Wise Use of the Hwaseong Wetlands Flyway Network Site:

2020 Final Report

A Report on the Hwaseong Wetlands Project (2020) prepared for Hwaseong City by Birds Korea, the Secretariat of the East Asian-Australasian Flyway Partnership (EAAFP) and Hwaseong Korean Federation for Environmental Movements, produced as part of the EAAFP-Hwaseong City Project, "International Symposium on the Hwaseong Wetlands and International Cooperation Projects."

The Hwaseong Wetlands Project is a collaboration developed between the East Asian-Australasian Flyway Partnership (EAAFP) Secretariat based in Incheon, Birds Korea, Korean Federation for Environmental Movements (KFEM) Hwaseong, National KFEM and Hwaseong City.

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Cover Image: Maehyangri tidal flat, Hwaseong Wetlands Flyway Network Site, December 2020 © Jung Hanchul (Gyeonggi KFEM)

Welcoming Statement, Chief Executive of the East Asian - Australasian Flyway Partnership Secretariat

I would like to express my delight at the publication of the "Wise Use of the Hwaseong Wetlands Flyway Network Site: 2020 Final Report" as part of the "International Symposium on the Hwaseong Wetlands and International Cooperation Projects". I also would like to express my sincere gratitude for all the contributions from our co-implementers – Korea Federation for Environmental Movements (KFEM) Hwaseong, Birds Korea, Hwaseong City Government, and staff members of the East Asian – Australasian Flyway Partnership (EAAFP) Secretariat.

Together, we have made sound progress on the 2020 Hwaseong Wetlands Project since signing the MOU between Hwaseong City and the EAAFP Secretariat in May 2020. This MOU is aimed at the conservation of the Hwaseong Wetlands and the migratory waterbirds they support. The Hwaseong Wetlands were listed in the EAAFP Flyway Site Network (EAAF142) in recognition as an international important habitat for migratory waterbirds in the East Asian – Australasian Flyway in 2018. As a part of the International Symposium on the Hwaseong Wetlands and International Cooperation Projects, the EAAFP Secretariat with the support of Birds Korea, Hwaseong City, KFEM and KFEM Hwaseong, held an international symposium in December 2020; implemented awareness activities with local stakeholders; conducted surveys; and built national cooperation including the establishment of the Far Eastern Curlew Network for the Korean Peninsula. In addition, we supported a survey project in Sumatra, Indonesia where many Far Eastern Curlews spend the winter. Linking with this local community in Indonesia that is caring for these birds during the northern winter is helping to maintain the population of Hwaseong's symbol bird.

This report describes our activities and provides a brief for the future. Conservation of the Hwaseong Wetlands is not a one-day project. We need to see farther. The Hwaseong Wetlands have diverse ecologies as well as a range of community stakeholders who rely on them. We hope this report shows the pressing need for the conservation and protection of the habitats, and has value in developing a clear vision for its designation as a national Protected Area and as a Ramsar Site. In the preparation process, the development of an effective management plan is crucial, and requires guidelines, scientific evidence, and the inclusion of local stakeholder opinions. We will continue to be a key supporter.

In conclusion, I also would like to recognise and thank the Ministry of Environment, the Ministry of Oceans and Fisheries, the Cultural Heritage Administration of the Republic of Korea, the Hanns Seidel Foundation, the Rural Community Corporation, local fisher and farming communities, KFEM, KFEM Gyeonggi, Seocheon County, Yeonsu District of Incheon Metropolitan City, and the Hwaseong Environment Foundation for all their support for the wise and sustainable use of the Hwaseong Wetlands, the heart of the East Asian – Australasian Flyway.

Doug Watkins

Contents

1. Introduction

1.1 Executive Summary

1. The Hwaseong Wetlands support the livelihoods of many local fishers and farmers, and provide a range of additional high-value ecosystem services. In addition to food production, these include water storage, pollution reduction, carbon sequestration, recreation and education, and high levels of biodiversity. Wise Use of the Hwaseong Wetlands as defined by the Ramsar Convention is therefore key to meeting the Sustainable Development Goals at a range of scales, including within Hwaseong City, and at the Provincial and National level.
2. The Hwaseong Wetlands in their present form were created by the reclamation of much of Namyang Bay, following the completion of a 9.81km long outer sea-dyke in 2002. The reclamation process destroyed thousands of hectares of tidal flat, saltmarsh and shallow inshore waters and caused huge damage to fisheries. The loss of tidal flat area and tidal flat health also caused massive declines in some shorebird species, which since 1988 were known be supported by these wetlands in internationally important concentrations. Reclamation also inadvertently created brackish and freshwater habitat now used by very large numbers of some species of waterbird and by important populations of threatened amphibians.
3. In 2018, in recognition of their international importance to wetland and waterbird conservation, 7,301 ha of the Hwaseong Wetlands were formally designated as the Hwaseong Wetlands Flyway Network Site (FNS) by Hwaseong City and the East Asian - Australasian Flyway Partnership.
4. The Hwaseong Wetlands FNS contains four main wetland types used by large numbers of waterbirds: (1) Tidal flats and shallow marine waters outside of the outer sea-dyke, (2) the Hwaseong Reclamation Lake, (3) rice-fields, and (4) additional freshwater wetlands created through the reclamation process. These four main wetland types still form a single wetland system as they are connected to each other hydrologically and ecologically, including through the daily movements of waterbirds.
5. From June to December 2020, research focused on waterbirds and wetland biodiversity was conducted for the Hwaseong Wetlands Project (June-December 2020) on behalf of Hwaseong City and the East Asian - Australasian Flyway Partnership. This research confirms that both separately and in combination, each of the four main wetland types of the Hwaseong Wetlands Flyway Network Site (FNS) meet Ramsar Criteria used to identify wetlands of international importance.
6. The Hwaseong Wetlands FNS fulfils Ramsar Convention Criterion 2, in that all four of the main wetland types, separately and in combination, support threatened species and threatened ecological communities. Between late June and mid-December 2020, we recorded 35 nationally or globally threatened bird species and 19 bird species designated as National Natural Monuments in the Hwaseong Wetlands FNS. This total was comprised largely of species which are ecologically dependent on tidal flats and of species which are ecologically dependent on freshwater wetlands. In addition, especially in rice-field areas, we recorded three species of nationally or globally threatened amphibian and one globally threatened mammal species.
7. The Hwaseong Wetlands FNS fulfils Ramsar Convention Criterion 5, in that the wetlands support more than 20,000 waterbirds regularly. Between June and December 2020, based on the sum of

the highest count of each species, we counted more than 119,000 individual waterbirds in the Hwaseong Wetlands FNS. Inclusion of data from other sources confirms that almost 150,000 waterbirds were counted in the Hwaseong Wetlands FNS in 2020. Moreover, based on the sum of the highest count of each species recorded during previous surveys, the five-year geometric mean of waterbirds counted each year within the Hwaseong Wetlands in 2015-2018 combined with research in 2020 is 98,607 individuals – almost five times the threshold of 20,000 called for in Criterion 5.

8. The Hwaseong Wetlands FNS fulfils Ramsar Convention Criterion 6, in that the wetlands support more than 1% of a population of waterbird. Between late June and mid-December 2020, we recorded 19 species of waterbird in concentrations of 1% or more of a population. The five-year geometric mean of count data from additional sources for 2015-2018 combined with data for 2020 confirms that at least 16 species of waterbird are regularly supported in internationally important concentrations by the Hwaseong Wetlands FNS.
9. Our research for the Hwaseong Wetlands Project confirms that the Hwaseong Wetlands are one of the most important sites in the world for the globally Endangered Far Eastern Curlew, a long-range migratory shorebird. The highest count of this species we recorded was 2,275, representing a minimum 6.5% of the world population. Similar to many waterbird species, Far Eastern Curlews in the Hwaseong Wetlands FNS depend on several different wetland types including the tidal flats for feeding; and the Reclamation Lake and other freshwater wetlands for roosting.
10. Our research identified multiple threats to the biodiversity and ecosystem health of the Hwaseong Wetlands FNS. These include occasionally high levels of disturbance in all of the four main wetland habitats caused e.g., by low flying aircraft, drones, construction and photographers. These and additional threats will need to be addressed by future management actions aimed at maintaining the ecological health and ecological character of the Hwaseong Wetlands FNS.
11. Based on successful conservation actions taken at other wetlands, steps that could now be taken toward Wise Use of the Hwaseong Wetlands FNS include:
    - the creation of a dedicated management team, with rangers responsible for day-to-day site work;
    - the establishment of a Management Committee, to oversee the development of a science-based and widely-supported management plan;
    - the establishment of appropriate funding mechanisms to support future conservation actions; and
    - the designation of the Hwaseong Wetlands FNS as a Ramsar site and as a legally-protected Wetland Protection Area.

1.2 The Hwaseong Wetlands Project

The Hwaseong Wetlands Project (the "Project") is an important step forward in ensuring the sustainable and wise use of the Hwaseong Wetlands. The Project was launched by Hwaseong City and the East Asian - Australasian Flyway Partnership (EAAFP) in June 2020, with three main inter-locking aims:

(1) To improve understanding of the ecology of the Hwaseong Wetlands, with a special focus on waterbirds and wetland biodiversity. This was achieved through 38 days of field work conducted between late June and mid-December ("The Project Surveys").
(2) To continue to raise public awareness of the importance of the Hwaseong Wetlands. This was achieved through sharing of survey results, online and in a series of interim reports; by holding a series of public awareness-raising events and meetings; by supporting the development of three documentaries on the Hwaseong Wetlands, for broadcast on local and national TV; and through the Third International Wetlands Symposium, held in Hwaseong City on December 1st 2020.
(3) To help identify potential issues and management approaches relevant to the long-term conservation and wise use of the Hwaseong Wetlands. This was done during surveys, meetings, the Third International Symposium, and most especially through the development of this report.

The Project is built upon decades of work; and in the future, wise use of the Hwaseong Wetlands will depend on decades more.

In 1988, the first calls to national government were made for the conservation of these wetlands, because of their international importance to waterbirds (Long *et al.* 1988). In 1997, the Republic of Korea acceded to the Ramsar Convention, and started to modify national wetland laws and policies. In the late 1990s and early 2000s, repeated calls were made to halt construction of a 9.81 km long seawall being built between Gungpyeongri and Maehyangri, in order to protect local fisheries. In 2002, the seawall (or outer dyke) was completed, closing off most of the former Namyang Bay from the sea. Thousands of hectares of tidal flats and sea-shallows were destroyed; fisheries were ruined; and promises were made to some fisherfolk that land would be provided as compensation. Even now, some of these promises have not yet been kept (see Section 2.3).

During the 2000s and 2010s, inner dykes and roads were built across former tidal flats; the Hwaseong Reclamation Lake was constructed; and rich shellfish beds were gradually ploughed into rice-fields (see Section 2.2). Counts of waterbirds which confirm the continuing national and international importance of the Hwaseong Wetlands have continued (Sections 3.3 and 3.4); as has work to raise awareness of the need to conserve what remains.

During the same period, the global increase in scientific understanding of wetlands and concern for the planet's worsening health have both accelerated. In 2012, an analysis by the IUCN determined that because of the reclamation and degradation of tidal flats, especially within the Yellow Sea, "Fisheries and vital ecological services are collapsing and ecological disasters increasing, with concomitant implications for human livelihoods. Observed rates of declines of waterbird species of 5–9% per year… are among the highest of any ecological system on the planet." (Mackinnon *et al*. 2012). Subsequently, Yellow Sea tidal flats were assessed by the IUCN (2020a) as an Endangered Habitat. Recent research also reveals that, by area, coastal wetlands are the most economically valuable ecosystems on Earth (Davidson *et al*. 2019). Moreover, this high value is increased further when factoring in the huge role that tidal flats and coastal wetlands have in sequestering carbon, now estimated to be at a rate ten times greater than mature tropical forests (NOAA 2020). The need to conserve wetlands and wetland biodiversity is therefore increasingly recognized as key to Sustainable Development, both through international conventions like Ramsar and

the Convention on Biological Diversity, and also through the UN's 17 inter-connected Sustainable Development Goals.

Throughout the world, we have now arrived at a time when, because of the overwhelming and inter-related crises of climate change, biodiversity loss and disease pandemics, "Making peace with nature must be the top, top priority for everyone, everywhere." (UN General-Secretary Gutteres, December 2020).

The maintenance and / or enhancement of the ecological health of the Hwaseong Wetlands is clearly and urgently in the local, national and international interest.

In September 2018, Hwaseong City therefore held the first of three international wetlands symposia, co-organised with the Project's current partners: KFEM Hwaseong, National KFEM and Birds Korea. And three months later, the Hwaseong Wetlands were formally listed as an EAAFP Flyway Network Site.

In May 2020, Hwaseong City and the EAAFP signed an MOU; in June the Project was launched; and in December 2020, the third symposium was held, entitled, "Hwaseong Wetlands: Getting the benefits of Wise Use".

This report is another small step forward. It is the product of seven-months of research and meetings conducted for the Project, and helps to provide baseline data and information for future management and Wise Use of the Hwaseong Wetlands. We welcome your feedback.

Figure 1. International applause for Hwaseong City as the Hwaseong Wetlands are formally recognized as a Flyway Network Site, Hainan, PR China, December 2018.

2 THE HWASEONG WETLANDS

2.1 Location of the Hwaseong Wetlands

The Hwaseong Wetlands (centred at approximately 37.115046° 126.731785°), are located in Gyeonggi Bay in the northwest of the Republic of Korea (ROK).

Situated on the eastern shore of the Yellow Sea about one hour's drive south from Seoul, the Hwaseong Wetlands sit at the heart of the East Asian-Australasian Flyway (EAAF), in a region where temperatures can exceed 35C in July and August, but fall well below zero for much of January.

Almost all waterbirds found in the Hwaseong Wetlands are therefore long-range migrants, with some species flying the length of the EAAF every year, from Alaska and Russia in the north, to Southeast Asia, Australia and New Zealand in the south.

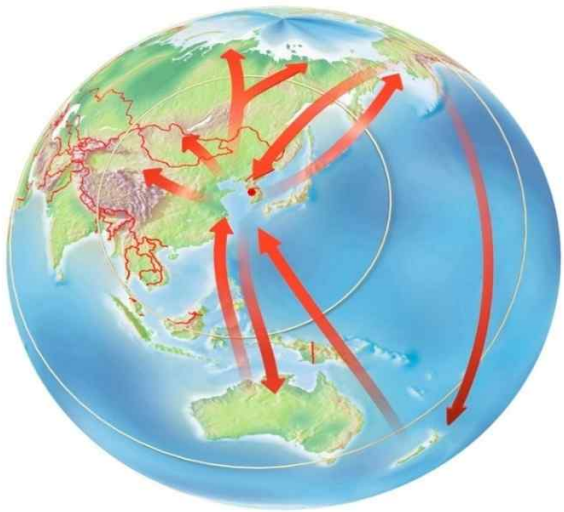

Figure 2. Location of the Hwaseong Wetlands at the heart of the East Asian-Australasian Flyway. Figure from Van de Kam *et al*. (2008)

Formerly known as Namyang Bay, the Hwaseong Wetlands are in the outer part of what was once the Asan-Namyang estuarine super-system. This super-system historically was larger than the now-reclaimed Saemangeum, being closer in size to the 62,000 ha Wash in the UK. The inner part of this historical super-system was formed by Asan Bay. Pre-reclamation, Asan Bay likely contained *c.* 30,000 ha of largely muddy tidal flats, of which less than 10 % now remains, with several large reclamation projects still ongoing.

Namyang Bay itself historically contained *c.* 8,000 ha of contiguous intertidal wetland, with a mix of sand and sand-mud substrates typical of the outer part of a large estuarine system. Most of Namyang Bay was

converted to land and the Hwaseong Reclamation Lake when it was closed off by the 9.81km long outer sea-dyke in 2002.

Figure 3. Location of the Hwaseong Wetlands (outlined in dark blue) as surveyed in the Project Surveys (see Sections 2.2 and 3.4). On left in 1988, when the first shorebird surveys were conducted in the wetlands (see Section 3.3); and on right, in 2020. Images from Google Earth.

A total of 7,301ha of the Hwaseong Wetlands were designated as a Flyway Network Site in 2018 (EAAFP 2018). The Hwaseong Wetlands Flyway Network Site is comprised of nine main component habitat types, including tidal flats, outside of the outer sea-dyke; the reclamation lake ("Hwaseong Reclamation Lake"); freshwater wetlands, excluding rice-fields; working rice-fields; areas undergoing construction; and immediately adjacent marine inshore waters. More details on these component parts are presented in Sections 2.2 and 3.4.

2.2 The Hwaseong Wetlands: Habitat Type, Area, Jurisdiction and Main Ecosystem Services

Introduction

The Hwaseong Wetlands are a diverse assemblage of ecologically-connected wetland types, still connected by the movement of species and water. Some parts of the wetland system, including extensive tidal flats and inshore marine waters (numbered 1 and 9 respectively in Figure 4), are natural or near-natural, and support an important coastal shellfishery and fishery; others are mostly artificial. These artificial areas were created this century through reclamation (defined as the conversion of natural wetland into artificial wetland and land by mechanical means: Birds Korea 2010) of the deeply-indented Namyang Bay.

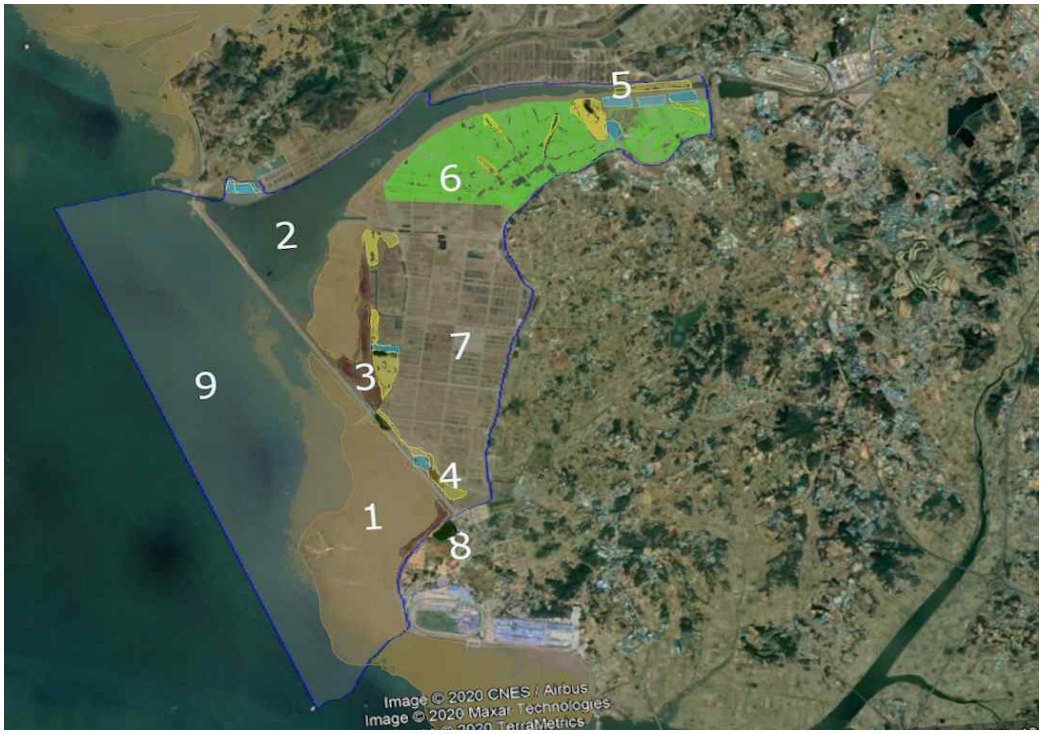

Figure 4. Nine main habitat types within the Hwaseong Wetlands Project Survey Area (outlined in dark blue). As numbered, 1=Tidal Flats at Lowest Low Tide; 2=Reclamation lake; 3= Saltmarsh type vegetation and vegetated tidal flats; 4= Shallow Freshwater Wetlands created accidentally by the reclamation process; 5= Freshwater Ponds created for water treatment and / or to use for irrigation; 6= working rice-fields; 7= Fallow land, largely covered by dry reed and other grasses (some undergoing preparation for conversion into arable land); 8 = Park-like areas with some trees and bushes; and 9= Inshore marine waters, outside of the sea-dyke.

The Reclamation Process

In its natural state, Namyang Bay was strongly influenced by marine waters and tidal action, with a tidal range of >9 m during highest spring tides, which exposed extensive tidal flats and saltmarshes at low tide. The tidal flats supported a very important shell-fishery and some of the largest concentrations of

shorebirds in the nation (see Long *et al*. 1988; Yi 2003). The hinterland of the bay was lined with a narrow strip of rice-fields and salt-farms; and there was little freshwater input into the system, as the bay was fed only by three small rivers (the Namyang Stream, the Jaan Stream and the Eoeun Stream).

The large-scale reclamation of this area entailed the construction of a 9.81 km long outer dyke which was completed in 2002. This outer dyke blocked off most of the bay from the sea. Reclamation then continued with the construction of elevated inner dykes to impound 1,730 ha of the lower parts of the bay and the construction of infrastructure to drain higher areas, and to remove salt from soils. This drainage process uses rainfall, gravity, waterways and pumps.

