



Report about National monitoring of Black-faced Spoonbills and study on their habitats in Republic of Korea



Research Institution | Waterbird Network Korea

2020. 12. 31.



This research is a project funded by the Incheon Metropolitan City as part of a
“Cooperative Project between the Incheon Metropolitan City and
the Hong Kong Government to Protect Black-faced Spoonbills.”

| **Submission Statement** |

Dear EAAFP Secretariat,

This report is submitted as the final result of the project, “National monitoring of Black-faced Spoonbills and study on their habitats in Republic of Korea.”

2020. 12. 31.

Waterbird Network Korea

| Research Summary |

| Overview of Research

- Identification of the population of Black-faced Spoonbills and analysis of habitat in Republic of Korea through national monitoring

| Contents of Research

- 3 times of national monitoring of Black-faced Spoonbills (conducted from August to October)
- Analysis of major habitats in Korea by colored bands and satellite tracking devices attached on Black-faced Spoonbills

| Key Results

- In September, 3,327 Black-faced Spoonbills were observed and the maximum number was estimated to be 3,861. Considering the breeding population (about 1,000) that uses North Korea as its habitat after breeding, the population in the Korea is estimated to exceed 5,000.
- About 65% of population were observed in the northwest region, including Incheon Metropolitan City, and about 98% inhabited on the west coast of Korea, including the mid-west region.
- The key habitats of Black-faced Spoonbills were tidal flats in Yeonggwang, the south of Ganghwa, Yeongjong-do, Song-do, Hwaseong wetland, and Yubu-do region.
- Among the color bands attached on the Korean breeding grounds, 47.6% (259 color bands) were re-observed in 2020, and 36.9% were confirmed in Korea alone. The annual survival rate is estimated to be about 80%, but it is considered to be lower for younger individuals. Observations of bands showed that Black-faced Spoonbills used most of its nearby habitat after breeding, but some of them showed a tendency to migrate away.

- The satellite tracking data showed that Black-faced Spoonbills have gradually expanded its habitat after left the nests and migrated to different places. In addition to tidal flats, they also used a variety of habitats, such as tidal channel, reservoir, waste salt pond, and agricultural land.
- The migration of Black-faced Spoonbills took place from mid-October to late-November, and depending on the individuals, they traveled from a shortest distance of around 400km to a farthest distance of more than 4,000km. They were distinguished from those who immediately crossed Yellow Sea to China and those who moved down along the west coast of Korea before migrating to China or Japan. The individuals having stayed in the middle along the west coast of Korea showed wandering passage with irregular direction, and which is assumed to be caused by their separation from experienced parents.
- The main threats that can affect the migration of Black-faced Spoonbill are assumed to be predators, collisions, fishing lines, diseases, coastal development and disturbance factors.

▮ Recommendations

- Efforts to preserve the major habitats of Black-faced Spoonbills in Incheon are needed, as well as the measures that restrict developments or landfills on coastal reservoirs, abandoned salt ponds and coastal wetland.
- It is believed that establishing an alternative habitat for landfills in Song-do Zone 11, which is linked to Namdong Reservoir and Gojan tidal flats, will be important for conservation.
- It is believed that restricting fishing activities and access to important roosting area for Black-faced Spoonbills are required, as well as the measures to spread ecological conservation culture to protect Black-faced Spoonbills.
- It is hoped that regular monitoring of Black-faced Spoonbills will expand citizens' awareness of the importance of protecting them and their habitats.
- The main habitats identified in this research are hoped to be listed in the Flyway Network Site.

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I. Overview

1. Overview of Research

A. Title of the Research Project

| National monitoring of Black-faced Spoonbills and study on their habitats in Republic of Korea

B. Background and Purpose

| Background

- In 2019, the Incheon Metropolitan Government and the Hong Kong government signed a memorandum of understanding (MOU) for mutual cooperation to protect Black-faced Spoonbills and promote public awareness.
- Research for Black-faced Spoonbills distributed along the East Asian-Australasian Flyway, is necessary focusing on the inhabitation status, distribution, breeding, migration route, and rate of inhabitation in Incheon area. For this purpose, the need is required for monitoring Black-faced Spoonbills throughout Korea.
- Research is required on breeding grounds and habitats used as resting or feeding sites for the conservation of Black-faced Spoonbills. The study on the attachment of color bands and satellite tracking devices will be helpful for this purpose.
- By identifying the habitat use and distribution of the Black-faced Spoonbills through tracking study, it will be possible to confirm the key habitats and contribute to the conservation of the region.

| Purpose

- In addition to identifying the total populations of Black-faced Spoonbills in Korea through national monitoring, various civic groups and related organizations will participate together which can increase citizens' awareness and utilize it for conservation management in the future.
- The purpose of the research is to understand the distribution and migration of the Black-faced Spoonbills through color bands and satellite tracking devices and to

identify its important habitat for the stable survival of the species to contribute to the conservation of the endangered Black-faced Spoonbills.

C. Overview of Project

| Overview

- Project Period: July 1st to December 31st, 2020
- Project Cost: 35,000,000 Korean won
- Organized by: EAAFP Secretariat
- Sponsored by: Incheon Metropolitan City
- Supervised by: Waterbird Network Korea
- Joint participating institutes and organizations: National Institute of Ecology Endangered Species Restoration Center, National Institute of Biological Resources, Incheon Black-faced Spoonbill Network, Ecological Education Hub Mulsae AI, Ganghwa Bird Watching Club, Yeongjong Environmental Union, Saemangeum Citizen Monitoring Group, Friends of Wetlands and Birds, Jeju Wildlife Research Center, Eco Horizon Institute, Green Korea Incheon, KFEM Incheon, etc.
- Leading Researchers: Ki-sup Lee, In-ki Kwon, Jong-hyun Park, Seong-yeon Yoo, Jong-gyeong Hwang, Jin-geum Kim, Kyung-oh Cho
- Participants : Chang-wan Kang, Sang-seop Kim, Eok-su Kim, Woo-cheol Kim, In-sook Kim, In-cheol Kim, Hyung-moon Kim, Sun-jeong Nam, Keon-seok Park, Jung-woon Park, Joong-rok Park, Taek-hyun Seol, Eun-hee Song, Ju-yeol Shin, Sang-kyung Yeo, Dong-pil Oh, Heung-beom Oh, Kye-suk Lee, Seon-ju Lee, Seung-hee Lee, Ye-soon Lee, Jason Lee, Hyeok-jae Lee, Yong-hoon Jung, Hyun-ja Cho, Yong-gi Joo, Nam-jun Ji, In-suk Ji, In-hwan Cha, Sun-rye Choi, Jun-sik Tak, Moon-woo Han, Hae-gwang Han, So-san Hong, etc.

2.

Project Plan

| National Monitoring of Black-faced Spoonbills

- Period: From August to October, 2020, survey once a month

- Description: By simultaneously monitoring of 20 sites including Incheon Metropolitan City and other major Black-faced Spoonbill habitats in South Korea, the habitat and numbers, the importance of the region, and threat factors are identified.

| Habitat study through color bands and Satellite tracking devices

- Period: July to December, 2020
- Description: Color bands and satellite tracking devices are attached in their major breeding grounds of Black-faced Spoonbills, and the characteristics of habitats, migration, migration routes, and threat factors are identified.

| Study on the status and inhabitation of Black-faced Spoonbills and waterbirds in the Yeongjong-do region

- Period: July to October, 2020
- Description: The status of inhabitation of Black-faced Spoonbills and waterbirds in the Yeongjong-do region was identified. Also, the need for conservation as a habitat for waterbirds and threats from development in Yeongjong-do were identified.
- Monitoring, tracking data, and the results for habitat study were put together.

| Project Promotion Schedule

Table I -1. a list of project promotion schedule in this research.

section	Research contents	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.
monitoring and research	National Monitoring							
	Study of habitat use (color bands, tracking devices)							
	survey on waterbirds in the Yeongjong-do							
Interim and final report								

*The results of the survey on waterbirds in Yeongjong-do are submit as a separate report after the interim report.

II. Current Status of Black-faced Spoonbills

1. Characteristics of Black-faced Spoonbill

A. Classification of Black-faced Spoonbill

- Black-faced Spoonbill (scientific name: *Platalea minor*) belongs to the order Pelecaniformes, family Threskiornithidae and genus *Platalea*. There are total six species in *Platalea* genus worldwide. Two species of Spoonbills, Black-faced Spoonbill and Eurasian Spoonbill (*P. leucorodia*), inhabit in East Asia including Korea (Hancock et al. 1992).
- Black-faced Spoonbill is a medium-sized waterbird with a body length of 70~90cm. It has a black face and white body with a wide and long beak shaped like a spoon (Del Hoyo et al. 1992; Hancock et al. 1992).
- In Korea, it is legally protected as endangered wildlife Class I designated by the Ministry of Environment, Natural Monument No. 205-1 designated by the Cultural Heritage Administration, and marine protected species designated by the Ministry of Oceans and Fisheries.
- Black-faced Spoonbill is an internationally endangered species (IUCN Redlist EN), but five other species are believed to have relatively stable populations (BirdLife International 2019).

B. Ecological Characteristics of Black-faced Spoonbill

- It walks open the long beak halfway and shake it to the side to catch on fish, shrimp, crustaceans, and other small animals with the sense of the beak (Figure II -1, Swennen & Yu 2004, 2005).
- It lives in various wetlands such as coasts, tidal flats, estuaries, agricultural lands, and reservoirs. It is often observed in the tidal flats of west coast and Jeju island in Korea (Choi et al. 2007; Yoo et al. 2019).
- Breeding is mainly grouped on unmanned islands on the west coast of the Korean Peninsula. It has been reported that a small number of Black-faced Spoonbills breeds in Liaoning Province of China, in Premorsky Krai of Russia, and a few

breeds in North Korea. (Chong et al. 1996; Ding et al. 1999; Kang et al. 2016; Shibaev 2010; Ueta et al. 2002; Wei et al. 2005).

- In Korea, since the first breeding site was discovered in 1994, more than 20 breeding sites have been found until now, and more than 90% of the breeding population is known to breed in Incheon area (Kwon 2017).
- In winter, they migrate to south such as southern Japan, southern China, Taiwan, and Hong Kong. In Korea, a small number of population spend the winter in Jeju island (Lee et al. 1995; Kim et al. 1998; Mendoza et al. 2002; Ueta et al. 2002; Wood et al. 2013; Ministry of Environment 2015).

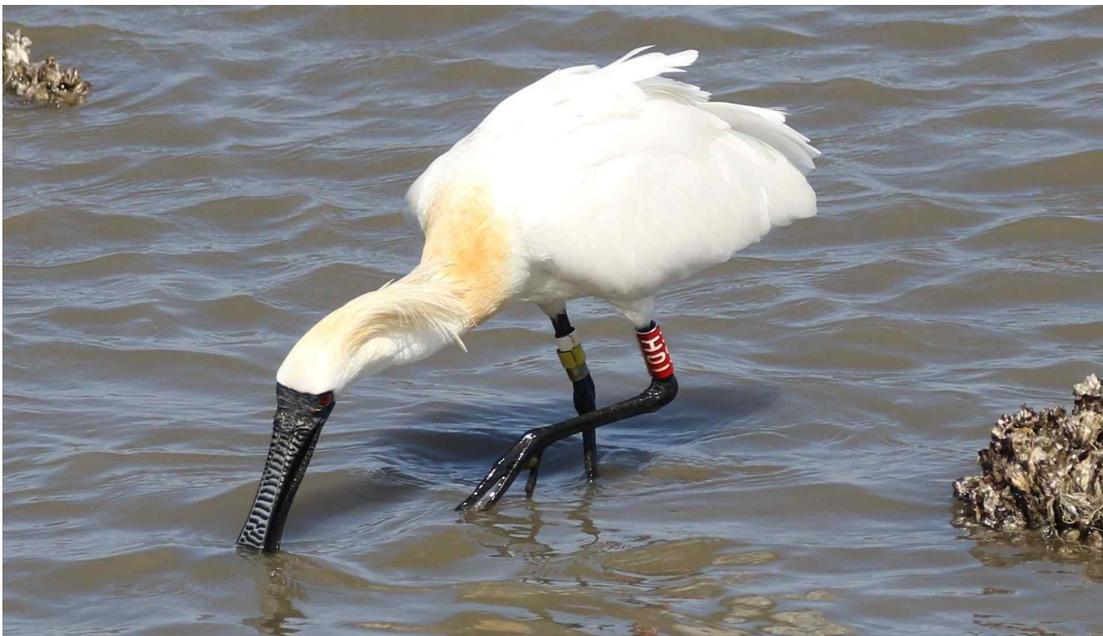


Figure II-1. A Black-faced Spoonbill looking for food in the intertidal area of Incheon.

