International Importance of the Hwaseong Wetlands Flyway Network Site: 2021 Report

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1 Introduction

1.1 *Executive Summary*

1. The Hwaseong Wetlands, comprised of shallow sea, tidal flats, the Hwaseong Reclamation Lake, rice-fields and other freshwater wetlands, together support the livelihoods of many local fishers and farmers, and provide a range of high-value ecosystem services. In addition to food production these services include water storage, pollution reduction, carbon sequestration, recreation and education, and maintaining exceptional biodiversity. Wise Use of the Hwaseong Wetlands is therefore key to meeting the Sustainable Development Goals (SDGs) at a range of scales, including within Hwaseong City, and at the provincial and national level.

2. In 2018, in recognition of their international importance to wetland and waterbird conservation, 7,301 ha of the Hwaseong Wetlands were designated as the Hwaseong Wetlands Flyway Network Site (FNS). In July 2021, 1,408 ha of the FNS were formally designated as the Hwaseong Maehyangri Tidal Flat Wetland Protected Area ("Tidal Flat WPA"); and similar protection is currently being considered for 900 ha of freshwater wetland within the basin of the Hwaseong Reclamation Lake ("Proposed Freshwater WPA").

3. As part of the Hwaseong Wetlands Project led by Hwaseong City and the Hwaseong Eco-Foundation and the East Asian-Australasian Flyway Partnership Secretariat, we conducted 59 dates of survey of waterbirds and other wetland biodiversity in the FNS through a one-year cycle, between late June 2020 and mid-May 2021, with fourteen additional dates of survey in June, July August and November 2021.

4. Our research confirms the Ramsar-defined international importance of the FNS as a whole, and also separately of the Tidal Flat WPA and the Proposed Freshwater WPA.

5. During a one-year cycle, we recorded a minimum of 150,246 individual waterbirds of 113 species in the FNS; >43,000 waterbirds of 61 species in the Tidal Flat WPA; and 103,000 waterbirds of 99 species in the Proposed Freshwater WPA.

6. During a one-year cycle, 17 globally threatened species were recorded in the FNS; eight were recorded in the Tidal Flat WPA; and 14 were recorded in the Proposed Freshwater WPA.

7. During a one-year cycle, we counted concentrations of 1% or more of 25 waterbird populations in the FNS; with 17 in the Tidal Flat WPA and 15 in the Proposed Freshwater WPA.

8. In combination with our research, the five-year geometric mean of count data gathered from a range of research confirms that at least 16 populations of waterbird are regularly supported in internationally important concentrations by the FNS.

9. We also conducted counts of waterbirds at adjacent wetlands on 27 dates. This research confirms the Ramsar-defined international importance of tidal flats along the Gunpyeong, Maehwari and Songgyori coast of Hwaseong City; and of Asan Bay in Pyeongtaek and Dangjin cities.

10. Our research also confirms that the FNS is one of the most important sites in the world for the globally Endangered Far Eastern Curlew, with a high count of 2,755, representing 8.6% of the world population. Similar to many waterbird species, Far Eastern Curlews in the FNS depend on several different wetland types including the tidal flats for feeding; and the Hwaseong Reclamation Lake and other freshwater wetlands for roosting.

11. Our research identifies multiple threats to the biodiversity and ecosystem health of the FNS including disturbance; habitat degradation and loss; and occasionally very high-water levels within the Hwaseong Reclamation Lake which do not permit shorebirds to roost or species to nest successfully. Management responses well-tested elsewhere would benefit both biodiversity and local livelihoods, and help Hwaseong City make progress towards fulfilling the SDGs.

Contents

1.2 *Aims, Definitions and Considerations of the Report*

This report is written primarily for those involved in the Hwaseong Wetlands Project (i.e., Hwaseong City, Hwaseong Eco-Foundation, the East Asian-Australasian Flyway Partnership Secretariat, Hwaseong KFEM, Birds Korea and potential site wardens) and for national government bodies responsible for the conservation of wetlands and biodiversity in the Hwaseong Wetlands Flyway Network Site (FNS), including consideration of listing of the Hwaseong Wetlands as a World Heritage property. It also provides information on adjacent wetlands, including the internationally important Maehwari Tidal Flats in Hwaseong City and the internationally important Asan Bay in Pyeongtaek and Dangjin cities (Moores & Park 2021).

This report builds on the extensive background information on the FNS contained in Moores *et al*. (2021). It provides analysis of and commentary on Hwaseong Wetlands Project count data gathered between June 2020 and May 2021, a one-year cycle in the life of a waterbird, and from additional surveys in June-November 2021. For essential background information on e.g., the history of the FNS; on stakeholders and their opinions on wise use; and an introduction to basic ecological concepts and Ramsar Convention criteria relevant to the FNS, please refer to that earlier report.

Throughout this report, the term "management" is used to describe any action that could be taken to reduce threats to priority species and to the ecological character of wetlands in the FNS. As already highlighted by Moores *et al*. (2021) and Ku *et al*. (2021), all commentary on possible management approaches is based fully in the understanding that successful management requires a combination of good research and analysis; discussion between stakeholders; and in areas where people work and live, the consensus and support of local communities,

The structure and contents of this report are strongly influenced by progress achieved since the start of the Hwaseong Wetlands Project in June 2020 including: (1) designation of the Hwaseong Maehyangri Tidal Flat as a Wetland Protected Area in July 2021; (2) development in 2021 of a Ramsar Information Sheet (RIS) for the same area, as part of proposed designation as a Ramsar Site (Birds Korea 2021); (3) discussion led by Hwaseong City on future conservation measures for an additional component part of the FNS within the basin of the Hwaseong Reclamation Lake (see Figure 7 in Moores *et al*. 2021); (4) the growth of a Far Eastern Curlew network, including a coordinated survey in July 2021 (covered in detail in Moores & Park 2021, so not included here); and (5) the development of training workshops for potential site wardens (in August and November 2021).

Throughout this report, "internationally important", "wetlands" and "waterbirds" are therefore defined strictly in accordance with definitions provided by the Ramsar Convention. There is frequent reference to Ramsar Criteria 2, 5 and 6 (Ramsar 2021). As intended by the Ramsar Convention, the 1% of a population threshold in Criterion 6 is used explicitly to help identify conservation priorities, and to suggest management options.

In accordance with the Ramsar Convention too, this report also follows the taxonomy and global conservation status of waterbirds as assessed by BirdLife International (2021) and of additional wetland species as assessed by the IUCN (2021). The report also uses the waterbird population estimates provided by Wetlands International (2021) as the baseline for identifying internationally important concentrations of 1% or more of a population. For further explanation of waterbird populations and their relevance to Ramsar criteria please see the introduction to Wetlands International (2021) and also Section 3.2 of Moores *et al*. (2021). Because many of these population estimates are out-of-date, additional relevant commentary is added where needed (e.g., in Table 5).

Please note that for ease of analysis and to support management planning, bird species discussed in this report are presented in four main groups (Table 1) because of major ecological differences between them:

1) Anatidae (ducks, geese and swans);
2) Shorebirds (comprised of Recurvirostridae, Glareolidae, Haematopidae, Scolopacidae, Charadriidae and Rostratulidae);
3) "Other Waterbirds" (comprised of Podicipedidae, Phalacrocoracidae, Ardeidae, Ciconiidae, Gruidae, Rallidae and Laridae);
4) Landbirds.

Table 1. Selected bird species referred to in the text of this report and their conservation status.

			Global Conservation Status (BirdLife 2021)	Nationally Endangered (MOE)	"Protected" MOMAF	National Natural Monument (CHA)
Anatidae	Swan Goose	*Anser cygnoides*	VU	Class II		325-1
	Taiga Bean Goose	*Anser fabalis middenforffi*	LC			
	Tundra Bean Goose	*Anser fabalis serrirostris*	LC			
	Greater White-fronted Goose	*Anser albifrons*	LC			
	Lesser White-fronted Goose	*Anser erythropus*	VU	Class II		
	Common Shelduck	*Tadorna tadorna*	LC			
	Ruddy Shelduck	*Tadorna ferruginea*	LC			
	Mallard	*Anas platyrhynchos*	LC			
	Common Pochard	*Aythya ferina*	VU			
	Greater Scaup	*Aythya marila*	LC			
Shorebirds	Far Eastern Oystercatcher	*Haematopus ostralegus*	NT	Class II	✓	326
	Grey Plover	*Pluvialis squatarola*	LC			
	Kentish Plover	*Charadrius alexandrinus*	LC			
	Lesser Sand Plover	*Charadrius mongolus*	LC			
	Greater Painted-snipe	*Rostratula benghalensis*	LC			449
	Far Eastern Curlew	*Numenius madagascariensis*	EN	Class II	✓	
	Eurasian Curlew	*Numenius arquata*	NT			
	Bar-tailed Godwit	*Limosa lapponica*	NT			
	Black-tailed Godwit	*Limosa limosa*	NT			
	Great Knot	*Calidris tenuirostris*	EN	Class II		
	Red-necked Stint	*Calidris ruficollis*	NT			
	Dunlin	*Calidris alpina*	LC			
	Terek Sandpiper	*Xenus cinereus*	LC			
	Common Redshank	*Tringa totanus*	LC			
	Common Greenshank	*Tringa nebularia*	LC			
	Nordmann's Greenshank	*Tringa guttifer*	EN	Class I	✓	
"Other"	Great Crested Grebe	*Podiceps cristatus*	LC			
	Saunders's Gull	*Chroicocephalus saundersi*	VU	Class II		
	Little Tern	*Sternula albifrons*	LC			
	Oriental Stork	*Ciconia boyciana*	EN	Class I		199
	Great Cormorant	*Phalacrocorax carbo*	LC			
	Black-faced Spoonbill	*Platalea minor*	EN	Class I	✓	205-1
	Chinese Egret	*Egretta eulophotes*	VU	Class I	✓	
Landbird	Ochre-rumped Bunting	*Emberiza yessoensis*	NT	Class II		

For a full list of waterbird populations recorded during the Project surveys, see Appendix One.

2 Project Surveys (June 2020-May 2021)

2.1 *Area and Dates*

The main Project Surveys were comprised of 60 full or part-days of survey conducted by NM and additional survey participants during a one-year cycle between June 23rd 2020 and May 27th 2021 (Table 2) in the FNS and at adjacent wetlands. Fifty-nine of those dates included survey of waterbirds within the FNS.

Dates of survey were divided into 19 periods of between two and five days each ("survey periods"). Because the surveys were focused on shorebirds and threatened waterbird species, most of which forage in the FNS on tidal flats, survey periods were timed to coincide with spring high tide series. During both the main southward migration period (from July to mid-November) and the main northward migration period (from early March to late May), survey periods were therefore spaced approximately two weeks apart, with the exception of late April which was missed due to logistical issues. In addition, surveys were conducted in June 2020, focused on breeding birds, and during the winter (December to February).

Table 2. Dates of the Main Project Surveys, with maximum tide heights in each of the 19 survey periods.

