 20.010°N 110.574°E)	NNR
13	Haikou Dongzhaigang	Intertidal wetland	19.920°N 110.620°E	PWP
14	Haikou Dongzhaigang	Intertidal wetland	Transect (midpoint at 19.949°N 110.608°E)	NNR
15	Haikou Dongzhaigang	Intertidal wetland	19.942°N 110.574°E	NNR
16	Haikou Dongzhaigang	Intertidal wetland	19.965°N 110.554°E	NNR
17	Haikou Dongzhaigang	Intertidal wetland	19.966°N 110.623°E	NNR
18	Wenchang Dongzhaigang	Intertidal wetland	20.007°N 110.614°E	PNR
19	Wenchang Bamen Bay	Intertidal wetland	19.598°N 110.892°E	PNR
20	Wenchang Bamen Bay	Intertidal wetland	19.564°N 110.825°E	
21	Wenchang Huiwen Coastal Wetland	Intertidal wetland	19.481°N 110.802°E	
22	Wenchang Huiwen Coastal Wetland	Intertidal wetland	19.416°N 110.750°E	
23	Wenchang Mingrenshan	Reservoir	19.767°N 110.671°E	MCNR**
24	Wanning Bo'aogang	Intertidal wetland	19.070°N 110.569°E	
25	Wanning Xiaohai	Intertidal wetland	18.884°N 110.519°E	
26	Wanning Xiaohai	Intertidal wetland	18.857°N 110.504°E	
27	Wanning Xiaohai	Intertidal wetland	18.791°N 110.486°E	
28	Wanning Xiaohai	Intertidal wetland	18.802°N 110.466°E	
29	Wanning Laoyehai	Intertidal wetland	18.692°N 110.382°E	
30	Wanning Wanning Reservoir	Reservoir	18.783°N 110.311°E	
31	Lingshui Xincungang	Intertidal wetland	18.407°N 110.023°E	MCNR**
32	Lingshui Li'angang	Intertidal wetland	18.436°N 110.069°E	MCNR**
33	Sanya Tielugang	Intertidal wetland	18.261°N 109.708°E	MCNR
34	Sanya Yulingang	Intertidal wetland	18.258°N 109.577°E	
35	Sanya Yalong Bay	Intertidal wetland	18.220°N 109.620°E	MCNR
36	Sanya Linchun River	Intertidal wetland	18.248°N 109.519°E	MCNR
37	Sanya Sanya River	Intertidal wetland	18.243°N 109.512°E	MCNR
38	Sanya Yazhou Bay	Intertidal wetland	18.363°N 109.108°E	
39	Ledong Shandao Reservoir	Reservoir	18.667°N 108.758°E	
40	Ledong Sanqugou Reservoir	Reservoir	18.559°N 108.796°E	
41	Ledong Yinggehai Saltpans	Intertidal wetland	18.524°N 108.767°E	
42	Ledong Yinggehai Saltpans	Intertidal wetland	18.508°N 108.768°E	
43	Ledong Yinggehai Saltpans	Intertidal wetland	18.524°N 108.712°E	
44	Ledong Yinggehai Saltpans	Intertidal wetland	18.534°N 108.744°E	
45	Ledong Yinggehai Saltpans	Intertidal wetland	18.534°N 108.712°E	
46	Ledong Wanglougang	Intertidal wetland	18.452°N 108.856°E	
47	Dongfang Daguangba Reservoir	Reservoir	18.969°N 109.017°E	
48	Dongfang Gaopoling Reservoir	Reservoir	19.077°N 108.733°E	
49	Dongfang Basuo	Freshwater ponds and marsh	19.102°N 108.648°E	
50	Dongfang Basuo	Intertidal wetland	19.090°N 108.623°E	