The Hwaseong Reclamation Lake was created through this process. The Hwaseong Reclamation Lake now occupies the deeper parts of the former bay (8-9 m deep at deepest), with a narrow set of sea-gates in the northwest corner to allow drainage of lake water into the sea. Because of persistent leakage of marine water through these sea-gates, the waters of the lower 750-850 ha of this lake (numbered 2 in Figure 4) are brackish, and there is a very modest tidal range, estimated at 10-20 cm on several survey dates in 2020. Importantly for management, water levels within this reclamation lake can also be controlled to some degree through the fuller opening or closing of the sea-gates; and by blocking and diverting freshwater water upstream. As much of the lower part of the Hwaseong Reclamation Lake is shallow (<1 m) even small changes in water level can result either in complete inundation or in the exposure of >100 ha of brackish tidal flat, used in recent years by very large numbers of waterbirds.

Landward of the inner dykes, reedbeds and freshwater ponds (numbered 4) and small reservoirs and water treatment ponds (numbered 5) now occupy former creek areas; and dry land has been made from the higher parts of former tidal flats. Conversion of 1,000 ha of these former upper tidal flats to create *c*. 850 ha of rice-fields in the inner part of the bay (numbered 6) was completed in the 2010s. Conversion of the remaining ~1,480 ha of former upper sand flats to the east of the bay (numbered 7) into arable land is still ongoing; as is the development of 768 ha of "Eco-Farmland" along the narrow strip of created land to the west of the Hwaseong Reclamation Lake.

This process of reclamation has caused massive and permanent changes to the ecological character of the former Namyang Bay, resulting in a loss of livelihood for many shell-fishers and fisherfolk and driving declines in several species of shorebird. Although thousands of hectares of tidal flat and marine shallows were destroyed, the area of freshwater wetland has been increased; and an extensive brackish zone has also been accidentally created.

Jurisdictional Issues

Wise Use of the Hwaseong Wetlands will require the active participation and support of local stakeholders (most especially fisherfolk and farmers) and also close collaboration between decision-makers at a range of scales. In addition to Hwaseong City's jurisdictional authority, provincial support and the active support of several central government bodies will be essential.

This is because, as called for by the Public Water Surface Reclamation Act (1962) and various amendments, the primary end-use of any reclaimed land and waters had to be agriculture. The recently reclaimed land and waters of the Hwaseong Wetlands therefore fall under the jurisdictional authority of the Ministry of Agriculture, Food and Rural Affairs, and relevant subsidiary agencies. Even now, rice-farmers are able to lease but not to own the reclaimed land. At the same time, remaining tidal flats and

inshore marine waters are under the jurisdictional authority of the Ministry of Oceans and Fisheries, with fishing rights for local fishing communities ensured through a license and permit system.

Responsibility to conserve the natural components of the Hwaseong Wetlands is also divided between different ministries and agencies. From the 1960s to the 1990s, the Cultural Heritage Administration (CHA) was the lead national agency for the conservation of threatened species, through the designation of National Natural Monuments. Although the CHA continues to designate sites and species as National Natural Monuments, the Wetlands Conservation Act (1999) legislated that responsibility to conserve freshwater species falls primarily with the Ministry of Environment (which is also responsible for ensuring water quality, and a "healthy environment" as part of the National Constitution); while the Ministry of Oceans and Fisheries is responsible primarily for the health of marine waters and the conservation of species which are ecologically dependent on tidal flats and marine waters.

This complicated arrangement means that the Black-faced Spoonbill is currently assessed as Nationally Endangered Class 1 by the Ministry of Environment; is designated as National Natural Monument 205-1; and is listed as a protected species by the Ministry of Oceans and Fisheries (For more examples, see Table 9 in Section 3.5). At the same time, there are still few legal or administrative mechanisms through which to ensure the long-term conservation of species like these or their habitats, if infrastructural development of an area used by the species is ruled as being in the national interest. To date, the most effective conservation measures have been the designation of key sites as Wetland Protected Areas and as Ramsar Sites.

The Hwaseong Wetlands Project Survey Area

The Hwaseong Wetlands Flyway Network Site (FNS) was delineated in 2018 by Hwaseong City. Because of issues with access, survey work conducted for the Project ("the Project Surveys") did not cover all of the FNS.

Nonetheless, the boundaries of the Project Survey Area (in Figure 4) are similar to the boundaries of the FNS. The Project Survey Area also has a similar total area (7,330 ha) compared with the FNS (7,301 ha), with approximately a third of this area poorly-delineated "Marine Inshore Waters".

Differences include:

(1) The Project Survey Area extends further northeast than the FNS, to include a series of water treatment ponds and rice-fields. This is because of their obvious ecological connectivity to the rest of the Hwaseong Wetlands, their high value to waterbirds, and their potential value for environmental education and ecotourism.
(2) The exclusion of a substantial part of the north of the FNS, along and either side of the Namyang Stream. This area was not surveyed because of access restrictions and ongoing construction.
(3) The exclusion of most of the Eco-Farmland area along the northern boundary, with the exception of a small group of water treatment ponds in the northwest of the site, because of very high levels of human use and disturbance.

Figure 5. Boundaries of the Project Survey Area (in dark blue) and 40 habitat based sub-units used in organizing count gathered data during the Hwaseong Wetlands Project. The boundaries follow (but are not identical to) the Flyway Network Site boundaries in EAAF (2018). Only data from sites within the boundaries are included within species counts and totals, unless explicitly stated otherwise. Larger numbering indicates higher importance for waterbirds, based on the Project Survey.

The component parts of the Hwaseong Wetlands Project Survey Area, and of immediately adjacent wetlands, are listed in Table 1. Wetland types follow Ramsar Site Information Sheet definitions.

Figure 6. Area 2--1 and 3--1, Hwaseong Reclamation Lake, in August and again in December. Coastal wetlands are highly dynamic ecosystems, with habitat boundaries that can change daily with the tides, and seasonally between wet and drier months.

Table 1. Main Habitats of the Hwaseong Wetlands: their type, area, use and main ecosystem services

Number in Fig. 5	Type & Area	Ramsar wetland Type*	Approximate Area**	Main Users	Value of Ecosystem Services (Potential or realized)
Within the Project Survey Area					
1	Tidal Flat (Maehyangri)	G	940 ha at lowest low tide outside of the outer sea-dyke	Shellfisheries; fisheries; tourism	Very High: fisheries and biodiversity
1	Tidal Flat (Reclamation Lake)	R	0-200 ha inside of the outer sea-dyke	None	Very High: biodiversity
1	Islets and rocky areas (Maehyangri)	D/ E	c. 15 ha	Shell-fishers	Moderate to High: shellfisheries
2	Open waters of Hwaseong Reclamation Lake	J	650-850 ha of open, brackish lagoon	Illegal fishing; some illegal recreational use	Very high: avian biodiversity; fisheries
2	Permanent waters of Stream flowing into the Hwaseong Reclamation Lake	M	135 ha	Occasional illegal fishing	High: Water quality (extensive reed-beds); biodiversity
3	Saltmarsh, outside of outer dyke	H	0.1-0.2 ha	None	High: carbon sequestration; plant diversity
3	Saltmarsh and salt-tolerant marsh inside of outer dyke	H/Ss	120 ha	Local people collect plants (for food/ medicine)	High: carbon sequestration; plant diversity; food
4	Shallow freshwater wetlands	Tp / (W)	443 ha	None	High: Water quality; biodiversity
5	Freshwater wastewater and irrigation ponds	2,8,9	95 ha	Water management	High: Water quality; biodiversity; potential for environmental education
6	Rice-fields	4	850 ha	Rice-farmers	Very high: Food production; biodiversity
7	Fallow land (largely dry reed)	-	1,480 ha	None	Low-medium: biodiversity
8	Park land type	-	2 ha	None	Medium: biodiversity
9	Inshore marine waters	A	c. 2400 ha	Fishers	Very high: Food production; use by recreational fishers; biodiversity
Contiguous Areas Included in the FNS but excluded from the Project Survey Area					
2	Permanent waters of Stream flowing into the Hwaseong Reclamation Lake	M	125 ha	Recreational fishing	High: water quality (extensive reed-beds); biodiversity
5	Freshwater wastewater and irrigation ponds	2,8,9	32 ha	Water management	Moderate to High: Water quality; biodiversity; potential for environmental education
7	Fallow land; undergoing construction into rice-fields; currently included in the	-	230 ha	None	Medium: biodiversity
Contiguous Intertidal Wetland					
1	Tidal Flat (Seokcheonri)	G	790 ha	Fishers	High: Fisheries, biodiversity
2	Tidal Flat (Gungpyeongri-Maehwari)	G	815 ha	Fishers	Very High: Fisheries, biodiversity

*Wetland types follow Ramsar offline RIS sheet (2020)

**Area calculated independently, using https://www.freemaptools.com/area-calculator.htm

2.3 Opinions of Local Stakeholders on the Wise Use of the Hwaseong Wetlands

2.3.1 Background

As a major component of the Hwaseong Wetlands Project, meetings were held with fishermen, farmers, residents, and Hwaseong civic groups to gather opinions. Many of these opinions were presented to the Hwaseong Wetlands Forum and at the Hwaseong International Symposium in December 2020.

Many local stakeholders' opinions on conservation and wise use of the Hwaseong Wetlands have been affected by decades of reclamation.

Reclamation projects, port development and rapid industrialization have led to a decrease in the area of tidal flats in Gyeonggi Province, including in Hwaseong. Tidal flats, which used to be a spawning ground for fish and shellfish, have disappeared. The marine ecosystem has been severely damaged by changes in industrial wastewater, hot water, excessive aggregate collection and dredging of shipping lanes.

Within Gyeonggi Province, Hwaseong has the largest population working in the fishing industry. Of about 2,700 people from 35 fishing villages in the Gyeonggi Southern Fisheries Cooperative, 2,100 people from 25 fishing villages in Hwaseong continue their fishing activities. As of 2019, fishing production in Gyeonggi Province amounted to about 32,000 tons (Tables 2 and 3), accounting for 1.96 percent of the nation's fishery production (3,287,000 tons). Of this total, the annual general marine fishery production (4,161 tons) is in decline, while mariculture production is increasing (27,491 tons). Prior to the Hwaseong reclamation project, fishermen's income amounted to more than 30 million won per year, accounting for about 40% of the total earned by fisherfolk in the Province, as they earned a relatively higher income than in other regions. There was a clear decrease in income after the reclamation project. The reclamation project has also changed the amount of fish caught and the type of fishery products. In 2002, many species were caught including Japanese swimming crab, swimming crab, and rockfish, octopus, but by 2019, main harvests were of seaweed, webfoot octopus, and short-neck clams. Before reclamation, general marine fisheries were more important and valuable than aquaculture, but now fish production is increasing significantly. Major products now include dried seaweed, white-legged shrimp, and salted shrimp.

Table 2. Change in types of fishery by year in Gyeonggi Province

Year	Total		일반해면어업		천해양식어업	
	Volume: M/T	Value: 1000 won	Volume: M/T	Value: 1000 won	Volume: M/T	Value: 1000 won
2002	14,553	43,441,879	13,532	41,624,072	1,021	1,817,807
2005	13,685	31,919,568	8,540	27,139,017	5,145	4,780,551
2008	18,940	48,958,290	9,557	41,642,795	9,383	7,315,495
2011	12,479	35,093,890	4,299	28,179,693	8,180	6,914,197
2014	17,653	39,966,811	4,184	28,331,541	13,469	11,635,270
2017	23,393	50,924,721	4,207	29,314,055	19,186	21,610,666
2018	22,761	51,524,741	4,348	32,363,642	18,413	19,161,099
2019	31,652	55,951,966	4,161	32,500,420	27,491	23,451,546

*Source: Fisheries Information Portal (www.fips.go.kr) fishery production statistics

Table 3. Status of fisherfolk in the fishing villages of Hwaseong, Gyeonggi Southern Fisheries Cooperative (as of December 31, 2018).

	Village Name	Inhabitants		
		Total	Male	Female
Hwaseong Villages (25)	Go-on	207	122	85
	Seokcheon	134	69	65
	Kukhwado	29	17	12
	Maehyang-2	177	126	51
	Hwasan	86	59	27
	Wonan	116	87	29
	Hokok	152	120	32
	Gungpyeong	165	107	58
	Baekmi	119	76	43
	Songgyo	119	73	46
	Jeibu	108	74	34
	Jeonkok	55	44	11
	Jihwa	34	28	6
	Gopo	159	132	27
	Eodo	30	26	4
	Dokji	42	38	4
	Gojeong	42	41	1
	Si	66	50	16
	Sinue	27	19	8
	Jangdeok	30	22	8
	Jukok [1]	58	32	26
	Sagot [1]	31	26	5
	Yongdu [1]	96	67	29
	Uumdo [1]	15	12	3
	Hyeongdo [1]	17	13	4

[1] 자연부락 Source: Gyeonggi Province (2018).

The biological excellence of the Maehyangri tidal flats and marine inshore waters was confirmed by the 2017 National Marine Ecosystem Comprehensive Survey. The Ministry of Oceans and Fisheries is currently seeking to designate a wetland protected area in 14.08 ㎢ of tidal flats and inshore waters outside of the seawall (excluding Nong Island and Maehyang 2nd Port); and the Ministry of Environment is seeking to designate an area of 9km^2 within the Hwaseong Reclamation Area (Figure 7).

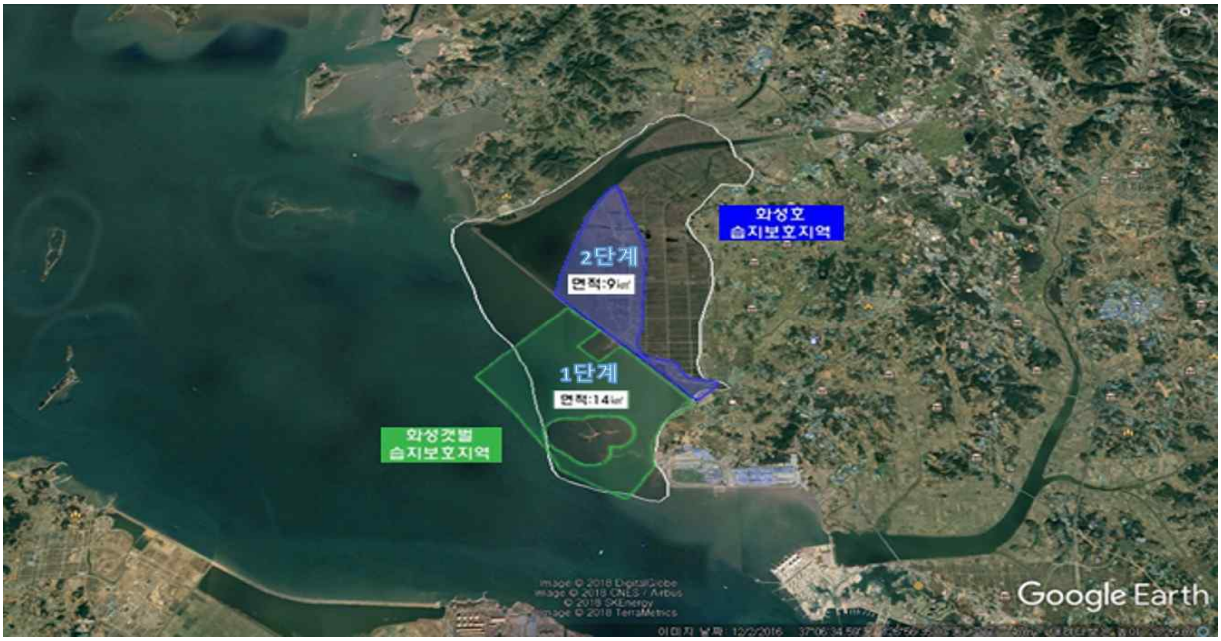

Figure 7. Proposed Wetland Protected Areas within the Hwaseong FNS (outlined in white).

2.3.2 Local stakeholders' opinions on the wise use and management of Hwaseong Wetlands

The following opinions were presented at the Hwaseong Wetlands Forum and at the Hwaseong Wetlands International Symposium:

(1) Mr. Jeon Man-kyu. Maehyang-ri Guard

- New fishing grounds and fishing licenses should be guaranteed in wetland protected areas.
- Local fishermen have been harmed by previous government policies, so policies and budgets for residents' support for wetland conservation and management should be established.
- A local committee should be formed where residents' opinions can be gathered.

(2) Mr. Han Gap-soo, Maehyang 2 fishing village chief

- If Korea Rural Community Corporation desalinates the Hwaseong Lake, water pollution will become serious like in the Sihwa Lake. Absolute opposition to desalination.
- It is expected that the tidal flats will be restored and fish resources will be revived by creating a bridge or sluice gate in some sections of the Hwaseong seawall to allow sea water to flow in and out all the time.
- There is no place in Maehyang Port for fishing boats to evacuate in the event of a typhoon. For safety reasons, facilities should be installed inside Hwaseong Lake where boats can enter to avoid storm damage.

(3) Mr. Choi Jin-Cheol, Hwaseong Lake Fishermen Development Council

- Due to sedimentation and erosion, tidal flats continue to change, and as the tidal flats change, problems can be caused to fishing grounds. Scientific research and analysis are needed to predict changes in flow of seawater and external changes to sediments over the long term which might be caused by any proposed changes to the seawall.

- The government should first lease reclaimed farmland promised to fishermen in 1991 to 13 fishing villages and 1,300 households who lost their fishing grounds. Under Article 15 of the Enforcement Decree of the Rural Modernization Promotion Act, there are residents who have waited 20 years after giving up the sea in order to farm rice paddies, believing in the allocation of farmland promised by the government. Past issues must be accurately sorted out before discussions on planning, management and preservation can begin. If the law is changed, the government should first explain it to the affected fishermen in advance, present alternatives to the promise of distribution, and conduct consultations on reclaimed farmland.

(4) Ahn Yong-jeong, Green Farmers Federation

- Eco-friendly agriculture of reclaimed farmland focuses on biodiversity and plays a leading role in preventing the climate crisis. Hwaseong area has many industrial areas and rivers are polluted due to reckless development, so eco-friendly agricultural conditions are not good, but this situation can be improved by managing Hwaseong reclaimed land to establish a national best standard. This is possible if the government or local governments purchase rice produced in reclaimed land at a stable price while benefiting humans and creatures living in paddy wetlands and securing habitat with biological conservation funds.
- An eco-friendly agricultural complex can be created if local governments support the eco-friendly agricultural product processing industry to generate economic profits and create jobs in the region.

(5) KFEM Hwaseong

- Stop reclamation. Conserving the ecosystem can help to overcome the global climate crisis.
- Designate an ecological conservation area and restrict human access to it. Ecological circulation should be created by designating conservation zones that can enhance biodiversity and restrict development or human access through conservation of the Hwaseong wetlands.
- Located near a metropolitan area, the Hwaseong Wetlands will be a valuable ecotourism resource. The reclamation project should be suspended and used as an ecological education space.
- Form a Hwaseong Wetland Committee involving the government, Hwaseong City, civic groups, local residents, fishermen, farmers and businesses. The Hwaseong Wetland Committee will consult to change the land use plan to ecological conservation area, suggest new management directions for reclaimed land, and enhance the status of international cities.

Figure 8. Fishers on the Maehyangri tidal flat, December 2020.

2.4 Biodiversity of the Hwaseong Wetlands

Biodiversity forms a very important component of the ecological character of the Hwaseong Wetlands, and was the main focus of the Project Surveys conducted from late June to mid-December 2020. Most of the research was focused on waterbirds.

2.4.1 Birds

A total of 204 bird species was recorded during the Project Surveys between June and December 2020. Thirty-four of these, listed in Table 4, are highlighted in different sections of the report because they are especially important as bio-indicators and as conservation priorities for future management actions. In this table, and throughout this report, the order of species follows and the nomenclature is based on the global checklist developed by the International Ornithological Congress (Gill *et al.* 2021).

Table 4. Selected bird species referred to in the text of this report

		Global Conservation Status (IUCN)	Nationally Endangered (MOE)	"Protected" MOMAF	National Natural Monument (CHA)
Swan Goose	*Anser cygnoides*	VU	Class II		325-1
Taiga Bean Goose	*Anser fabalis*	LC			
Tundra Bean Goose	*Anser 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			
Great Crested Grebe	*Podiceps cristatus*	LC			
Far Eastern Oystercatcher	*Haematopus osculans*	(NT)	Class II	✓	326
Grey Plover	*Pluvialis squatarola*	LC			
Kentish Plover	*Charadrius alexandrinus*	LC			
Mongolian 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	✓	
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	✓	
Ochre-rumped Bunting	*Emberiza yessoensis*	NT	Class II		

Research by Senfeld *et al.* (2020) support species-level recognition of Far Eastern Oystercatcher. Melville *et al*. (2014) assessed this taxon as Near Threatened.

2.4.2 Mammals and Amphibians

KOEM (2017) includes the results of surveys of biodiversity in intertidal areas of the Hwaseong Wetlands FNS. The Project Surveys were focused more narrowly on waterbirds, and no time was invested in trying to identify most non-avian species groups, with the exception of mammals and amphibians. Even then, observations were mostly made opportunistically, although we also conducted a more focused search for amphibians by walking and driving through rice-field areas between 19:30 and midnight on June 26th with leading amphibian expert Dr. Amael Borzée.