Month	Dates of Survey	Maximum Tide Height during survey periods	Additional Survey Participants
June	23rd-28th,	8.99m	Jung Hanchul, Park Hea-Jeong, Amael Borzee
July	7th-10th; 21st and 24th	8.95m & 8.47m	Jung Hanchul, Park Hea-Jeong, Ha Jungmoon
August	4th-7th; 24th-26th	8.86m & 8.63m	Jung Hanchul, Park Hea-Jeong
September	8th-10th; 17th-20th & 24th	8.07m & 9.67m	Park Hea-Jeong
October	13th-15th & 18th; 28th-30th	9.89m & 8.16m	Park Hea-Jeong
November	17th-18th	9.56m	Jung Hanchul, Park Hea-Jeong
December	2nd & 16th-17th	8.6m & 8.96m	Hanns Seidel Foundation, Amael Borzee, EAAFP Secretariat, Jung Hanchul
January	12th-14th	8.8m	Jung Hanchul
February	3rd-5th	7.83	Jung Hanchul
March	10th-12th; 30th-31st	8.11m & 9.42m	Jung Hanchul
April	15th-16th	8.46m	Jung Hanchul
May	10th-14th; 26th-27th	8.76m & 9.57m	Jung Hanchul

Three additional survey periods were also conducted in 2021 by NM and Jung Hanchul from June 23rd-25th, July 21st-25th, and August 14th-15th and 2021 in the FNS and at tidal flats to the north and south of the FNS, and further waterbird counts were made in the FNS by NM, Lee Jiwone and Jung Hanchul between November 16th and 20th (in combination, "Supplementary Surveys"; and see Section 5). Fieldwork was also conducted by NM together with potential site wardens as part of a training workshop from August 9th-13th.

During each survey period, a circuit was completed through all the wetland habitats of the FNS, with the greatest survey effort invested in areas likely to support large numbers and / or diversity of waterbirds. In order to help map waterbird distribution in the FNS, all counts were organized into nine main habitats, further divided into 39 individually-numbered "sub-units" within the FNS, e.g., 1--1, 4--1 etc. (Figure 1).

Figure 1. The Project Surveys sub-units (modified since Moores *et al*. 2021). The provisional outer boundary of the FNS, revised in early 2021, is outlined in white. The first of the two numbers in each of the 39 sub-units within the FNS, and in three of the subunits outside of the FNS, identifies the main habitat type. Sub-units starting with "1" = open tidal flat outside of the sea-dyke; "2" = "wet" habitats within the Hwaseong Reclamation Lake; "3" = areas above the high-water mark adjacent to the Hwaseong Reclamation Lake; "4" = shallow freshwater wetlands, with reeds and open water; "5" = small reservoirs and water treatment ponds; "6" = active rice-fields; "7" = inactive fields and dry grassland; "8" = parkland type habitat; and "9" =inshore marine waters. Image courtesy of Google Earth.

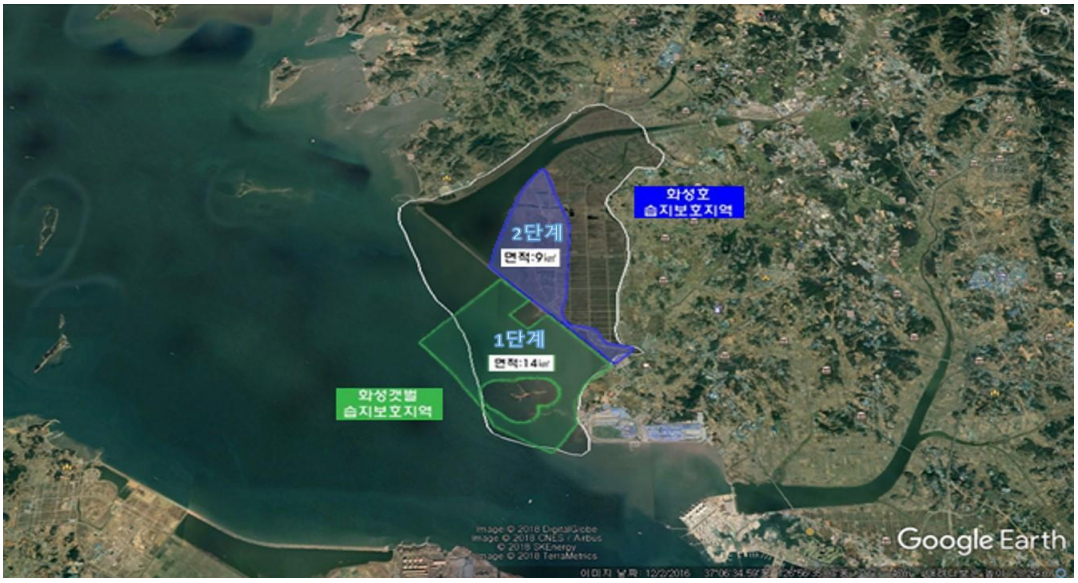


Figure 2. The Hwaseong Wetlands Flyway Network Site (FNS), with boundary as of 2021 (outlined in white) and the two proposed Wetland Protected Areas (reproduced from Moores *et al*. 2021). The Tidal Flat WPA, designated in July 2021, covers most of the tidal flats and some of the inshore marine waters of the FNS (shaded green); the "Proposed Freshwater WPA", would cover part of the Hwaseong Reclamation Lake basin (shaded blue). Image courtesy of Google Earth.

Importantly for planning and management, the use of sub-units means that the Project Survey data can be organized to assess component parts of the FNS independently, including:

1) “The Hwaseong Maehyangri Tidal Flat Wetland Protected Area which was formally designated in July 2021 (from hereon, the “Tidal Flat WPA”);

2) The Proposed Hwaseong Reclamation Lake Wetland Protected Area” (from hereon, the “Proposed Freshwater WPA”).

Both areas are described in detail in Section 4.

2.2 *Methods*

One major aim of the Project Surveys was to identify which populations of waterbird in the FNS meet the 1% of a population threshold, both as part of preparation for designating part or parts of the Hwaseong Wetlands as a Ramsar site and also for identifying management priorities. Another major aim was to assess the total number of waterbirds supported by the FNS (and its component parts) during the course of a year, which is directly relevant to the application of Ramsar Criterion 5. A third aim was to improve understanding of how waterbirds use different parts of the FNS. A fourth aim was, as time and capacity allowed, to improve understanding of the distribution and abundance of amphibians and mammals within the FNS.

The Hwaseong Wetlands are large (*c*. 7,300ha: Moores *et al*. 2021), with several component parts and a high diversity of waterbird species. In addition, on almost all dates our surveys were conducted by only two people. Because waterbirds move within these wetlands each day, both predictably (e.g., in response to tides and to the time of day) and also unpredictably (e.g., in response to disturbance), surveys can easily over-estimate the numbers of birds present on any given day, by double-counting the same individuals; or can as easily undercount them, through mis-timing counts (see Section 3.3, Moores *et al*. 2021).

The Project Surveys were designed to try to maximize counts of waterbirds, while striving to reduce the likelihood of double-counting. On each date of survey, all observations were organized by time and sub-unit, with notes taken on the direction of movement of flying birds. At the end of each day, highest counts were then selected with “obvious” double-counted birds omitted. At the end of each 2- to 5-day survey period, only the highest single day-count of each waterbird was then selected for analysis.

Count method varied for each of the three main groups of waterbirds.

To generate robust counts of tidal flat obligate shorebirds, survey periods included more dates of survey during the main shorebird migration periods than e.g., during the winter. In addition, survey dates were selected to include spring high tides and to avoid neap tides. Tidal flat obligate shorebirds were primarily counted within two hours of high tide when birds were concentrated at roost; with counts on some dates also made of birds flying to and from roost. During all of the survey periods, counts of roosting shorebirds were made multiple times, both on the same date and on subsequent dates.

Two main approaches were used for counting Anatidae. Ducks were counted on a single date throughout the day within each survey period along a circuit around the FNS, either as they fed or roosted. Geese were counted primarily at dawn from one or more fixed points, as flocks departed their roost, with additional counts made at other times of the day in order to determine the ratio of each species and population. Where possible, counts of geese were repeated on consecutive dates to improve accuracy.

With the exception of tidal flat obligate species like Black-faced Spoonbill which were actively searched for, most "Other Waterbirds" were counted somewhat opportunistically, during counts of shorebirds and Anatidae. Survey was therefore comprised of a combination of fixed-point counts of birds out on tidal flats and in open wetlands and also of birds seen along transects, either driven or walked through, in areas of reedbed and rice-fields, when some additional shorebirds and Anatidae were also found.

The Project Surveys data are therefore likely to be most robust for tidal flat obligate shorebirds; and least robust for "Other Waterbirds" (with substantial undercounting of some species possible).

Landbirds, with the exception of Ochre-rumped Bunting in the breeding season, were counted opportunistically. Most species and most individual landbirds were either seen from a moving car or were recorded on the basis of their vocalisations.

Most survey of amphibians and mammals was also opportunistic. However, on June 26th 2020 survey of amphibians was led by Professor Amael Borzee in rice-fields and some other wetland areas for five hours after sunset; and on June 23rd 2021, this survey was repeated from dusk by NM and Jung Hanchul until dawn of the 24th, with estimates of the numbers of calling amphibians made in several of the sub-units.

3 Results: Flyway Network Site (FNS)

A total of 218 species of bird were recorded during the one-year cycle of the Project Surveys in the FNS: 113 species were waterbirds and 105 species were landbirds. These surveys also recorded five species of amphibian (with one additional species recorded by different projects); and four species of mammal (with one additional species, River Otter *Lutra lutra*, recorded by a different project). Four additional waterbird species (고니 *Cygnus columbianus,*원앙 *Aix galericulata* 재두루미 *Antigone vipio* and 큰부리도요 *Limnodromus semipalmatus*) were recorded during the "Supplementary Surveys" in June-November 2021.

3.1 *Waterbirds*

3.1.1 *Diversity*

A minimum of 119 populations of 113 species of waterbird were identified in the Hwaseong FNS during the one-year cycle between late June 2020 and late May 2021. This total is comprised of 46 species and 48-53 populations of shorebird (several shorebird populations are extremely difficult to identify in field conditions); 29 species and 30 or more populations of Anatidae; and 38 species and 40 populations of "Other Waterbirds" (Appendix One).

By month, diversity of waterbird species was highest in October (72 species) and May (74 species) and was lowest in January (33 species) (Figure 3), when much of the freshwater in the wetland was frozen.

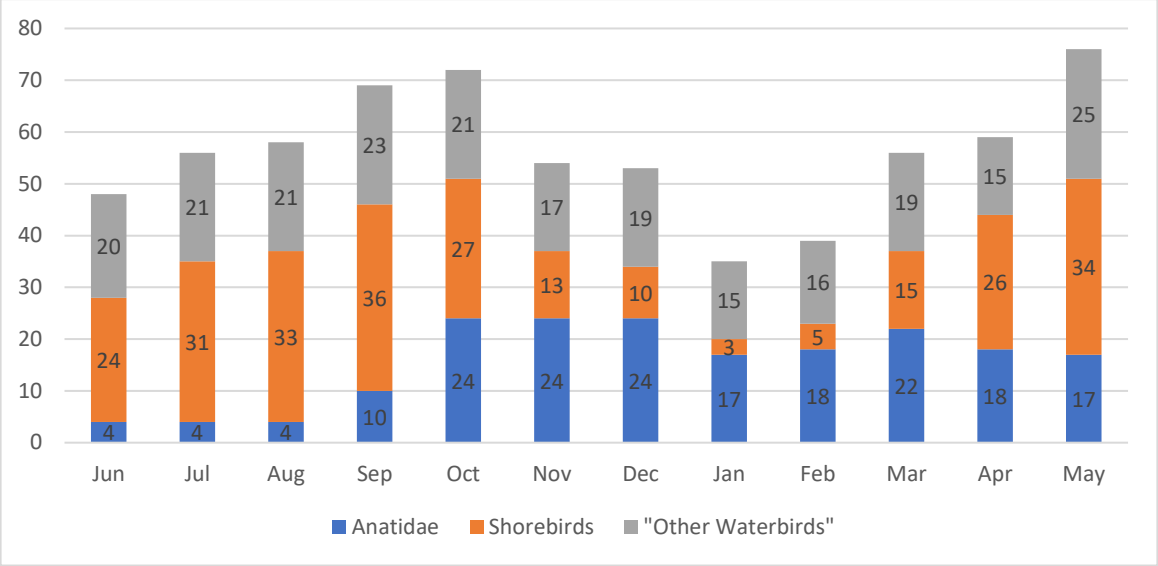


Figure 3. Number of waterbird species recorded during the Project Surveys by month and main category.