51	Dongfang Basuo	Intertidal wetland	19.161°N 108.685°E	
52	Dongfang Beili Bay	Intertidal wetland	19.213°N 108.646°E	PNR
53	Dongfang Beili Bay	Intertidal wetland	19.222°N 108.639°E	
54	Dongfang Beili Bay	Intertidal wetland	19.238°N 108.639°E	
55	Dongfang Changhuajiang River Estuary	Intertidal wetland	19.279°N 108.663°E	
56	Changjiang Changhuajiang River Estuary	Intertidal wetland	19.301°N 108.678°E	
57	Changjiang Changhua Town	Intertidal wetland	19.426°N 108.820°E	
58	Changjiang Haiwei Wetland	Freshwater ponds and marsh	19.441°N 108.849°E	NWP
59	Changjiang Dagentang	Freshwater ponds and marsh	19.459°N 108.960°E	WMR**
60	Changjiang Yangtang	Freshwater ponds and marsh	19.457°N 108.975°E	

Number	Site	Wetland type	Coordinates	Legal status*
61	Danzhou Haitou Town	Intertidal wetland	19.496°N 108.941°E	
62	Danzhou Shuiyatang	Freshwater ponds and marsh	19.531°N 108.971°E	
63	Danzhou Songtao Reservoir	Reservoir	19.361°N 109.545°E	
64	Danzhou Paipugang	Intertidal wetland	19.641°N 109.155°E	
65	Danzhou Bay	Intertidal wetland	19.722°N 109.214°E	
66	Danzhou Bay	Intertidal wetland	19.722°N 109.272°E	
67	Danzhou Bay	Intertidal wetland	19.720°N 109.294°E	MCNR**
68	Danzhou Bay	Intertidal wetland	19.748°N 109.285°E	MCNR**
69	Danzhou Bay	Intertidal wetland	19.762°N 109.270°E	MCNR**
70	Danzhou Emangang	Intertidal wetland	19.855°N 109.262°E	
71	Danzhou Yugugang	Intertidal wetland	19.897°N 109.293°E	
72	Danzhou Houshui Bay	Intertidal wetland	19.840°N 109.499°E	
73	Danzhou Houshui Bay	Intertidal wetland	19.868°N 109.548°E	NWP
74	Lingao Houshui Bay	Intertidal wetland	19.878°N 109.559°E	MCNR**
75	Lingao Houshui Bay	Reservoir	19.844°N 109.549°E	
76	Lingao Maniaogang	Intertidal wetland	19.927°N 109.841°E	
77	Chengmai Nanshan Reservoir	Reservoir	19.922°N 109.938°E	
78	Chengmai Yubaogang	Intertidal wetland	19.981°N 109.915°E	
79	Chengmai Yinglanggang	Intertidal wetland	19.920°N 109.988°E	MCNR**
80	Chengmai Dongshuigang	Intertidal wetland	19.976°N 110.093°E	
81	Qiongzhong Guyue Villa	Reservoir	19.181°N 109.948°E	

*NNR: National Nature Reserve; PNR: Provincial Nature Reserve; MCNR: Municipal/County level Nature Reserve; NWP: National Wetland Park; PWP: Provincial Wetland Park; WMR: Wetland Mini-Reserve.
** Gazetted protected area without administration structure, staffing and funding.

Appendix 2. Numbers of waterbird species recorded during annual wintering waterbird surveys in Hainan, China, 2008–2020.