2. Population changes of Black-faced Spoonbills

A. Winter Monitoring and Population Changes of Black-faced Spoonbills

- Historical data on Black-faced Spoonbill population is lack, but before 1950, it was known as a “common bird” in East Asia (Austin 1948). It is estimated that more than 10,000 individuals survived in the early 1900s (Yeung *et al.* 2006).
- The number of individuals decreased to 288 in 1988 due to various causes such as

the War, egg collection, development, environmental pollution, pesticide and human interference (Chan et al. 2010). It was designated as Critically Endangered species on the IUCN Red List in 1994 (BirdLife International 2019).

- Since then, simultaneous monitoring has been carried out in every winter (January) from wintering grounds such as Hong Kong, mainland China, Taiwan, Japan, and other countries in southeastern Asia in order to understand the global distribution and the number of surviving populations along with international efforts for conservation of Black-faced Spoonbills.
- As a result, the population has gradually increased from 351 individuals in 1994, to 4,864 individuals in 2020 by simultaneous monitoring in winter (Yu et al. 2020, Figure II-2, Figure II-3).

B. Changes in Breeding Grounds and Breeding Populations in Korea

- A full-scale survey of the domestic breeding population began in 2003, and about 100 pairs of Black-faced Spoonbill breeding were found in five breeding grounds (Figure II-4).
- Since 2006, small-scale breeding grounds have begun to be identified in coastal regions close to land, such as Gaksiam, Suhaam, artificial islands in Namdong Reservoir, and Mae-do.
- The domestic breeding population also continued to increase, with 1,009 pairs breeding in 2016 and 1,548 pairs breeding in 2020 (Figure II-4).

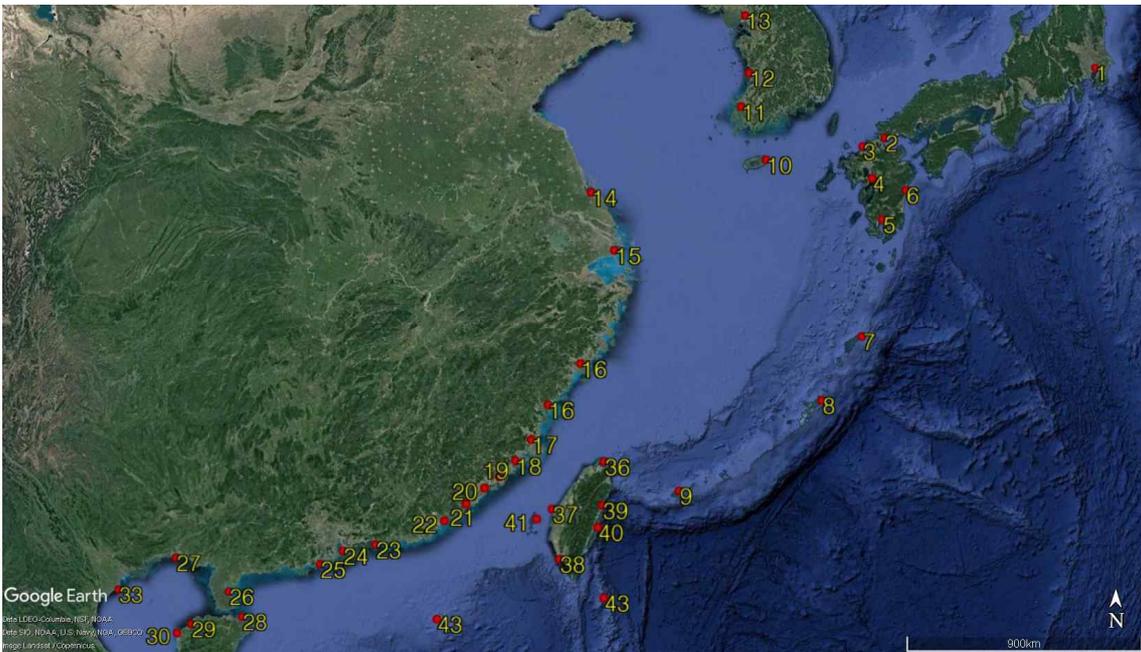


Figure II-2. Locations of wintering Black-faced Spoonbills recorded during the 2020 international census.

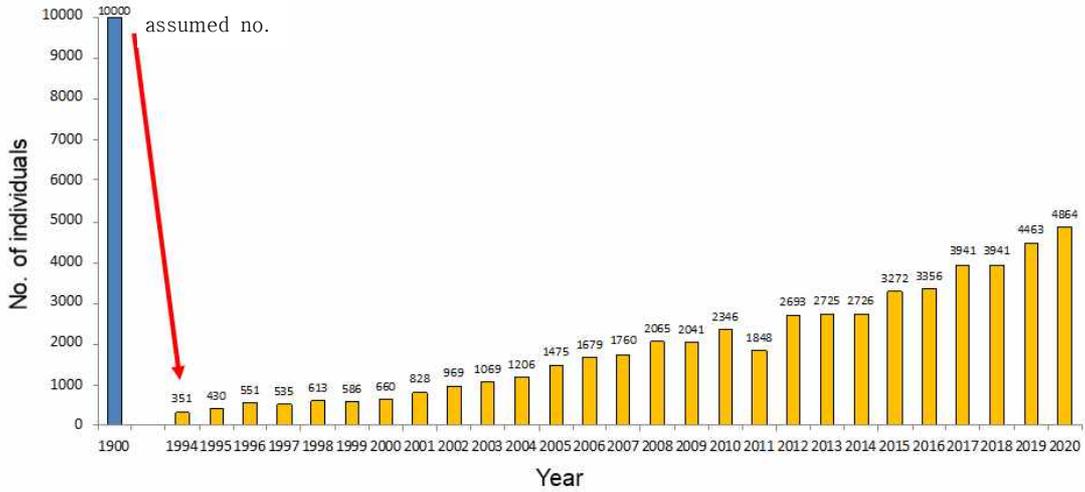


Figure II-3. Annual changes in the number of Black-faced Spoonbills.

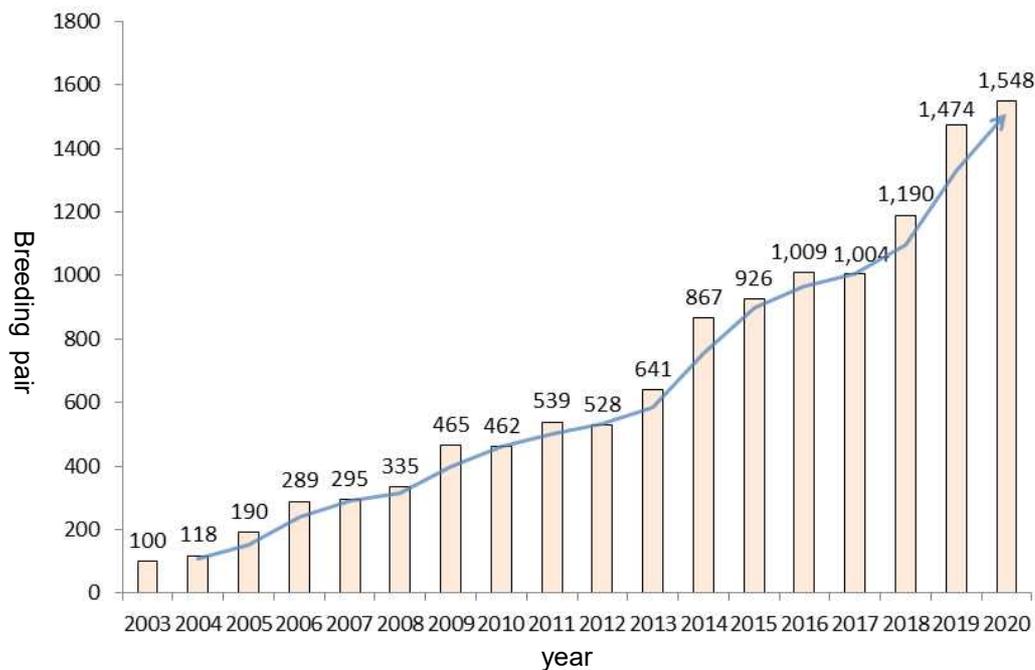


Figure II-4. Annual changes of the breeding pairs of Black-faced Spoonbills in Republic of Korea.

C. Status of Black-faced Spoonbills Breeding in 2020

- In 2020, the Endangered Species Restoration Center in National Institute of Ecology and Waterbird Network Korea visited the breeding islands from April to July to check the breeding populations (pairs) of Black-faced Spoonbills (Figure II-5).
- A total of 18 breeding islands have been identified as a result in 2020, and at least 1,548 pairs are assumed to have bred (Figure II-6, Table II-1). Some breeding islands were visited several times to determine relatively accurate number, but some islands (around 10) were visited 1 or 2 times. or only checked the breeding pairs from a distance. This means 1,548 pairs are the minimum breeding pairs, considering that the missed nests not seen well or that additional breeding nests started after the visit, or the nests failed before.
- Among the breeding grounds in Korea, Guji-do in Ongjin-gun had the largest number of breeding pairs with 294 pairs. The next largest number was Bi-do in

Ganghwa-gun, with at least 210 pairs (checked only once). The third large number of breeding pairs were identified from the small island on Namdong Reservoir, with 165 pairs. It was followed by 120 pairs in Seoman-do, 114 pairs in Mae-do, and 107 pairs in Yo-do in Ongjin-gun.

- Most of the big population of Black-faced Spoonbills were located in Incheon Metropolitan City, and the breeding scale in Incheon was about 1,280 pairs on 12 islands, which was accounted for 82.8% of the total. 5 islands were discovered from Chilsan-do archipelago in Yeonggwang-gun, accounting for 10.5% with 162 pairs, while Noru island in Seocheon-gun accounted for 6.8% of the total with 105 pairs.



Figure II-5. Black-faced Spoonbills breeding on a small islet in Namdong Reservoir.

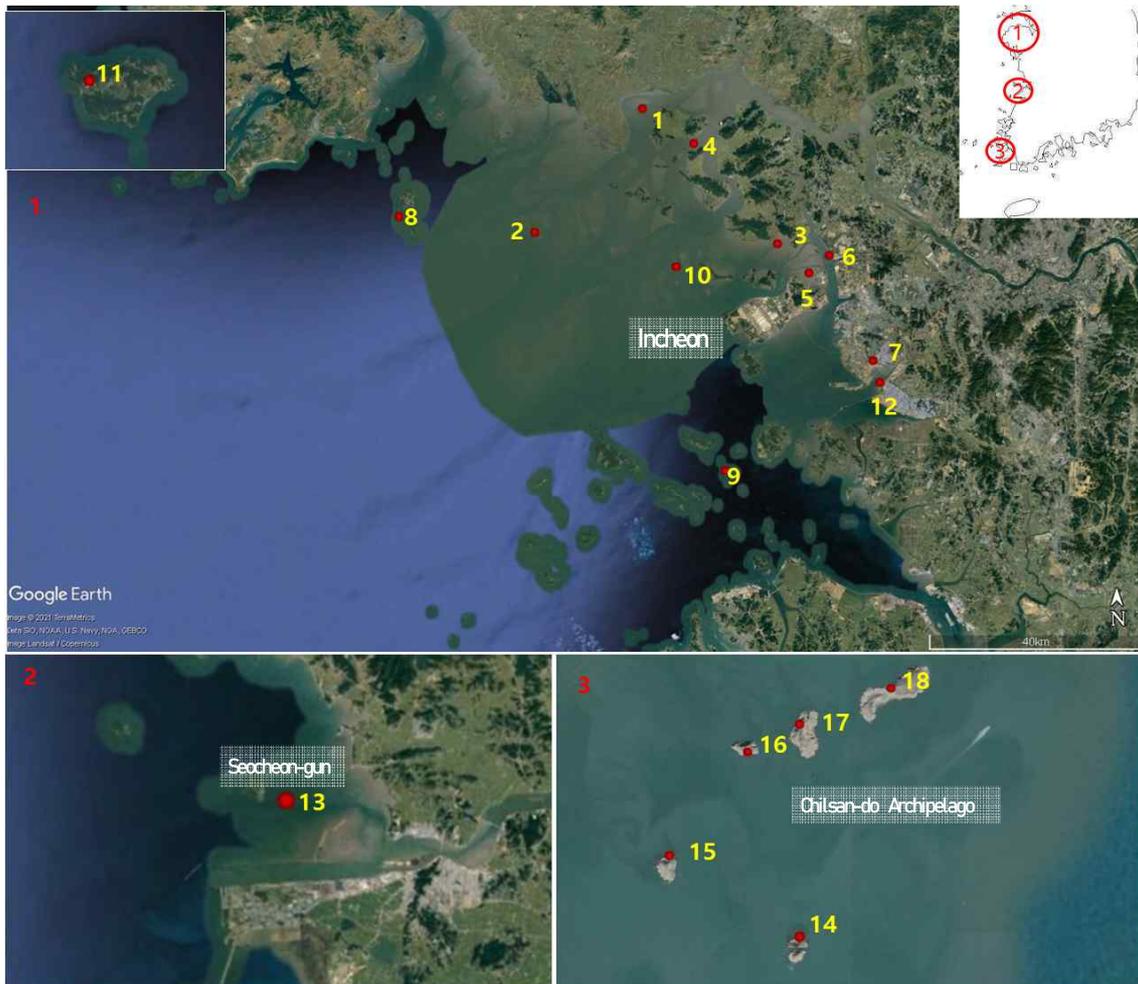


Figure II-6. location of breeding islands of Black-faced Spoonbills in 2020(1: Yo-do, 2: Bi-do, 3: Gaksiam, 4: Sangyeobawi, 5: Suhaam, 6: Mae-do, 7: Namdongji, 8: Guji-do, 9: Hwangseo-do, 10: Seoman-do, 11: Baekryong-do, 12: Okgwi-do, 13: Noruseom, 14: Ilsan-do, 15: Yisan-do, 16: Samsan-do, 17: Sasan-do, 18: Yuksan-do).