3.1.2 *Migratory Status*

Our count data confirms that all of the 113 waterbird species recorded during the Project Surveys were either "largely migratory" (12 species, recorded in every month) or were "completely migratory" in the FNS (101 species, absent in at least one month of the year). None of the 12 "largely migratory" waterbird species had minimum monthly counts which reached even 10% of their maximum monthly count (Table 3).

Table 3. The highest and lowest monthly counts of "largely migratory" waterbird species in the FNS between June 2020 and May 2021.

	Highest Monthly Count	Lowest Monthly Count	Lowest Count expressed as % of Highest Count
Eastern Spot-billed Duck	1,995	99	5%
Mallard	15,000	3	<1%
Eurasian Coot	396	3	<1%
Little Grebe	34	2	6%
Great Crested Grebe	2,466	4	<1%
Grey Plover	2,795	115	4%
Eurasian Curlew	3,700	90	2%
Dunlin	14,850	400	<3%
Black-tailed Gull	4,500	91	2%
Great Cormorant	1,550	1	<1%
Grey Heron	151	4	<3%
Great Egret	234	6	<3%

The high number of migratory species and individuals supported by the FNS suggests that actual numbers of waterbirds will likely have been rather higher than the sum of highest counts of each species (because of their asynchronous migration strategies). It also means that conservation actions to maintain their populations are needed at both the local level and along the Flyway. Published research suggests that many individuals of even those waterbird species which can be found throughout the year in the FNS and in the ROK typically also

undergo long-range migration, including e.g., Mallard to PR China and Russia; Black-tailed Gull to DPR Korea, PR China and Japan; and Great Egret to the Philippines (Shin *et al*. 2016; Park 2020; Lee 2020).

3.2 *Threatened Species and Ecological Communities: Ramsar Criterion 2*

Ramsar Criterion 2 states that, "A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities."

The Project Surveys were focused on waterbirds, and not on other species' groups. Nevertheless, they confirm that all nine of the major habitat types of the FNS shown in Figure 1 supported at least one globally threatened species, with a substantial number of these species typical of either freshwater floodplain wetland or intertidal wetland (see Section 3.5 in Moores *et al*. 2021). In total, two species of globally threatened amphibians; 14 species of globally threatened birds (13 of which are species of wetlands); and two species of globally threatened mammals were recorded in the FNS during a one-year cycle, between June 2020 and May 2021 (Table 5). For more information on amphibians and mammals, please see Section 2.4 in Moores *et al*. (2021). In addition, the FNS contains an extensive area of Yellow Sea tidal flat, currently assessed as an endangered habitat type by the IUCN (2021).

Table 4. Globally threatened marine and wetland species (as assessed by IUCN 2021) observed during the Project Surveys in the FNS as a whole, in the Tidal Flat WPA, and in the Proposed Freshwater WPA, with their national conservation designations (NBC 2018).

		BirdLife / IUCN (2021)	Ministry of Environment Endangered Species	National Natural Monument (Cultural Heritage Administration)	Ministry of Oceans and Fisheries "Protected Species"	FNS	Tidal Flat WPA	Proposed Freshwater WPA
Marine Waters	*Neophocaena asiaeorientalis*	EN			✓	✓	✓	
Yellow Sea Intertidal Wetlands	*Numenius madagascariensis*	EN	EN II		✓	✓	✓	✓
	Calidris tenuirostris	EN	EN II			✓	✓	✓
	Tringa guttifer	EN	EN I		✓	✓	✓	✓
	Chroicocephalus saundersi	VU	EN II			✓	✓	✓
	Platalea minor	EN	EN I	#205-1	✓	✓	✓	✓
	Egretta eulophotes	VU	EN I	#361	✓	✓	✓	✓
Floodplain-type Freshwater Wetland	*Pelophylax chosenicus*	VU	EN II			✓		✓
	*Dryophytes suweonensis**	EN	EN I			✓		✓
	Anser cygnoides	VU	EN II	#325-1		✓		✓
	Anser erythropus	VU	EN II			✓	✓	✓
	Aythya ferina	VU				✓		✓
	Mergus squamatus	VU	EN I			✓		
	Grus monacha	VU	EN II	#228		✓		
	Ciconia boyciana	EN	EN I	#199		✓		✓
	Haliaeetus pelagicus	VU	EN I	#243-3		✓		✓
	Hydropotes inermis	VU				✓		✓

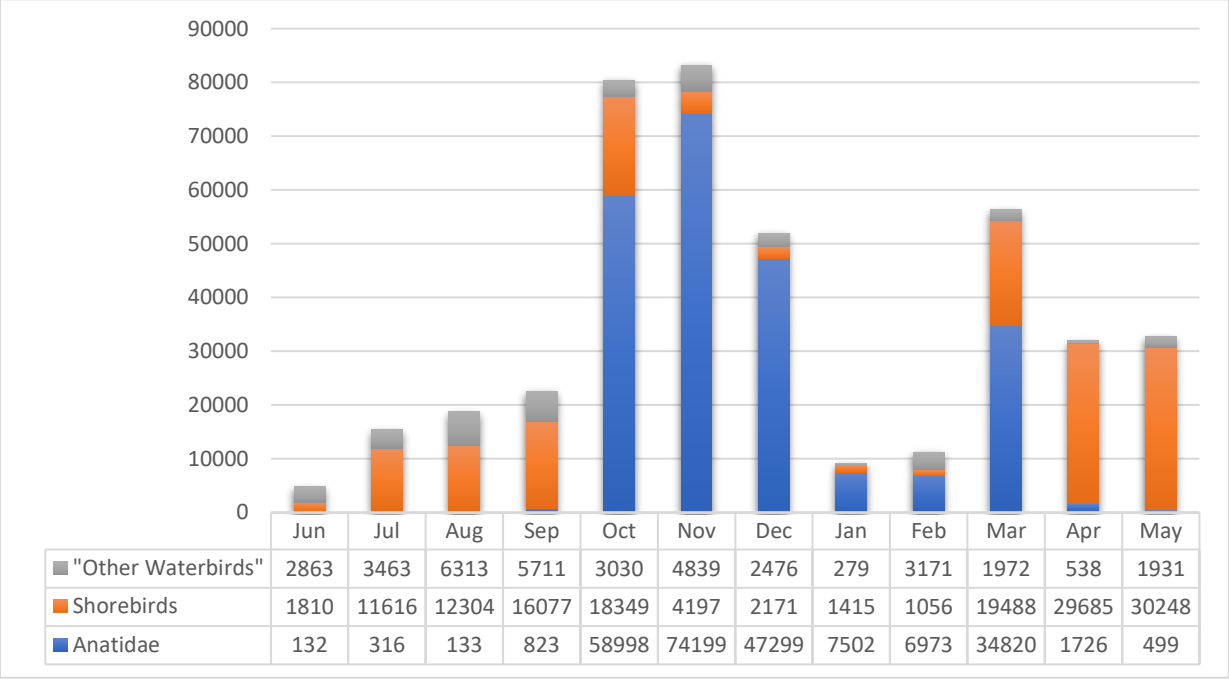
*Recorded during surveys by Hwaseong KFEM in late June 2021.

3. 3 *Waterbird Abundance: Ramsar Criterion 5*

Ramsar Criterion 5 states that "A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds".

3.3.1 *Project Surveys*

Based on the sum of highest day counts only, one count per species, we recorded a minimum of 150,246 individual waterbirds during the one-year cycle of the Project Surveys. This total is comprised of 95,566 Anatidae, 43,129 shorebirds and 11,551 "Other Waterbirds". More than 20,000 waterbirds were recorded in seven different months (Figure 4), with the highest number of individuals counted in October and November and again in March, the peak periods of southward and northward migration of Anatidae.

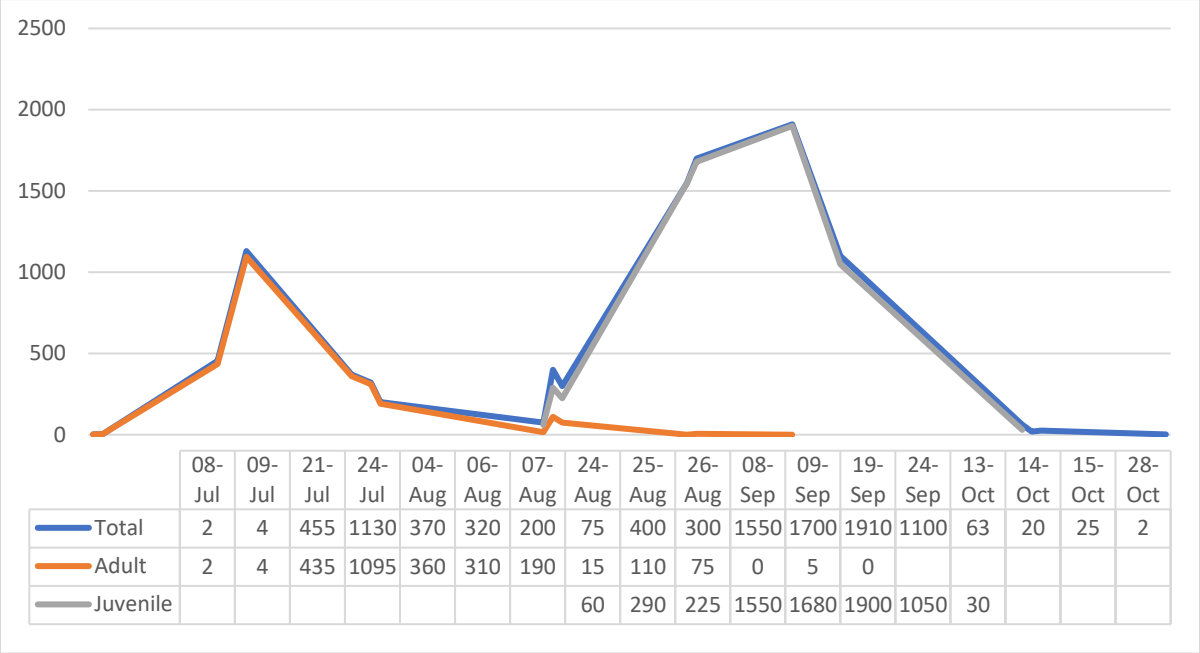


	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
"Other Waterbirds"	2863	3463	6313	5711	3030	4839	2476	279	3171	1972	538	1931
Shorebirds	1810	11616	12304	16077	18349	4197	2171	1415	1056	19488	29685	30248
Anatidae	132	316	133	823	58998	74199	47299	7502	6973	34820	1726	499

Figure 4. Number of individual waterbirds recorded by month during the Project Surveys, subdivided into three main groups of Anatidae, Shorebirds and "other Waterbirds".

We are confident that substantially more than 150,000 individual waterbirds were present in the FNS between June 2020 and May 2021. This is because our surveys only covered 59 dates (i.e., they "missed" many dates even during the main migration periods), and because our total is based on the summing of the single highest day count of each species, without factoring in turnover.

Most migratory waterbird species have asynchronous migration strategies. In some of these species, turnover during southward migration can be detected because of the obviously different plumages of adults and of juveniles. For example, although our highest count of the globally Near Threatened Red-necked Stint was 1,910 (comprised almost entirely of juveniles in September), we also recorded a peak of 1,310 adults (in July). We can therefore be confident that more than 3,000 Red-necked Stint were present in the FNS during the southward migration period in 2020 (Figures 5 and 6).