Species	2008	2009	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	Survey sites recorded
Lesser Whistling-duck *Dendrocygna javanica*	600		1,018	680	1,255	1,500	970	417	310	420	1,110	1,005	9,285	7%
Greylag Goose *Anser anser*	11	2		2									15	1%
Common Shelduck *Tadorna tadorna*												1	1	1%
Garganey *Spatula querquedula*		157	43	211	181	210	7	112	100	354	259	326	1,960	7%
Northern Shoveler *Spatula clypeata*				5		70	400	34	8	101	77	35	730	5%
Falcated Duck *Mareca falcata*										2			2	1%
Eurasian Wigeon *Mareca penelope*				2				101		55	33	60	251	5%
Eastern Spot-billed Duck *Anas zonorhyncha*							1			1			2	1%
Northern Pintail *Anas acuta*	1		120	131	13	5	780	71	6	150	23	1,100	2,400	7%
Eurasian Teal *Anas crecca*	1	803	590	532	55	610	270	250	300	583	596	134	4,724	10%
Tufted Duck *Aythya fuligula*		7								2	3	1	13	5%
Slaty-breasted Rail *Gallirallus striatus*	1				1					1			3	5%
White-breasted Waterhen *Amaurornis phoenicurus*	1	7	5	4	2	3	5	3	4	24	14	11	83	19%
Grey-headed Swamphen *Porphyrio poliocephalus*	1		17	16	10	42	19	19	14	6	5	1	150	2%
Common Moorhen *Gallinula chloropus*	18	63	20	39	15	19	9	7	24	27	48	27	316	15%
Eurasian Coot *Fulica atra*	2	26	16		5		12	3		5	7		76	5%
Little Grebe *Tachybaptus ruficollis*	4	14	36	6	2	5	37	11	5	12	85	22	239	25%
Black-winged Stilt *Himantopus himantopus*	6	14	24	22			36	208	24	240	653	451	1,678	12%
Pied Avocet *Recurvirostra avosetta*					2			3		1			6	1%
Pacific Golden Plover *Pluvialis fulva*	85	4	313	232	399	54	22	5	231	349	193	408	2,295	17%
Grey Plover *Pluvialis squatarola*	60	43	65	39	89	54	57	63	98	165	179	251	1,163	15%
Little Ringed Plover *Charadrius dubius*	62	40	349	151	105	54	121	38	73	96	194	548	1,831	27%
Kentish Plover *Charadrius alexandrinus*	520	644	1,179	135	1,030	850	438	1,152	961	582	403	1,653	9,547	32%
Lesser Sand Plover *Charadrius mongolus*	464	28	58	371	341	246	723	906	1,293	1,184	2,823	3,657	12,094	26%
Greater Sand Plover *Charadrius leschenaultii*	80	16	44	48	459	484	131	95	12	68	115	875	2,427	20%
Pheasant-tailed Jacana *Hydrophasianus chirurgus*	17	11	9	8			3	5	11	3	1		68	7%
Eurasian Whimbrel *Numenius phaeopus*		54	4	3	18	2	11	64	79	51	137	66	489	11%
Far Eastern Curlew *Numenius madagascariensis*						2				3			5	2%
Eurasian Curlew *Numenius arquata*	30	34	38	36	36	13	3	137	15	48	144	125	659	9%
Bar-tailed Godwit *Limosa lapponica*	5	3	1	5		8	57	10	16	2	10	17	134	10%
Black-tailed Godwit *Limosa limosa*	10	27	47	35	160	5	12	177	168	61	343	196	1,241	11%
Ruddy Turnstone *Arenaria interpres*	20	18	6	32	39	1	16	1	11	57	44	47	292	10%
Great Knot *Calidris tenuirostris*	40				42	95	39	3	9	40	22	37	327	9%

Species	2008	2009	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	Survey sites recorded
Red Knot *Calidris canutus*	2			80	3						5	14	104	6%
Ruff *Calidris pugnax*	4		15					3		15	1	4	42	7%
Broad-billed Sandpiper *Calidris falcinellus*		1	8	2	1			14		2	102	100	230	5%
Sharp-tailed Sandpiper *Calidris acuminata*												1	1	1%
Curlew Sandpiper *Calidris ferruginea*		43	7				7		6	6	10	203	282	10%
Temminck's Stint *Calidris temminckii*	11	3	255	24	42	742		40	44	78	151	58	1,448	17%