Mammals

Only two mammal species were observed during the Project Surveys: Racoon Dog *Nyctereutes procyonoides,* assessed nationally and globally as Least Concern, and Korean Water Deer *Hydropotes inermis argyropus*, assessed Nationally as Least Concern and globally as Vulnerable (IUCN 2020b). Tracks and scat of both species were recorded in many areas, especially along the inner dyke road and in areas close to freshwater wetland, e.g., at 4--3, 5--3 and 7--1. Singles of both species were also found as roadkill, with one dead Korean Water Deer on the inner dyke road; and one dead Racoon Dog on the outer dyke road.

Two more mammal species of conservation concern are known to occur within the Hwaseong Wetlands FNS. The nationally Endangered Class II Amur Leopard Cat *Prionailurus bengalensis* is widespread at the site, with several territories, and scat and tracks were seen in several areas, as were one or two individuals during survey work in January 2021. Also outside of the Project Surveys, the tracks and scat of the nationally Endangered Class 1 and globally Near Threatened River Otter *Lutra lutra* were identified in the wetlands, also in 2020 (KFEM Hwaseong).

Figure 9. Amur Leopard Cat *Prionailurus bengalensis*, Hwaseong Wetlands FNS, January 12th 2021

Amphibians

The Project Surveys found substantial populations of five species of amphibian (Table 5), with a coarsely estimated 100 Gold-Spotted Pond Frog *Pelophylax chosenicus* and 200 Black-spotted Pond Frog *Pelophylax nigromaculatus* heard on June 26th in the rice-fields of 6--2 and 6--3; and dozens of both species heard in other rice-field areas through into July. The largest concentration of Boreal Digging Toad *Kaloula borealis* was 30 on July 24th, in wet grassland bordering the Hwaseong Reclamation Lake. While *P. nigromaculatus* is listed as Near Threatened, its population size is declining similarly to the population of *P. chosenicus* (globally Vulnerable) and *K. borealis* (nationally Endangered Class II). The area is therefore an important site for the conservation of three threatened amphibian species.

Although searched for and not found during the Project Surveys, according to a media report the nationally and globally Endangered Suweon Treefrog *Dryophytes suweonensis* was recorded in one of the wet reedbed areas (perhaps 4--3) by a documentary team in 2020 (Park 2020). This record is in general agreement with historical records on the distribution of the species within Hwaseong. More research will be required in 2021 to confirm the distribution of this species within the Hwaseong Wetlands.

Table 5. Amphibians recorded during the Project Surveys.

Popular Name	Scientific Name	Global Conservation Status	National Conservation Status	Distribution (For numbering, see Fig. 5, Section 2.2)
Japanese Treefrog	*Hyla japonica*	LC	LC	4--1, 5--3,6--3, 6--4, 6--5, 8--2
Boreal Digging Frog	*Kaloula borealis*	LC	EN II	3--1, 4--1, 5--3, 6--3, 6--4
Black-spotted Pond Frog	*Pelophylax nigromaculatus*	NT	LC	4--4, 6--2, 6--3, 6--4, 6--5
Gold-spotted Pond Frog	*Pelophylax chosenicus*	VU	EN II	6--2, 6--3, 6--4, 6--5
American Bullfrog	*Rana catesbeiana*	LC	Invasive	4--3,4--4,4--6,6--4, 6—5, 7--2

As noted by Borzée & Jang (2019), within the ROK, the Suweon Treefrog has a fast-declining total population of fewer than 2,500 individuals and is predicted to become extinct in the country within decades. All have been found exclusively in rice paddies, with none of these rice-field areas currently within Protected Areas. In order to conserve the species, the authors recommend a shift toward ecological agriculture as recommended by the ROK government (Ministry of Agriculture, Food and Rural Affairs 2013) in rice-field complexes where the species occurs, with special branding for rice-products from these areas; and also a change in management of grass edges to rice-fields.

SECTION 3 THE NATIONAL AND INTERNATIONAL IMPORTANCE OF THE HWASEONG WETLANDS

3.1 Introduction to the Ramsar Convention

The Ramsar Convention on Wetlands is the intergovernmental treaty that provides a framework for national action and international cooperation for the conservation and wise use of wetlands and their resources (Ramsar 2020a). Wetland resources include e.g., water storage, fisheries, biodiversity, their capacity to absorb atmospheric and oceanic carbon and their value as places of recreation and learning. Together, these make wetlands the most economically valuable ecosystem types on Earth.

Davidson *et al*. (2019) estimated that the global monetary value of natural wetland ecosystem services in 2011 was Int$47.4 trillion per year. This represents 43.5% of the value of all-natural biomes. Among wetlands, coastal wetlands (including intertidal flats and coastal marshes) had the highest values. Despite forming only 15% of global natural wetland area, coastal wetlands in 2011 were estimated to deliver 43.1% (Int$20.4 trillion per year) of the total global ecosystem services monetary value of all-natural wetland classes.

Wise use of wetlands as called for by the Ramsar Convention has at its heart "the conservation and sustainable use of wetlands and their resources, for the benefit of people and nature" (Ramsar 2020b). Wise use therefore requires wetland management to be based on a solid scientific understanding of ecological values, interactions and processes, so as to ensure that ecosystem structures and functions are maintained and managed for the benefit of present and future generations.

Wise use of wetlands is therefore fully compatible with the 17 Sustainable Development Goals (SDGs) set out by the United Nations. Wise Use of wetlands can: reduce poverty, by improving human livelihoods (SDG 1); reduce hunger through improving wetland productivity and maintaining food security (SDG 2); contribute to good health and well-being by providing peaceful places for relaxation (SDG3) and for quality education (SDG 4); support decent work and economic opportunity for both women and men (SDG 5 and 8); provide clean water and help with sanitation (SDG 6); contribute to the sustainability of communities (SDG 11) and to responsible consumption and production (SDG 12); contribute to climate action (SDG 13); help conserve life below water (SDG 14) and life on land (SDG 15). And if based on science and a good understanding of ecosystem function, wetlands can also help in the generation of clean energy (SDG 7), as called for in the national Green New Deal. And because of the international nature of the convention, wise use of wetlands can even contribute to winning peace (SDG 16) and building national and regional partnerships (SDG 17).

Ramsar (2020b) states that the mission of the Ramsar Convention is the "conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world." To achieve this, work of the Ramsar Convention is organized around three pillars:

i) The wise use of all wetlands through national plans, policies and legislation, management actions and public education;
ii) The designation and sustainable management of suitable wetlands for inclusion on the list of Wetlands of International Importance; and
iii) International cooperation on transboundary wetlands and shared species.

The ROK joined the Ramsar Convention in 1997, and hosted the global Ramsar Convention Conference of the Parties in Changwon in 2008, under the theme of "Healthy Wetlands, Healthy People". The nation currently has 23 sites designated as "Wetlands of International Importance" (more popularly known as Ramsar Sites), with a surface area of 19,618 hectares (Ramsar 2020c). Many of the nation's Ramsar sites are important for fisheries and for fishing communities. These include famous tourist destinations like Upo Wetland and Suncheon Bay and Daebudo Tidal Flat, which is currently the only Ramsar site in Gyeonggi Province.

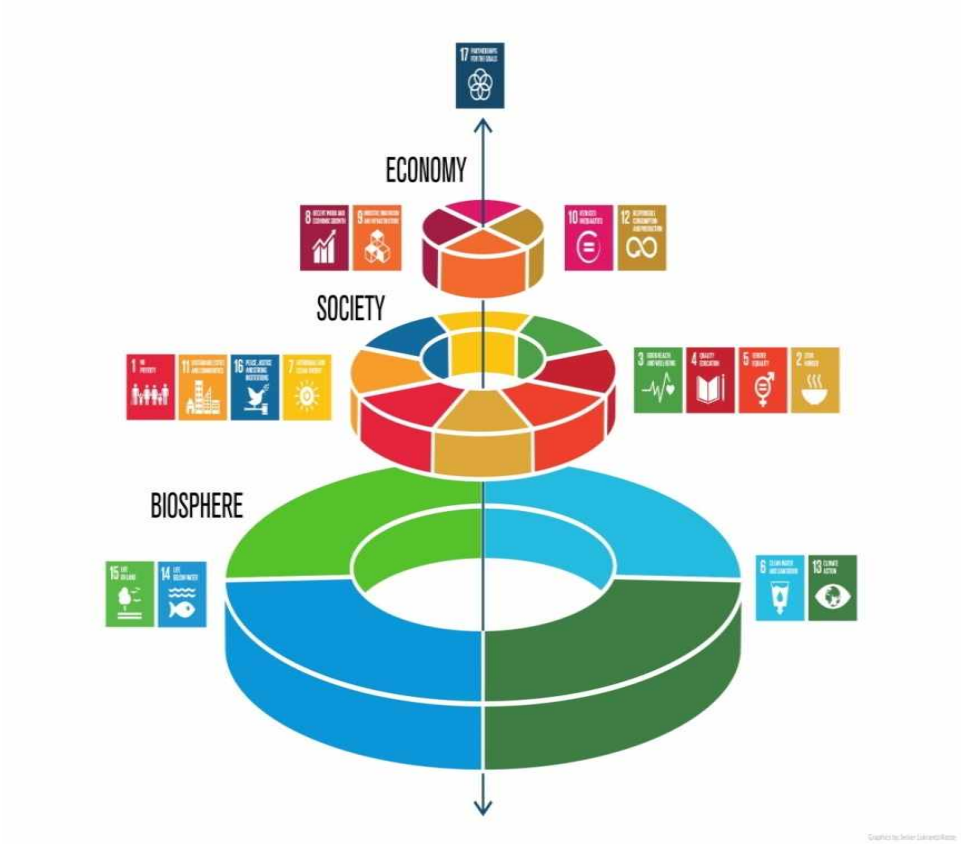

Figure 10. Natural resource management as the foundation for fulfilling the 17 Sustainable Development Goals. Stockholm Resilience Centre.

3.2 Introduction to Waterbirds of the Hwaseong Wetlands

The Ramsar Convention defines waterbirds as bird species within 33 taxonomic families which are "ecologically dependent on wetlands". These taxonomic families include e.g., ducks, geese and swans (Anatidae); and shorebirds (Charadriidae and Scolopacidae) (Wetlands International 2020). Surveys conducted as part of the Hwaseong Wetlands Project in only six months of 2020 found more than 119,000 individuals of 108 different species of waterbird in the Hwaseong Wetlands, including almost 80,000 individual ducks and geese and more than 28,000 shorebirds, based on a simple summing of peak day counts of each species

Waterbirds are a vital (essential and living) part of the Hwaseong Wetlands. They are beautiful and interesting in themselves. And in addition, all the different waterbird species are also remarkably valuable as "bio-indicators", helping people to identify and measure changes in wetland health and productivity with scientific objectivity.

Tundra Bean Goose

Great Crested Grebe

Black-faced Spoonbill

Eurasian Curlew

Figure 11. Four waterbird species found in the Hwaseong Wetlands in Ramsar-defined Internationally Important Concentrations. Each species has a different structure and feeds in different parts of the Hwaseong Wetlands. This is because differences in their structure, especially differences in bill length and shape, limit each waterbird species to feeding on a narrow range of food items, in a narrow ecological niche. This relationship between structure and ecological niche is the main reason why waterbirds are such excellent indicators of wetland health and productivity; and why changes in their populations help to reveal changes in ecosystem health.

For example:

- The Great Crested Grebe feeds on fish, caught by diving. They require permanent freshwater ponds in summer, building their nests on the edge of reedbeds or other emergent vegetation. In winter, they move to more open water, in the best wetlands forming flocks of several hundred individuals. As freshwater wetlands start to freeze, Great Crested Grebes then move for a few weeks to sheltered bays and coastal waters. In the Hwaseong Wetlands, several pairs breed in freshwater ponds; and in 2020 more than 2,000 were counted on the Hwaseong Reclamation Lake in autumn.
- The Eurasian Curlew is entirely a migrant to the Korean Peninsula, with several thousand also remaining through the winter. Away from their breeding areas, the Eurasian Curlew depends entirely on tidal flats for feeding, where they use their long bills for probing deep into the mud in search of small crabs and tidal flat worms. The Hwaseong Wetlands are perhaps the most important site for this species in Korea. Our surveys found 3,700 here in August 2020, with flocks feeding on tidal flats at low tide; and roosting on Hwaseong Reclamation Lake and "Pond 13" (4--1) at high tide.
- The Bean Goose, often treated as two species (the more numerous Tundra Bean Goose and the much more locally-distributed Taiga Bean Goose: Moores *et al*. 2018) breeds across much of northern Eurasia, wintering in parts of eastern Europe and Far East Asia, including in the ROK. The Tundra Bean Goose feeds primarily by grazing on fallen rice grain, rice stubble and wild plants growing on the bunds between rice-fields. Detailed research has shown that grazing geese help to control weeds and to fertilise rice-fields with their droppings (Kurechi 2007). The longer-billed Taiga Bean Goose feeds primarily on emergent wetland vegetation found in shallow lakes. Our surveys found more than 40,000 Tundra Bean Goose in the Hwaseong Wetlands in October 2020, with most geese roosting overnight on the Hwaseong Reclamation Lake before flying out to feed in harvested rice-fields.
- The Black-faced Spoonbill, known in some languages as the Korean Spoonbill, is primarily a summer visitor to the Yellow Sea. Nesting on small islands, birds feed on tidal flats and in shallow coastal wetlands by wading through shallow water, sweeping their bills from side-to-side in order to catch fish and shrimp. In the Hwaseong Wetlands, large numbers start to arrive in late summer after breeding in Gyeonggi Bay, feeding along the tidal flat edge and roosting in the shallow waters of the Hwaseong Reclamation Lake and "Pond 13" (4--1). Research suggests that the Hwaseong Wetlands are one of the most important wetlands for the species in the world, with a high count of 254 in 2020

Because of the value of waterbirds as indicators of wetland health and productivity (MacKinnon *et al*. 2012), two out of nine Ramsar Convention criteria developed for identifying wetlands of international importance are based explicitly on waterbirds (Ramsar 2002).

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

In addition, Ramsar Convention Criterion 2 states that, "A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities". This criterion is also often applied to waterbirds.

Based on these criteria the Hwaseong Wetlands are internationally important for waterbirds.

These criteria were agreed upon by Contracting Parties to the Ramsar Convention in the understanding that many of the wetlands which are especially naturally-productive are likely to meet Criterion 5 (so that they can support abundance, including healthy fisheries); and only wetlands which are especially diverse, ecologically healthy and ecologically resilient will likely meet Criteria 2 and 6.

The Ramsar Convention criteria therefore allow for the presence of large numbers of waterbirds to be used to identify the most important wetlands quickly, in advance of other more time-consuming and costly research on e.g., hydrology and other species groups.

Proper use of these criteria requires an appropriate level of research effort and access to information on global conservation status and population estimates of each waterbird species.

BirdLife International, on behalf of the IUCN, maintains a database on the conservation status of every bird species in the world; and population estimates of each waterbird species are managed in an online global database maintained by Wetlands International (2020). This database provides population estimates, based on decades of research and on expert opinion, for each waterbird species and even for each "biogeographic" population of each waterbird species, i.e., for populations of species which breed, migrate or spend the winter in different areas to other populations of the same species (Figure 12).

Order Family Species Population	Discontinued	Size - year	Size	Size estimate quality	Size references	Trend - year	Trend	Trend quality	Trend references	1% threshold	1% yearset	Notes
Anseriformes												
Anatidae												
Anser fabalis (Bean Goose)												
fabalis, North-east Europe/North-west Europe		1999 - 2011	40,000 - 45,000	Census based	[R866]	1999 - 2009	DEC	Reasonable	[R866] [R891]	420	2012	[T5690]
rossicus, West & Central Siberia/NE & SW Europe		1999 - 2009	550,000 - 550,000	Expert opinion	[R866]	1999 - 2009	STA	Reasonable	[R866]	5500	2012	[T5693]
johanseni, West & Central Siberia/Turkmenistan to W China		2004 - 2004	1,000 - 5,000	Expert opinion	[R309]	2000 - 2010	DEC	Poor	[R866]	20	2012	[P1800] [S7763]
serrirostris, Kamchatka/Japan		1998 - 2011	1,200 - 6,800	Census based	[R1287] [R1290]	1998 - 2011	DEC	No quality assessment		30	2012	[P2438] [S7760]
serrirostris: Central & Eastern Siberia		2010 - 2010	80,000 - 150,000	Expert opinion		0 - 0	DEC	No quality assessment		1100	2012	[P2439] [S7761]
middendorffi, Okhotsk/Kamchatka-Japan		2008 - 2011	6,000 - 10,000	Census based	[R1287] [R1290]	2008 - 2011	DEC	No quality assessment		75	2012	[P2440] [S7764]
middendorffi, Yakutia/E Asia		2010 - 2010	5,000 - 20,000	Expert opinion		0 - 0	DEC	No quality assessment		100	2012	[P2441] [S7765]
middendorffi, Sayan/E China		2010 - 2010	2,000 - 5,000	Expert opinion	[R1300]	0 - 0	DEC	No quality assessment		30	2012	[P2442] [S7766]

Figure 12. Biogeographic populations of the Bean Goose: example page of the Waterbird Populations Estimate database maintained by Wetlands International (2020).

This organization of information reveals that:

1. The EAAF is the most species-rich of the world's nine major flyways. The EAAF also has the highest proportion of declining waterbird populations (Delaney *et al.*, 2010; Conklin *et al.,* 2014).
2. More than 25% of Near Threatened and Threatened Waterbird species are shorebirds.
3. The Far Eastern Curlew is a globally Endangered shorebird, with a total population of only 32,000. We counted *c*. 7% of the world population of this species in the Hwaseong Wetlands in late July 2020.

3.3 Measuring Change: Waterbird Surveys 1988-2018

Surveys confirm that the Hwaseong Wetlands have been internationally important as defined by the Ramsar Convention for shorebirds and some threatened waterbird species since at least 1988. However, much of the research conducted before the Hwaseong Wetlands Project substantially underestimated the importance of the Hwaseong Wetlands for geese and some duck and shorebird species.

Waterbird surveys are valuable in identifying wetlands of international importance; in helping with the prioritization of conservation actions and site-management; and in assessing changes in the ecological character of wetlands (Ramsar 2002; Jackson *et al*., 2020). This is because the structure (e.g., bill shape and length; leg length) of waterbirds restricts them to feeding on certain food items in often narrow ecological niches within wetland ecosystems.

Changes to wetland ecosystems result in changes in numbers of affected waterbird species supported by those ecosystems. For example, reclamation results in a loss of area and quality of tidal flats used by foraging shorebirds. This decline in feeding opportunity has driven declines in the numbers of many species of shorebird, both at the site and population level, including along the East Asian-Australasian Flyway and especially in the Yellow Sea (Amano *et al*., 2010; Mackinnon *et al*., 2012; Piersma *et al*., 2015; Clemens *et al*., 2016; Melville *et a*l., 2016; Moores *et al*., 2016).

At the same time, the reclamation of tidal flats can inadvertently create new waterbird habitat, most especially for ducks and geese and some additional waterbirds which are ecologically-dependent on freshwater floodplain-type wetlands. Such areas can have very high value for conservation, because almost all natural floodplain wetlands have been reclaimed in Korea (Moores 2002). In some areas, including in the recently-created Hwaseong Wetlands, the shallow reclamation lake and other artificial wetlands, as in many other nations, are now used by roosting shorebirds at high tide (Jackson *et al*. 2020); while surrounding rice-fields and newly-created freshwater wetlands are used by large numbers of duck and geese for both feeding and roosting.

Figure 13. Shorebirds roosting in the Hwaseong Reclamation Lake, July 2020.

Waterbird Surveys: 1988-2009

The first formal bird survey along the shores of the highly-indented Namyang Bay before large-scale reclamation was in April and May 1988. Several teams conducted eight counts of shorebirds and threatened waterbirds over high tide periods between April 24th and May 29th, the period of peak northward migration of shorebirds through the Republic of Korea (Moores 2012, Moores *et al*., 2016). Although some roost sites could not be found and access to other roosts was prohibited, a minimum of 33,973 up to 52,330 individual shorebirds in total were counted (Long *et al*., 1988). At least six shorebird species were found in Ramsar-defined internationally important concentrations based on contemporaneous population estimates of those species, including Great Knot and Nordmann's Greenshank.

According to Yi (2003, 2004) from 1993, researchers within the Wildlife Division of the National Institute of Environmental Research (NIER) initiated regular counts at major shorebird sites along the west coast of the ROK, including Namyang Bay. Between 1997 and 2003, as knowledge of the site and as survey methods improved, NIER found an estimated 70,000 shorebirds annually during northward migration and 30,000 shorebirds annually during southward migration at Namyang Bay. These counts identified Namyang Bay as the second most important site for shorebirds in the ROK after Saemangeum. Among species found in internationally important concentrations, the NIER found an average of 57 globally Endangered Nordmann's Greenshank during northward migration.

Following seawall closure in 2002, Yi (2003) documented a sudden and rapid decline in numbers of shorebirds (Figure 14).