	08-Jul	09-Jul	21-Jul	24-Jul	04-Aug	06-Aug	07-Aug	24-Aug	25-Aug	26-Aug	08-Sep	09-Sep	19-Sep	24-Sep	13-Oct	14-Oct	15-Oct	28-Oct
Total	2	4	455	1130	370	320	200	75	400	300	1550	1700	1910	1100	63	20	25	2
Adult	2	4	435	1095	360	310	190	15	110	75	0	5	0					
Juvenile								60	290	225	1550	1680	1900	1050	30			

Figure 5. Changes in the number of adult-plumaged and juvenile Red-necked Stints in the Hwaseong Wetlands FNS revealed by 18 dates of counts made during the southward migration period, July-October, 2020.

Figure 6. Different plumages of Red-necked Stint. On left, adults in July in 2--1; on right, juveniles in September in 1--1.

In addition, we also recorded a peak of 450 Red-necked Stint during northward migration in 2021. Because we did not see any Red-necked Stints with individually-marked flags or bands, we cannot know whether these 450 individuals were already included in the 3,000 recorded during southward migration or whether they were additional birds. At least some Red-necked Stints are considered to take a different route during northward and southward migration (e.g., Livsovski *et a*l. 2020).

If individuals recorded during southward and northward migration are treated as being separate, then we recorded *c*. 3,500 or more Red-necked Stint in total during the Project Surveys. This is almost two times higher than our highest count, and reaches the 1% threshold of 3,200 for the species (Wetlands International 2021).

3.3.2. Five-year Geometric Mean: Criterion 5

According to guidance provided by the Ramsar Convention, "regularly" is defined as the geometric mean of five-years of count data, if data are available (Prof. Nick Davidson *in lit*. 2020). Moores *et al.* (2021) provide a detailed explanation of the count data used to establish this five-year geometric mean for waterbirds in the FNS, and explain the rationale for selecting data largely from NIBR and Hwaseong KFEM for years 2015-2018; and data from NIBR, Hwaseong KFEM and the Project Surveys for 2020. As Project Survey count data for 2021 are available only up to June, they cannot be used in full for such an analysis.

These count data confirm that in each of the five years, substantially more than 20,000 waterbirds were recorded in the Hwaseong Wetlands (Figure 7).

Moreover, the five-year geometric mean of waterbirds counted each year within the Hwaseong Wetlands in 2015-2018 and in 2020 was 98,607 individuals – almost five times the threshold of 20,000 called for in Criterion 5.

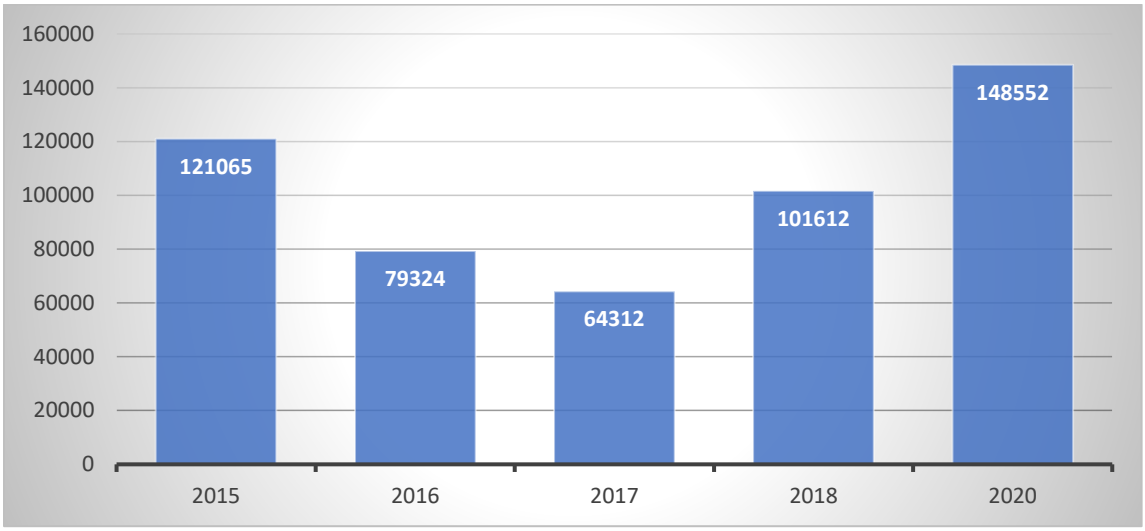


Figure 7. Sum of the highest count of individual waterbirds of each waterbird species by year, in the FNS.

3.4 *Waterbird Populations that meet the 1% Threshold*

Ramsar Convention Criterion 6 states that, "A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird" (Ramsar 2021). As with Criterion 5, "regularly" is defined as the geometric mean of five-years of count data, if data are available. In addition, the Ramsar Strategic Plan (2018) provides guidance on selecting which 1% threshold to use for species with two or more populations: "Where such mixed populations occur, and these are inseparable in the field, it is suggested that the larger 1% threshold be used in the evaluation of sites."

3.4.1 *Project Surveys (2020-2021)*

Based on highest day counts recorded during the one-year cycle of the Project Surveys, at least 25 waterbird populations matched or exceeded the 1% threshold used in the identification of internationally important wetlands (Table 5). It was not possible to identify or count several shorebird species to subspecies level, so in these species (i.e., Lesser Sand Plover, Bar-tailed Godwit and Dunlin), the population with the highest 1% threshold was selected.

Table 5. Highest counts of twenty-five waterbird populations in the FNS recorded during the Project Surveys that reach the internationally important 1% threshold (Wetlands International 2021), with expert-proposed revisions.

	Population(s) in the FNS	1% Threshold	Proposed revisions to 1% threshold	Project Surveys
"Taiga" Bean Goose	*middendorffi*, Yakutia / E Asia	100	77= 1% Li *et al*. (2020)	**484**
"Tundra" Bean Goose	*serrirostris*: Central and Eastern Siberia	1,100	806= 1% Li *et al*. (2020)	**40,500**
Greater White-fronted Goose	*frontalis*: Korea	840	3,275 = 1% Deng *et al.* (2020)	**16,000**
Common Shelduck	E Asia (non-bre)	600		**1,031**
Ruddy Shelduck	E Asia (non-bre)	710*		**990**
Mallard	*platyryhnchos*, E Asia (non-bre)	15,000*		**15,000**
Common Pochard	E Asia (non-bre)	3,000*		**3,510**
Greater Scaup	*nearctica*, E Asia	2,400*		**3,927**
Great Crested Grebe	*cristatus*, E Asia (non-bre)	250		**2,466**
Far Eastern Oystercatcher	*osculans*	70	110 = Conklin *et al.* (2014)	**623**
Grey Plover	*squatarola*, E, SE Asia & Australia (non-bre)	1,000		**2,795**
Kentish Plover	-	1,000*		**1,013**
Lesser Sand Plover	*mongolus*	260	255=1 % (Conklin *et al*. 2014)	**870**
Lesser Sand Plover	*stegmanni (?)*	130		
Far Eastern Curlew	C & E Asia (bre)	320		**2,275**
Eurasian Curlew	*orientalis*, E and SE Asia (non-bre)	1,000		**3,700**
Bar-tailed Godwit	*menzbieri & (anadyrensis)*	1,500	Decline of 3-5% / year (Conklin *et al.* 2014)	**2,580**
Bar-tailed Godwit	*baueri*	1,300	Decline of 3-5% / year (Conklin *et al.* 2014)	
Great Knot	SE Asia, Australia (non-bre)	2,900		**8,500**
Dunlin	*arcticola*	4,900		**14,850**
Dunlin	*sakhalina*	10,000*		
Dunlin	*kistchinskii (?)*	10,000*		
Terek Sandpiper	E, SE Asia & Australia (non-bre)	500		**1,710**
Common Greenshank	E, SE Asia & Australia (non-bre)	1,000		**1,035**
Nordmann's Greenshank	NE Asia (bre)	5	12=1% Maleko *et al*. (2021)	**20**
Saunders's Gull	NE Asia (bre)	85		**138**
Great Cormorant	*sinensis*, E, SE Asia (non-bre)	1,000		**1,550**
Black-faced Spoonbill	*minor*	20	c.50= 1% (EAAFP 2021)	**254**
Chinese Egret	E, SE Asia	35		**70**

Note: 1% Threshold, *in Waterbird Population Estimates 5 (Wetlands International 2020)

3.4.2 *Five-year Geometric Mean*

Survey effort in previous years was insufficient to identify all species which occur in internationally important concentrations of 1% of a population every year in the FNS. Based on count data and analysis in Moores *et al*. (2021), 16 populations met that threshold in years 2015-2018 and in 2020 (Table 6), with an additional 5-7 populations likely to have met that threshold, based on the results of the more comprehensive Project Surveys.

Table 6. Waterbird species regularly supported by the Hwaseong Wetlands in concentrations of 1% or more of a population based on the five-year geometric mean of counts made in 2015-2018 and in 2020.

	1%	2015	2016	2017	2018	2020	5yr Geo. mean	%
Bean Goose	1,100	11,794	10,848	10,180	3,549	40,500	11,336	10%
Greater White-fronted Goose	840	848	764	1,277	216	16,000	1,233	1.5%
Common Shelduck	600*	1,261	2,500	781	735	1,375	1,200	2%
Ruddy Shelduck	710	900	416	1,042	1,000	990	827	>1%
Mallard	15,000	75,952	26,531	5938	18,750	11,897	19,287	>1%
Far Eastern Oystercatcher	70-110	430	468	459	643	623	517	~5%
Grey Plover	1,000	1,021	1,800	680	1,065	1,450	1,140	1%
Mongolian Plover	390	800	430	500	420	870	575	>1%
Far Eastern Curlew	320	500	1,063	470	1,150	2,275	918	~3%
Eurasian Curlew	1,000	3,300	4,220	3,106	2,680	3,700	3,374	>3%
Bar-tailed Godwit	1,500	1029	930	3,583	2,500	1,760	1,721	>1%
Great Knot	2,900	3,001	8,000	6,023	34,900	9,625	8,655	~3%
Dunlin	10,000*	5,665	4,500	14,001	18,000	25,401	11,029	1%
Terek Sandpiper	500	140	750	550	970	1,710	625	>1%
Saunders's Gull	85	91	193	398	203	138	182	2%
Black-faced Spoonbill	20-48	124	146	214	160	254	173	>4%
Chinese Egret	35	132	83	45	97	70	80	>2%

*Based on estimates provided in the Wetlands International portal (July 2021).

Seven additional populations of waterbird likely meet the 1% threshold regularly: two ("Taiga Bean Goose" and Nordmann's Greenshank) were likely undercounted during previous research because they are difficult to identify; and five (Table 7) were likely undercounted because surveys apparently did not cover all of the FNS:

1) The "Middendorffi, Yakutia / E. Asia" population of Bean Goose ("Taiga Bean Goose") is listed as a species, by Gill *et al*. (2021), but not by BirdLife International (2021); and is not listed separately by the NIBR in their research at the Hwaseong Wetlands. The Project Surveys recorded 5-7% of this population.
2) The Nordmann's Greenshank was recorded regularly in internationally important concentrations in the Hwaseong Wetlands until at least 2008 (e.g., Yi 2004, Moores 2012, Moores *et al*. 2016). During the Project Surveys, five were seen in one scan in September 2020 and 20 (4% of the current 1% threshold) were seen in one scan in May 2021.
3) Common Pochard, Greater Scaup, Great Crested Grebe, and Great Cormorant depend on the open waters of the Hwaseong Reclamation Lake (2--7) for feeding and roosting, often at long range from shore;

4) The geometric mean of Common Greenshank almost reached the 1% threshold. Because this species uses several wetland types including rice-fields, it seems likely that at least some individuals will have been overlooked during some surveys.