Long-toed Stint *Calidris subminuta*	25	11	331	21	17	25	1	26	24	220	42	163	906	16%
Spoon-billed Sandpiper *Calidris pygmaea*										2			2	1%
Red-necked Stint *Calidris ruficollis*	30	191	118	12	107	45	73	47	8	104	630	593	1,958	19%
Sanderling *Calidris alba*	10		14	2	79		16	9	40		191	80	441	10%
Dunlin *Calidris alpina*	41	514	121		149	42	236	676	514	826	780	699	4,598	17%
Pin-tailed Snipe *Gallinago stenura*			1	30			28	4					63	6%
Common Snipe *Gallinago gallinago*	40	21	51	42	3	4	2	67	33	69	20	55	407	16%
Terek Sandpiper *Xenus cinereus*	4	6	5	2	25	13	6		8	3	19	9	100	10%
Red-necked Phalarope *Phalaropus lobatus*							2					1	3	2%
Common Sandpiper *Actitis hypoleucos*	59	40	37	45	32	12	36	24	22	45	43	41	436	40%
Green Sandpiper *Tringa ochropus*	20	6	2	2	3	2	10		1	4			50	10%
Grey-tailed Tattler *Tringa brevipes*			1								1		2	1%
Common Redshank *Tringa tetanus*	92	122	306	91	37	401	61	37	22	331	544	125	2,169	16%
Marsh Sandpiper *Tringa stagnatilis*	160	221	2,019	101	318	1,151	483	427	736	258	906	530	7,310	26%
Wood Sandpiper *Tringa glareola*	54	61	238	22	53	199	81	99	77	83	151	209	1,327	21%
Spotted Redshank *Tringa erythropus*	115	256	309	40	384	138	13	24	743	101	386	16	2,525	12%
Common Greenshank *Tringa nebularia*	267	1,106	1,283	244	249	211	248	199	134	335	225	462	4,963	33%
Nordmann's Greenshank *Tringa guttifer*							1			1	3	3	8	1%
Oriental Pratincole *Glareola maldivarum*												4	4	1%
Black-headed Gull *Chroicocephalus ridibundus*	80	911	195	10	238	810	133	146	45		30	301	2,899	6%
Black-tailed Gull *Larus crassirostris*	3	2		2	2	22				140	2		173	4%
Lesser Black-backed Gull *Larus fuscus*	4		282	7	4			114					411	9%
Gull-billed Tern *Gelochelidon nilotica*	2												2	1%
Caspian Tern *Hydroprogne caspia*	5	21	25	56	55	15	14	187	110	246	659	302	1,695	7%
Greater Crested Tern *Thalasseus bergii*			2										2	1%
Common Tern *Sterna hirundo*				13									13	1%
Whiskered Tern *Chlidonias hybrida*		625	85	10		15	451		75	2	820	213	2,296	7%
White-winged Tern *Chlidonias leucopterus*											20		20	1%
Great Cormorant *Phalacrocorax carbo*		1			1								2	2%
Eurasian Spoonbill *Platalea leucorodia*		1		1				2	1		2		7	4%
Black-faced Spoonbill *Platalea minor*	91	75	60	44	47	56	54	77	66	79	102	108	859	7%
Yellow Bittern *Ixobrychus sinensis*		1	1		1	4		1		7	3	3	21	7%
Cinnamon Bittern *Ixobrychus cinnamomeus*					2	4	1				2	3	12	4%
Black-crowned Night Heron *Nycticorax nycticorax*		654	1	803	400	423	535	280	1105	760	413	310	5,684	10%
Striated Heron *Butorides striata*					1	2	1		2	8	1	1	16	7%
Chinese Pond Heron *Ardeola bacchus*	240	145	198	250	130	131	143	32	203	184	765	374	2,795	46%
Eastern Cattle Egret *Bubulcus coromandus*	125	191	135	152	10	347	64	97	43	50	214	394	1,822	26%
Grey Heron *Ardea cinerea*	88	188	285	276	434	583	291	172	183	344	570	588	4,002	33%
Purple Heron *Ardea purpurea*			2		2		2	5		2	2	1	16	2%
Great Egret *Ardea alba*	250	585	220	752	610	417	965	525	536	686	1,354	1,819	8,719	38%
Intermediate Egret *Ardea intermedia*	149	150	49	10	26	70	13	7	38	5	25	143	685	20%
Little Egret *Egretta garzetta*	515	1,103	1,463	783	1,173	707	715	896	1,189	1,033	1,926	2,237	13,740	49%
Pacific Reef Heron *Egretta sacra*	2			4									6	1%