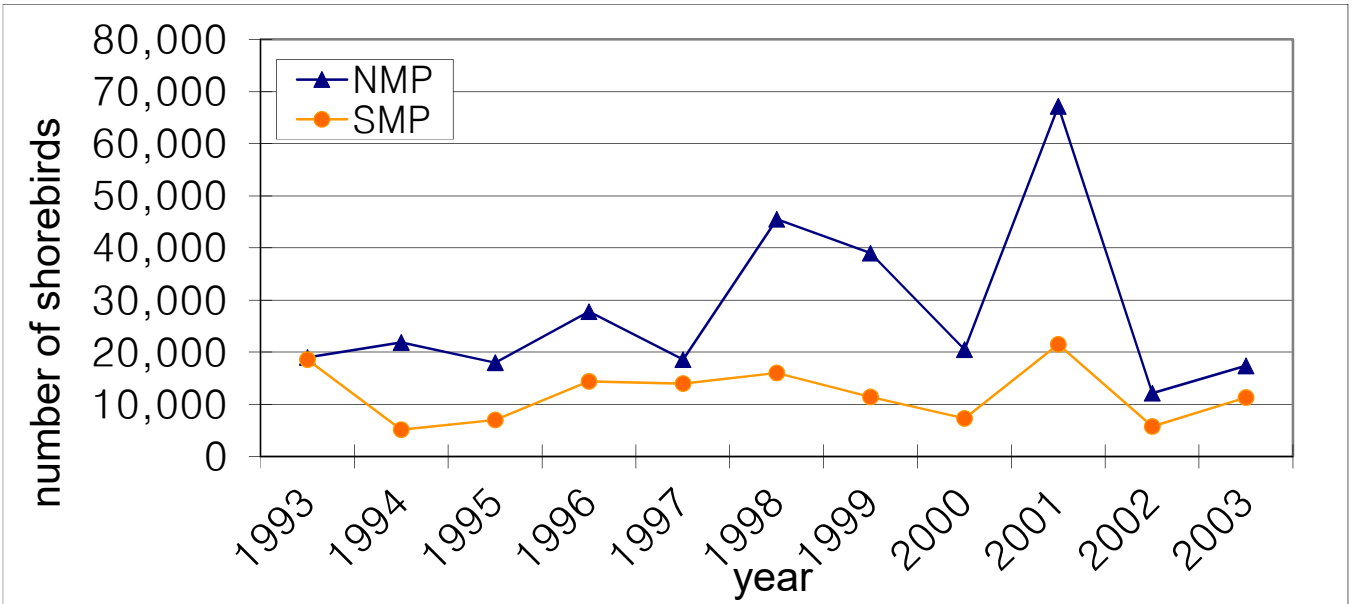

Figure 14. Number of shorebirds counted by the NIER at Namyang Bay between 1993 and 2003 during the Northward Migration Period (NMP) and Southward Migration Period (SMP) (from Yi 2003).

During the same period, MOE Census data reveal a sudden rise in numbers of waterbirds wintering in the newly-formed Hwaseong Reclamation Lake. Excluding shorebirds, these rose from 3,300 in February

1999 to 32,750 individual waterbirds in January 2005. During the same period, there was a simultaneous decline in wintering shorebirds – halving from 1,140 in 1999 to only 579 in 2005 (MOE Census 1999-2005), indicating a loss in feeding opportunities caused by the reduction of tidal flat area. Between 2006 and 2010, the five-year geometric mean of wintering waterbirds (all taxonomic families) was 11,500 (MOE Census 2006-2010).

Fewer easily-accessible data are available for shorebirds during the main migration periods. However, in May 2008, research by three teams of experienced counters on one date still counted more than 36,000 shorebirds within the Namyang Bay area, including in areas now known as the Hwaseong Wetlands and additional extensive areas of adjacent rice-fields. Six shorebird species were found in concentrations of 1% or more of population, including Far Eastern Curlew (334); Great Knot (12,105); and Nordmann's Greenshank (34) (Moores 2012).

Based on research in other areas (e.g., Yang *et al*. 2011, Moores 2012, Moores *et al*., 2016), it can reasonably be suggested that construction and closure of the seawall in 2002 caused a sudden loss of suitable foraging habitat for several species of shorebird (including e.g. Great Knot and Nordmann's Greenshank) resulting in their decline at the local and population level. In the years that followed, changes in substrates caused by the reclamation process; loss of habitat in adjacent areas (including reclamation of much of Asan Bay); and a reduction in disturbance (formerly caused by use of some of Namyang Bay as a bombing range), led to a shift in distribution and increased concentration of several shorebird species within parts of Gyeonggi Bay, including within the Hwaseong Wetlands. At the same time, large numbers of ducks and geese were able to exploit newly-created freshwater and brackish-water habitats.

Figure 15. Construction of the inner dyke. Hwaseong Wetlands, January 2008.

Waterbird Surveys: 2010-2018

One or two counts per year in 2010-2014 by the Shorebird Network Korea (2013, 2014, 2016) confirmed the continuing international importance of the Hwaseong Wetland into last decade. Eight species of shorebird were counted in Ramsar-defined internationally important concentrations of 1% or more of biogeographic population in at least two of the four years: Far Eastern Oystercatcher (peak of 473 in 2013), Grey Plover (peak of 1,800 in 2010), Mongolian Plover (peak of 880 in 2010), Far Eastern Curlew (peak of 735 in 2011), Eurasian Curlew (peak of 1,264 in 2012), Bar-tailed Godwit (peak of 4,443 in 2011), Great Knot (peak of 10,560 in 2011) and Common Greenshank (peak of 1,100 in 2011).

For the period 2015-2018, two main sources of research can be used to identify waterbird species supported in concentrations of 20,000 or more individuals (Ramsar Criterion 5) in addition to the 1% or more of biogeographic population (Ramsar Criterion 6):

1. One-day a month counts of wintering birds from October to March each year by the National Institute of Biological Resources (NIBR), which are very helpful for assessing numbers of ducks, geese and some other waterbirds;
   and
2. Surveys by KFEM Hwaseong. These were usually conducted for several hours over high tide once a month in 2015 (all months), in 2016 (February-November), in 2017 (March-November) and in 2018 (March-September). These are helpful in estimating the numbers of shorebirds supported by the Hwaseong Wetlands during the main migration periods (April-May and again August-September). Although some KFEM Hwaseong data are available for 2019, these do not cover the northward migration period, so cannot be used in this assessment.

In order to estimate the minimum number of waterbirds supported by the Hwaseong Wetlands each year between 2014 and 2018, we added together the highest count that year of each species of waterbird made by NIBR between January and March and again from October to December to the highest counts made by KFEM Hwaseong in that year, with the latter's survey effort focused largely on tidal flat dependent species. We also incorporated peak counts made in 2017 by KOEM (2017); shorebird counts made by Birds Korea in 2018 (once each in April and September); and one reviewed count by a Birds Korea member in December 2018 (Birds Korea Archives). The combined totals generated through this process are listed in Appendix Two.

Through this process, it is possible to confirm that the number of waterbirds counted each year in the Hwaseong Wetlands greatly exceeds the threshold of 20,000 waterbirds provided by Ramsar Criterion 5 (Table 6). Indeed, these survey efforts combined recorded a geometric mean of 89,005 individuals for the four years 2015-2018.

In addition, these combined survey efforts found a total of 22 waterbird species in internationally important concentrations of 1% or more of a biogeographic population. Nine of these were recorded in concentrations of 1% or more in all four years: Tundra Bean Goose, Far Eastern Oystercatcher, Mongolian Plover, Eurasian Curlew, Far Eastern Curlew, Great Knot, Saunders's Gull, Black-faced Spoonbill and Chinese Egret. Two additional species, Mallard and Grey Plover, were recorded in concentrations of 1% or more in three of the four years; and the geometric mean of the counts of these two species for the four years also exceeds the 1% threshold (see Table 10 in Section 3.5)

Table 6. Waterbirds in the Hwaseong Wetlands, 2015-2018, with details by year of the number of individuals, and the sum of each species' highest count ("Minimum Total"); the number of waterbird species found each year; the number of waterbird species found each year in Ramsar-defined concentrations of 1% or more of population; and the number of globally and / or nationally Threatened waterbird Species as assessed by IUCN (2020b) and the Ministry of Environment (NBC 2018).

	2015	2016	2017	2018	Minimum Total (2015-2018)
Number of waterbird individuals	121,065	79,324	64,312	101,612	184,447
Number of waterbird species	66	74	69	68	84
Number of waterbird species at 1% or more of population	15	15	15	15	22
Number of globally and / or nationally threatened waterbird species	11	15	9	12	17

One species recorded in an internationally important concentration by KOEM (2017) requires explanation. KOEM (2017) includes a count of 1,600 Temminck's Cormorant *Phalacrocorax capillatus*. Based on research by Birds Korea in multiple years and by the Hwaseong Wetlands Project, this count is considered to refer instead to the very similar-looking but ecologically well-separated Great Cormorant, a species with a 1% threshold of 1,000. A very similar total of 1,550 Great Cormorant were counted in June 2020 as part of the Hwaseong Wetlands Project.

In summary, count data for the period 1988-2018 reviewed for this report suggest:

1. A major difference between numbers of shorebirds supported by the wetland in 1988 and in the present decade. Following seawall closure in 2002, there has been a substantial decline in overall numbers of shorebirds, with very substantial declines of some species (e.g., Black-tailed Godwit and Nordmann's Greenshank). However, count data also suggest an increase in importance of the Hwaseong Wetlands for both Far Eastern Curlew and Eurasian Curlews, especially in the last decade.
2. Following seawall closure in 2002, the Hwaseong Wetlands have become increasingly important for other species of waterbirds, many of which are globally of Least Concern; some of which are also globally threatened.
3. During the present decade, different research projects all support identification of the Hwaseong Wetlands as nationally and internationally important for waterbirds, with many of the same species identified in internationally important concentrations by different projects. At the same time, numbers of most species recorded in the same year by different projects (e.g., in 2017) showed huge variation. Based on survey work conducted for the Hwaseong Wetlands Project in 2020 a large part of the variation suggested within the counts is most likely due more to under-counting by one project rather than over-counting by another.

3.4 Hwaseong Wetlands Project Waterbird Surveys (June-December 2020)

Introduction

Waterbirds are excellent indicators of wetland productivity, diversity and health. Surveys of waterbirds are therefore very important for identifying conservation priorities and for informing management decisions.

Due to various practical constraints, previous survey effort in the Hwaseong Wetlands by KFEM Hwaseong, by NIBR and by other research projects (e.g., KOEM 2017; Rural Community Development Corporation 2017) appears to have been limited to single-day or part-day counts, with a maximum of one count per month (see Section 3.3). In a large area with diverse habitats used by many tens of thousands of migratory birds, this infrequent survey effort likely results in some species and many individual waterbirds being missed. In addition, count data from some published research cannot be used in any assessment of international importance as defined by the Ramsar Convention because of the way the data are presented.

For example, monthly species counts conducted for Rural Community Development Corporation (2017) are organized by area. The totals which are presented appear to be a summing together of each count by each area in each month. This is even though some waterbirds likely remain for several months in the Hwaseong Wetlands; and even though many of these same birds move between different parts of the wetland dependent on the tide state and time of day. The counts therefore likely include much "double-counting" (i.e., they likely include the same birds counted multiple times). Because of this method of data collation and presentation, the report lists extremely high totals of 732 Black-faced Spoonbill and 5,923 Great Cormorant, but it is not possible to estimate how many individuals were actually present in the wetland. Were there only 25-30 Black-faced Spoonbill counted 25 times, or 732 counted once?

For the Hwaseong Wetlands Project, waterbird surveys ("Project Surveys") single-day peak counts of each waterbird species are used throughout to indicate abundance, and for applying Ramsar Criteria 5 and 6.

Aims

Aims of the Project Surveys included:

1. Establishment of a more robust baseline on waterbird presence and abundance within the Hwaseong Wetlands FNS, to help identify conservation priorities;
2. Improved understanding of the use of the Hwaseong FNS by waterbirds in general and by Far Eastern Curlew in particular, to help inform possible management options;
3. Increased local survey capacity, to help improve future research effort by "wardens" (as called for in Ramsar Articles 4.1 and 4.5);
4. Increased national and international awareness of the Hwaseong Wetlands FNS, through documentation of each survey-cycle in a series of interim reports; and by the sharing of images and notable counts through online media, to support decision-making toward wise use of the wetland.

Dates

Project surveys were primarily conducted by Dr Nial Moores from Birds Korea and by Park Heajeong from Hwaseong KFEM and Jung Hanchul (KFEM), on a total of 38 dates between June 23rd and December 17th 2020. Dates were divided into eleven survey periods of 2-5 days each, centred on consecutive spring high tide series: June 23rd-28th; July 7th-10th; July 21st and July 24th; August 4th-7th and August 24th-26th; September 8th-10th and 17th-20th (with an additional count on 24th); October 13th-15th and 28th-30th (with an additional count on 18th); November 17th-18th; and December 16th-17th (with an additional count on December 2nd).

To increase transparency of the Project Survey method and to help organize data in ways that can better inform management options, counts in the Hwaseong Wetlands and contiguous habitats were organized into nine habitat-based categories. Each of these categories were further sub-divided into a total of 40 sub-units (as shown in Figure 5, Section 2.2). On most dates of survey, each count of each species was listed by area and habitat type; along with the time of the count and the name of the observer(s). Additional notes were also recorded on the size and time of movements e.g., of birds from the tidal flat at Maehyangri to the Hwaseong Reclamation Lake. This was in order to understand these movements better and also to avoid counting the same individuals twice in day totals.

The habitat categories we selected identify nine ecologically-different types (as used in the first number of each annotation in Figure 5, Section 2.2): 1, Open tidal flats; 2, Largely unvegetated parts of the Hwaseong Reclamation Lake; 3, Heavily vegetated parts of the Hwaseong Reclamation Lake; 4, Smaller shallow freshwater wetlands with open water, created inadvertently during the reclamation process; 5, Smaller artificial wetlands, created intentionally as part of the reclamation process; 6, Active rice-fields; 7, Fallow areas intended for agriculture with no current use; 8, Patches of park land and areas with trees; 9, Inshore marine waters. Some of these habitat types are shown in Figure 16.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>1--3, December 2020</td><td>2--2, July 2020</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>4--1, October 2020</td><td>6--3, October 2020</td></tr>
<tr><td colspan="2">Figure 16. Some of the main habitats within the Hwaseong FNS.</td></tr>
</table>

Project Surveys Count Methods

During the Project Surveys, different count methods were used for different species groups in each of the main wetland habitats (again, as numbered per Figure 5):

1. During each of the eleven survey periods, counts were made of tidal-flat obligate shorebirds on at least two days, with repeat counting of birds from different vantage points. On the incoming and falling tide and on days with high tides peaking below ~8.5m, these counts were concentrated on the Maehyangri tidal flat (1--1) and during highest high tides on 4--1 and at the lower end of the Hwaseong Reclamation Lake (2--1 to 2--2). In this way, most shorebird species were counted three times or more during most high tides. Each day, and each survey period, only the highest count of each species was selected, unless evidence suggested that this count was erroneous in some way.
2. Geese started to arrive in the FNS in mid-September, and subsequently numbers built up rapidly. As in many other wetlands, geese tend to roost at night in large, undisturbed areas of open water; and to feed during the day in rice-fields and other wetlands (see e.g., Johnson *et al*. 2014). Geese typically leave their roost within one hour of sunrise and return to roost after sunset. In October and November, geese flying out from their roost were counted on three dates for one hour starting shortly before sunrise, with birds counted by two counters at the same fixed point looking in different directions. One counter counted geese flying to the north and east; and the other counted geese flying to the south and south-southeast. On the day following these counts, efforts were then made to estimate proportions of each of the two main goose species, Tundra Bean and Greater White-fronted Goose, by counting birds still at roost, at e.g., 4--1 and between 2--1 and 2--2. On one date in November, numbers of geese were also estimated at and after sunset, as they returned to roost on the Hwaseong Reclamation Lake. In December, because of increasing ice cover, geese increasingly appeared to be confined to roosting only within the Hwaseong Reclamation Lake. On all three dates of survey, geese were therefore counted from the inner dyke between 2--1 and 2--2 from shortly before sunrise to 30 minutes after sunrise.
3. Dabbling ducks tend to feed at night, and to loaf and roost close to or on open water, near areas used for foraging during the day. Dabbling ducks were counted by active search along the whole reclamation lake; with additional counts made of loafing birds on ponds and in wet reed areas.
4. Although small numbers of diving duck (especially *Aythya* and *Mergus*) and some grebes are distributed in similar areas to dabbling ducks, the vast majority were found in flocks in open water, especially in the main reclamation lake (2--7). Many of these birds were between 1km and 2km from shore. These larger flocks could therefore only be counted properly in good light with high quality optics from the main barrage road. Our counts were therefore made in the morning (when the winds were light, and with the light behind the observer), on days with good visibility.
5. Many other waterbird species were searched for actively, especially in rice-field areas and in freshwater ponds during the summer and early autumn, with search on foot and by car continuing after sunset for some species that vocalize at night (e.g., Greater Painted-snipe). Counts of secretive species that depend largely on vegetated rice-fields and reed-beds were likely to be undercounts, as many potentially suitable areas were not surveyed.
6. Most landbirds were counted opportunistically, during counts of waterbirds from the car or when walking through rice-field areas. The main exception was a small breeding colony of globally Near Threatened Ochre-rumped Bunting *Emberiza yessoensis* which we discovered in July.

Supplementary counts of shorebirds and threatened waterbirds were also made on six dates in a major reclamation area in Asan Bay, Pyeongtaek, to the south, and at Songgori and Maehwari to the north of the Hwaseong Wetlands. These counts outside of the Hwaseong FNS were conducted primarily in order to assess whether there is movement of waterbirds between sites; and to improve our understanding of changes in numbers of shorebirds recorded between survey periods. A secondary aim was to confirm these additional sites' international importance to waterbirds.

Project Surveys' Results

The Project surveys found Ramsar-defined internationally important concentrations of 19 species of waterbird; multiple threatened species; and strong evidence of dependence on more than one habitat type by a large number of species.

Between late June and mid-December 2020, in the Hwaseong Wetlands:

1. We recorded a minimum of 119,379 individual waterbirds of 108 species (monthly counts of each of these species is listed in Appendix One). This number is based on the simple summing of the highest day count of each waterbird species recorded during the Project surveys, with only one count per species tabulated for the period June-December 2020. Based on peak counts of adults and juveniles of the same species, this total is certainly an under-count of the number of waterbirds which were actually present.
2. We recorded an additional minimum 4,324 land-birds of 96 species (Figure 17).

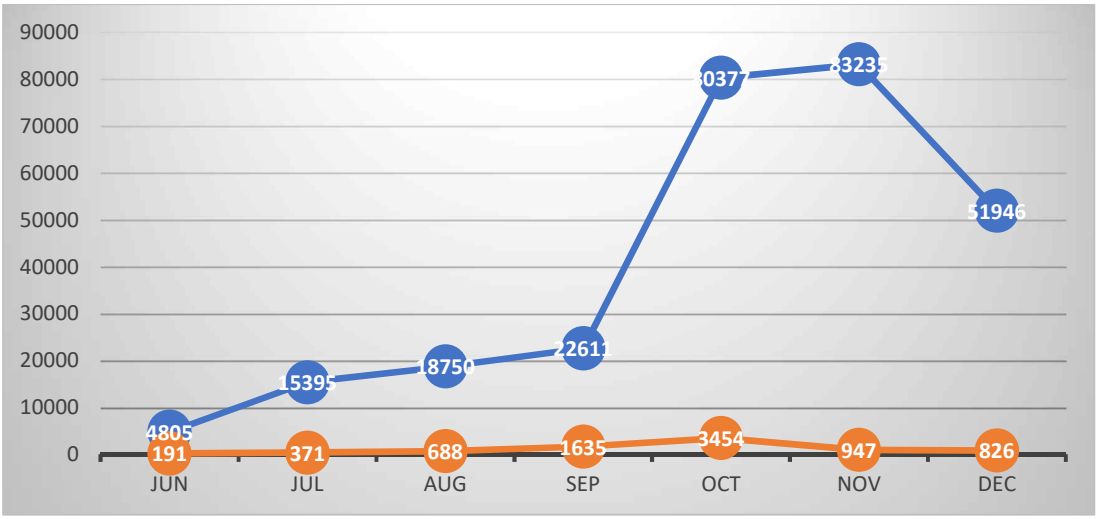

Figure 17. Number of individual waterbirds (blue line) and landbirds (brown line) recorded during the Project Survey by month.

3. We recorded substantially higher numbers of both individual birds and species than previous surveys during the same months in different years. For example:
   (1) For each month, the number of individual birds and the number of species we recorded greatly exceeded those recorded in months June-December in 2017 as presented in Table 5 in

KOEM (2017). In KOEM (2017) the highest monthly count of individual birds was in October, when 27,035 individual birds of 65 species were recorded. In October 2020, our surveys recorded a minimum of 83,831 birds of 139 species. The October count by KOEM (2017) therefore found a third of the number of individual birds our surveys found in October 2020; and less than half the number of species.

(2) For the month of October, the geometric mean of five years of counts (2015-2019) of all birds counted by NIBR was 12,944 individuals, with a range of 34-59 species recorded. This is equivalent to only 15% of the number of individual waterbirds, and about a third of the number of species we recorded in October 2020. Species found during our surveys on multiple dates in October 2020 which were not found during any survey by NIBR in months January-March and October-December in years 2015-2019 included globally Vulnerable Swan Goose, globally Vulnerable Lesser White-fronted Goose and globally Endangered Nordmann's Greenshank.