Table 7. Additional waterbird species that probably occur regularly in concentrations of 1% or more of a population in the Hwaseong FNS.

	1%	2015	2016	2017	2018	2020	5yr Geo. mean
Common Pochard	3,000	1,665	3,555	1,420	940	3,510	2,149
Greater Scaup	2,400	287	96	234	87	3,927	294
Great Crested Grebe	350	194	160	200	184	2,466	308
Common Greenshank	1,000	825	880	1,505	830	1,035	987
Great Cormorant	1,000	500	271	1,600	581	1,550	721

3.5 *Main Habitats of Internationally Important Concentrations of Waterbirds in the FNS*

During the Project Surveys internationally important concentrations of one or more of 25 waterbird populations were found in one or more each of the five main wetland types in the FNS (Table 8).

Mallard were dispersed in flocks of several thousand throughout the FNS. In contrast, 14 of the 25 waterbird populations were recorded in internationally important concentrations (marked with a "✓" in Table 8) only on tidal flats and along the edge of the Hwaseong Reclamation Lake. Ten of these are shorebird species, which primarily fed on tidal flats and roosted along the shores of the Hwaseong Reclamation Lake at high tide.

This dependence by the majority of internationally important concentrations of shorebirds on this combination of a small number of sub-units in two habitats (one used for foraging; the other for roosting) has obvious management implications for maintaining the ecological character both of the Tidal Flat WCA and of the Hwaseong Wetlands FNS as a whole. For example, even a small rise in the water level of the Hwaseong Reclamation Lake can cover all open areas with water. This prevents shorebirds from being able to roost; and can also flood the nests of Little Tern, a ground-nesting, nationally Vulnerable species.

Figure 8. Differences in water levels in the Hwaseong Reclamation Lake. Left, 2--1 in July 2020, with no area available for roosting shorebirds. Right, 2--1 in December 2020.

Table 8. Distribution of internationally important populations and concentrations of waterbird in the Hwaseong Wetlands FNS during the Project Surveys. ("✓") indicates an internationally important concentration; ("☒") indicates presence in less than an internationally important concentration.

Waterbird Population	Tidal Flats	Reclamation Lake: Open Waters	Reclamation Lake Edge; shallow wetlands	Rice-field Areas	Marine Waters
	Sub-units 1—1, 1--4	Sub-units 2--7, 2--3	Sub-units 2--1, 2--2, 4--1	Sub-units 6--2, 6--4, 6--5, 5--3	Sub-units 9--1, 9--2
"Taiga" Bean Goose	☒		✓	☒	
"Tundra" Bean Goose	✓		✓	✓	
Greater White-fronted Goose	☒		✓	✓	
Common Shelduck	☒		✓		
Ruddy Shelduck			☒	☒	
Mallard	☒	☒	☒	☒	☒
Common Pochard		✓	☒		☒
Greater Scaup		✓	☒		☒
Great Crested Grebe		✓	☒		☒
Far Eastern Oystercatcher	✓		✓	☒	
Grey Plover	✓		✓		
Kentish Plover	✓		☒	☒	
Mongolian Plover	✓		✓		
Far Eastern Curlew	✓		✓		
Eurasian Curlew	✓		✓		
Bar-tailed Godwit	☒		✓		
Great Knot	✓		✓		
Dunlin	✓		✓		
Terek Sandpiper	✓		☒		
Common Greenshank	✓		☒	☒	
Nordmann's Greenshank	✓		✓		
Saunders's Gull	✓		☒		☒
Great Cormorant		✓	☒	☒	☒
Black-faced Spoonbill	✓		✓	☒	
Chinese Egret	✓		✓		

3.6 *Breeding Bird and Amphibian Surveys*

Breeding bird and amphibian surveys were conducted in June and July 2020 as part of the one-year cycle Project Surveys, and again in June and July 2021 as part of Supplementary Surveys. Vocalising amphibians were also mapped coarsely during the same surveys, with particular focus on globally Vulnerable *Pelophylax chosenicus* (widespread and numerous in most rice-field areas, especially in 6--1 and 6--4) and on searching for globally Endangered *Dryophytes suweonensis* (not found by our research).

Breeding was confirmed or strongly suggested in at least eleven waterbird species (with sightings of sitting birds, food-carrying or of young), with breeding also suspected in six additional waterbird species, all of which breed elsewhere in western ROK (Table 9).

Table 9. Breeding waterbirds in the FNS in 2020 and 2021

Species	Evidence of Breeding	Estimated Number of Nesting Pairs 2020 & 2021
Eastern Spot-billed Duck	Multiple ducklings seen; and multiple young juveniles seen	20-40
Mallard	Several young juveniles seen in 2021	1-2
Common Moorhen	Young juveniles seen in several sub-units	10-20
Eurasian Coot	Young chicks seen in 5+ sub-units	10-20
Little Grebe	Young chicks seen in 3+ sub-units	5-10
Great Crested Grebe	Young chicks seen in two sub-units; breeding suspected in several areas	3-5
Far Eastern Oystercatcher	One sitting bird and one immature seen in 6--6	2-3
Black-winged Stilt	Young chicks seen in 4--1, and at least five occupied nests seen (most in 6--6 and 6—7) in 2021	3-30
Little Ringed Plover	Very young juveniles seen in several rice-fields	10-15
Kentish Plover	Very young juveniles seen in several areas of rice-field	5-10
Greater Painted-snipe	3-4 birds heard giving territorial calls both years; in 2021 the main area was destroyed during the peak of the breeding season	3-6
Common Redshank	One sitting bird seen in 2021; several young juveniles seen both years	3-6
Mongolian Gull	Previous nesting area in 1--4 not visited in 2021	0-1
Little Tern	Several nests seen in agricultural areas in 2020; in 2021 main colony in 2--2 held more than 100 Apparently Occupied Nests in early May. Because of flooding, this colony was deserted by June. Subsequently, only two birds were seen food-carrying in 2--4	5 (2020); >100 (2021)
Yellow Bittern	Several adults seen in suitable habitat	2-10
Von Schrenck's Bittern	One heard in both 2020 and 2021	0-1
Striated Heron	Young juvenile seen in 2020; adult present in same area in 2021	1

A minimum of 23 landbird species were also found in apparently suitable breeding habitat in June and July 2021, and are presumed to breed within the FNS or in areas immediately adjacent to it. Most numerous among these was Oriental Reed Warbler *Acrocephalus orientalis*. Based on the number of singing birds, the extent of habitat, and the density of breeding pairs in other areas (e.g., Dyrcz & Nagata 2002), we estimate that there were perhaps 1,000 or more breeding territories of this species within the FNS in 2021, making it the most numerous breeding species.

We also recorded several globally Near Threatened Ochre-rumped Bunting in breeding habitat in both 2020 and 2021, and saw a female carrying food to her nest in June 2021 in sub-unit 6--7. This species is known to breed at only two other sites on the Korean Peninsula: The Rason Migratory Bird Ramsar Site in the DPRK; and Shihwa Reclamation Area in Gyeonggi Province (ROK) (Birds Korea Archives). Although an area of habitat used by this species in the summer of 2020 was bulldozed in early 2021 as part of rice-field creation, sufficient habitat still remained in the FNS in 2021 for probably 10-20 pairs.

Other breeding landbird species of national conservation importance include 1-2 pairs of Eurasian Eagle-Owl *Bubo bubo* (presumed to breed in an immediately adjacent area of trees), Common Kestrel *Falco tinnunculus* and Eurasian Hobby *Falco subbuteo*.

4. Proposed Wetland Protected Areas

4.1 *Tidal Flat WPA*

4.1.1 *Introduction*

The Hwaseong Maehyangri Tidal Flat was designated in July 2021 as a national Wetland Protected Area ("Tidal Flat WPA"). The Tidal Flat WPA is comprised of 1,408ha of largely unvegetated tidal flats and immediately adjacent shallow seas. It contains almost all of the sub-units of open tidal flat (1--1, 1--2, 1--4) and some of the inshore marine waters (9--1) of the FNS. However, it excludes 1--3 (an area of tidal flat between two small outer islands, and the islands themselves); and the higher parts of narrow beach in 1--1. As a result, the whole of the Tidal Flat WPA is covered by sea during high tides so cannot be used by roosting shorebirds during high tides above ~8.8m.

Figure 9. The Hwaseong Maehyangri Tidal Flat WPA. Outer boundary in dark blue; inner exclusion zone marked in light blue. Figure created in ArcGIS by Amael Borzee.

The designation of the Tidal Flat WPA was based primarily on the tidal flat's national importance for fisheries and its international importance for waterbirds (Birds Korea 2021).

A Ramsar Information Sheet for the exact same area is currently under preparation, using four criteria for identifying the site as internationally important. For detailed information on these criteria, on proposed site boundaries and on jurisdictional responsibilities, please see Birds Korea (2021), a preparatory report developed by Birds Korea under contract from Hwaseong City.

4.1.2 *Waterbird Use*

During the Project Surveys, counts were made on 27 dates within the Tidal Flat WPA. Counts were made on an additional 23 dates along the southern shores of the Hwaseong Reclamation Lake (at 2--1/ 2--2).

A total of >43,000 individuals of 61 species of waterbird was observed foraging or roosting in the Tidal Flat WCA. Twenty-eight of these species are widely considered to be tidal flat obligate species.

At least 17 populations of waterbird were recorded in internationally important concentrations; 16 of these are tidal flat obligate species, comprised of Shorebird species (including Far Eastern Curlew) and three globally threatened "Other Waterbird Species": Black-faced Spoonbill, Saunders's Gull and Chinese Egret.

Tidal flat obligate species foraged on the tidal flat at low tide; roosted on the tidal flat during neap high tides; and flew into the Hwaseong Reclamation Lake (2--1 / 2--2) or into 4--1 for roosting during high spring tides above about 8.8m.

On High Tides above ~9.2m, roosts of birds from the Tidal Flat WPA were supplemented by large numbers of shorebirds coming into roost from the northwest of the FNS, from tidal flats along the Goongpyeong-Maehwari -Songgyori coast ("The Maehwari Tidal Flat") (see 4.2.2 and Section 5).

4.1.3 *Major Management Issues*

1) The Tidal Flat WPA is completely inundated at high tide. This means that all tidal flat obligate waterbird species need to move out of the Tidal Flat WPA at high tide to find a secure roost, until the tide falls and areas of tidal flat are again exposed. Paragraph 44 of Ramsar Resolution XIII.20, "ENCOURAGES Contracting Parties to ensure that intertidal Ramsar Site boundaries include the entire ecosystem of importance to migratory waterbirds and other dependent species, including inland roost and feeding sites; and INVITES Parties to review and extend boundaries of relevant Sites as appropriate" (Ramsar 2018). Unless these roost areas in adjacent areas are properly managed and protected, the number of waterbirds supported by the Tidal Flat WPA will decline. Expert guidance on roost sites, some of it based on research in the FNS, is provided by Jackson & Straw (2021).

2) The Tidal Flat WPA is contiguous with other tidal flat areas. During both the Project and Supplementary Surveys, a substantial percentage of tidal flat obligate waterbirds recorded in the Tidal Flat WPA also foraged in areas outside of this area, either on the Seokcheon Ri Tidal Flats or the Maehwari Tidal Flat. For example, in mid-May 2021, 30,115 shorebirds were counted in the FNS. 7,500 of these foraged on the Seokcheon Ri Tidal Flats at lowest low tide, returning to the Tidal Flat WPA on the incoming tide. Unless adjacent tidal flats are also properly managed and protected, the number of tidal flat obligate shorebirds supported by the Tidal Flat WPA will decline.