Table II-1. Status of breeding population of Black-faced Spoonbills in 2020.

No	Breeding site	Administrative district	*breeding pairs
			2020년
1	Yo-do	Ganghwa-gun, Incheon	107
2	Bi-do	Ganghwa-gun, Incheon	210
3	Gaksiam	Ganghwa-gun, Incheon	38
4	Sangyeobawi	Ganghwa-gun, Incheon	22
5	Suhaam	Jung-gu, Incheon	34
6	Mae-do	Seo-gu, Incheon	114
7	Namdongji	Namdong-gu, Incheon	165
8	Guji-do	Ongjin-gun, Incheon	294
9	Hwangseo-do	Ongjin-gun, Incheon	106
10	Seoman-do	Ongjin-gun, Incheon	120
11	Baekryong-do	Ongjin-gun, Incheon	8
12	Okgwi-do	Siheung-si, Gyeonggi-do	63
13	Noruseom	Seocheon-gun Chungcheongnam-do,	105
14	Ilsan-do (Chilsan-do)	Yeonggwang-gun, Jeollanam-do	20
15	Yisan-do (Chilsan-do)	Yeonggwang-gun, Jeollanam-do	15
16	Samsan-do (Chilsan-do)	Yeonggwang-gun, Jeollanam-do	50
17	Sasan-do (Chilsan-do)	Yeonggwang-gun, Jeollanam-do	35
18	Yuksan-do (Chilsan-do)	Yeonggwang-gun, Jeollanam-do	42
Total			1,548

*The total breeding pairs suggested as the minimum estimated population. Because some of breeding sites have been estimated through 1-2 visits or observation from a distance.

III. National Monitoring of Black-faced Spoonbills

1. Method

A. Scope of Monitoring

| Scope of Time

- Conducted once a month in the middle of the month from August to October, 2020 (3 times in total)
- Selected the most appropriate time to investigate considering the tidal cycle

| Scope of Space

- Categorized into 20 regions nationwide, including major habitats of Black-faced Spoonbills in Incheon Metropolitan City (Table III-1, Figure III-1).
- Divided into 3 main regions (Northwestern, Midwestern, Southern)
- Other observation areas are included depending on the time of the year (Boryeong, Muan tidal flat, Jangheung, Yeoja Bay, Gwangyang Bay, etc.)

Table III-1. A list of survey sites of National Black-faced Spoonbill monitoring.

Region	Sites	Note
Northwestern	Backryeong-Yeonpyeong*, Onjin(Sin-do, Si-do, Jangbong-do)*, Ganghwa-gun*, Seo-gu*, Yeongjong-do*, Song-do*, Han river-Imjin river estuary, Ansan(Sihwa Lake, Daebu-do), Hwaseong wetland, Asan Bay	Incheon (bold) and Gyeonggi
Midwestern	Tae-an, Cheonsu Bay-Boryeong, Seocheon-Gunsan, Saemangeum, Gomso Bay, Yeonggwang tidal flat, Sinan-Muan tidal flat	Chungcheong and Jeolla
Southern	Suncheon-Yeoja-Gwangyang Bay, Nakdong-river estuary, Jeju island	

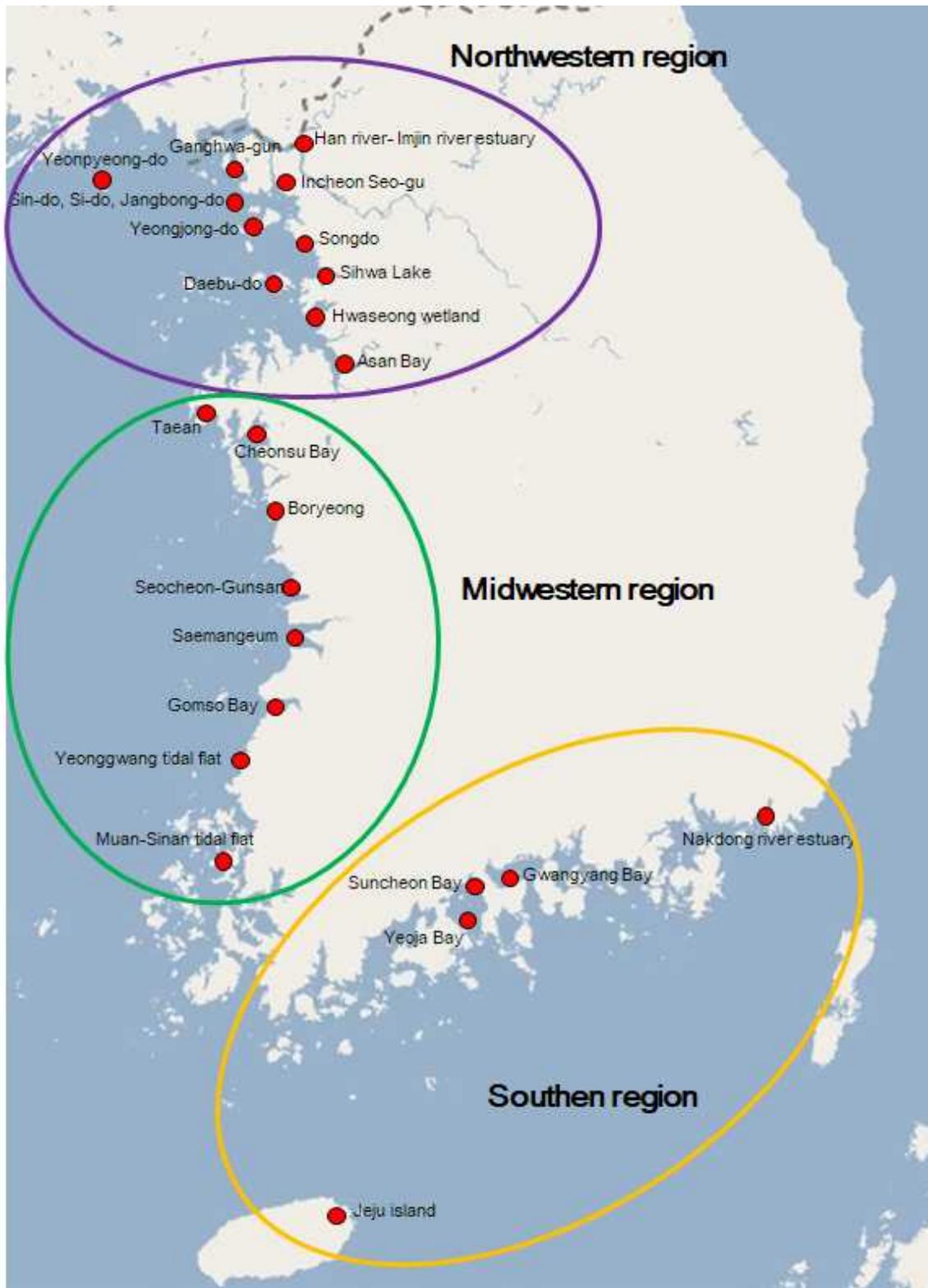


Figure III-1. Sites and regions of National Black-faced Spoonbill monitoring.

B. Investigation Method and Data Collection

| Investigation Method

- Monitoring was conducted nationwide simultaneously in the middle of every month.
- The investigation date was selected for a 3-day period centered on the weekend in August to mid-October, and a suitable date was selected according to the region.
- During high tide, the investigation was conducted focusing on resting grounds, and if there were many resting sites or the region was wide, the region was subdivided and investigated. Adjacent regions were investigated on the same date to prevent overlapping investigations.
- Vehicles were used (in some regions, ships were used) to approach the points where observation was easy. Binoculars and telescopes were used to observe and record the number of individuals and their colored bands.

| Data Collection and Analysis

- The “2020 Black-faced Spoonbills National Monitoring” mission was established in the civic participatory ecological monitoring platform, “Getbol Keepers”, and approved to upload data and related photos observed and recorded by the investigator. The uploaded data was then collected (Figure III-2) and compiled.
- GIS program was used to analyze distribution data by region and time.

The screenshot displays the 'Getbol Keepers' website interface. At the top, there is a navigation bar with icons for '조사기록' (Survey Record), '미션' (Mission), '자료실' (Resource Room), and '소개' (Introduction). The main content area is titled '2020년 저어새 전국모니터링' (2020 National Black-faced Spoonbill Monitoring Mission). It features a profile picture of a Black-faced Spoonbill, a search bar, and a map of South Korea with blue dots indicating monitoring locations. Below the map is a gallery of six photographs showing Black-faced Spoonbills in their natural habitat. The page also includes metadata such as the creator '한국물새네트워크', the start date '2020년 7월 28일', and the mission period '2020년 8월 1일 오전 1시부터'.

Figure III-2. National Black-faced Spoonbill monitoring mission on biodiversity observation platform ‘Getbol Keepers’.

3. Results

A. Monitoring Result

| Overall Result

- Monitoring conducted from August to October confirmed that 3,861 Black-faced Spoonbills inhabitation based on the maximum number of observed individuals in each region (Table III-2).
- In August, 3,239 individuals were observed in 17 regions. In September, 3,327 individuals in 18 regions, and in October, 2,203 individuals in 18 regions were observed. (Table III-2, Appendix 1, 2, 3).

Table III-2. Number of individuals from National Black-faced Spoonbill monitoring from August to October.

No.	Site	Number of individuals			
		August	September	October	Max. count
1	Baekryeong-do & Yeonpyeong-do	1	0	0	1
2	Sin-do, Si-do, Jangbong-do*	177	72	73	177
3	Ganghwa-gun	624	444	356	624
4	Han river-Imjin river estuary	1	5	30	30
5	Incheon Seo-gu	9	6	0	9
6	Yeongjong-do	499	671	405	671
7	Songdo(Namdong, Siheung)	341	247	72	341
8	Ansan(Sihwa Lake, Daebu-do)	194	211	152	211
9	Hwaseong wetland	221	277	214	277
10	Asan Bay	27	216	54	216
11	Tae-an**	0	12	1	12
12	Cheonsu Bay-Boryeong	0	8	3	8
13	Seocheon-Gunsan	249	190	140	249
14	Saemangeum	101	135	72	135
15	Gomso Bay	35	64	41	64
16	Yeonggwang tidal flat	736	688	545	736
17	Muan-Sinan tidal flat	2	7	9	9
18	Sunchen-Yeoja-Gwangyang Bay	16	73	15	73
19	Nakdong river estuary	6	1	5	6
20	Jeju island	0	0	12	12
Total		3,239	3,327	2,203	3,861

- Incheon-Ansan-Hwaseong regions, Seocheon-Saemangeum, and Yeonggwang were investigated as densely populated areas of Black-faced Spoonbills, and Incheon was confirmed to be the most important region.
- A large group of more than 300 individuals was observed in three areas of Northwestern region in Ganghwa-do, Yeongjong-do and Song-do, and one Yeonggwang tidal flat in the Midwestern region (Figure III-3).