In combination, this is compelling evidence that previous survey effort has greatly underestimated the national and international importance of the Hwaseong Wetlands for the conservation of the nation's avian biodiversity.

4. In total, during the Project Surveys we found 13 globally threatened and 11 Near Threatened waterbird species, and two globally threatened and one Near Threatened landbird species, as assessed by BirdLife International (2020).

5. In total, we counted 19 species of waterbirds in concentrations of 1% or more of population, as assessed by Wetlands International (2020) (Table 7).

Table 7. Peak Day-count by month of 19 Waterbird Species found in concentrations of 1% or more of population in the Hwaseong Wetlands during Project Surveys

	1% Threshold	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tundra Bean Goose	1100	0	0	0	290	**40,500**	**40,500**	**18,000**
Greater White-fronted Goose	840	0	0	0	0	**6685**	**14,100**	**16,000**
Ruddy Shelduck	710	0	0	0	0	263	**990**	158
Common Pochard	3000	0	1	0	2	**3510**	2702	744
Greater Scaup	2400	0	0	0	0	**2714**	**3927**	1564
Great Crested Grebe	350	14	13	4	11	**786**	**2466**	**750**
Far Eastern Oystercatcher	70-110	66	**518**	**623**	**545**	5	0	0
Grey Plover	1000	154	155	835	**1370**	**1450**	560	210
Kentish Plover	1000	90	**1013**	560	300	330	5	0
Mongolian Plover	390	2	**540**	**870**	266	198	0	0
Far Eastern Curlew	320	816	2275	1835	731	180	3	0
Eurasian Curlew	1000	234	**2450**	**3700**	**2626**	**3100**	**2220**	850
Terek Sandpiper	500	90	**1710**	**1200**	350	140	0	0
Common Greenshank	1000	69	817	**1035**	486	117	3	1
Nordmann's Greenshank	5	0	0	0	**5**	1	0	0
Saunders's Gull	85	0	9	28	34	22	**121**	**138**
Great Cormorant	1000	**1550**	**1340**	940	755	53	174	80
Black-faced Spoonbill	20-48	**93**	**143**	**166**	**254**	**98**	0	1
Chinese Egret	35	6	8	**70**	26	1	0	0

*Note: bold is used to indicate counts that meet or exceed the 1% threshold

6. In months June and July, we found evidence of breeding by a total of 32 bird species. This included evidence of breeding within the Hwaseong Wetlands by six shorebird species: Far Eastern Oystercatcher on a rocky islet at 1--4; Black-winged Stilt *Himantopus himantopus*, Little Ringed Plover *Charadrius dubius*, Kentish Plover and Greater Painted-snipe in rice-fields in 6--4 and 6--5, with some birds nesting on unpaved roads in these areas; and Common Redshank, apparently in rice-fields in 6--4 and in salt-marsh in 3--1/ 3--2. Although all of these species were found in only small numbers (approximately 1-10 pairs), to the best of our knowledge there are perhaps no other sites in the ROK with six or more species of breeding shorebird. We also found a small colony (at least four singing males) of Ochre-rumped Bunting, in fallow grassland in 7--2. This species is known to breed at only two other sites on the Korean Peninsula: in Shihwa Reclamation Area, Ansan; and in Rason Ramsar site in the northeastern DPRK (Birds Korea Archives).

Ecological Connectivity

7. We observed substantial numbers (100s-1000s) of some shorebird species moving between the Hwaseong Wetlands and e.g., Maehwari tidal flats to the north during highest high tides, in order to roost in the Hwaseong Reclamation Lake. We also found some evidence that small numbers of shorebirds (<100) move between Seokcheonri tidal flats to roost southward, perhaps in the Asan Bay Reclamation Area. However, we found no evidence that Black-faced Spoonbills move between adjacent wetlands and the Hwaseong Wetlands at high tides. Instead, they both forage and roost in such sites. We also found no compelling evidence that waterbirds moved between Asan Bay Reclamation Area and the Hwaseong Wetlands FNS during the Project Surveys.

8. Within the Hwaseong Wetlands, we found waterbirds within all nine of the major habitat types depicted in Figure 5 and in each of the subunits. However, very few waterbirds were recorded in habitat types 7 (fallow land) and 8 (parkland type habitat). The vast majority of waterbirds were found in habitat types 1 (tidal flats), 2 (open waters of the Reclamation Lake), 4 (shallow freshwater ponds, most especially "Pond 13", 4--1), 5 (intentionally constructed smaller artificial wetlands) and 6 (rice-fields). For example:
   (1) The largest concentrations of 5,000-15,000 shorebirds were on the tidal flat at 1--1 close to high tide and roosting (or trying to roost) in the southern part of the Hwaseong Reclamation Lake at 2--1 to 2--2 during highest high tides (Figure 18);
   (2) The largest concentrations of roosting Black-faced Spoonbills were in 4--1 and in shallow parts of 2--2 at high tide (254), with small numbers some dates feeding north to pond 5--3;
   (3) Concentrations of >2,000 Great Crested Grebe, 3,950 Greater Scaup and of >3,000 Common Pochard were counted in 2--7 both at high tide and at low tide, with additional groups of both Great Crested Grebe and Common Pochard found in other parts of the site, including 130 Great Crested Grebe on the sea at 9--1;
   (4) The largest concentrations of geese were found roosting along the edge of the Hwaseong Reclamation Lake at night and before sunrise. The highest day count of geese was 54,650 counted flying within one hour of sunrise on November 17th. On 18th, during a single scan of one part of 2--1 at least 32,000 geese were counted at dawn on November 18th; with another ~10,000 seen flying up from further north along the lake side, and an additional ~5,000 roosting in 4--1. Each day, geese dispersed over wide areas to feed during the day, before returning at and after sunset to the Reclamation Lake. The proportion of geese feeding in

harvested rice-fields within the Hwaseong Wetlands increased between mid-October and mid-November, as the number of fields which were harvested increased.

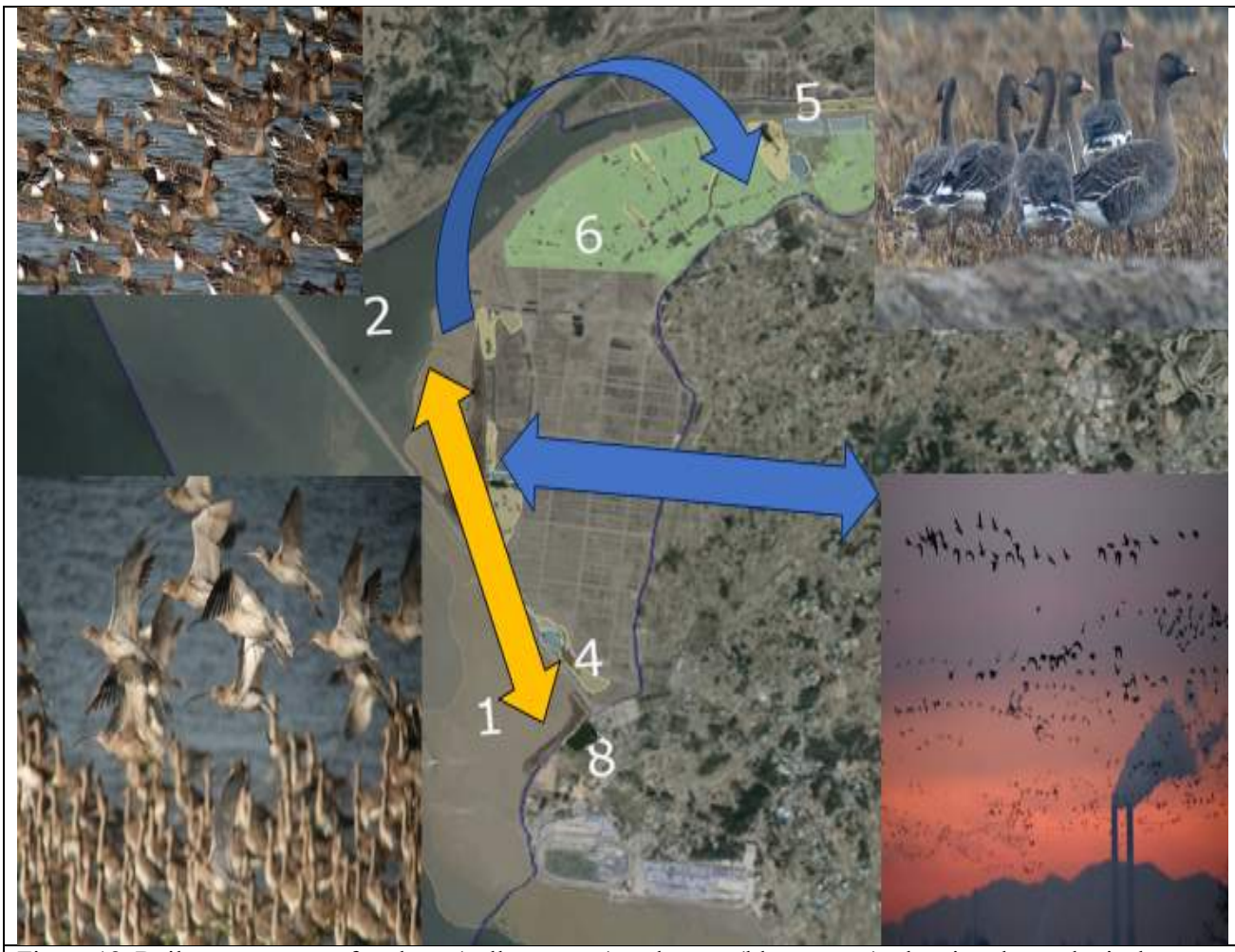

Figure 18. Daily movements of curlews (yellow arrow) and geese (blue arrows), showing the ecological connectivity of different component parts of the Hwaseong Wetlands FNS.

9. Many of the waterbird species used different parts of the Hwaseong Wetlands when feeding and when roosting, indicating their ecological dependence on more than one main wetland type. Table 8 lists the main habitat type and area sub-unit where internationally important concentrations of 19 species of waterbird were found during the Project Surveys.

Table 8. Location and Main Habitat Type of Internationally Important Concentrations of Waterbirds

	Tidal Flats	Reclamation Lake: Open Waters	Reclamation Lake (shallow edges) & "Pond 13"	Rice-fields & Freshwater Wetlands	Marine Waters
Sub-Unit	1--1	2--7, 2--3	2--1, 2--2, 4--1	6--2, 6--4, 6--5, 5--3	9--1, 9--2
Tundra Bean Goose	✓		✓	✓	
Greater White-fronted Goose	✓		✓	✓	
Ruddy Shelduck			✓	✓	
Common Pochard		✓			
Greater Scaup		✓			
Great Crested Grebe		✓			(✓)
Far Eastern Oystercatcher	✓		✓		
Grey Plover	✓		✓		
Kentish Plover	✓				
Mongolian Plover	✓				
Far Eastern Curlew	✓		✓		
Eurasian Curlew	✓		✓		
Terek Sandpiper	✓				
Common Greenshank	✓		✓		
Nordmann's Greenshank	✓				
Saunders's Gull	✓				✓
Great Cormorant		✓			
Black-faced Spoonbill	✓		✓		
Chinese Egret	✓		✓		

10. Our surveys found large numbers of smaller shorebird species (most especially Red-necked Stint) continued to forage at high tide on exposed areas of mud in the Hwaseong Reclamation Lake through the high tide period in July. In August and September, water levels within the Hwaseong Reclamation Lake were maintained at maximum levels, so that these open areas of mud were inundated. Subsequently, the number of Red-necked Stint fell rapidly within the Hwaseong Wetlands, while numbers continued to increase during the same period in the Asan Bay Reclamation Area where open mud still remained. This suggests, unsurprisingly, that smaller species are sensitive to water levels within the Hwaseong Reclamation Lake. In addition, on some dates even larger species (including curlews) were unable to find sufficiently shallow water for roosting in the Hwaseong Reclamation Lake in August and September, and instead were seen in prolonged flight at highest high tide. This suggests strongly that differences in water level of even 10-15cm in the Hwaseong Reclamation Lake has major effects on use of some areas by some waterbird species.

3.5 Ramsar Criteria for identifying the International Importance of the Hwaseong Wetlands

Our research confirms that the Hwaseong Wetlands fulfil Ramsar Criteria 2, 5 and 6 for identifying wetlands of international importance. These three criteria are especially useful in helping to identify local, national and Flyway-level conservation priorities and in the assessment of potential management issues.

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". This criterion can be applied both to non-avian wetland species (as already listed in Section 2.4.2) and also to communities of bird species.

During the Wetlands Project, 35 nationally or globally threatened bird species and 19 bird species designated as National Natural Monuments (9 waterbird species, 10 landbird species), were recorded in the Hwaseong Wetlands. As important bio-indicators, these species can be considered both as national conservation priorities and also as representative species of threatened ecological communities. Of this total, 13 are globally threatened waterbird species (as defined by the Ramsar Convention) and two are globally Vulnerable landbird species, both typically associated with wetlands; and 29 are nationally threatened bird species (16 waterbird and 13 landbird species). Five of these species are also classed as Protected Species by the Ministry of Oceans and Fisheries (all globally threatened or Near Threatened waterbird species).

In addition to their own importance as Vulnerable or Endangered species, 25 out of these 35 nationally and / or globally threatened bird species are ecologically-dependent on either Tidal Flats or on Freshwater Wetlands. These species (listed in Table 9) are in themselves therefore important component parts of ecological communities of nationally or globally threatened habitat types:

(1) Tidal flats. Following the assessment by Murray *et al*. (2015), the IUCN (2020a) formally lists Yellow Sea tidal flats as an Endangered Ecosystem. Six of the species listed in Table 9 are globally threatened species which are largely ecologically dependent on Yellow Sea tidal flats.

(2) Floodplain-type wetlands. Moores (2002) described the near total loss of natural floodplain habitat in the ROK as being coincident with the declines and national extirpation of several globally threatened species, including endemic fish species and threatened bird species; ROK (2014) highlighted the widespread degradation of riverine habitats caused by dams, dredging and building of reservoirs leading to the decline or loss of freshwater biodiversity; and Borzée *et al*. (2017) described the negative impacts on threatened amphibians of widespread conversion of natural freshwater wetland to agricultural use, followed by infrastructural development and further conversion to other uses. Seventeen of the nationally or globally threatened bird species recorded during the Project Surveys are ecologically dependent on freshwater wetland; with most of these dependent on seasonally-flooded floodplain-type wetland. Eight of these are globally Threatened or Near Threatened, and nine are restricted to East Asia. Within the Hwaseong Wetlands, many of these bird species are part of larger ecological communities which are now dependent on rice-fields, including substantial numbers, of e.g., Golden-spotted Pond Frog a species assessed as globally Vulnerable by IUCN (2020b) and Nationally Endangered Class II by the Ministry of Environment (NBC 2018).

Table 9. Selected globally or nationally threatened bird species recorded during the Project Survey, with their global status (BirdLife International) and national conservation designations by the Ministry of Environment, National Cultural Heritage Administration and Ministry of Oceans and Fisheries (NBC 2018).

		BirdLIfe (2020b)	Ministry of Environment Endangered Species	National Natural Monument (Cultural Heritage Administration)	Ministry of Oceans and Fisheries "Protected Species"
Yellow Sea Intertidal Wetland	*Haematopus osculans*	(NT)	EN II	326	✓
	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 Wetland	*Anser cygnoides*	VU	EN II	325-1	
	Anser fabalis	LC	EN II		
	Anser erythropus	VU	EN II		
	Cygnus cygnus	LC		201-2	
	Aythya ferina	VU			
	Mergus squamatus	VU	EN I		
	Grus monacha	VU	EN II	228	
	Charadrius placidus	LC	EN II		
	Rostratula benghalensis	LC		449	
	Ciconia boyciana	EN	EN I	199	
	Platalea leucorodia	LC	EN II	205-2	
	Ixobrychus eurhythmus	LC	EN II		
	Pandion haliaetus	LC	EN II		
	Circus spilonotus	LC		323-3	
	Haliaeetus albicilla	LC	EN I	243-4	
	Haliaeetus pelagicus	VU	EN I	243-3	
	Emberiza yessoensis	NT	EN II		

Figure 19. Steller's Sea Eagle *Haliaeetus pelagicus*, Hwaseong Wetlands, December 2020. This globally Vulnerable and Nationally Endangered Class I species depends on river estuaries, rivers and shallow lakes in winter.

Ramsar Criterion 5

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

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). The results of four years of previous survey effort (2015-2018) primarily by NIBR and Hwaseong KFEM is provided in Section 3.3 and in Appendix Two.

Because of a paucity of accessible shorebird data for 2019, count data from 2020 is considered more appropriate to use as the fifth year of counts in the calculation of any 5-year geometric mean. For the first half of 2020, counts of waterbirds made by NIBR and by Hwaseong KFEM can be used. For the second half of the year (late June to mid-December), count data generated by the Hwaseong Wetlands Project can be used. Based on the summing of the peak count within 2020 of each waterbird species, this gives a total of almost 150,000 waterbirds recorded in the Hwaseong Wetlands in 2020; and 250,000 waterbirds counted during the five years.

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

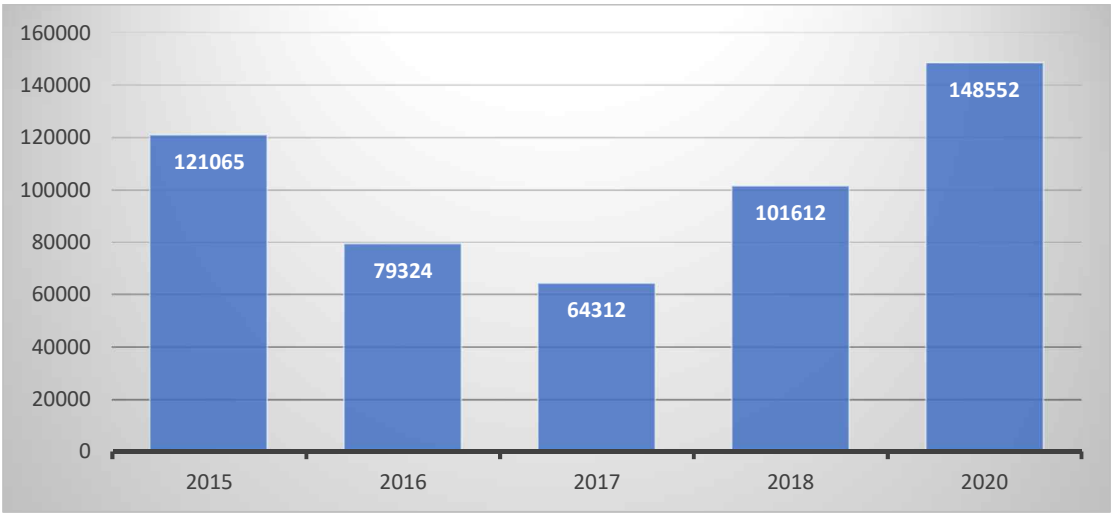

Figure 20. Sum of the peak count of individual waterbirds of each waterbird species by year, in the Hwaseong Wetlands.

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

Ramsar Convention Criterion 6

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".

The geometric mean of five-years (2015, 2016, 2017, 2018 and 2020) of peak counts each year of populations of 16 species of waterbird exceed the 1% threshold as listed by Wetlands International (2020). These 16 species are listed in Table 10.

Table 10. 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	%
Tundra Bean Goose	1100	11794	10848	10180	3549	40500	11336	10%
Greater White-fronted Goose	840	848	764	1277	216	16000	1233	1.5%
Common Shelduck	1200	1261	2500	781	735	1375	1200	1%
Ruddy Shelduck	710	900	416	1042	1000	990	827	>1%
Mallard	15000	75952	26531	5938	18750	11897	19287	>1%
Far Eastern Oystercatcher	70-110	430	468	459	643	623	517	~5%
Grey Plover	1000	1021	1800	680	1065	1450	1140	1%
Mongolian Plover	390	800	430	500	420	870	575	>1%
Far Eastern Curlew	320	500	1063	470	1150	2275	918	~3%
Eurasian Curlew	1000	3300	4220	3106	2680	3700	3374	>3%
Bar-tailed Godwit	1500	1029	930	3583	2500	1760	1721	>1%
Great Knot	2900	3001	8000	6023	34900	9625	8655	3%
Terek Sandpiper	500	140	750	550	970	1710	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%

In addition, in consideration of the much higher numbers of many species of waterbird recorded by the Project Surveys between June and December 2020 than during previous surveys, it seems reasonable to suggest that increased survey effort will identify several additional waterbird species that are also present regularly in concentrations of 1% or more of population (examples are given in Table 11).

Based on our surveys, three or four species that seem likely to meet this threshold include *Aythya ferina*, *Aythya marila*, *Podiceps cristatus* and *Phalacrocorax carbo*. Importantly, all four of these species depend on the open waters of Hwaseong Reclamation Lake (2--7) for feeding and roosting; and all four appear to have been substantially under-counted by previous survey effort.

Table 11. Additional waterbird species that possibly occur regularly in internationally important concentrations in the Hwaseong FNS.