3) As outlined in Moores *et al*. (2021), shorebirds which roost on neap tides close to the shoreline are often disturbed. Disturbance elements include military drones, recreational aircraft, and increasingly cars and people moving along the unpaved road between 1--1 and 8--2. A proposed hotel resort area, road paving, removal of the fence and other developments in this same area will likely greatly increase disturbance, reducing foraging time and area and increasing time in flight (Birds Korea 2021b). Unless proper measures are taken to reduce disturbance levels, the number of tidal flat obligate waterbirds supported by the Tidal Flat WPA will decline.

4.2 *Proposed Freshwater WPA*

4.2.1 *Introduction*

As currently proposed, the Proposed Freshwater WPA (contained within the blue boundary in Figure 10) is comprised of 900 ha of largely wetland habitats within the basin of the Hwaseong Reclamation Lake. The proposed boundary (as shared by Hwaseong City officials) was drawn following discussion between Hwaseong City and central government bodies. According to meetings held in July and August, 2021 Hwaseong City remains open to revising this boundary.

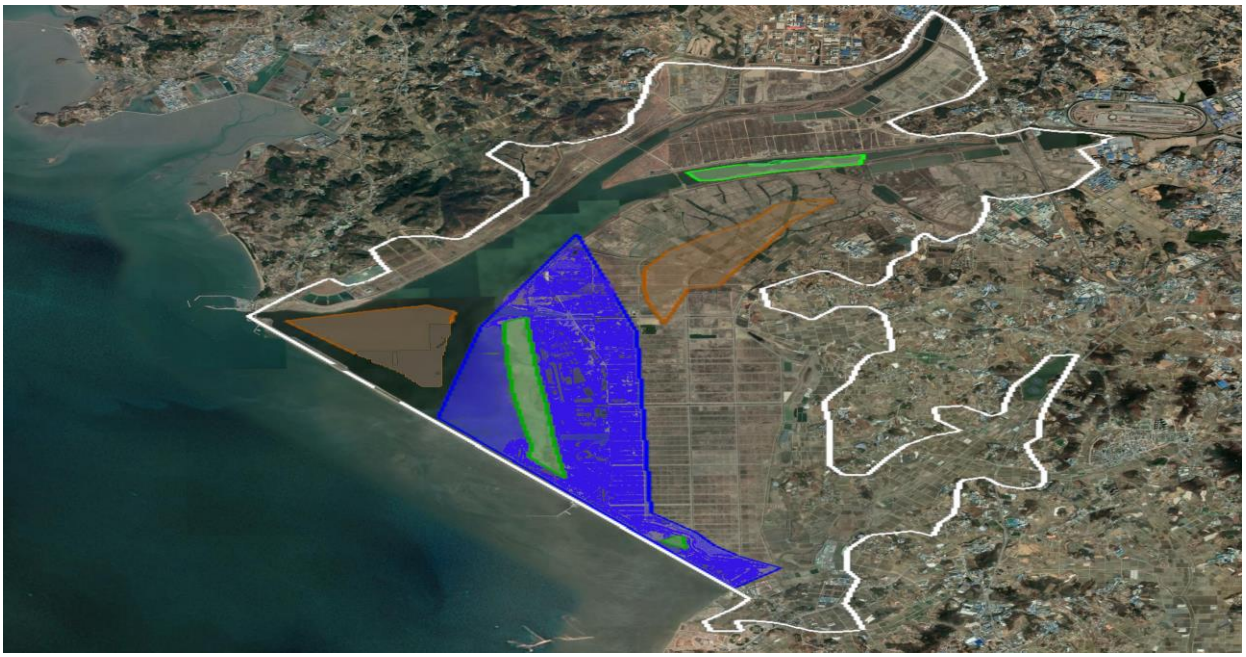


Figure 10. The white outer line indicates the area of more-or-less contiguous freshwater or brackish water wetland, comprised mostly of the Hwaseong Reclamation Lake, feeder streams, rice-fields, ponds and areas with wet or dry reeds; and the blue coloring indicates the approximate boundary of the Proposed Freshwater WPA. Based on the Project and Supplementary Surveys, green lines indicate approximate areas with internationally important concentrations of several species of roosting waterbirds; and brown indicates approximate areas with internationally important concentrations of several species of foraging waterbirds. Image courtesy of Google Earth.

The current boundaries include probably all of sub-units 2--1, 2--2, 3--1, 3--2, 4—1 (“Pond 13”), 4--2, 4--3, 4--4, 5--5, and 6--5, and part of 2--3 and 6--7 (an area converted to rice-field between 2020 and 2021). The Proposed Freshwater WPA therefore contains shallow vegetated freshwater wetland; some freshwater and brackish type wetland; and most of the exposed areas of sand and mud along the eastern shore of the Hwaseong Reclamation Lake. Moores *et al*. (2021) highlighted this sand and mud area (2--1 and 2--2) as vital for roosting shorebirds during high tide; and for roosting geese at night. Importantly, the extent of this exposed mud and sand in the Hwaseong Reclamation Lake varies greatly throughout the year, being most extensive in winter and least extensive, almost absent, in late spring and early summer. This is a result both of seasonal differences in rainfall and of active manipulation of water levels through sluices and water diversion, to ensure that rice-farmers have an adequate water supply for irrigating their fields, especially in May and June.

4.2.2 *Wetland Biodiversity*

During Project and Supplementary Surveys, we recorded 177 bird species within the relevant sub-units of the Proposed Freshwater WPA. This total was comprised of 104,000 individuals of 102 waterbird species and 75 landbird species during a one-year cycle. We also recorded five species of amphibian (see Table 5 in Moores *et al*. 2021), including a substantial population of the globally Vulnerable *Pelophylax chosenicus*. Research by others also found one or more individuals of the globally Endangered *Dryophytes suweonensis* in 4--3 and 7--3.

We recorded 15 populations of waterbird in internationally important concentrations of 1% or more of a population (Table 10). The vast majority of waterbirds (individuals and populations) were found in two main areas: sub-unit 4--1 (also known as Pond 13); and sub-units 2--1 and 2--2, the muddy and sandy margin of the Hwaseong Reclamation Lake. Substantial numbers of only two of these populations (Taiga Bean Goose and Black-faced Spoonbill) foraged within the Proposed Freshwater WPA. In contrast, almost all individuals of the 13 other populations used the area primarily or exclusively for roosting.

Table 10. Highest counts during Project and Supplementary Surveys of waterbirds found in internationally important concentrations within the Proposed Freshwater WPA.

		1%	Highest Count	Primary Use
Anatidae	"Taiga Bean Goose"	75-205	320	Foraging and overnight roost
	Tundra Bean Goose	1100	40,000	Overnight roost
	Greater White-fronted Goose	840	25,000	Overnight roost
Shorebirds	Far Eastern Oystercatcher	70	580	High tide roost
	Grey Plover	1000	2262	High tide roost
	Lesser Sand Plover	390	640	High tide roost
	Eurasian Whimbrel	550	550	High tide roost
	Far Eastern Curlew	320	2,755	High tide roost
	Eurasian Curlew	1000	3,100	High tide roost
	Bar-tailed Godwit	1500	2,580	High tide roost
	Great Knot	2900	8,500	High tide roost
	Dunlin	10000	14,850	High tide roost
	Nordmann's Greenshank	5	20	High tide roost
"Other Waterbirds"	Black-faced Spoonbill	20	298	Foraging and high tide roost
	Chinese Egret	35	35	High tide roost

Importantly for future bird research:

1) The largest concentrations of geese were present in October and November. After roosting overnight along the eastern shore of the Hwaseong Reclamation Lake, in 4--1, and in additional water bodies within the FNS, they flew out within one hour of sunrise to forage in rice-fields which had already been harvested. Some of the geese foraged in harvested rice-fields within the FNS; others, based on their direction of flight, likely flew 15km or more to forage in harvested rice-fields in Dangjin.
2) The largest concentrations of shorebirds were present between July and September and again between late March and mid-May. The vast majority of shorebirds (and of Chinese Egret and Black-faced Spoonbill), flew into the Proposed Freshwater WPA during highest high tides. The largest

concentrations of most of these species were recorded within two hours of those high tides which peaked above 9m.

3) During highest high tides, observations of the direction of flight between the roost and potential foraging areas confirm that the largest high tide concentrations contain birds which forage in the Tidal Flat WPA to the south of the roost and also birds which forage on the Maehwari Tidal Flat to the northwest of the roost. In late March, for example, 80% of the Far Eastern Curlew recorded in the Hwaseong Wetlands FNS flew northwest out of the roost, presumably to forage on the Maehwari Tidal Flat; only 20% flew southwest out of the roost to forage in the Tidal Flat WPA (Table 11).

Table 11. Direction of flight of selected shorebird species and of Black-faced Spoonbill from the Hwaseong Reclamation Lake roost within two hours of a 9.42m high tide on March 31st 2021.

	Highest count in the FNS March 30th-31st	Number counted flying Northwest	% of total flying Northwest
Far Eastern Oystercatcher	27	8	30%
Grey Plover	710	310	44%
Far Eastern Curlew	1,855	1,475	80%
Eurasian Curlew	2,860	454	16%
Bar-tailed Godwit	1,180	20	2%
Great Knot	1,082	310	29%
Dunlin	11,500	1,715	15%
Black-faced Spoonbill	35	15	43%

4) Landbirds recorded during the Project and Supplementary Surveys included several species of national conservation concern, including a single globally Vulnerable Steller's Sea-Eagle *Haliaeetus pelagicus*, at least 16 White-tailed Eagle *Haliaeetus albicilla*, 3+ Upland Buzzard *Buteo hemilasius* and Northern Goshawk *Accipiter gentilis*, and single Western Osprey *Pandion haliaetus* and Peregrine Falcon *Falco peregrinus* on multiple dates. We also found several globally Near Threatened Ochre-rumped Bunting in 6--7, within the eastern boundary of the Proposed Freshwater WPA. Although more research is required, our surveys suggest that the majority of nesting Ochre-rumped Bunting pairs are currently outside of the Proposed Freshwater WPA.

4.2.3 *Main Management Issues*

1) The Proposed Freshwater WPA provides two main areas used for roosting by internationally important concentrations of waterbirds (4--1, and especially 2--1/ 2--2). The majority of waterbirds using the Proposed Freshwater WPA forage outside of the site, either in rice-fields or on tidal flats. Unless these areas are also protected and managed properly, the number of waterbirds using the area will decline.

2) The Proposed Freshwater WPA excludes the open waters of the Hwaseong Reclamation Lake, and therefore does not include most of the areas used for foraging and roosting by internationally important concentrations of Great Crested Grebe, globally Vulnerable Common Pochard, and Great Scaup.

3) Water levels in the Hwaseong Reclamation Lake are currently controlled primarily to benefit farmers without consideration for biodiversity. Our research documented periods during the migration periods and in the summer in which water levels were maintained too high to allow roosting shorebirds in 2--1 and 2--2; and which also resulted in the flooding of a nesting colony of nationally Vulnerable Little Tern. If current levels of biodiversity are to be maintained, then either water levels need to be controlled to avoid flooding out roosts and nesting birds; or some reprofiling of the shoreline is required, to increase the elevation of some areas above the high-water mark, creating islands with a gentle slope (see Figure 12).