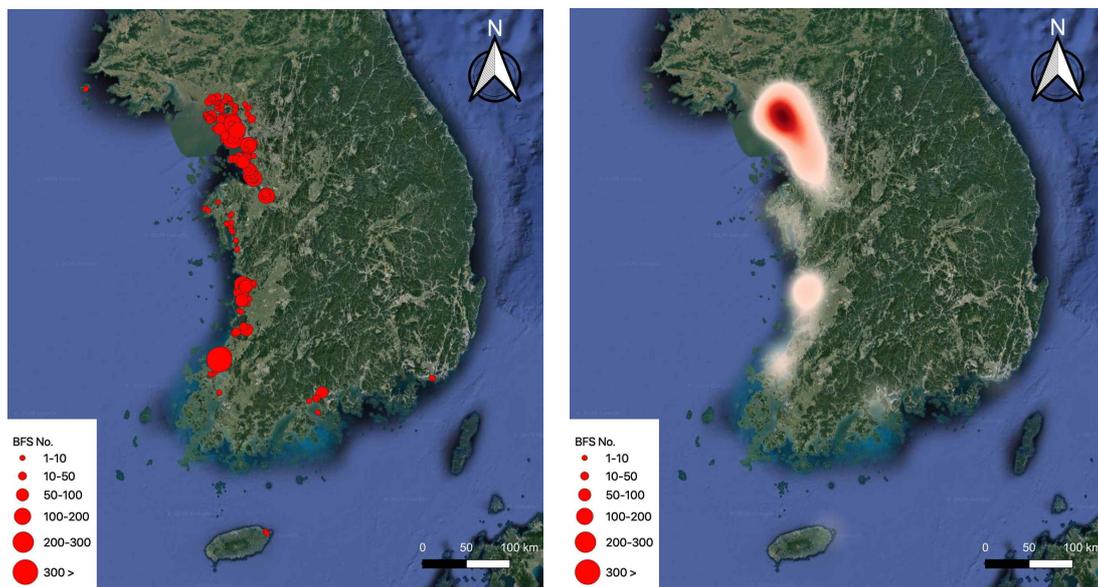


Figure III-3. Distribution and heatmap of Black-faced Spoonbills by national monitoring.

- The monthly distribution of Black-faced Spoonbills showed no large-scale migration or change.
- Incheon Yeongjong-do, Sihwa Lake and Daebu-do, Hwaseong wetland, Asan Bay, Saemangeum, and Suncheon Bay were identified with the largest number of Black-faced Spoonbills in September (Figure III-4).
- Among the investigated regions, Black-faced Spoonbills were observed only in August in Baekryeong-do and Yeonpyeong-do in the northernmost region and October in Jeju island in the southernmost region.
- Ganghwa-do, Song-do, Seocheon & Yubu-do, and Yeonggwang, where breeding sites are located, tended to decrease in population gradually from August to October.

- Bukdo-myeon (Ongjin), Ansan, Hwaseong wetland, Asan Bay, Saemangeum, Gomso Bay did not have breeding grounds in the investigated region, but they were the regions where many Black-faced Spoonbills inhabited.
- Further investigation in November, the number of Black-faced Spoonbills decreased significantly to less than 100 birds, but in December, 83 birds stayed in Korea, mainly in the southern part of the country (Appendix 4).

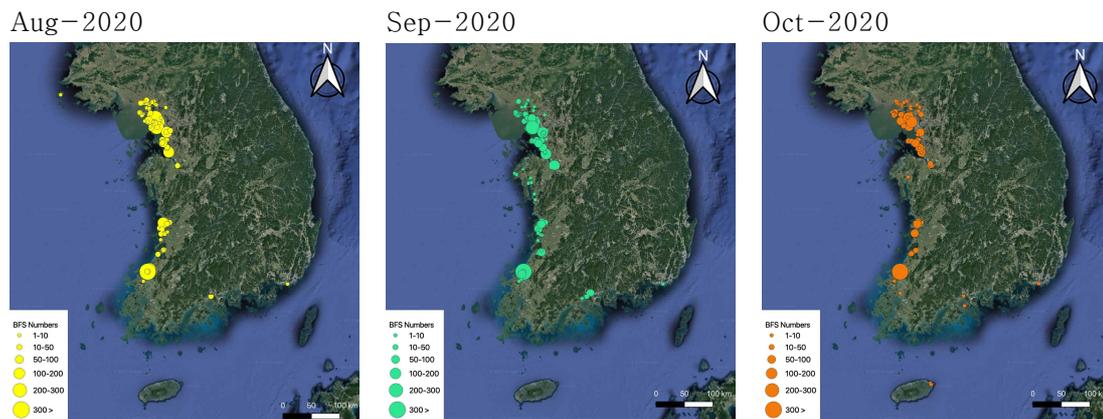


Figure III-4. Monthly distribution and number of Black-faced Spoonbills from August to October.

Regional Results

- In August, 2,094 birds (64.7%) were observed in the Northwestern region, 1,123 birds (34.7%) in the Midwestern, and 22 birds (0.7%) in the Southern region.
- In September, 2,149 birds (64.6%) were observed in the Northwestern region, 1,104 birds (33.2%) in the Midwestern, and 74 birds (2.2%) in the Southern region.
- In October, 1,356 birds (61.7%) were observed in the Northwestern region, 811 birds (36.9%) in the Midwestern, and 32 birds (1.5%) in the Southern region.
- The number of Black-faced Spoonbills observed in each region showed a decreasing trend over time, but the percentage change did not show any difference (The Northwestern and Midwestern regions account for about 98% of the total, Figure III-5).
- In Incheon Metropolitan City, where most breeding grounds are distributed, the gradual decline from 1,651 birds (51.0%) in August to 1,440 birds (43.3%) in

September and 906 birds (41.2%) in October is believed to be attributed to the fact that the Black-faced Spoonbills gathered in reclaimed lakes located in the southern part of Incheon, such as Sihwa Lake, Hwaong Lake, Pyeongtaek Port, and Saemangeum, before they migrate to wintering sites.

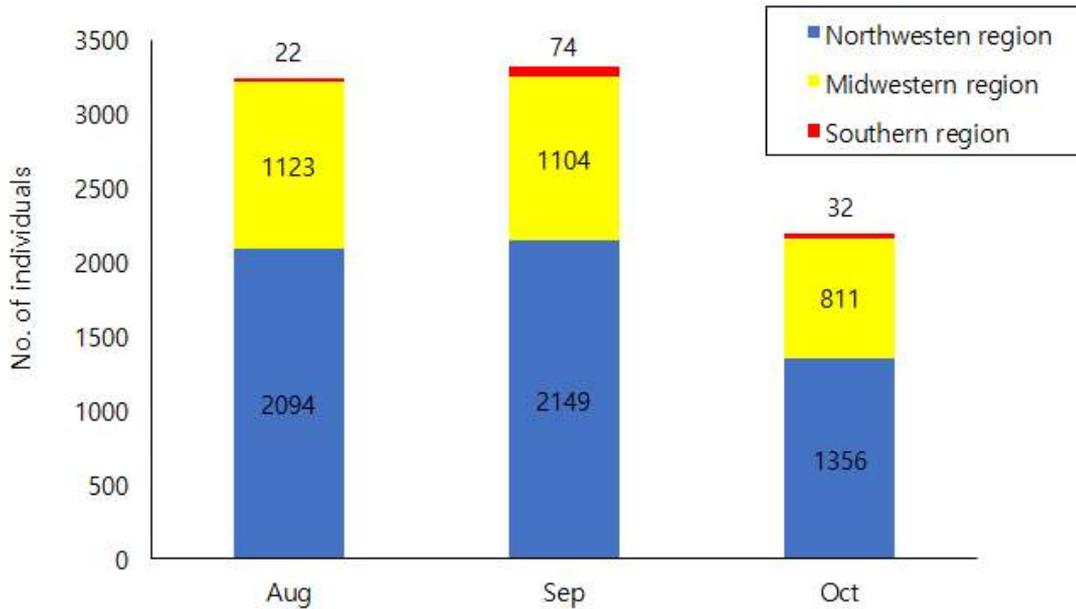


Figure III-5. Changes of number of Black-faced Spoonbills in three regions from August to October.

I Major Habitat Regions

- In August, the region where the most number of Black-faced Spoonbills were observed was Yeonggwang (736 birds), followed by Ganghwa-do (624 birds), Yeongjong-do (499 birds), Song-do (341 birds), and Yubu-do (249 birds) in Seocheon.
- In September, the region where the most number of Black-faced Spoonbills were observed was Yeonggwang (688 birds), followed by Yeongjong-do (671 birds), Ganghwa-do (444 birds), Hwaseong wetland (277 birds), and Song-do (247 birds).
- In October, the region where the most number of Black-faced Spoonbills were observed was Yeonggwang (545 birds), followed by Yeongjong-do (405 birds), Ganghwa-do (356 birds), Hwaseong wetland (214 birds), and Ansan with 152 birds (Sihwa Lake, Dae-bu).

- The number of Black-faced Spoonbills observed in the top five regions of the monthly population was 2,449 birds (75.6%) in August, 2,327 birds (69.9%) in September, and 1,672 birds (76.0%) in October, The number of individuals decreased significantly in October when the full-scale migration to wintering sites began (Table III-3).
- Ganghwa-do, Yeongjong-do, and Song-do in Incheon, which are concentrated in breeding grounds such as Gaksiam, Sangyeobawi Rock, Yo-do, Mae-do, Suhaam, Namdong Reservoir, and Okgwi-do, were all included in the top population observation regions in August and September.

Table III-3. Five most observed sites from National Black-faced Spoonbill monitoring from August to October.

Rank	August		September		October	
	Site	Nb of individuals(%)	Site	Nb of individuals(%)	Site	Nb of individuals(%)
1	Yeonggwang	736(22.7)	Yeonggwang	688(20.7)	Yeonggwang	545(24.8)
2	Ganghwa*	624(19.3)	Yeongjong-dob*	671(20.2)	Yeongjong-dob*	405(18.4)
3	Yeongjong-dob*	499(15.4)	Ganghwa*	444(13.4)	Ganghwa*	356(16.2)
4	Songdo*	341(10.5)	Hwaseong wetland	277(8.3)	Hwaseong wetland	214(9.7)
5	Seocheon & Gunsan	249(7.7)	Songdo*	247(7.4)	Ansan	152(6.9)
	Total	2,449(75.6)	Total	2,327(69.9)	Total	1,672(76.0)

B. Detailed Results by Region and Period

| Baeknyeong-do and Yeonpyeong-do in Ongjin-gun

- In August, one Black-faced Spoonbill was observed in a wetland inside Baengnyeong-do in Ongjin-gun in the northernmost region of the investigation, but it was not observed on Yeonpyeong-do (Figure III-6, investigation not conducted after September).

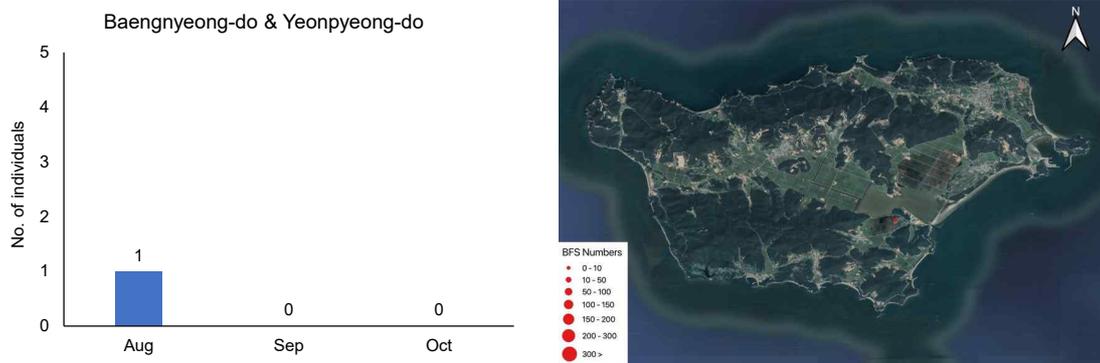


Figure III-6. Monthly distribution and numbers of Black-faced Spoonbills on Onjin-gun(Baekryeong-do and Yeonpyeong-do) from August to October.

■ Ganghwa-gun, Incheon Seo-gu, Han river-Imjin river Estuary

- In Ganghwa-gun, Black-faced Spoonbills were widely distributed in the southernmost region of Ganghwa, the northernmost region of Gyodong-do, Seokmo-do and the whole region of Bolum and Jumun-do in Bukdo-myeon (Figure III-7).
- Except for the southernmost region of Ganghwa, a single or small groups of 10 or less were mostly observed.
- Dongju Farm in the southernmost region of Ganghwa, Seonjeong-ri stonework, and Gaksiam were observed to be used by a group of over 200 birds during high tide, confirming that they are important habitats.
- There were only a few Black-faced Spoonbills using An-am Lake in Incheon Seo-gu, and environmental changes caused by rising water levels in the lake are considered to be a major factor.
- In the Han river estuary, it was confirmed that Hynge island near Ilsan Bridge was used as a resting area for Black-faced Spoonbills.