	1%	2015	2016	2017	2018	2020	5yr Geo. mean
Common Pochard	3000	1665	3555	1420	940	3510	2149
Greater Scaup	2400	287	96	234	87	3927	294
Great Crested Grebe	350	194	160	200	184	2466	308
Dunlin	14900	5665	4500	14001	18000	25401	11029
Common Greenshank	1000	825	880	1505	830	1035	987
Greater Cormorant	1000	500	271	1600	581	1550	721

3.6 Far Eastern Curlew

Introduction

The Far Eastern Curlew is a long-range migratory shorebird, which breeds in northeastern Asia; primarily stages in the Yellow Sea; and winters southward, with > 70% of the population considered to spend the boreal winter in Australia (Conklin *et al*. 2014). The species is endemic to the East Asian-Australasian Flyway and has a declining global population estimated at between 32,000 and 35,000 individuals (Hansen *et al.* 2016; Wetlands International 2020). The population decline of the Far Eastern Curlew has been estimated at between 30-49% and 81% over 30 years (Garnett *et al.* 2011; EAAFP 2017).

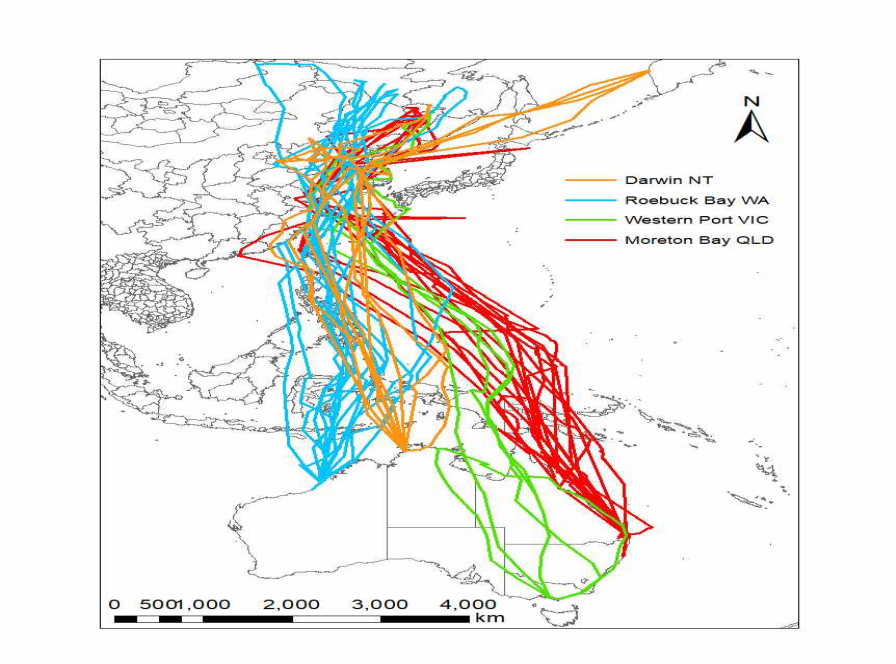

Figure 21. Migration routes of Far Eastern Curlew tracked between different parts of Australia and their breeding grounds. The vast majority of individuals depend on Yellow Sea tidal flats during migration. Figure copyright of the National Environment Science Programme, Threatened Species Recovery Hub, Strategic Planning for the Far Eastern Curlew, Amanda Lilleyman.

The Far Eastern Curlew is currently assessed as Endangered Class II by the ROK's Ministry of Environment (NBC 2018), and as globally Endangered by BirdLife International (2020), because "new information suggests (the species) is undergoing a very rapid population decline which is suspected to have been primarily driven by habitat loss and deterioration in the Yellow Sea region." The Far Eastern Curlew is therefore the focus of a dedicated EAAFP Task Force and of a Single Species Action Plan which identifies five priority actions. These actions include managing remaining sites; monitoring the species' population trend; and determining key demographic parameters to support population modelling (EAAFP 2017).

Namyang Bay was listed as one of the 50 most important sites globally for the species by Conklin *et al.* (2014); and the species has been adopted as Hwaseong City's symbol bird. The Hwaseong Wetlands Project Survey therefore had a special focus on Far Eastern Curlew. A comparison with counts of the globally Near Threatened Eurasian Curlew is also included here, because Far Eastern Curlew and

Eurasian Curlew are often difficult to separate in field conditions, especially in poor light or at distance. This means that the two species are often confused with each other, especially by inexperienced counters or when there is inadequate time to count the two species properly.

Figure 22. Juvenile Far Eastern Curlew, Hwaseong Wetlands, August 6th 2020.

Survey Results

Our surveys between late June and mid-December 2020 recorded highest day-counts of 2,275 Far Eastern Curlew and of 3,700 Eurasian Curlew within the Hwaseong Wetlands (Figure 23). We also recorded a day count of 915 Far Eastern Curlew (2.5% of population) within the Asan Bay Reclamation Area.

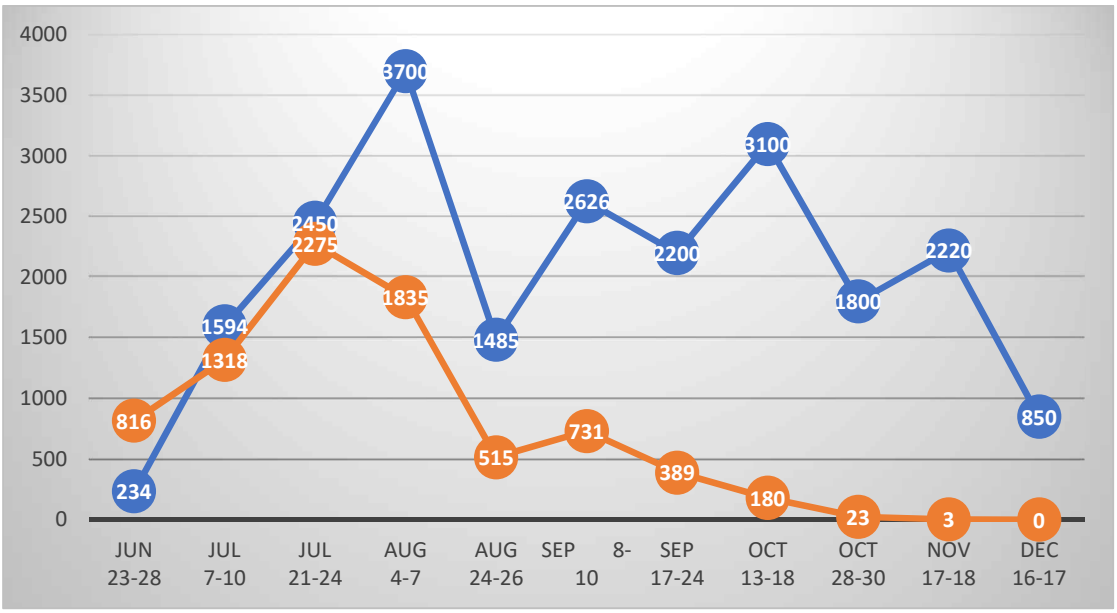

Figure 23. Highest single day counts in the Hwaseong Wetlands of Far Eastern (orange line) and Eurasian Curlews Blue line) during the 11 survey periods (June to mid-December 2020).

Our peak count of Far Eastern Curlew is substantially higher than counts made in earlier years by Shorebird Network Korea (2010-2014) and by KFEM Hwaseong (2015-2019) at the Hwaseong Wetlands. This is likely because of a combination of two factors: (1) Most shorebird counts during southward migration in previous years have been made in August and September. Such research would have missed their highest peak, which occurred in 2020 in July; (2) Eurasian and Far Eastern Curlew can be difficult to identify. On the Maehyangri tidal flat on neap and lower high tides, Eurasian Curlew tend to roost closer to the road than Far Eastern Curlews. This would likely encourage counters to misidentify more distant birds as Eurasian Curlew.

In support of these two assumptions, our surveys found that Far Eastern Curlews were similar in number to Eurasian Curlew in June and July; and still comprised more than a quarter of curlews present in mid-September. Based on a comparison of peak counts, Far Eastern Curlews represented almost 40% of curlews which were present. This compares with counts in e.g., 2015 and 2017, when the peak of Far Eastern Curlew was considered to comprise only 13% of the curlews which were present (Figure 24).

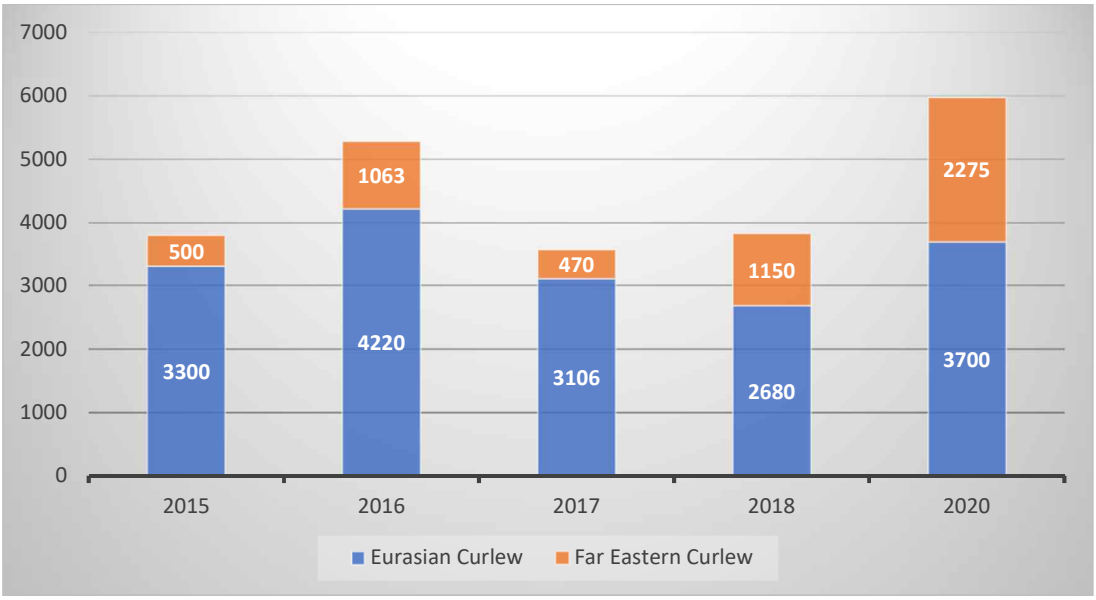

Figure 24. Proportion of Peak Counts of Far Eastern and Eurasian Curlews (2015-2020). Highest count each year of Far Eastern and Eurasian Curlews in the Hwaseong Wetlands (KFEM Hwaseong count data: 2015-2018) and the Project Surveys in 2020.

Key findings of our Research: Flyway-level

1. Based on peak day counts alone, the Hwaseong Wetlands supported a minimum 6.5-7 % of the estimated global population of Far Eastern Curlew and more than 3% of the Flyway population of Eurasian Curlew during the Project. This count of Far Eastern Curlew would have placed the Hwaseong Wetlands in the top ten known sites globally for the species as listed in Conklin *et al.* (2014).
2. Our series of counts, with a second smaller peak in September, in combination with observations of presumed departures (starting on July 21st), and of the changing ratio of birds in different plumage states, suggests that between 2,500 and 3,000 Far Eastern Curlew staged in the Hwaseong Wetlands during the Project

3. The main peak in number of Far Eastern Curlew in the Hwaseong Wetlands was recorded in late July, with few birds remaining into late October and November and none recorded in December. The highest day count in the adjacent Asan Bay Reclamation Area was also in late July. The pattern of dates in our research fit well with current knowledge of migration timing of Far Eastern Curlew between Chinese and Russian breeding grounds, Yellow Sea staging areas and wintering areas – especially Australia – as outlined by e.g., Ueta (2004), Choi *et al*., (2016) and EAAFP (2017).
4. As at some sites elsewhere in the Yellow Sea (e.g., Bai in EAAFP 2017; Moores & Loghry 2017), a substantial number of Far Eastern Curlew (250+) were observed moulting their primaries in the Hwaseong Wetlands. Primary moult was first seen in late July and appeared to be completed in September. Based on their very worn-looking plumage, the majority of individuals which underwent primary moult were likely to be in their Second Calendar-year (or perhaps Third Calendar-year). As such, these birds would likely not have migrated all the way to the breeding grounds and might instead have over-summered within the Yellow Sea. Very worn-looking birds comprised the majority of Far Eastern Curlew in June and July; and again from mid-September to mid-October. Importantly, birds like these that undergo primary moult in the Yellow Sea are thought not to return to Australia for the boreal winter, as available evidence suggests that Far Eastern Curlew in Australia initiate moult post-arrival in August / September. Up until at least 2017, there was not a single record of a Far Eastern Curlew showing evidence of suspended moult among 900+ records of primary moult collected by the Victoria Wader Studies Group in Australia (Danny Rogers *in lit*. November 2017). It is therefore plausible that many of these birds which moult in the Yellow Sea might instead spend the boreal winter in coastal China (where 3,000 are already estimated to overwinter: EAAFP 2017) or instead disperse throughout coastal Asia (as suggested by the records generated by the Asian Waterbird Census: Mundkur *et al.*, 2017).

Figure 25. Far Eastern Curlew in primary moult. Note the gap in the outer wing on the bird on the left. The timing of moult is important in helping to understand ages of birds; migration timing; and perhaps even in estimating the numbers of Far Eastern Curlew wintering outside of Australia.

5. The first juvenile Far Eastern Curlew was seen on July 21st; and the highest count of juvenile Far Eastern Curlew was 95 on September 8th. All individuals remaining from mid-October were aged as First Calendar-years.
6. Probably >50% of Eurasian Curlew underwent primary moult. It seems likely that this higher percentage is due to the difference in their wintering areas, with many of the Eurasian Curlew seen in August and September likely to remain at the Hwaseong Wetlands (or at least in the Yellow Sea) through the winter.

Key Findings of our Research: Local-Level

7. Curlews (both species) fed during low tide on tidal flats; and used three different roost areas dependent on tide height and water levels: (1) On neap tides, the vast majority of individuals roosted at 1--1, usually >300m away from the fences and roads lining the hinterland; (2) on higher tides which inundated all of the tidal flat or left less than 100m width of exposed mud, curlews then flew into the lower part of the Hwaseong Reclamation Lake (along the eastern shoreline, between 2--1 and 2--2); and (3) when water levels in the reclamation lake were too high, many curlews tried to roost in "Pond 13" (4--1). However, these birds were often flushed by people (especially by those trying to take photographs). We were unable to find where birds went after being flushed from 4--1.
8. Although some curlew groups were mixed, most of the curlews roosted in single-species flocks when conditions allowed.
9. The highest numbers of Far Eastern Curlew were observed during high tides greater than 8.5m. Direct observations confirm that those curlews which would otherwise feed and roost on tidal flats to the north of the Hwaseong Wetlands (at Seonggyori and Maehwari) also roost in the Hwaseong Wetlands during highest high tides.
10. Although observations were limited, between a third and a half of the 150+ Far Eastern Curlew which fed on the Seokcheonri tidal flat (1--5) appeared to fly south for roosting, presumably flying to the ongoing Asan Bay Reclamation Area. The remainder (at least half) instead appeared to commute between the Seokcheonri Tidal Flat and Maehyangri Tidal Flat (1--1).

SECTION 4 MANAGEMENT

4.1 Developing a Management Plan

Wise use of the Hwaseong Wetlands will require a management plan and appropriate management actions.

As established in Section 3, the Hwaseong Wetlands meet Ramsar Convention criteria for identifying wetlands of international importance, both as a whole and in each of their main component parts (tidal flats and inshore waters; brackish reclamation lake; and rice fields and freshwater wetlands). A major part of the Hwaseong Wetlands' value is derived from their ability to support internationally important concentrations of waterbirds. Wise use requires the maintenance of these waterbird populations (Ramsar Article 4.4). Wise use also requires maintaining the health of the Hwaseong Wetlands and of ecosystem services vital to the livelihoods of many local people (Section 2.3). However, currently there is very little consensus between different stakeholder groups or decision-makers on future use of these wetlands; and there are multiple threats to the ecological health of these wetlands (see Section 4.2) and to the services they provide.

The lack of consensus between stakeholder groups is due in part to the history of reclamation; the different jurisdictional authorities involved in the site; and the existence of several development proposals that would substantially impact the current ecological character of the site including causing substantial declines in some species of waterbird. A series of steps now need to be taken, to help strengthen scientific understanding and to build consensus for wise use (Figure 26). These can be grouped broadly under two main headings ("Science-based" and "People-centred").

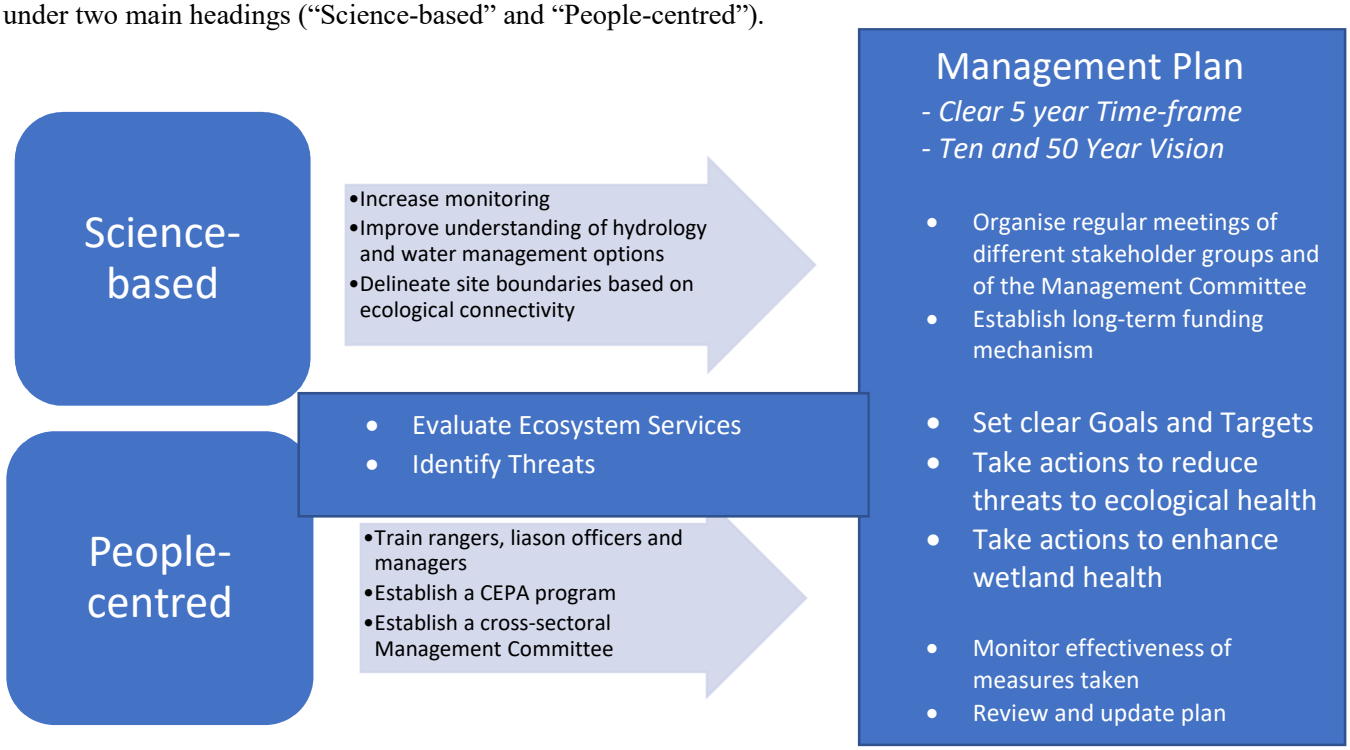

Figure 26. Steps in the development of a management plan for the Hwaseong Wetlands. Adapted from a figure by Dr. Lew Young, in Ramsar Regional Centre – East Asia (2017).

Ideally, the steps in Figure 26 would be used to develop a Management Plan for the Hwaseong Wetlands as this would inform and support its designation a Wetland Protected Area and/or Ramsar Site. Considering the great importance of the Hwaseong Wetlands for the conservation of wetland biodiversity and of the role that coastal wetlands have in carbon sequestration, such designation would fit well with existing national commitments to the Ramsar Convention, the Convention on Biological Diversity (CBD) and to the United Nations Framework Convention on Climate Change (UNFCCC).

For example, Ramsar Article 4.1 states that each "Contracting Party shall promote the conservation of wetlands and waterfowl by establishing nature reserves on wetlands, whether they are included in the List or not, and provide adequately for their wardening"; Article 8 of CBD calls for contracting parties to, "Establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity…Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species…through the development of plans or other management strategies"; and Article 4.1d of the UNFCCC asks all contracting parties to "cooperate in the conservation and enhancement…of sinks and reservoirs of all greenhouse gases".

Formal protection would signal agreement between local and national government about the need for conservation of the Hwaseong Wetlands; it would facilitate the development of a long-term vision for the site, without the need to consider major changes in land-use; and it would help to raise the profile of the wetlands locally, nationally and internationally. In turn, all would help to support progress toward greater sustainability in fishing and farming practices, and in the development of successful environmental education and eco-tourism programs at the site.

Some of the rationale for the steps and actions outlined in Figure 26, from left to right, includes:

(1) Previous surveys have under-represented the importance of the Hwaseong Wetlands to biodiversity (see Section 3.5). Therefore, more research needs to be conducted both in the short-term and over the longer term.

In the short-term, there is a need to establish a more robust baseline estimate of how many waterbirds are currently supported by the site. This will enable monitoring programs in the future to determine whether or not certain species are changing in number from year to year. And because waterbird species are excellent bio-indicators, any changes can then be used to help identify drivers of decline and to inform possible management responses. Almost all of the waterbird species that depend on the Hwaseong Wetlands are migratory. We therefore consider that a minimum one-year period of intensive waterbird survey is appropriate (e.g., from late June 2020 to mid-June 2021).