4) Waterbird roosts are often very sensitive to disturbance. Efforts have already been made to restrict water sports activities and illegal fishing on the Hwaseong Reclamation Lake. However, on multiple dates, wind surfers and illegal fishing boats were seen on the lake, resulting in many birds being flushed. In addition, on multiple dates, recreational aircraft flushed geese and shorebirds. The impacts of disturbance from these aircraft were greatest on shorebirds when high tide was between 07:30 and 09:30AM, as aircraft often started to take off at 09:00.

5) Rice-field areas (e.g., 6--5, 6--7) in the FNS are very important to include in the Proposed Freshwater WPA. They:

   (i) Provide vital foraging areas for geese and for some species of shorebird which prefer freshwater wetland;
   (ii) Support important concentrations of nationally or globally threatened amphibians;
   (iii) Provide livelihoods of local people who will be affected by management decisions made for the WPA, including decisions on water levels and water quality in the Hwaseong Reclamation Lake. Inclusion of rice-fields creates opportunities for enhancing agricultural sustainability while providing economic benefits for farmers, potentially creating a model that can be reproduced in other parts of the ROK.

At present, however, none of the agricultural areas in the FNS consider biodiversity. Instead, we documented clearing and flattening of fallow fields with nesting shorebirds and Ochre-rumped Bunting during the breeding season; and soft-edged drainage channels required by amphibians being replaced in some areas with concrete drains.

To reduce negative impacts on biodiversity, it would be advisable to restrict clearing and flattening of fallow fields to the winter months, and to avoid such activities between March and September. We therefore repeat the opinion given in Moores *et al* (2021) that a team of trained wardens and a management committee is urgently needed to identify issues, facilitate discussion, build consensus and develop solutions which meet the needs of both local farmers and of biodiversity.

6) "Pond 13" (4--1) has very high potential for both biodiversity conservation and for environmental education and ecotourism. To achieve these goals, the following issues need to be addressed:

   (i) **Disturbance levels**. The wetland is situated next to the main road on the barrage. Already, there are high levels of disturbance to waterbirds using the wetland caused by some of the traffic (e.g., especially loud vehicles); by walkers and cyclists; and by tourists and bird photographers. As outlined in Moores *et al.* (2021), screening is required along the footpath alongside the wetland; and signage is required to inform and educate visitors about wetlands, waterbirds and disturbance.

In anticipation of an increase in visitors who want to see birds, some parking bays need to be provided along the road to reduce the risk of traffic accidents.

(ii) **Water levels**. Following construction work, most of the freshwater which used to flow through this area has been redirected away from the wetland. In August 2021, water levels were very low. Low water levels can allow land-based predators to access nesting waterbirds; can increase the risk of disease outbreaks because waterbirds are concentrated into smaller and smaller areas; and can result in open areas of mud being colonized by plants, rendering them unavailable to shorebirds. Management is required to maintain water levels that can benefit priority species.

7) Eighty-nine hectares of the Proposed Freshwater WPA (marked 3 and 5 in Figure 11), is at present of rather limited value to biodiversity in large part because the freshwater input is now controlled in a managed stream. Our surveys found few waterbirds and only a small colony of the nationally Vulnerable *Kaloula borealis* within this area Although an increasing number of people try stop to look at birds on 4--1 ("Pond 13": numbered 6 in Figure 11), adjacent freshwater areas provide little opportunity to see wildlife or to understand the value of wetlands in helping Hwaseong City and the nation fulfill the Sustainable Development Goals.

Figure 11. Current status of part of the Proposed Freshwater WPA immediately adjacent to the outer dyke road. The stream and open water of 4--1 are in light blue. 1= The Hwaseong Maehyangri Tidal Flat (most of which is contained in the Tidal Flat WPA); 2 = the permanent waters of the Hwaseong Reclamation Lake; 3 = area above high-water mark immediately adjacent to the lake (sub-unit 3--1), some parts colonized by saltmarsh vegetation, other parts increasingly overgrown with grasses; 4= wet reedbed (artificial wetland eco-park); 5= dried grasses and reed; 6 = open water, reedbeds and former saltpans of Sub-Unit 4--1. 7= dried reed and grasses, which as proposed might be converted to arable land. Image courtesy of Google Earth.

Even in this small area, a range of well-tested management options are available to enhance biodiversity, to increase ecosystem services and to provide a meaningful experience for tourists and school parties (Figure 12).

For example:

(i) Moving sediments ("reprofiling') in area 1 to create a slightly higher area of bare mud and sand which could be used by roosting shorebirds and nesting Little Tern even when water levels are high or if tidal exchange is increased in the Hwaseong Reclamation Lake.

(ii) Removing sediments around the elevated area from area 2, to allow lake water to surround the elevated area so that the roost and nesting area for Little Terns becomes an island. With appropriate profiling, this could even result in the creation of a shallow, freshwater or brackish lagoon, of value to fisheries and used by foraging waterbirds;

(iii) Construction of sluices (represented by short black lines) in area 3, and additional channels and low banks to create shallow, freshwater wetland that would be flooded after heavy rain. If designed appropriately, such areas could support large populations of amphibians, and also provide foraging opportunities for some waterbird species, including Oriental Stork.

(iv) Redirection of existing stream in area 4, to improve flow of water through 4--1, and to provide more freshwater to help flood downstream areas.

(v) Placement of Oriental Stork nesting platforms. Red "T" shapes indicate potentially suitable locations for Oriental Stork nesting platforms.

Figure 12. Possible management actions that could be made in the same part of the Proposed WPA as in Figure 11 to enhance biodiversity, to help reduce water pollution, and to create a memorable experience for tourists. Image courtesy of Google Earth.

Based on available evidence, larger projects to enhance and restore wetlands in the FNS could greatly increase carbon sequestration, help to support fisheries, and support the conservation of biodiversity.

One case study introduced at the 2021 Hwaseong Wetlands International Symposium by the Wildfowl and Wetlands Trust (WWT) was the restoration of the 488ha Steart Marshes in the UK (WWT 2021; and Figure 13). An existing seawall protecting an old reclamation area was deliberately broken; and reprofiling and channel creation has been conducted to allow high tides to flood parts of the area. Extensive areas of shallow wetland and saltmarsh are starting to replace farmland which had become uneconomic to maintain.

The diverse benefits of the restoration of the Steart Marshes are being measured through a collaboration between the WWT and a university in Manchester. In addition to saving money which would otherwise have been spent on maintaining sea-walls, benefits include e.g., an improvement in storage of "blue carbon", an increase in some fish populations and other biodiversity, and in increase in human well-being, through having controlled access to a healthy wetland for recreation and education.

Figure 13. Aerial view of Steart Marshes, UK. Copyright of Wildfowl and Wetlands Trust.

5 Adjacent Wetlands

Understanding movements of waterbirds within and between wetlands is essential for monitoring changes in populations and for the proper delineation of conservation areas. We therefore conducted supplementary surveys of waterbirds in tidal flats up to 11km northwest of the FNS along the Hwaseong Coast, and up to 20km to the southeast, in Asan Bay (Figure 14). Because of the comparatively low survey effort, these surveys likely substantially underestimated the number of waterbirds present at these sites.

Figure 14. Tidal flat areas included in our Project and Supplementary Surveys: 1= Gunpyeong, Maehwari and Songgyori tidal flats ("Maehwari Tidal Flat"); 2= Tori Do (viewed from Gunpyeong harbour, included in counts of Maehwari Tidal Flat); 3= Hwaseong Maehyangri Wetland Protected Area / Hwaseong Wetlands Flyway Network Site; 4= Seokcheonri Tidal Flat; 5=Asan Bay (Pyeongtaek and Dangjin).

5.1 Maehwari Tidal Flat, Hwaseong

Counts were conducted on 17 dates between June 2020 and August 2021 of waterbirds along the Hwaseong coast between Tori Do, Gunpyeong harbour and Songgyori ("Maehwari Tidal Flat"), an area of c. 2,000 ha of tidal flat at lowest low tide. Most of our survey effort was concentrated in a bay used for roosting shorebirds during neap tides at approximately 37° 9'23"N, 126°41'2"E.

There are insufficient data to develop 5-year geometric means. However, our surveys strongly suggest that the Maehwari Tidal Flat is internationally important for waterbirds, with eight species found in concentrations of 1% or more of their population (Table 12). These species include Far Eastern Curlew. We also confirmed that large numbers of shorebirds fly regularly between the Maehwari Tidal Flat and the Hwaseong Reclamation Lake during highest spring tides above about 8.9m (and especially when tides are 9.2m or above). This is a straight-line distance of *c*. 7-8km.

Table 12. Waterbirds which qualify under or contribute to Ramsar Criteria 2, 4 or 6 counted at Maehwari Tidal Flat during the Project and Supplementary Surveys (June 2020-August 2021); and evidence of their dependence on the Hwaseong Reclamation Lake for roosting during spring high tides.

	Global Conservation Status	1% Criterion	Highest Count	Date	Ramsar Criterion 2	Ramsar Criterion 4	Ramsar Criterion 6	Movement to / from FNS
Far Eastern Oystercatcher	NT	70	87	Aug 15 2021		✓	✓	Yes
Grey Plover	LC	1,000	1,080	Apr 16 2021		✓	✓	Yes
Mongolian Plover	LC	260	1,410	Aug 10 2021		✓	✓	Probably
Eurasian Whimbrel	LC	550	800	Aug 15 2021		✓	✓	Yes
Far Eastern Curlew	EN	320	525	Jul 24 2021	✓	✓	✓	Yes
Eurasian Curlew	NT	1,000	1,970	Jul 22 2021		✓	✓	Yes
Great Knot	EN	2,900	1,475	Apr 16 2021	✓	✓		Yes
Spoon-billed Sandpiper	CR	3	1	Aug 2021	✓			No
Terek Sandpiper	LC	500	1,400	10 Aug 2021		✓	✓	Unclear
Saunders's Gull	VU	85	45	Mar 12 2021	✓	✓		No
Black-faced Spoonbill	EN	20	103	Sep 19 2020	✓	✓	✓	Yes
Chinese Egret	VU	35	18	Aug 15 2021	✓	✓		No

5.2 Seokcheonri Tidal Flat, Hwaseong

Full counts were made on only six dates of the Seokcheonri Tidal Flat in Hwaseong, to the southwest of the FNS. Tidal flats extend for about 1,050-1,100 ha at lowest low tide, and are contiguous with the southeastern boundary of the Tidal Flat WPA. Because of the loss of upper tidal flat areas to reclamation, the whole of this tidal flat is inundated on tides above *c*. 8m and there are no roost sites for most shorebird species.

We counted 7,500 shorebirds on one date; and observed globally threatened species at low tide on several dates, with e.g., high counts of 151 Far Eastern Curlew and 1,300 Great Knot. As the tide moved back in, waterbirds flew back northwest toward the Tidal Flat WPA. During highest spring tides, birds foraging on Seokcheon Ri Tidal Flat would need to fly a straight-line distance of about 9km to reach the Hwaseong Reclamation Lake roost area. More research is needed, but our data suggest that in Hwaseong even large shorebirds like Far Eastern Curlew appear to try to avoid commuting more than c.8km regularly (Moores & Park 2021). Creation of a roost area in or closer to the Seokcheonri Tidal Flat might therefore enable more shorebirds to use this tidal flat for foraging.

5.3 Asan Bay

Asan Bay in Pyeongtaek and Dangjin cities was first identified as internationally important for shorebirds in 1988 (Long *et al.* 1988) and subsequent effort suggests that the bay has remained internationally important for several tidal flat obligate species, despite substantial declines following extensive reclamation (see Moores 2021).

In 1998, large numbers of Great Knot and Black-tailed Godwit were seen commuting between Asan Bay and Seokcheon Ri / Namyang Bay (Moores 1999). Subsequent count effort suggests that the bay remained internationally important for several tidal flat obligate species, despite substantial declines following extensive reclamation (see Moores 2021).