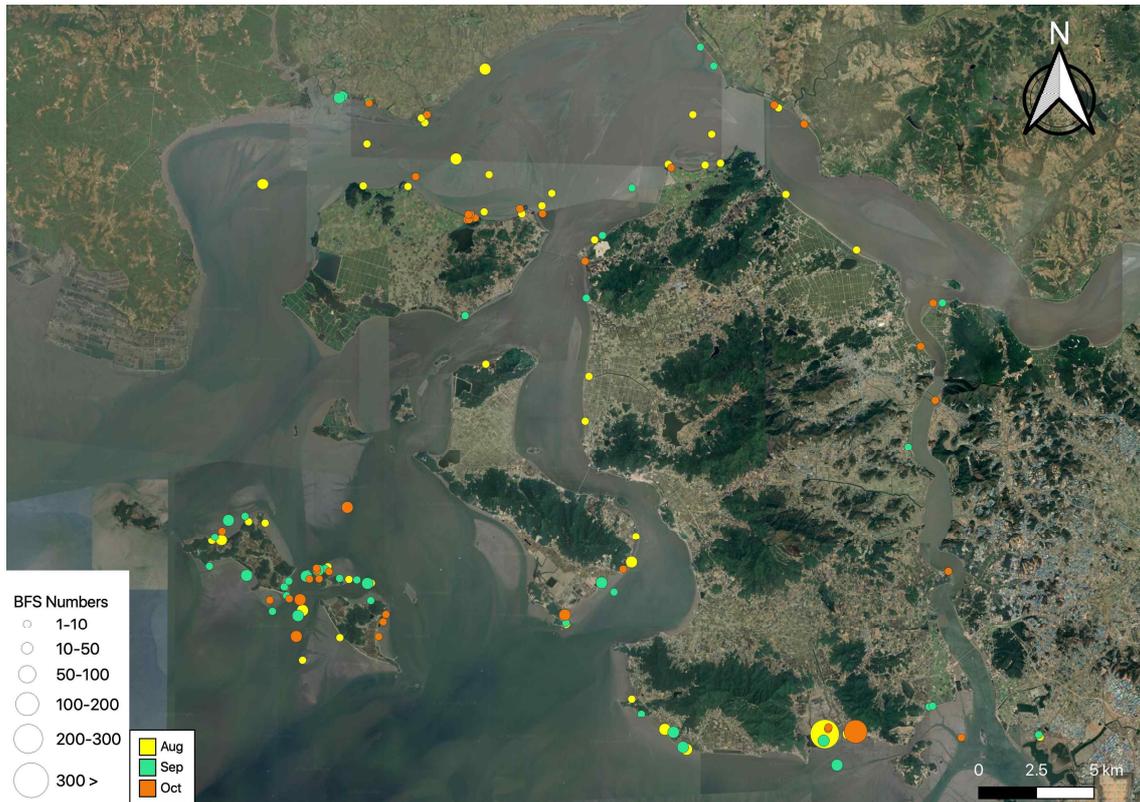


Figure III-7. Monthly distribution of Black-faced Spoonbills on Ganghwa-gun, Incheon Seo-gu, from August to October.

- In Ganghwa-gun, the population gradually decreased to 624 in August, 444 in September, and 356 in October. Incheon Seo-gu also decreased in number to 9 in August, 6 in September, and 0 in October. But the Han river-Imjin river estuary increased to 1 in August, 5 in September, and 30 in October (Figure III-8).

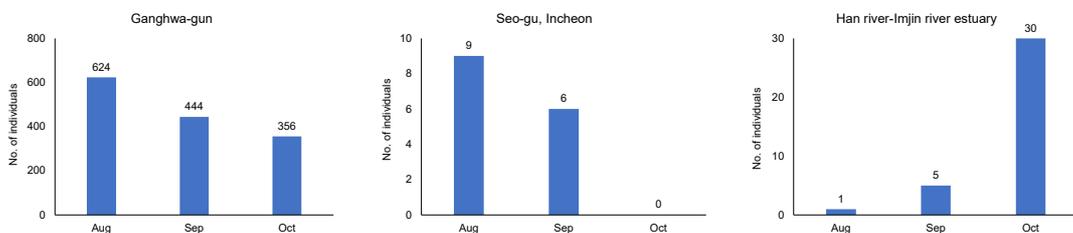


Figure III-8. Monthly number of Black-faced Spoonbills on Ganghwa-gun, Incheon Seo-gu, Han-river, and Imjin-river estuary from August to October.



Resting spoonbills on a dike in Seondu-ri



Dongju farm in southern part of Ganghwa-do



Resting spoonbills in Suribong



Resting spoonbills in Anam Lake, Seo-gu, Incheon

Yeongjong-do, Bukdo-myeon Sin-do and Jangbong-do

- The 2nd dredging site in Yeongjong-do, Hongdae salt pond, Sin-do and Si-do tidal flats, and Jangbong-do Gamtu island were identified as major habitats.
- The 2nd dredging site in Yeongjong-do and the Hongdae waste salt pond were confirmed to be key habitats used by large groups of more than 200 birds as resting and feeding grounds.
- In Sin-do and Jangbong-do, a small group of around 10 birds sought food from the tidal channel. Gamtu island in the northwest of Jangbong-do was used as a resting area during high tide (Figure III-9).
- The number in Yeongjong-do increased significantly in September from 499 birds in August to 671 birds in September, which is estimated to have flowed in from inhabiting in the southernmost region of Ganghwa-do, and the number decreased to 405 in October.
- In Bukdo-myeon (Sin-do, Si-do, and Jangbong-do) in Ongjin-gun, 177 individuals were observed in August, 72 in September, and 73 in October (Figure III-10). However, due to the failure to observe in the high tide period in September and

October, the number of observations could be low.

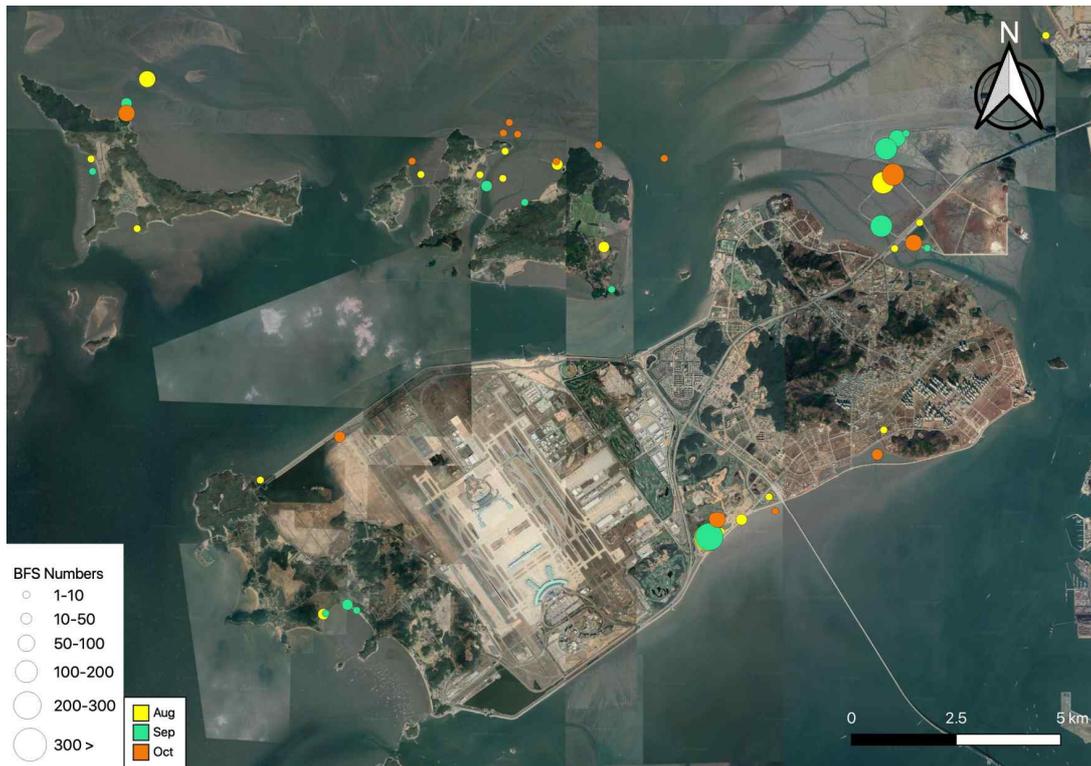


Figure III-9. Monthly distribution of Black-faced Spoonbills on Yeongjong-do, Sin-do, Si-do, and Jangbong-do (Bukdo-myeon) from August to October.

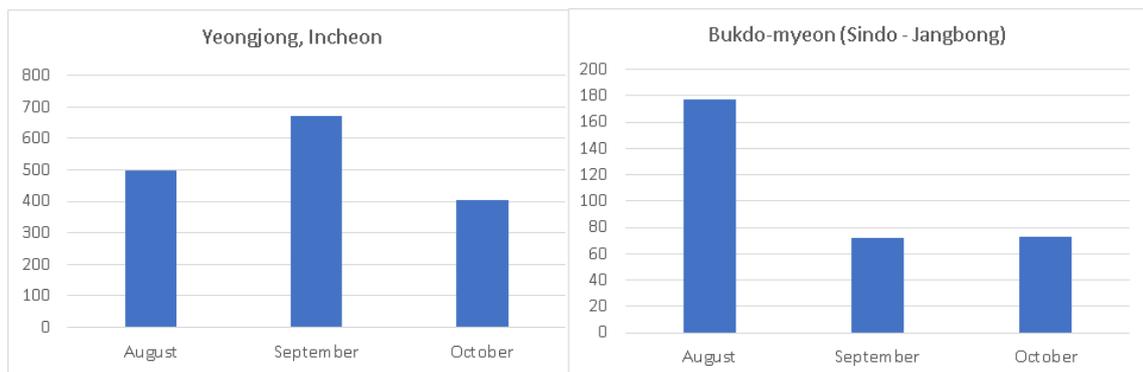


Figure III-10. Monthly number of Black-faced Spoonbills on Yeongjong-do, Sin-do, Si-do, and Jangbong-do (Bukdo-myeon) from August to October.

I Incheon Song-do (Namdong Reservoir, Song-do tidal flat, Siheung tidal channel)

- Black-faced Spoonbills were mainly distributed in Namdong Reservoir, Aam-do, Song-do Zone 10 and Zone 11 tidal flats, Gojan tidal flat, Sorae Wetland Ecological Park, and Siheung tidal channel. Some birds used Okgwi-do (Hwangsaeabawi Rock) as a resting ground during high tide (Figure III-11).



Figure III-11. Monthly distribution of Black-faced Spoonbills on Songdo area (Namdong reservoir, Gojan tidal flat, and Sorae tidal channel) from August to October.

- The population decreased significantly to 341 in August, 247 in September, and 72 in October. It is estimated that most of the populations moved to Sihwa Lake and Hwaong Lake after breeding (Figure III-12).
- Due to the high frequency of leisure activities (fishing) in most areas, including Sorae Wetland Ecological Park, Siheung tidal channel, Zone 10 and Zone 11 tidal flats, there are concerns about damage caused by fishing waste.

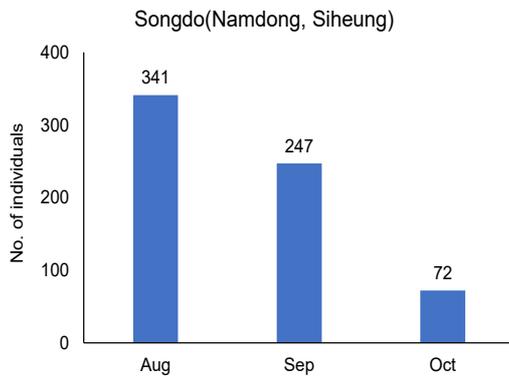


Figure III-12. Monthly number of Black-faced Spoonbills on Songdo area from August to October and a threat(fishing).

| Ansan (Sihwa Lake, Daebu-do)

- In Sihwa Lake, which is included in Ansan City, mainly single or small group of less than 10 were widely distributed in Daesong wetland, Hyeong-do wetland, and Tando waterways.
- It has been investigated that populations about 20 to 70 use Keunhaem island in the southernmost region of Daebu-do and Kkaejin island in the west of Seonjae-do in Ansan City as a resting area during high tide (Figure III-13).
- The population was 194 individuals in August and 211 in September. It is estimated to have increased slightly gathered from nearby breeding sites after breeding is done. In October, when the migration to the wintering sites began, it decreased to 152 individuals.