Over the longer-term, a team of trained staff will be needed to conduct regular monitoring of waterbirds and of other biodiversity at the site, to help inform management decisions; and to ensure that threats to the site are identified and addressed rapidly. In this regard, we note that Ramsar Article 4.5. states that, "Contracting Parties shall promote the training of personnel competent in the fields of wetland research, management and wardening."

(2) The Project surveys were not designed to fill information gaps on hydrology. A detailed understanding of site hydrology is essential for appropriate habitat management. Water levels are currently controlled in large parts of the site by the Korea Rural Community Corporation, including in rice-field areas and in the Hwaseong Reclamation Lake, but without any consideration of biodiversity. In the future, in addition to meeting the vitally important needs of rice-farmers,

much of the existing water infrastructure could be used to help create seasonally optimal conditions for biodiversity (see Section 4.3).

(3) A clear and agreed delineation of site boundaries is required, especially if the wetlands are designated as a Ramsar site. For future wise use of the Hwaseong Wetlands, the site boundaries should be based as much as possible on ecological factors. We consider that the area covered by the Project Survey with a few amendments is the most appropriate area to be used at this time, both for management and for designation as a Wetlands Conservation Area and Ramsar site. However, as noted in Section 2.2. there are some differences between parts of the boundary of the Project Surveys and of the published FNS (EAAFP 2018). And there is also a lack of certainty over how far the boundary of the site should extend into the sea. In addition, based on the economic and ecological value of tidal flats it would also seem appropriate to consider expanding the site boundaries to include all areas of contiguous tidal flat (i.e., southward to include the Seokcheonri 'Kia" tidal flats; and northward to include the Gungpyeongri tidal flats).

(4) There is still an incomplete understanding of ecosystem services provided by the Hwaseong Wetlands. We propose that Rapid Assessments of Wetland Ecosystem Services (see e.g., Ramsar Convention 2018) in each of the different component parts of the Hwaseong Wetlands could be conducted by trained specialists together with representatives from local communities, in order to improve understanding and to build trust.

(5) In order to maintain the ecological character of a wetland, threats need to be identified and addressed through management. Some threats to the ecological character of the Hwaseong Wetlands have already been identified (see Section 4.2). They include some which can best be resolved over time through consensus-building (see below); and others which need more urgent action, including the control of alien invasive species. In the future, appropriately trained professional wardens (rangers) and managers will be required to identify and to help respond to these threats and to any additional threats, as they arise.

(6) The involvement of a range of stakeholders is central to the concept of wise use. Ramsar Regional Centre - East Asia (2017) therefore advises that appropriate communication, capacity building, education, participation and awareness (CEPA) activities should aim to involve different stakeholders at all stages of the designation and management process.

(7) Building consensus and support for conservation, including CEPA programmes, requires coordination and opportunities for different groups of stakeholders to have their voices heard and responded to. A formal Site Management Committee is needed for this role. Examples of such committees can be found in the ROK in Suncheon Bay (see Ramsar Regional Centre-East Asia 2017); and internationally in San Francisco Bay, where decades of discussion have been conducted between diverse stakeholders (see http://sfbayrestore.org/advisory-committee). A wetlands management committee in Hwaseong organized with national / international wetland experts, local community leaders, NGOs etc., could deal with matters directly pertaining to management (e.g., establishment of relevant support ordinances and mid- to long-term plans). Furthermore, the committee could help to raise more local participation though promotional campaigns (Department of Suncheon Bay Conservation, 2019); and could also help to explore ways to integrate wise use of the Hwaseong Wetlands into ongoing city-wide and national initiatives, including e.g., the

Green New Deal, eco-tourism and organic farming initiatives, and the Gyeonggi SDGs and Hwaseong SDGs.

As advised by Ramsar Regional Center-East Asia (2017), a site management committee is able to "take responsibility for the decision-making process and future management of [a] site with the intention to maintain a balance of all the services for which the site is important…Committee membership should include persons who can represent or support the services and features for which the site is important. A typical committee might include site management and programme staff, site stakeholders including local people, funders (e.g., commercial sector), researchers, government department staff (e.g., planners, conservationists), interest groups and NGOs."

(8) Coastal wetlands have extremely high economic value in their natural state. These values can be enhanced further through appropriate management and conservation actions, including restoration of degraded areas, special marketing of healthy wetland products and a managed increase in ecotourism. Restoration and management often require substantial investment and always need a stable funding mechanism. Financial support for wise use of the Hwaseong Wetlands can be sourced through local and central government; and in addition, through funders who are invited to participate in the proposed Site Management Committee or in related activities. Many high-profile industries are located very close to the Hwaseong Wetlands, including Kia and Hyundai Namyang. A strong investment in conservation of the Hwaseong Wetlands and in the sustainability of surrounding infrastructure by companies like these would be ethically responsible. It would also likely provide substantial benefits for these companies, including improved green-recreation opportunities for workers and their families and fuller identification with genuinely sustainable development.

(9) A wise use management plan requires appropriate Goals and Targets, in order to focus conservation actions. Throughout the management plan, species-specific Targets should be selected in preference to poorly-defined Goals on "Nature" and "Green Space". Research for the Project already confirms that the Hwaseong Wetlands are internationally important for at least 16 species of waterbird (Section 3.5); and for several species of nationally or globally-threatened amphibians (Section 2.4.2). These species are important in themselves and are also important as indicators of wetland health. Targets should therefore prioritise either (i) the maintenance of populations or (ii) an increase in the populations of target species.

(10) Wetland ecosystems are dynamic. In addition to day-to-day evaluation of management actions by the management team, the management plan developed for the Hwaseong Wetlands will also require periodic (e.g., annual) review and revision. This review should be conducted in public by the Site Management Committee, with sufficient time given to collect comments and opinions before any major revisions are put into effect.

4.2 Threats to the Ecological Character of the Hwaseong Wetlands

In the future, management will be required to maintain or improve the ecological character of the Hwaseong Wetlands, that unique "combination of the ecosystem components, processes, benefits and services that characterise the wetland at a given point in time" (Ramsar Convention 2005a, Resolution IX.1 Annex A).

In addition to fisheries and rice-farming, biodiversity is an important element of the ecological character of the Hwaseong Wetlands. A formal threat assessment would help to identify which of the five main drivers of biodiversity decline listed by CBD (2010) (i.e., habitat change, pollution, over-harvesting, invasive species and climate change) currently threaten the biodiversity of the Hwaseong Wetlands.

Nonetheless, as part of the Project Surveys, direct observation of several threats to biodiversity were made. These threats affected species in all nine main habitats of the Hwaseong Wetlands (as shown in Figure 4, Section 2.2).

Disturbance

The most prevalent and widespread threat observed during the Project surveys was disturbance to waterbirds. Disturbance in birds is defined here as "any deviation from normal behaviour in response to unexpected occurrences in the vicinity of a bird" (Platteeuw & Henkens 1997). Even though much of the inner dyke road has restricted access and there is a fence along the tidal flat at 1--1, our research found occasionally high levels of disturbance to waterbirds in all the main habitats and in almost all 40 survey subunits of the Hwaseong Wetlands.

Among types of disturbance recorded on multiple dates of the Project Surveys were: people approaching waterbirds too closely, sudden loud noises, construction, cars and trucks, recreational use of wetlands, boats, low-flying aircraft and drones. The negative impacts of all of these types of disturbance on waterbirds have been assessed by research elsewhere (e.g., Audubon California undated; Blanc *et a*l. 2006; Blumstein 2003; Burger 1994; Burton 2007; Jarrett *et al*. 2020; Livezey *et al*. 2016; Navedo & Herrera 2012; Mayer *et al.* 2019; Rodgers & Schwikert 2002; Valente & Fischer 2011).

Adverse effects of disturbance similar to those we observed in the Hwaseong Wetlands include reductions in feeding rates (e.g., Bélanger and Bédard 1989; Burger 1994) and a reduction in breeding success (e.g., Beale & Monaghan 2004; Medeiros *et al.* 2007; Valente, J. & Fischer, R. 2011). In the Hwaseong Wetlands, disturbance on multiple dates flushed flocks of geese and shorebirds repeatedly. On some days this prevented multiple species (e.g., geese, ducks, grebes and shorebirds) from roosting or feeding in the wetlands for substantial periods of time; and disturbance was likely responsible for the failure of several breeding waterbird species including Little Tern.

Disturbance in wetlands elsewhere has been shown to force waterbirds to use roost sites distant from foraging areas, requiring them to fly further and for longer (Navedo & Herrera 2012). This then requires birds to feed for longer to compensate for lost energy. If no undisturbed alternative roosts are available, then shorebirds can even be forced to remain in flight throughout the high tide period, requiring very high energy expenditure indeed (Prater 1981). Both of these behaviours caused by disturbance were also noted in the Hwaseong Wetlands during the Project Survey.

The cumulative costs of such disturbance can be substantial, both on individual waterbirds and potentially at the population level on some species like Far Eastern Curlew. Anderson & Keith (1980) determined

that disturbance can lead to a decline in survival. Research on two migratory shorebird species in Australia also concluded that the increased energy use associated with as few as 10 escape flights per day could have negative consequences to the point of reducing survival or reproductive success (Lilleyman *et al*. 2016). Based on our research in 2020, it seems likely that, many species in the Hwaseong Wetlands are forced to undertake substantially more than ten escape flights from human-caused disturbance in a day, especially during weekends.

Figure 27 Shorebird roost, Maehyangri (1--1). In order to put on enough weight to fuel their long migrations, many shorebird species spend all their time out on the tidal flats, feeding at low tide and sleeping at high tide. They try each day to keep as much distance as they can from land and from tall structures like trees and buildings which might hide predators. However, because shorebirds do not swim well, they are forced twice each day during Spring High Tides into smaller and smaller areas of remaining mud and sand, often close to land. At such times, these concentrations of birds are extremely vulnerable to predation and are therefore especially sensitive to disturbance. Even modest levels of disturbance at shorebird roosts like that at Maehyangri can force all of the birds to fly several extra kilometers to an alternative roost site, using up precious energy.

Methods used to reduce disturbance to waterbirds are also assessed in a large number of research papers and site management reports (e.g., Borgmann *et al*., undated; and see Section 4.3). Preferred methods include zoning (including in some nations imposing flight restrictions over protected areas: Canada 2020); increased signage; educating people on the needs of birds; and screens and hides

To help guide management decisions an often-used measurement is the Flight Initiation Distance (FID). This is the distance from the source of disturbance at which a species usually takes flight. Although this distance is influenced by several factors (including flock size, wetland area and the regularity or irregularity of disturbance events), FID has often been used to help inform decisions on zoning and on the best location for screens and birdwatching hides.

Research on the Far Eastern Curlew suggests that the mean FID can be up to 154m (Weston *et al*. 2012); while a separate study in Australia recorded a maximum FID of almost 200m (Glover *et al*. 2011). Many

Far Eastern Curlew in the Hwaseong Wetlands appeared to flush at distances of 150-200m from people and at >200m from drones.

Habitat change

As part of the ongoing conversion of former tidal flat to arable land, concrete roads and drains are being built in parts of 7--3, 7--4 and 7--5; soils are being bulldozed in fields north of 2--5 and 2--6; and new roads are being constructed close to the freshwater ponds at 5--6. In addition, a Peace Park and Observation Tower are being built in parts of the hinterland of 1--1. The construction in these areas creates high levels of disturbance to waterbirds; creates additional barriers to the movement of amphibians and fish in affected areas; and likely will influence hydrology in adjacent areas. Moreover, much of this construction work will likely result in a substantial reduction in restoration potential of the site.

In addition, there are also well-advanced plans to build a hotel in 8--2, perhaps within 100m of the main high tidal flat shorebird roost at 1--1. If built, the location of this hotel and the access road to it will likely be well-within the FID of Far Eastern Curlew and several other shorebird species.

Finally, half or more of the Seokcheonri Tidal Flat is still slated for reclamation. If reclamation of this area proceeds it will have major impacts on tidal flat and marine species (shellfish, fish, birds) that depend on the immediately adjacent Hwaseong Wetlands; and will likely increase the risk of major pollution incidents.

Alien Invasive Species

The American Bullfrog is widespread in freshwater wetland areas of the Hwaseong Wetlands. The species has been listed as one of the world's 100 worst invasive species (Lowe *et al*. 2000). In the ROK, the species is associated with increased rates of disease in native amphibians including the globally Endangered Suweon Tree Frog *(*Borzée *et al*. 2017b). Trapping appears to be the most widely-used method of trying to control or eradicate the species.

Spartina anglica has recently been found on the tidal flats of Ganghwa Island, Incheon (Park *et al*. 2019). Although considered less damaging than *Spartina alterniflora* (David Melville *in lit*. December 2016), if found in the Hwaseong Wetlands or in adjacent areas the species should be eradicated immediately. By 2014, the related *Spartina alterniflora* had spread from a few sites to cover more than 77,892 ha of tidal flats along the east coast of China (Gao *et al*. 2014). Where it occurs, *Spartina alterniflora* has changed the pattern of macrobenthos community distribution; accelerated the process of land cover formation; and formed a "green barrier" between the waterbirds and their food (in Moores *et al.* 2019).

Water quality and quantity

The water quality of the Hwaseong Reclamation Lake and its upper streams are controlled by the Rural Research Institute of Korean Korea Rural Community Corporation and Han River Basin Environmental Office. The Project Surveys did not investigate issues of water quality and water quantity. However, water quality in the Hwaseong Reclamation Lake has been assessed as too low quality for use in agriculture (see EAAFP 2018); and some areas of the site appear to lack adequate supplies of freshwater to support arable farming. Some positive remedial measures have already been taken, including the

creation of water treatment ponds in three areas.

In addition, water levels in the Hwaseong Reclamation Lake currently do not consider the needs of biodiversity. In August and September 2020, the water levels were maintained too high to allow shorebirds to roost in the Hwaseong Reclamation Lake.

4.3 Wetland Management Options

"Wetland management" describes a diverse array of possible options for maintaining or improving the health of a wetland. The challenge of deciding what needs to be done can often seem overwhelming at first. However, guidance provided by the Ramsar Convention, based on decades of experience across the world, is designed to make this decision-making process less complicated.

As made clear by the Ramsar Convention, the primary goal of management of an internationally important wetland, whether listed as a Ramsar site or not, is the maintenance or enhancement of the ecological character of that wetland. And ecological character is defined by the Ramsar Convention as that unique "combination of the ecosystem components, processes and benefits and services that characterise the wetland at a given point in time".

Every wetland is different. Nonetheless, in order to maintain or enhance the ecological character of an internationally important wetland, the best wetland management plans are based on Ramsar principles (see Australia 2020) and include aspirational goals, well-defined targets and a list of specific actions that need to be taken. These goals, targets and actions all need to be based firmly in an understanding of that particular site's ecology and hydrology and of the needs of local communities.

For wetlands with few known threats and little human use, the list of essential management actions will likely be quite short, e.g., the hiring of a warden and the erection of signs to help delineate the site boundaries.

At other sites, including at all of the sites introduced at the Second International Wetlands Symposium in Hwaseong City (May 2019), a much longer list of management actions will be required. For example, at Mai Po in Hong Kong SAR and at Chongming Dongtan in Shanghai, essential management actions have included: the establishment of a team of wardens and managers; the development of a permanent environmental monitoring system; the eradication of alien invasive species; changes in land and water use to benefit both people and biodiversity; creation of appropriate compensation and subsidy schemes set up to support local people; the restoration of important habitats; the creation of new habitats; zoning to manage visitors; and the setting up of appropriate facilities to enable ecotourism and environmental education, integrated into wider sustainable development projects.

As noted throughout this report, the Hwaseong Wetlands are diverse, and extremely important for biodiversity. Biodiversity is an essential component of the ecological character of the Hwaseong Wetlands. Currently, there are multiple issues that threaten this biodiversity (Section 4.2). The seeding of tidal flats with imported shellfish spat also suggest that shellfisheries, another key component of the site's ecological character, are operating at an unsustainable level (Section 2.3).

Management actions are required to solve these issues. And only by taking such actions in the near future, will it be possible to maintain and increase the benefits that these wetlands can provide to people for generations to come. Potential benefits of "Wise Use" achieved through good management practice identified during the Third International Wetlands Symposium (December 2020) and in this report

include: improvements in livelihoods, improved food security, improved sequestration of carbon, improvements in water quality, improvements in the diversity and abundance of life supported below water and on land, improvements in health and well-being, and improvements in the sustainability of cities and communities.

And as stated by Professor Nick Davidson, the former Deputy General of the Ramsar Convention Secretariat, in his Keynote Speech to the Third Symposium, “Wise Use” of the Hwaseong Wetlands can also be used by Hwaseong City to demonstrate “global leadership” in sustainability.

All three of the international symposia on wetlands held in Hwaseong City (in 2018, 2019 and 2020) were designed to share experience and knowledge, to engage the local community, and to inform potential management options.

A range of potential planning and management options have been suggested during these three symposia and through the Hwaseong Wetlands Project including:

- Limiting additional reclamation as this would reduce the area of wetland habitat,
- Evaluating the potential of increasing tidal exchange in the Hwaseong Reclamation Lake to improve water quality and to enhance the fishery.
- In currently unused areas (e.g., in 7--4 and 7--5), deepening some wetland areas and installing additional dykes to increase wetland diversity.
- If requested, constructing some salt-farms and fish ponds for the local community.
- Planting vegetation as screens along roads to reduce disturbance to roosting and feeding waterbirds.
- Identifying suitable areas for tourism and eco-tourism.

These decisions are for Hwaseong City and central government to make, with the support of local stakeholders and technical experts. However, both the report and especially the second and third symposia were intended to help provide examples of best management practice, and to generate much of the information needed for a management plan, as required for Ramsar site designation.

4.4. The Legal Procedure for Designation of Ramsar Sites and Wetland Protected Areas in the Republic of Korea

4.4.1. Designation of Ramsar Sites in the Republic of Korea

The Ministry of Environment is the national focal point for the Ramsar Convention. The Ministry of Environment is therefore responsible for filling out the Ramsar Information Sheet (RIS) and passing the RIS onto the Ramsar Convention Secretariat. The Secretariat checks and confirms whether the wetland meets Ramsar criteria for identifying internationally important wetlands. The process is finalized when the Ramsar Secretariat sends a certificate of registration to the Contracting Party.

Following Article 9 (Implementation of Convention) of the Wetland Conservation Act of Korea, for the government to notify candidate wetlands to the Secretariat, the Ministry of Environment (ME) and the Ministry of Oceans and Fisheries (MOF) should consult with the relevant central administrative agencies about the subject area (National Law Information Center, 2020).

The Procedure of Ramsar Site (Inland) Designation

Process	Designation procedure	Agency in charge	Applicable law	Average duration
Selection process	Selection of Sites	The Sites Center of NIE / Local gov't	Article 9 of the Act	At all times
	Designation standards review	WC NIE		6months
	RIS preparation	WC NIE		6months
Planning	Establish-ment of registration plan	ME		1month
Gathering opinions	Gathering of stakeholder s' opinions.	local gov't - opinions from local residents/ME- opinions from local gov't	Article 9 of the Act	1month
Consultation of ministries	Consultatio n of RCAA	ME-the Secretariat	Article 9 of the Act	1month
Designation	Designation request	ME-RCAA	Article 9 of the Act	3months
Notification	Designation notification	the Secretariat-ME		1month

Figure 28. Designation Procedure for Inland Ramsar Sites (NIE 2020)

The ME has responsibility for the conservation and management of inland wetlands, but currently does not have a specific management regulation for Ramsar Sites under the Wetland Conservation Law. The ME has therefore been promoting Ramsar Site designation of existing protected areas where management and conservation plans have already been established (NIE, 2020). Although it is possible to designate a wetland as a Ramsar Site when it is not yet within a national protected area, there is no institutional

mechanism to manage that wetland after Ramsar Wetland nomination. Hence, they are often registered as Wetland Protected Areas at the same time as Ramsar nomination, or in advance (as confirmed to the EAAFP Secretariat by the Ministry of Environment's Natural Ecology Policy Division in December 2020).

The legal and institutional systems to fulfil the obligations of the Convention, and also to agree effective management solutions for the sites, will likely be prepared in the future (NIE, 2020). To date, in the process of Ramsar Site designation, some wetlands first joined the Flyway Site Network (FNS) of the EAAFP, before applying for Ramsar Site status. This is because the criteria are similar to the Ramsar Convention's, and the process can help with the establishment of local institutional systems and management conservation plans (e.g., as at Janghang Wetland).

It is necessary to thoroughly prepare and organize the RIS. When the Ramsar Secretariat reviews RIS sent from the Contracting Parties, it reviews both the ecological, hydrological, and geographical information of the wetlands, and also gives a lot of weight to the explanation of the standards and application of the criteria, conservation measures, and management plans.

Once registered, there are obligations to maintain the ecological character of a Ramsar Sites. Contracting Parties are required to inform the Ramsar Secretariat of any changes in area, status or ecological character (Article 3, Paragraph 2 of the Ramsar Convention). Furthermore, if the ROK intends to delist a Ramsar Site or to reduce its size, it would need to prepare corresponding measures for conservation and management, including conservation and management of the area, joint research with other members of the Ramsar Convention, and data sharing, in accordance with Article 9 of the Wetlands Conservation Act. Finally, RIS information should be updated and resubmitted every six years.