We counted waterbirds in the main reclamation impoundments in Asan Bay (centred at 36°55'N, 126°52'E), on 11 dates, including twice in late July 2021 as part of the coordinated Far Eastern Curlew survey (Moores & Park 2021). All counts were conducted at or close to high tide, with a mean duration of about an hour. We found no evidence of birds moving between Asan Bay and the FNS.

On May 13th 2021 we counted 24,272 waterbirds; and between June 2020 and May 2021, we counted a minimum total of 38,993 waterbirds of 51 species. Asan Bay therefore meets Ramsar Criterion 5. In addition, we found concentrations of 1% or more of ten waterbird species, including almost 3% of the world population of Far Eastern Curlew; and a diverse assemblage of globally threatened waterbird species.

Table 13. Waterbirds which qualify under or contribute to Ramsar Criteria 2, 4 or 6 counted in Asan Bay during the Project and Supplementary Surveys (June 2020-August 2021)

	Global Conservation Status	1% Threshold	Highest Count	Date	Ramsar Criterion 2	Ramsar Criterion 4	Ramsar Criterion 6
Common Shelduck	LC	600	2,181	29 Mar 2021		✓	✓
Common Pochard	VU	3,000	1	Jul 21 2021	✓		
Grey Plover	LC	1,000	1,072	29 Mar 2021		✓	✓
Mongolian Plover	LC	260	2,893	5 Aug 2020		✓	✓
Far Eastern Curlew	EN	320	915	24 Jul 2020	✓	✓	✓
Great Knot	EN	2,900	7,000	13 May 2021	✓	✓	✓
Red-necked Stint	NT	3,200	4,170	5 Aug 2020		✓	✓
Dunlin	LC	10,000	11,700	29 Mar 2021		✓	✓
Common Greenshank	LC	1,000	2,340	Aug 26 2020		✓	✓
Nordmann's Greenshank	EN	(5)	2	Aug 2020, May 2021	✓		
Saunders's Gull	VU	85	145	26 Aug 2020	✓	✓	✓
Black-faced Spoonbill	EN	(20)	479	Sep 18 2020	✓	✓	✓

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APPENDIX: WATERBIRD POPULATION ESTIMATES AND HIGHEST COUNTS RECORDED DURING THE PROJECT SURVEYS (JUNE 2020-MAY 2021)

Species' order follows Gill *et al*. (2021); subspecies follow Moores (2018); populations (including spelling) and regional annotation follow Wetlands International (2021). Notes: In 1% Threshold, *from Waterbird Population Estimates 5 (Wetlands International 2020)

		Populations found in FNS	1% Threshold	Project Surveys Highest Count
1	Cackling Goose	*leucopareia*, Kuril (Ekaramar-Japan)	1**	1
2	Snow Goose	*caerulescens*, E Asia	1	**1**
3	Swan Goose	C & E Asia	680	2
4	Taiga Bean Goose	*middendorffi*, Yakutia / E Asia	100	**484**
5	Tundra Bean Goose	*serrirostris*: Central and Eastern Siberia	1,100	**40,500**
6	Greater White-fronted Goose	*frontalis*: Korea	840	**16,000**
7	Lesser White-fronted Goose	C & E Siberia	260	5
8	Whooper Swan	E Asia	600	24
9	Common Shelduck	E Asia (non-bre)	600	**1,031**
10	Ruddy Shelduck	E Asia (non-bre)	710*	**990**
11	Baikal Teal	E Asia	7,100	5,015
12	Garganey	E & SE Asia (non-bre)	10,000	22
13	Northern Shoveler	E & SE Asia (non-bre)	5,000	410
14	Gadwall	*strepera*, E Asia (non-bre)	7,100	959
15	Falcated Duck	C & E Asia	830	84
16	Eurasian Wigeon	E Asia (non-bre)	7,100	125
17	Eastern Spot-billed Duck	*zonoryncha*	11,300*	1,995
18	Mallard	*platyryhnchos*, E Asia (non-bre)	15,000*	**15,000**
19	Northern Pintail	E & SE Asia	2,400	939
20	Eurasian Teal	*crecca*, E and SE Asia (non-bre)	7,700	1,100
21	Common Pochard	E Asia (non-bre)	3,000*	**3,510**
22	Ferruginous Duck	No population recognised	N/A	3
23	Tufted Duck	E and SE Asia (non-bre)	2,400*	225
24	Greater Scaup	nearctica, E Asia	2,400*	**3,927**
25	Long-tailed Duck	E Asia (non-bre)	7,100*	2
26	Common Goldeneye	*clangula* E Asia (non-bre)	10,000*	2,130
27	Smew	E Asia (non-bre)	250*	160
28	Common Merganser	*orientalis*, E Asia (non-bre)	710	217
29	Red-breasted Merganser	E Asia (non-bre)	1,000	703
30	Scaly-sided Merganser	E and SE Asia	50	2
31	Eastern Water Rail	*indicus*	Unknown	1
32	Ruddy-breasted Crake	*erythrothorax*	Unknown	1
33	Common Moorhen	Not recognised	Unknown	22
34	Eurasian Coot	*atra*, E & SE Asia (non-bre)	20,000	396
35	Hooded Crane	Korea-Japan non-bre	110	26
36	Little Grebe	*poggei*	10,000	40

37	Great Crested Grebe	*cristatus*, E Asia (non-bre)	250	**2,466**
38	Black-necked Grebe	*nigricollis*, E Asia (non-bre)	1,000	301
39	Far Eastern Oystercatcher	*osculans*	70	**623**
40	Black-winged Stilt	*himantopus*, E & SE Asia	1,000	68
41	Pied Avocet	E Asia	1,000	1
42	Northern Lapwing	E, SE Asia (non-bre)	1,000	45
43	Pacific Golden Plover	E, SE Asia, Australia & Oceania (non-bre)	1,000	3
44	Grey Plover	*squatarola*, E, SE Asia & Australia (non-bre)	1,000	**2,795**
45	Long-billed Plover	E, SE & S Asia	250	1
46	Little Ringed Plover	*curonicus*, C & E Asia	250	29
47	Kentish Plover	-	1,000*	**1,013**
48	Mongolian Plover	*mongolus*	260	**870**
49	Mongolian Plover	*stegmanni (?)*	130	
50	Greater Sand Plover	*leschenaultii*, SE Asia, Australia (non-bre)	790	3
51	Greater Painted-snipe	Asia	250	7
52	Eurasian Whimbrel	*variegatus*, E and SE Asia (non-bre)	550	272
53	Far Eastern Curlew	C & E Asia (bre)	320	**2,275**
54	Eurasian Curlew	*orientalis*, E and SE Asia (non-bre)	1,000	**3,700**
55	Bar-tailed Godwit	*menzbieri & (anadyrensis)*	1,500	**2,580**
56	Bar-tailed Godwit	*baueri*	1,300	
57	Black-tailed Godwit	*melanuroides*	1,400	177
58	Black-tailed Godwit	*bohaii***	N/A	61
59	Ruddy Turnstone	*interpres*, Pacific & SE Asia	290	43
60	Great Knot	SE Asia, Australia (non-bre)	2,900	**8,500**
61	Red Knot	*piersmai*	560	
62	Red Knot	*rogersi*	540	25
63	Ruff	Not recognised	N/A	1
64	Broad-billed Sandpiper	*sibirica*	250	39
65	Sharp-tailed Sandpiper	C & E Siberia (bre)	1,600	22
66	Curlew Sandpiper	E, SE Asia & Australia (non-bre)	1,400	4
67	Temminck's Stint	E and SE Asia (non-bre)	1,000*	1
68	Long-toed Stint	Siberia (bre)	250	3
69	Red-necked Stint	NE Siberia (bre)	3,200	1,910
70	Sanderling	E and SE Asia, Australia, New Zealand (non-bre)	220	3
71	Dunlin	*arcticola*	4,900	
72	Dunlin	*sakhalina*	10,000*	**14,850**
73	Dunlin	*kistchinskii (?)*	10,000*	
74	Little Stint	-	N/A	1
75	Pectoral Sandpiper	C & E Siberia, N N America (Bre)	15,300	1
76	Long-billed Dowitcher	N & C America (non-bre)	5,000	1
77	Pin-tailed Snipe	E and SE Asia (non-bre)	10,000*	3
78	Common Snipe	*gallinago*, E and SE Asia (non-bre)	10,000	65
79	Terek Sandpiper	E, SE Asia & Australia (non-bre)	500	**1,710**
80	Red-necked Phalarope	NE Asia (bre)	10,000	45

81	Common Sandpiper	E and SE Asia to Oceania (non-bre)	500	4
82	Green Sandpiper	E and SE Asia (non-bre)	1,000*	7
83	Grey-tailed Tattler	C & E Siberia (bre)	440	64
84	Common Redshank	*ussuriensis*, S & E Asia (non-bre)	1,000	45
85	Common Redshank	*terrignotae* /*craggy* (?)	1,000/1,000	*?*
86	Marsh Sandpiper	E, SE Asia, Oceania (non-bre)	10,000	40
87	Wood Sandpiper	E and SE Asia & Australia (non-bre)	1,000	107
88	Spotted Redshank	E, SE Asia (non-bre)	250	116
89	Common Greenshank	E, SE Asia & Australia (non-bre)	1,000	**1,035**
90	Nordmann's Greenshank	NE Asia (bre)	5	**20**
91	Oriental Pratincole	E, SE Asia, Australia	28,800	2
92	Black-headed Gull	E & SE Asia (non-bre)	20,000	615
93	Saunders's Gull	NE Asia (bre)	85	**138**
94	Black-tailed Gull	E Asia	10,500	4,500
95	Common Gull	*camtschatschensis*	1,000	3
96	Vega Gull	*vegae*	UNKNOWN	50
97	Mongolian Gull *	*mongolicus*	610	56
98	Slaty-backed Gull	NE Asia	10,000	1
99	Heuglin's Gull *	Not recognised	N/A	3
100	Gull-billed Tern	*affinis*	UNKNOWN	2
101	Little Tern	*sinensis*	1,000	326
102	Common Tern	*longipennis*	460	1
103	Whiskered Tern	*hybrida* (*swinhoei*) (?)	UNKNOWN	7
104	White-winged Tern	Asia, Australasia	10,000	2
105	Black Tern	Niger, Europe & Western Asia/Atlantic coast	4,000	1
106	Oriental Stork	E Asia	30	8
107	Great Cormorant	*sinensis*, E, SE Asia (non-bre)	1,000	**1,550**
108	Eurasian Spoonbill	*leucorodia*, E Asia	100*	72
109	Black-faced Spoonbill	*minor*	20	**254**
110	Eurasian Bittern	*stellaris*, E, SE Asia (non-bre)	1,000	5
111	Yellow Bittern	E, SE Asia	10,000	10
112	Von Schrenck's Bittern	E, SE Asia	250*	1
113	Black-crowned Night Heron	*nycticorax*, E, SE Asia	10,000	21
114	Green-backed/ Striated Heron	*amurensis*	N/A	2
115	Chinese Pond Heron	E, SE Asia	10,000	1
116	Eastern Cattle Egret	*coromanda*, E, SE Asia	10,000	150
117	Grey Heron	*jouyi*, E, SE Asia	10,000	151
118	Purple Heron	*manilensis*, E, SE Asia	1,000	1
119	Great Egret	*modestus*, E, SE Asia (non-bre)	1,000	234
120	Great Egret	*alba*	N/A	169
121	Intermediate Egret	*intermedia*, E, SE Asia	1,000	40
122	Little Egret	*garzetta*, E, SE Asia	10,000	23
123	Chinese Egret	E, SE Asia	35	**70**