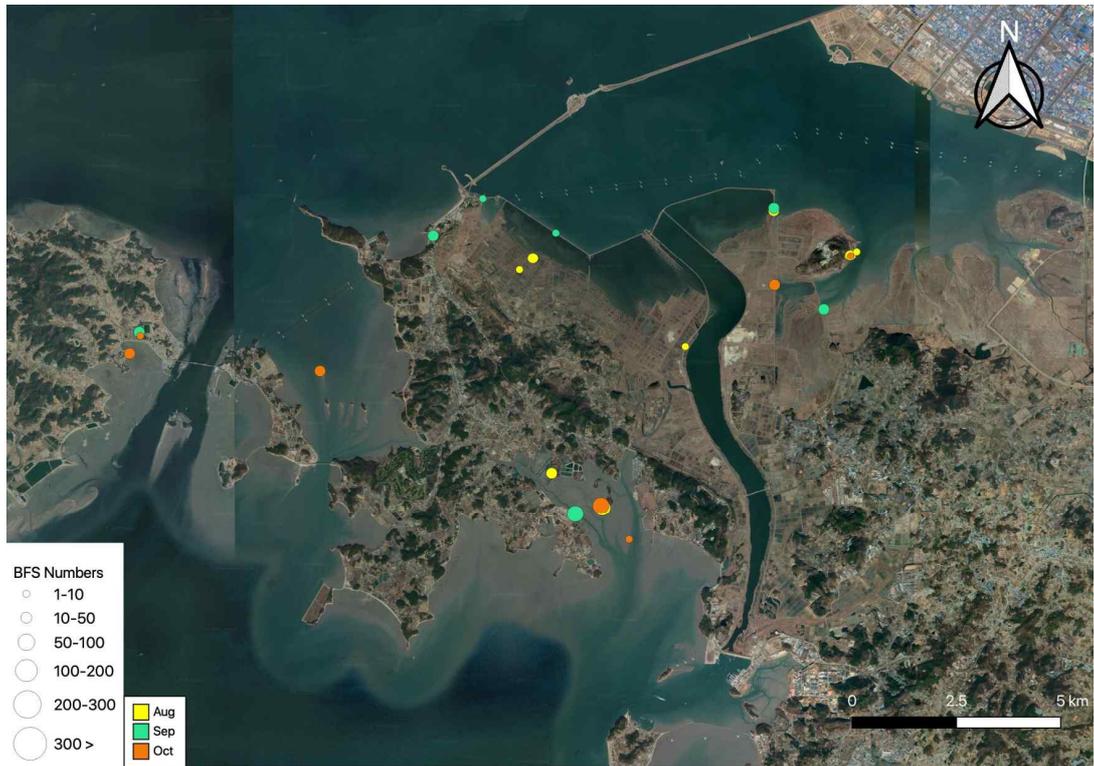


Figure III-13. Monthly distribution of Black-faced Spoonbills on Ansan (Sihwa lake and Daebu-do) from August to October.



Figure III-14. Monthly number of Black-faced Spoonbills on Ansan from August to October and roosting flock on Keunhaemseom islet.

I Hwaseong Tidal Flat (Wetland)

- Black-faced Spoonbills were mainly distributed in Maehyang-ri tidal flat, Hwaong Lake and inner wetland, Seosin tidal flat and waste salt pond.
- It was investigated that Hwaong Lake is an important habitat for more than 100 individuals to feed and rest.

- It has been observed that the waste salt pond located in Seosin-myeon Maehwa-ri, is used as a resting area for Black-faced Spoonbills during high tide (Figure III-15).
- Population increased from 221 in August to 277 in September, and decreased again to 214 in October, but the decline was not significant compared to other regions (Figure III-16).



Figure III-15. Monthly distribution of Black-faced Spoonbills on Hwaseong wetland from August to October.

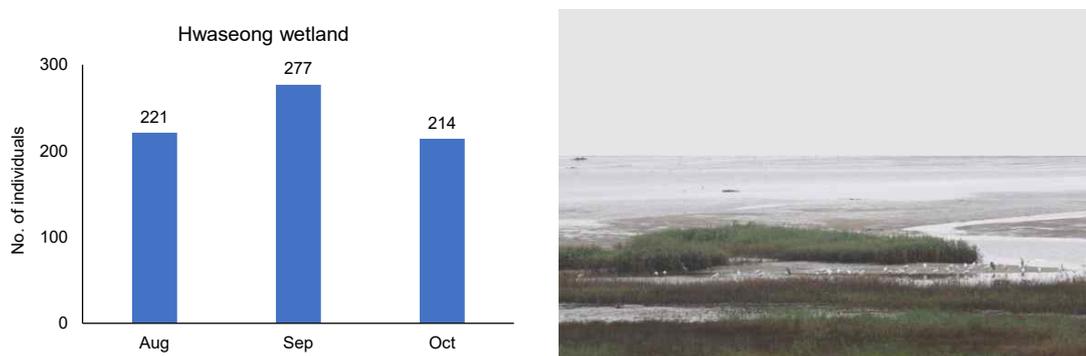


Figure III-16. Monthly number of Black-faced Spoonbills on Hwaseong wetland from August to October and a view of Hwaseong Lake.

| Asan Bay

- Geolmae-ri tidal flat and the Pyeongtaek Port wetland are the main habitats that serve as both feeding and resting sites, and it has been identified that the two sites are used interchangeably according to the tidal cycle (Figure III-17).
- The population increased from 27 in August to 216 in September, and decreased again to 54 in October when the migration to wintering site began (Figure III-18).



Figure III-17. Monthly distribution of Black-faced Spoonbills on Asan Bay from August to October.

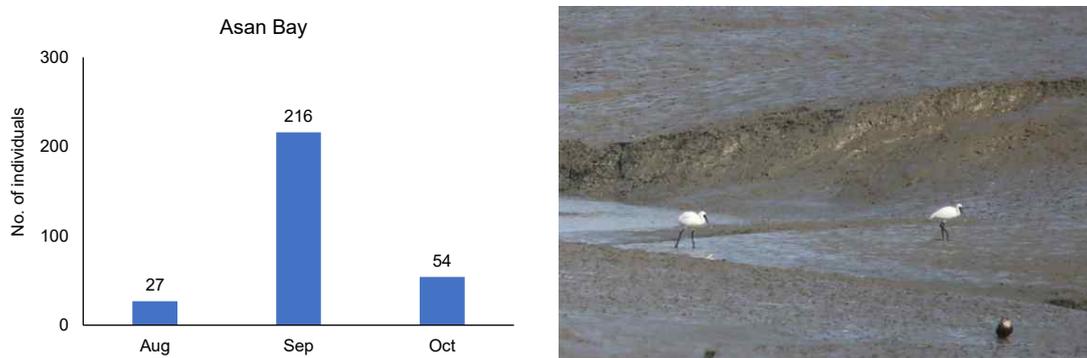


Figure III-18. Monthly number of Black-faced Spoonbills on Asan Bay from August to October and foraging spoonbills on tidal flat.

| Taeon, Cheonsu Bay-Boryeong

- It has been identified that a small population were distributed in Garorim Bay, Cheonsu Bay, and the coast of Geunheung-myeon in Taeon, and Daecheon Embankment in Boryeong (Figure III-19).
- Black-faced Spoonbills were not observed in August in both regions, and in September, when migrating population after breeding increased, it increased to 12 in Taeon, 8 in Cheonsu Bay-Boryeong. The population decreased again to 1 in Taeon and 3 in Cheonsu Bay-Boryeong in October (Figure III-20).
- This region is located between Asan Bay and Seocheon, and it is considered to be used as a stopover for a short stay as a small population is observed compared to its area.

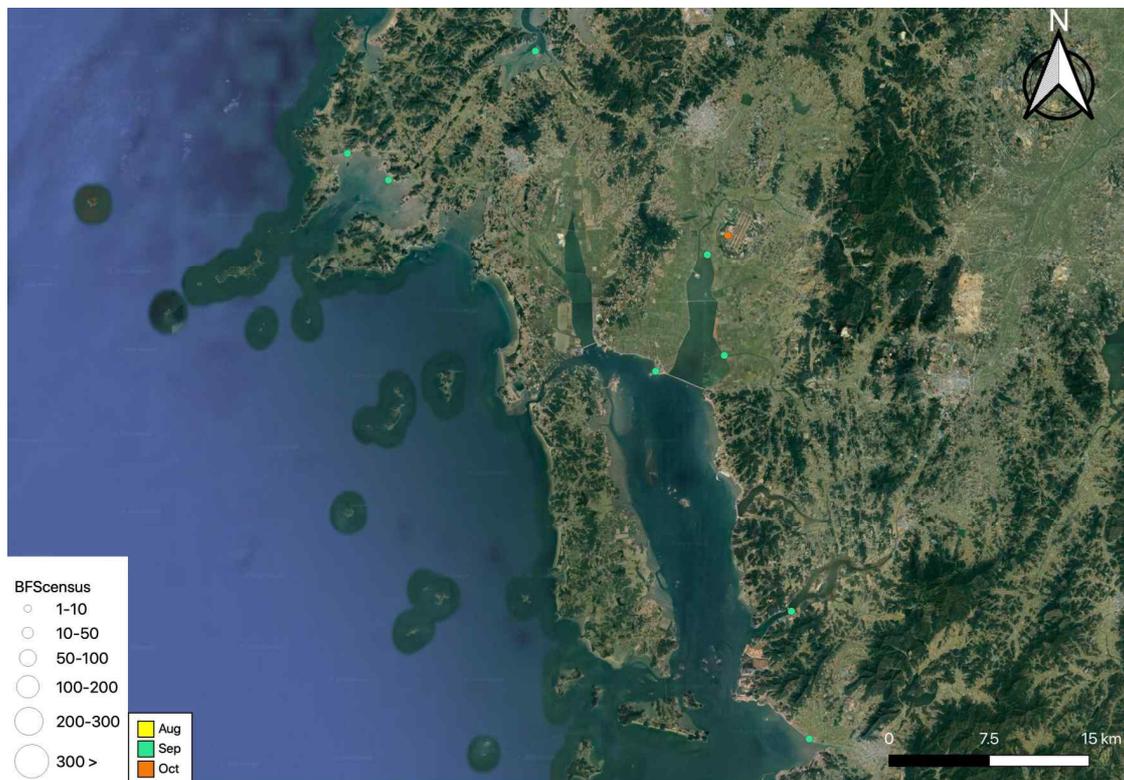


Figure III-19. Monthly distribution of Black-faced Spoonbills on Taeon and Cheonsu Bay-Boryeong from August to October.

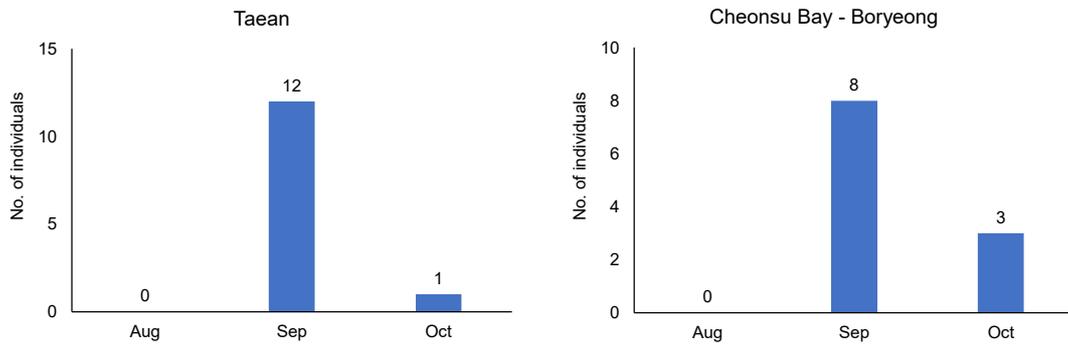


Figure III-20. Monthly number of Black-faced Spoonbills on Taeon and Cheonsu Bay-Boryeong from August to October.

Seocheon Yubu-do

- Black-faced Spoonbills were mainly distributed in the tidal flat of Yubu-do in Seocheon, the coast of Seocheon, the tidal flat of Geumgang estuary bank, and Geumran-do in Gunsan.
- Large tidal flats of Yubu-do and Geum river estuary were used as a feeding site, and small rocky islands scattered throughout the region, and the old salt pond banks were used as a resting site during high tide (Figure III-21).
- The population showed a tendency to decrease to 249 in August, 190 in September, and 140 in October (Figure III-22).



Figure III-21. Monthly distribution of Black-faced Spoonbills on Seocheon and Gunsan from August to October.