In addition, the ROK is currently promoting and publicizing the Ramsar Wetland City Certification System, especially for the development of the local community. The criteria for Wetland City Certification include Linkage to Ramsar Sites; approaches taken to conserve wetland ecosystems; an integrated wetland conservation plan; education on and promotion of benefits and ecological services from wetlands; and the composition and operation of local communities for wetland management.

4.4.2. Procedure of designation for Wetland Protected Area in the Republic of Korea

The Wetlands Conservation Act conserves a wetland's ecological value through designation as a Wetland Protected Area. Wetlands are selected on the basis of maintaining native continuity, or rich biodiversity, or because they have extraordinary scenic, topographic, or geologic value. Forty-four wetlands have been designated as Wetlands Protected Areas by 2020. Twenty-five of these are inland wetland protected areas, managed by the ME; 12 sites are coastal protected areas, designated by the MOF; and seven sites were designated by mayors or provincial governors.

The inland Wetland Protected Areas designated by the ME are selected by the Wetlands Center of the National Institute of Ecology (NIE) through a process of survey and assessment. The designation process needs discussion both with NIE and also with local residents, representatives of metropolitan government (mayor/ province governor), and related central administrative agencies.

In the case of inland Wetland Protected Areas designated by Mayors/ Province Governors, all the process is either implemented independently, or they can involve the Wetlands Center in the process (Figure 29).

The whole designation process consists of selection, planning, collection of opinions, consultation among the ministries, and prescription. The selection process consists of general survey, monitoring of wetlands, selecting the site, and detailed survey (Figure 28). For the case of the coastal wetlands protected area, local governments select and recommend sites as candidate sites. After indicating the suitability of the result of the National Comprehensive Investigation into Marine Ecosystems, the designation of the protected area will be decided by the MOF (Figure 29).

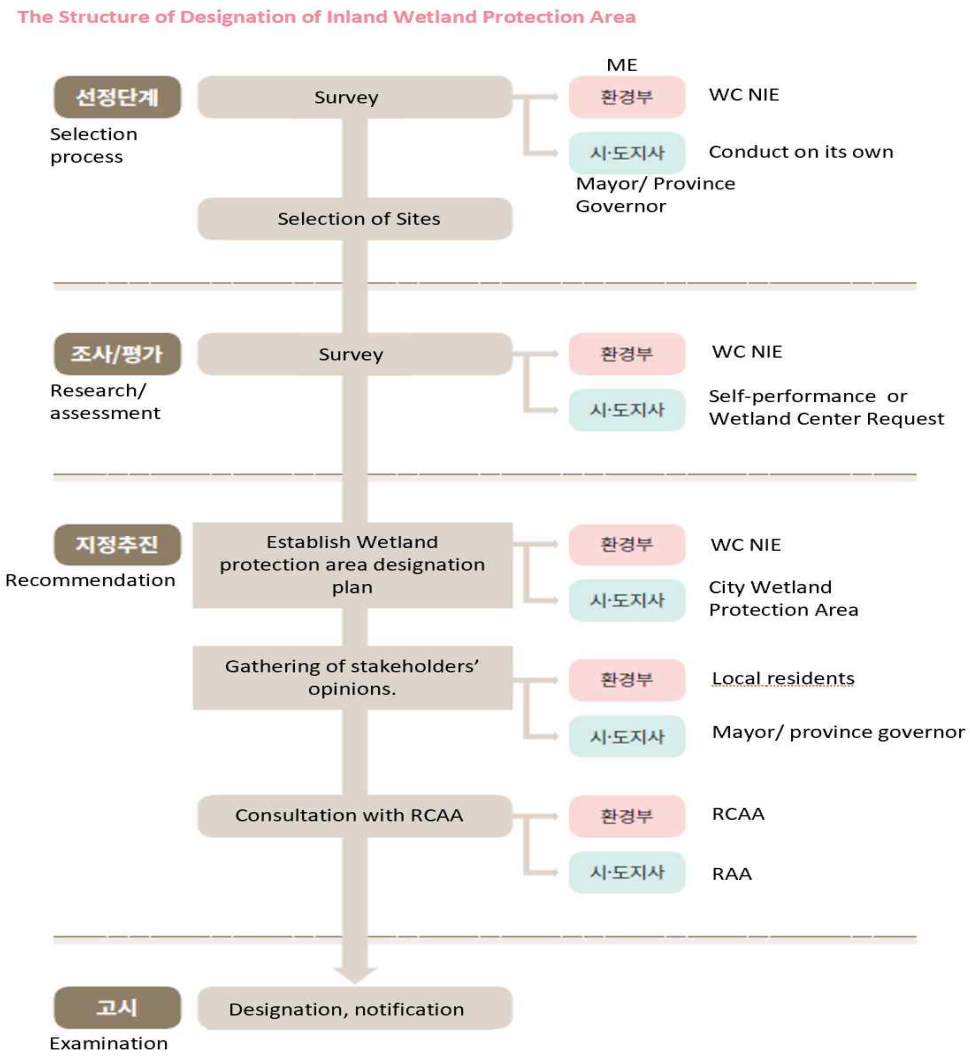

Figure 29. The structure of designation of Inland wetland protection area (2020, NIE; translated)

The Procedure of Designation of Inland Wetland Protection Area

Process	Designation procedure	Agency in charge	Applicable law	Average duration
Selection process	General survey and monitoring of Sites	WC NIE	Article 4 of the Act	At all times
	Area selection	WC NIE / local gov't		At all times
	Precision research	WC NIE / local gov't	Article 4 of the Act	A year
Planning	Establish designation plan	ME/mayor		1month
Gathering opinions	Gathering of opinions	ME/Mayor-local gov't	Article 8 of the Act	2months
	Result reporting of the opinion gathering	Local gov't-ME/mayor		
Consultation of ministries	Consultation of RCAA	ME/Mayor-RCAA/RAA	Article 8 of the Act	1month
Notification	Designation notification	ME/mayor	Article 8 of the Act	1month

Figure 30. The procedure of designation of inland wetland protection area (2020, NIE; translated)

The Procedure of Designation of Coastal Wetland Protection Area

Pre-preparation process	Recommendation of wetland protection area	Local government designation proposal Evaluate suitability via National Marine Ecosystem Survey
	Scrutiny (when needed)	Relevant investigation to assess compliance with the designation prohibition of wetland protection area
Designation Preparation process	Preparation of designation plan	Preparation of designation plan
	Gather local gov't/residents' opinions	Gather mayor/province governor's opinion Holding meetings and public hearings for residents;
	Consultation of RCAA	RCAA such as the Ministry of Environment, the Ministry of National Defense, the Ministry of Land
Designation	Designation, notification of Site	Publishing a branch newsletter
	Publish related info system	Posting the website of the Ministry of Oceans and Fisheries and the marine environment information portal, etc.
Post-designation	Establish a conservation plan	Ministry of Oceans and Fisheries (Local Maritime and Fisheries)

Figure 31. The procedure of designation of coastal wetland protection area (2020, NIE; translated)

4.5 Concluding Remarks

This report provides much of the necessary baseline information required for a Hwaseong Wetlands Management Plan.

Section 2 includes suggestions on site boundaries (and see Figure 32 below) and the organization of component parts of the wetlands into main habitat types, divided into subunits, with the hectarage provided of each wetland type as defined by the Ramsar Convention. Section 3 identifies priority species for conservation based on Ramsar criteria, supported by data on their abundance and distribution within the Hwaseong Wetlands FNS. And Section 4 provides information on management structures and experience from elsewhere which could help to deal with the list of threats identified during the Project Surveys.

Figure 32. Area of highest importance to waterbirds in the Hwaseong Wetlands as identified during the Project Surveys, taking into account clearly defined landscape boundaries.

In conclusion, as described throughout the report (e.g., in Figure 26, Section 4.1), steps taken in the near future in order to achieve the wise use of the Hwaseong Wetlands could therefore include:

(1) Detailed discussion on the dependence of wetland biodiversity on agricultural areas in the Hwaseong Wetlands with various government bodies, especially those within the Ministry of Agriculture, Food and Rural Affairs;

(2) Fuller, more explicit, integration of the values of wetlands and biodiversity into the Hwaseong SDGs;
And,
(3) The development of management guidelines; and the establishment of an appropriately-trained team of managers and wardens and of a Management Committee.

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APPENDIX ONE

Peak counts by month of waterbird species recorded in the Survey Areas during the Project Surveys (2020).

	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Branta hutchinsii	0	0	0	0	1	0	0
Anser caerulescens	0	0	0	0	1	0	1
Anser cygnoides	0	0	0	0	2	0	0
Anser fabalis	0	0	0	0	30	8	5
Anser serrirostris	0	0	0	290	40500	40500	18000
Anser albifrons	0	0	0	0	6685	14100	16000
Anser erythropus	0	0	0	0	5	5	4
Cygnus cygnus	0	0	0	0	20	4	14
Tadorna tadorna	1	0	0	0	27	21	58
Tadorna ferruginea	0	0	0	0	263	990	158
Sibirionetta formosa	0	0	0	0	65	7	5
Spatula querquedula	0	0	8	10	0	0	0
Spatula clypeata	0	0	0	5	76	113	38
Mareca strepera	0	0	0	0	28	959	119
Mareca falcata	0	0	0	24	84	60	4
Mareca penelope	5	1	0	15	52	118	7
Anas zonorhyncha	119	310	120	440	1995	295	735
Anas platyrhynchos	7	4	3	12	2208	8307	8343
Anas acuta	0	0	2	20	34	642	57
Anas crecca	0	0	0	5	542	1100	111
Aythya ferina	0	1	0	2	3510	2702	744
Aythya nyroca	0	0	0	0	3	1	0
Aythya fuligula	0	0	0	0	149	225	81
Aythya marila	0	0	0	0	2714	3927	1564
Clangula hyemalis	0	0	0	0	0	0	1
Bucephala clangula	0	0	0	0	0	57	314
Mergellus albellus	0	0	0	0	0	16	160
Mergus merganser	0	0	0	0	3	34	73
Mergus serrator	0	0	0	0	1	6	703
Mergus squamatus	0	0	0	0	0	2	0
Rallus indicus	0	0	0	0	0	1	0
Porzana fusca	0	1	0	0	0	0	0
Gallinula chloropus	8	17	22	11	6	1	4
Fulica atra	24	25	29	54	276	245	396
Grus monacha	0	0	0	0	26	0	0
Tachybaptus ruficollis	6	6	34	32	21	19	21
Podiceps cristatus	14	13	4	11	786	2466	750

Podiceps nigricollis	0	0	0	0	44	265	301
Haematopus ostralegus	66	518	623	545	5	0	0
Himantopus himantopus	66	6	3	2	3	5	5
Recurvirostra avosetta	0	0	0	0	0	1	1
Vanellus vanellus	0	0	0	0	45	23	1
Pluvialis fulva	0	0	2	0	3	0	0
Pluvialis squatarola	154	155	835	1370	1450	560	210
Charadrius placidus	0	0	0	1	0	0	0
Charadrius dubius	9	4	0	0	1	0	0
Charadrius alexandrinus	90	1013	560	300	330	5	0
Charadrius mongolus	2	540	870	266	198	0	0
Charadrius leschenaultii	1	0	3	1	0	0	0
Rostratula benghalensis	1	7	0	0	0	0	0
Numenius phaeopus	116	125	115	35	0	0	0
Numenius madagascariensis	816	2275	1835	731	180	3	0
Numenius arquata	234	2450	3700	2626	3100	2220	850
Limosa lapponica	7	79	305	34	28	2	0
Limosa limosa	21	177	21	27	3	16	0
Arenaria interpres	1	4	22	20	1	0	0
Calidris tenuirostris	9	9	201	335	473	0	0
Calidris canutus	0	1	13	15	25	0	0
Calidris pugnax	0	0	1	0	0	0	0
Calidris falcinellus	0	5	20	39	3	0	0
Calidris acuminata	0	4	3	0	0	0	0
Calidris ferruginea	0	0	1	0	0	0	0
Calidris temminckii	0	0	0	1	0	0	0
Calidris subminuta	0	1	3	1	0	0	0
Calidris ruficollis	2	1130	400	1910	63	0	0
Calidris alba	0	0	3	1	0	0	0
Calidris alpina	3	400	350	6875	12120	1340	1100
Calidris minuta	0	1	0	1	0	0	0
Calidris melanotos	0	0	0	1	0	0	0
Gallinago stenura	0	0	0	3	0	0	0
Gallinago gallinago	0	0	0	65	4	0	1
Xenus cinereus	90	1710	1200	350	140	0	0
Phalaropus lobatus	0	45	1	2	0	0	0
Actitis hypoleucos	0	1	4	4	1	0	1
Tringa ochropus	0	1	2	1	2	2	1
Tringa brevipes	5	7	64	2	0	0	0
Tringa totanus	45	19	5	4	0	0	0
Tringa stagnatilis	1	4	18	6	40	0	0
Tringa glareola	1	107	85	9	5	0	0
Tringa erythropus	1	1	1	3	8	17	0
Tringa nebularia	69	817	1035	486	117	3	1
Tringa guttifer	0	0	0	5	1	0	0
Chroicocephalus ridibindus	0	0	1	5	8	160	440

Chroicocephalus saundersi	0	9	28	34	22	121	138
Larus crassirostris	920	1430	4500	4254	1340	1200	20
Larus canus	0	0	0	0	0	0	2
Larus vegae	0	0	0	0	12	25	42
Larus mongolicus	5	15	40	56	43	20	3
Larus heuglini	0	0	0	1	3	1	2
Gelochelidon nilotica	0	2	0	1	0	0	0
Sternula albifrons	4	0	0	0	0	0	0
Chlidonias hybrida	0	1	0	1	0	0	0
Chlidonias leucopterus	0	0	0	1	0	0	0
Ciconia boyciana	0	0	0	0	0	1	8
Phalacrocorax carbo	1550	1340	940	755	53	174	80
Platalea leucorodia	0	0	0	2	72	48	45
Platalea minor	93	143	166	254	98	0	1
Botaurus stellaris	0	0	0	1	1	0	2
Ixobrychus sinensis	10	4	2	0	0	0	0
Ixobrychus eurhythmus	1	1	0	0	0	0	0
Nycticorax nycticorax	6	21	2	2	4	0	0
Butorides striata	1	0	1	0	0	0	0
Ardeola bacchus	0	0	1	0	0	0	0
Bubulcus coromandus	5	1	150	2	0	0	0
Ardea cinerea	63	136	107	95	69	38	51
Ardea purpurea	1	0	0	0	0	0	0
Ardea alba	135	234	180	100	133	45	169
Ardea intermedia	3	33	13	10	8	0	0
Egretta garzetta	8	23	23	3	4	9	1
Egretta eulophotes	6	8	70	26	1	0	0
Monthly Total	4805	15395	18750	22611	80377	83235	51946

APPENDIX TWO

Combined peak counts of waterbirds by year (2014-2018 and 2020), with data sourced primarily from NIBR and Hwaseong KFEM monthly surveys and from the Project Surveys.

~~species~~	2015	2016	2017	2018	2020	Peak Count All 5 years
Branta hutchinsii	0	0	0	0	1	1
Anser caerulescens	0	0	0	0	1	1
Anser cygnoides	0	2	0	0	2	2
Anser fabalis	0	0	0	0	30	30
Anser serrirostris	11794	10848	10180	3549	40500	40500
Anser albifrons	848	764	1277	216	16000	16000
Anser erythropus	0	0	0	4	5	5
Cygnus cygnus	16	13	12	0	54	54
Tadorna tadorna	1261	2500	781	735	1375	2500
Tadorna ferruginea	900	416	1042	1000	990	1042
Sibirionetta formosa	0	0	25	3580	65	3580
Spatula querquedula	3	1	0	0	10	10
Spatula clypeata	221	362	393	272	134	393
Mareca strepera	122	61	46	36	959	959
Mareca falcata	6	38	6	44	84	84
Mareca penelope	46	12	41	34	118	118
Anas zonorhyncha	2770	3067	2010	2130	2164	3067
Anas platyrhynchos	75952	26531	5938	18750	11897	75952
Anas acuta	521	168	300	72	642	642
Anas crecca	771	975	723	495	1100	1100
Aythya ferina	1665	3555	1420	940	3510	3555
Aythya nyroca	0	0	0	0	3	3
Aythya fuligula	490	84	170	316	225	490
Aythya marila	287	96	234	87	3927	3927
Clangula hyemalis	0	1	0	0	1	1
Bucephala clangula	143	239	142	33	314	314
Mergellus albellus	14	18	2	1	160	160
Mergus merganser	185	155	132	51	73	185
Mergus serrator	1	2	0	0	703	703
Mergus squamatus	0	0	0	0	2	2
Rallus indicus	0	0	0	0	1	1
Porzana fusca	0	0	0	0	1	1
Gallinula chloropus	2	2	2	6	22	22
Fulica atra	206	234	70	86	396	396
Grus monacha	0	549	0	0	26	549
Tachybaptus ruficollis	47	15	17	16	34	47
Podiceps cristatus	194	160	200	184	2466	2466
Podiceps nigricollis	0	0	0	0	301	301
Haematopus osculans	430	468	459	643	623	643

Himantopus himantopus	1	1	4	4	68	68
Recurvirostra avosetta	2	0	0	0	1	2
Vanellus vanellus	0	0	0	0	45	45
Pluvialis fulva	2	14	0	6	3	14
Pluvialis squatarola	1021	1800	680	1065	1450	1800
Charadrius placidus	0	0	0	0	1	1
Charadrius dubius	0	23	14	4	10	23
Charadrius alexandrinus	150	150	250	60	1013	1013
Charadrius mongolus	800	430	500	420	870	870
Charadrius leschenaultii	0	0	0	0	3	3
Rostratula benghalensis	0	0	0	0	7	7
Numenius phaeopus	730	430	294	342	265	730
Numenius madagascariensis	500	1063	470	1150	2275	2275
Numenius arquata	3300	4220	3106	2680	3700	4220
Limosa lapponica	1029	930	3583	2500	1760	3583
Limosa limosa	95	121	29	122	177	177
Arenaria interpres	39	68	51	29	22	68
Calidris tenuirostris	3001	8000	6023	34900	9625	34900
Calidris canutus	5	10	7	3	25	25
Calidris pugnax	7	0	1	0	1	7
Calidris falcinellus	2	5	15	6	39	39
Calidris acuminata	1	6	4	1	24	24
Calidris ferruginea	0	0	0	1	1	1
Calidris temminckii	0	0	0	0	1	1
Calidris subminuta	0	1	0	0	3	3
Calidris pygmea	0	0	0	1	0	1
Calidris ruficollis	338	434	345	506	1910	1910
Calidris alba	0	0	0	0	3	3
Calidris alpina	5665	4500	14001	18000	25401	25401
Calidris minuta	0	0	0	0	1	1
Calidris melanotos	0	0	0	0	1	1
Gallinago stenura	0	0	0	0	3	3
Gallinago gallinago	0	0	1	0	65	65
Xenus cinereus	140	750	550	970	1710	1710
Phalaropus lobatus	0	0	0	0	45	45
Actitis hypoleucos	2	5	5	1	4	5
Tringa ochropus	0	2	0	0	2	2
Tringa brevipes	24	28	5	2	64	64
Tringa totanus	4	91	19	7	45	91
Tringa stagnatilis	76	28	3	15	40	76
Tringa glareola	4	1	8	10	107	107
Tringa erythropus	55	13	32	67	21	67
Tringa nebularia	825	880	1505	830	1035	1505
Tringa guttifer	0	1	1	3	5	5
Chroicocephalus ridibindus	230	215	243	151	440	440
Chroicocephalus saundersi	91	193	398	203	138	398
Ichthyaetus relictus	1	0	0	0	0	1
Larus crassirostris	2703	1891	3077	2981	4500	4500
Larus canus	0	1	0	0	2	2
Larus vegae	115	137	845	42	67	845
Larus mongolicus	12	0	27	51	56	56
Larus heuglini	0	0	0	0	3	3
Gelochelidon nilotica	0	0	0	0	2	2

Sternula albifrons	0	2	8	0	4	8
Chlidonias hybrida	0	0	0	0	1	1
Chlidonias leucopterus	0	0	0	0	1	1
Ciconia boyciana	0	20	12	8	8	20
Phalacrocorax carbo	500	271	1600	581	1550	1600
Platalea leucorodia	23	96	182	100	72	282
Platalea minor	124	146	214	160	254	254
Botaurus stellaris	0	0	2	2	2	2
Ixobrychus sinensis	0	0	0	0	10	10
Ixobrychus eurhythmus	0	0	0	0	1	1
Nycticorax nycticorax	0	0	0	0	21	21
Butorides striata	0	0	0	0	2	2
Ardeola bacchus	0	0	0	0	1	1
Bubulcus coromandus	29	60	0	0	150	150
Ardea cinerea	149	397	201	87	136	201
Ardea purpurea	0	0	0	0	1	1
Ardea alba	198	416	297	144	234	416
Ardea intermedia	0	3	1	0	33	33
Egretta garzetta	45	52	32	20	23	52
Egretta eulophotes	132	83	45	97	70	132
Grand Totals	121065	79324	64312	101612	148552	250202