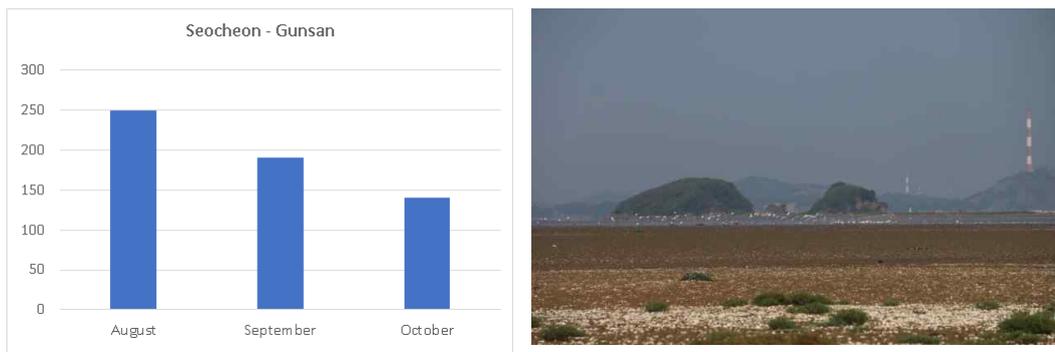


Figure III-22. Monthly number of Black-faced Spoonbills on Seocheon and Gunsan from August to October and a view of Yubu-do tidal flat.

| Saemangeum

- Black-faced Spoonbills were mainly distributed at the confluence of the Sura tidal flat in the north of the embankment, Dongjin river, and Mangyeong river.
- A small group of less than 10 individuals were observed at the estuary of the Dongjin and Mangyeong rivers, and large group of more than 50 were observed in

the Sura tidal flat, confirming that these areas are important habitats in the Saemangeum region (Figure III-23).

- Population increased from 101 in August to 135 in September and decreased to 72 in October (Figure III-24).



Figure III-23. Monthly distribution of Black-faced Spoonbills on Saemangeum from August to October.

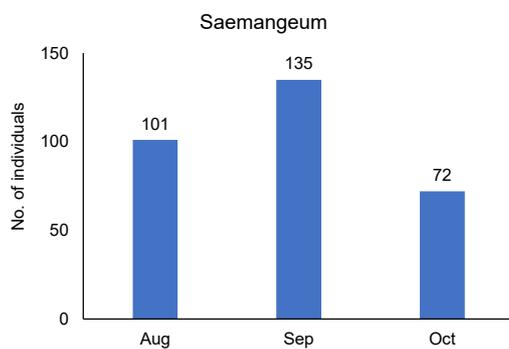


Figure III-24. Monthly number of Black-faced Spoonbills on Saemangeum from August to October and spoonbills on Sura tidal flat.

| Gomso Bay

- Black-faced Spoonbills were distributed in the tidal flats and fish farms in Boan-myeon in Buan-gun and Simwon-myeon and Buan-myeon in Gochang-gun, and small group of less than 10 were mainly observed.
- Y80 (individual born in Samsan-do in 2020) was observed in Shimwon-myeon in Gochang, confirming that it is a habitat used by spoonbills of Chilsan-do in Yeonggwang after breeding (Figure III-25).
- Population increased from 35 in August to 64 in September and decreased to 41 in October (Figure III-26).

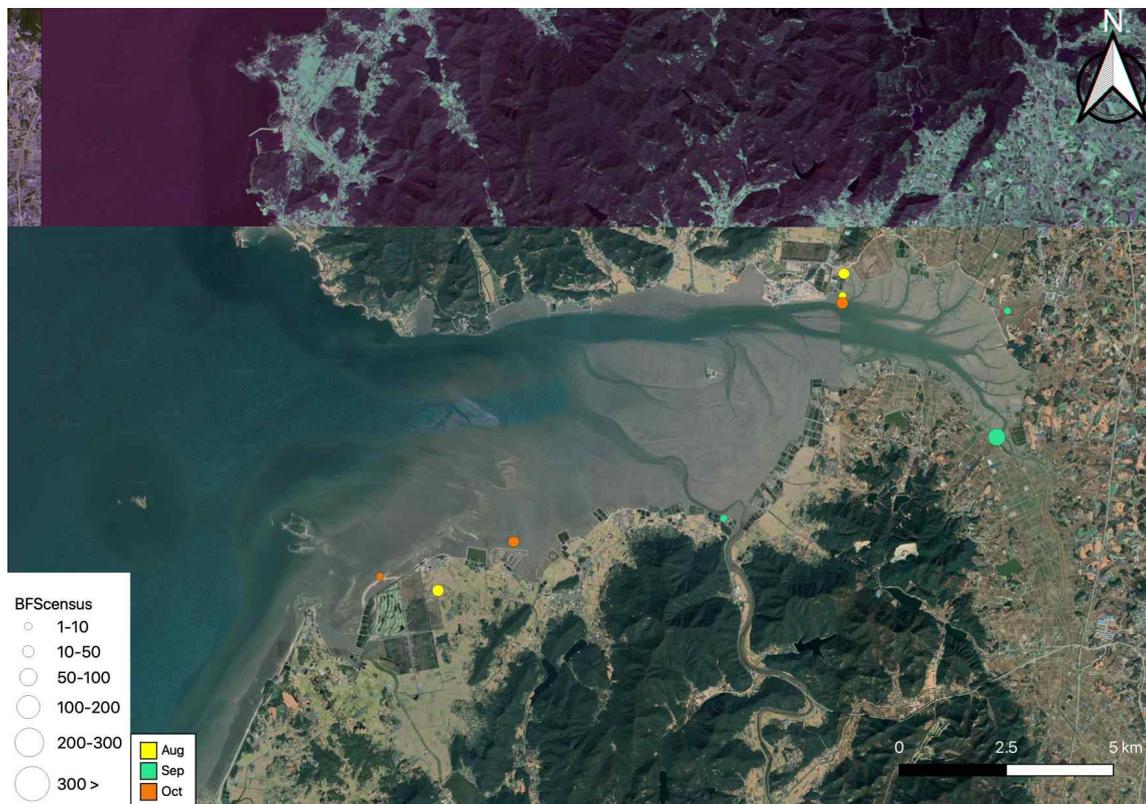


Figure III-25. Monthly distribution of Black-faced Spoonbills on Gomso Bay from August to October.

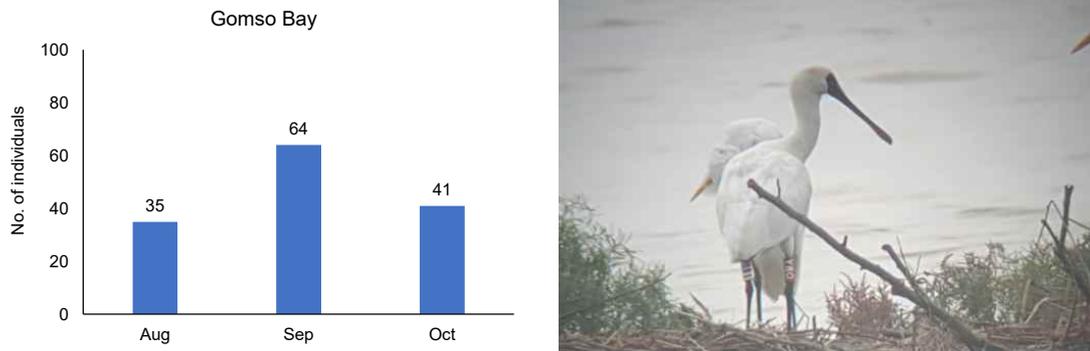


Figure III-26. Monthly number of Black-faced Spoonbills on Gomso Bay from August to October and a marked spoonbill Y80(born in Chilsan-do).

Yeonggwang tidal flat

- Spoonbills were mainly distributed in Baeksu-ri and Hasa-ri tidal flats, Hasa-ri salt pond, and Yeomsan-myeon salt pond.
- Hasa-ri salt pond is a resting site where more than 400 populations gather during high tide and has been identified as a key habitat where the largest number of spoonbills are observed in a single habitat (Figure III-27).
- It showed a steady decline from 736 in August, 688 in September, and 545 in October (Figure III-28).

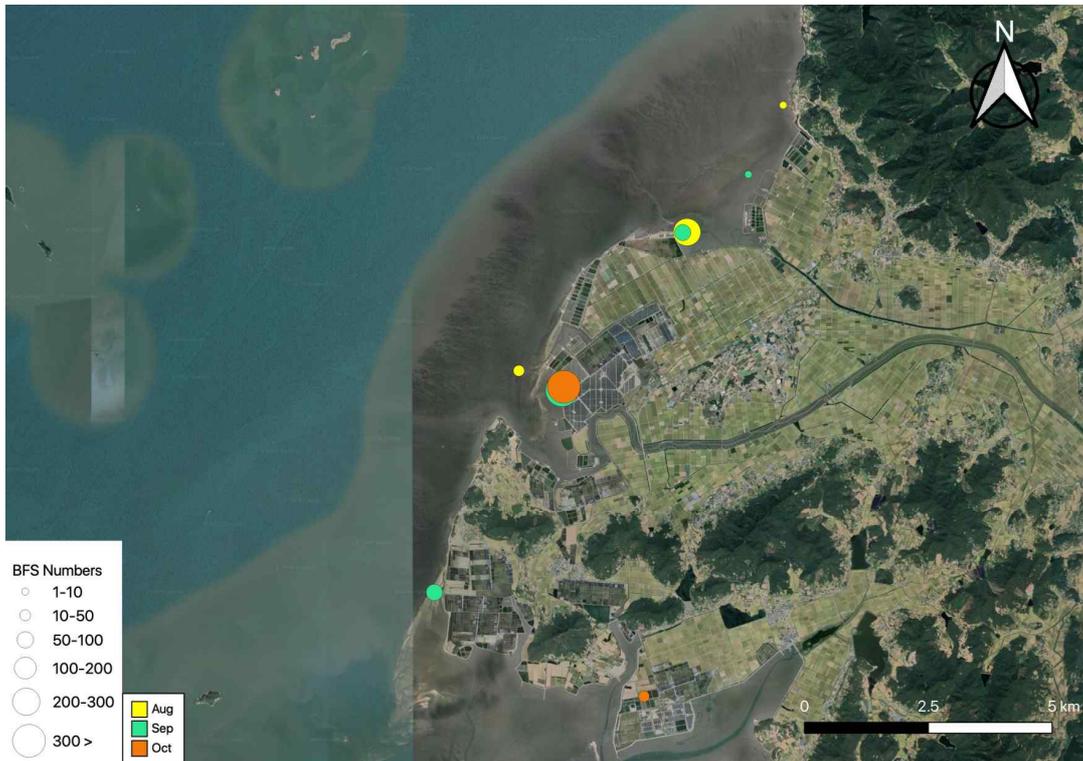


Figure III-27. Monthly distribution of Black-faced Spoonbills on Yeonggwang tidal flat from August to October.

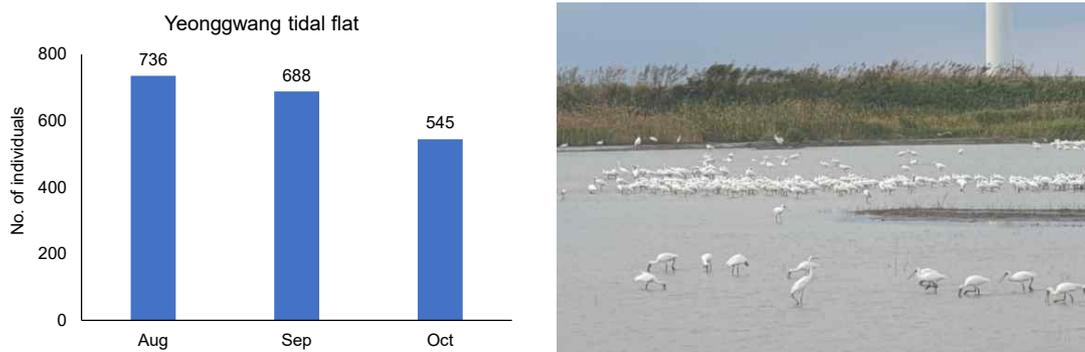


Figure III-28. Monthly number of Black-faced Spoonbills on Yeonggwang tidal flat from August to October and spoonbills on a salt pan in Hasa-ri.

■ Muan-Sinan tidal flat

- A small group of less than 10 individuals was observed in the Muan tidal flat (Figure III-29). It was not observed on the Sinan tidal flat, but 31 were confirmed in December, including 22 populations in Sinan (Appendix 4).
- In Muan, there was a tendency to gradually increase from 2 in August, 7 in September, and 9 in October (Figure III-30).



Figure III-29. Observed points of Black-faced Spoonbills on Muan-Sinan tidal flat.

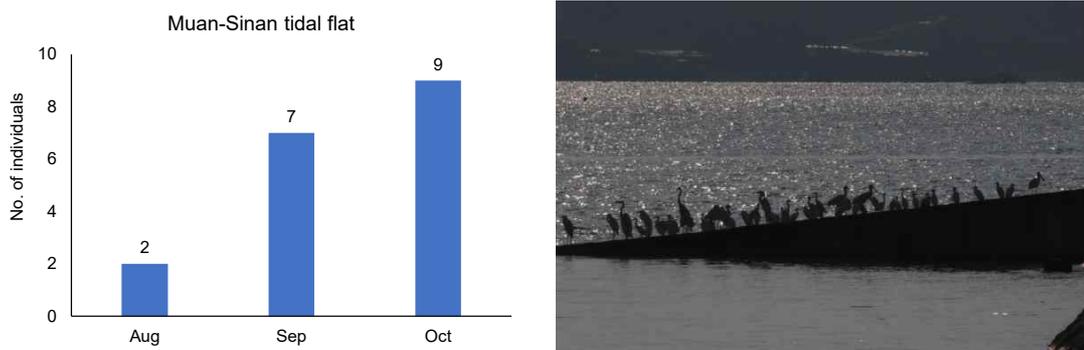


Figure III-30. Monthly number of Black-faced Spoonbills on Muan-Sinan tidal flat from August to October and spoonbills on a dike in Seokryong-ri.

■ Suncheon Bay region / Nakdong river estuary / Jeju island

- Black-faced Spoonbills were distributed in the tidal flat of Suncheon Bay, Sepung-ri Reservoir in Gwangyang Bay, Maenggeummeori at the Nakdong river estuary, and Hado-ri in Jeju island.
- In Suncheon Bay-Yeolja Bay-Gwangyang Bay, 16 populations were observed in

August, 73 in September, 15 in October. In Nakdong river estuary, there were 6 in August, 1 in September, 5 in October, and in Jeju island, 12 were observed in October alone.

- Gwangyang Bay Sepung-ri Reservoir, where 54 individuals were observed in September, is used as a resting and feeding grounds, and the largest number of populations was observed among a single habitat in the Southern region (Figure III -31).
- Although a small number was observed in the Southern region, it is estimated that Black-faced spoonbills are distributed in small groups in many other areas that have not yet been investigated in the southern region from October to December.
- Jeju island has seen an increase in the number of Black-faced Spoonbills since October, and Hado-ri and Seongsanpo are important wintering sites identified in Korea (Appendix 4).

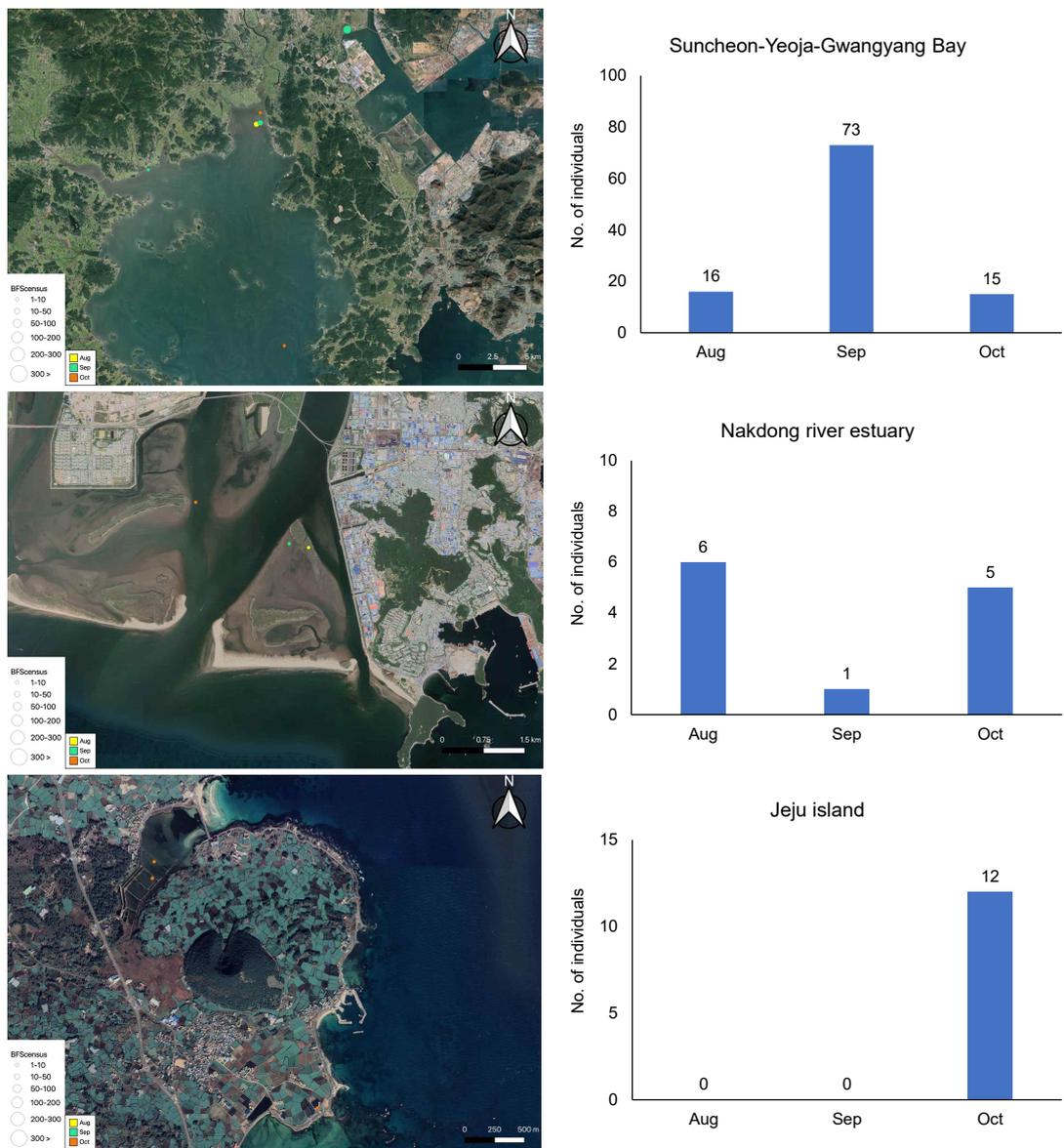


Figure III-31. Monthly distribution and numbers of Black-faced Spoonbills on southern region of South Korea from August to October.

4. Considerations

A. Current Status of Black-faced Spoonbill Population in Korea after Breeding

- The Black-faced Spoonbills monitoring identified 3,239 populations in August, 3,327 in September, and 2,203 in October. Although the population observed in August and September did not show much difference, it is believed that the population inhabiting in Incheon decreased and the population increased in other regions (Ansan, Hwaseong, Asan Bay, Saemangeum, Gomso Bay, Gwangyang Bay), gradually migrating south to the southwest coast and spreading their habitats.
- In October, the population decreased by two-thirds compared to September, which is believed to be due to the early wintering of experienced Black-faced Spoonbills, and observations that hundreds of Black-faced Spoonbills arrived in Taiwan's main wintering site in Tainan during October 11 to 15 indirectly support this.
- At least 1,548 pairs of Black-faced Spoonbill breeding have been identified in the 2020 breeding population, assuming that they have successfully raised an average of one offspring, the population is estimated to be at least 4,600. Considering non-breeding individuals, it is estimated to be about 5,000 populations.
- Among the domestic breeding grounds, breeding populations such as in Baengnyeong-do, Guji-do, and Bi-do, located in the far sea of Incheon, are known to migrate to Hwanghaenam Province in North Korea after breeding, and the size of these populations is estimated to be more than 1,500.
- Excluding the populations that uses North Korea as their habitat, the number is estimated to be around 3,500, which was close to 3,327 in September. However, considering the population that has not yet been observed or the population that has come back without breeding, it is estimated to be similar to the maximum number of 3,800 populations.

B. The Significance of Incheon as a Habitat for Black-faced Spoonbills

- In 2020, of the 3,096 breeding populations in Korea, 2,436 breeding populations in Incheon region accounted for 78.7% of the total. In the case of breeding sites, 11 out of 18 (61.1%) belong to Incheon in terms of administrative districts, making

them a key habitat for the international endangered Black-faced Spoonbills.

- According to national monitoring, the number of Black-faced Spoonbills identified in Incheon was 1,651 (51.0%) in August, 1,440 (43.3%) in September, and 906 (41.2%) in October, which were less than the breeding season, and decreased over time.
- This is believed to be the result of the migration of the breeding population and young spoonbills leaving the nest in search of habitats which are easier to find food and stable as a resting ground.
- For example, in the case of Black-faced Spoonbills that feed on the tidal flats of Song-do and Siheung, they tend to migrate to Sihwa Lake or Namyang Bay, which provides both feeding and resting grounds at the end of the breeding season, rather than using Namdong Reservoir as a resting site for high tide. In the case of habitats that include both eating and resting functions, such as tidal flat in the southernmost region of Ganghwa-do and dredging site in Yeongjong-do, it seems that there is a tendency to stay there until migrating to the wintering sites.
- As the number of breeding populations in Song-do and Siheung region has been increasing recently in the large Black-faced Spoonbill island in Namdong Reservoir and Okgwi-do, it is believed that more populations can be maintained in the long term if a resting site for high tide is established for Black-faced Spoonbills to live stably after the breeding season.
- The tidal flats and wetlands of Ganghwa-do and Yeongjong-do are ranked top second or third regions (accounting for about 33% of the total) of the monthly number of Black-faced Spoonbills, and 5 breeding sites are located nearby, which is very valuable region for the conservation of Black-faced Spoonbills not only during the breeding season but also in the late breeding period.
- Although Incheon maintains a very high value for Black-faced Spoonbill conservation and some of its habitats are designated as Natural Monument area (No. 419), Wetland Protection Area, Ramsar Wetland, and EAAFP Network Site, the development projects that threaten the habitat of spoonbills is expected to continue extensively. The intensity of leisure activities (fishing) on this region is

also very high.

- There is an urgent need to establish measures to control the threat factors and reduce impact, such as creating alternative habitats, public relations and campaigns to increase public awareness.

C. Other regions

- Yeonggwang tidal flat is located in Chilsan-do, where it was confirmed to have Black-faced Spoonbill breeding for the first time in Korea in 1991. Baeksu tidal flat and Hasa-ri salt pond are an important habitat where the largest number of Black-faced Spoonbills was observed in a single habitat, but threatening factors remain in these regions because wind power generators are very densely distributed nearby.
- Reclamation lakes such as Sihwa Lake, Hwaseong wetland, Pyeongtaek Port wetland, and Saemangeum are where Black-faced Spoonbills gather after the breeding season, and are known as important habitats for migratory waterbirds such as snipes, plovers, ducks, and geese. Thus, appropriate protection measures and wetland management measures should be established for each period on these regions.
- Saemangeum region is an area where the populations that have finished breeding in Yeonggwang and Seocheon are migrated and inhabited, and the Sura tidal flat in the northernmost region is a major habitat. However, it is a region where there is concern about a decline in habitat quality due to development projects.
- Suncheon-Yeoja-Gwangyang Bay is a region where the number of Black-faced Spoonbills has been increasing recently. In particular, Suncheon Bay is considered to have a high potential to provide a stable habitat environment for Black-faced Spoonbills because it has a lot of local interest in maintaining biodiversity and protecting the natural environment.

5. Recommendations

A. Regular Implementation of National Monitoring

| Expanding Citizen Participation in Projects to Protect Migratory Endangered Birds

- As the first national monitoring of Black-faced Spoonbills to identify the distribution and major habitats of spoonbills after the breeding season, citizens who were engaged in conservation activities based on each region participated.
- In response to the changing environments, it is essential to establish appropriate conservation goals and conduct regular monitoring projects to carry out conservation activities.
- There is a need for a plan to secure financial resources such as from local governments, government funds, and corporate sponsorships.
- It is believed that if the monitoring of migratory endangered birds, which are of high value for conservation, are conducted along with the monitoring of Black-faced Spoonbills, it can accumulate basic data for establishing conservation policies for a larger amount of migratory birds.
- By encouraging the participation of ordinary citizens through active promotion, the public awareness of protecting Black-faced Spoonbills can be improved.

B. Systematization of Monitoring Data Collection and Result Sharing

- In the future, there is a need to collect data through regular monitoring of the Black-faced Spoonbill observed sites across the country and to establish conservation areas and protection measures for important areas including breeding grounds.
- It is necessary to share domestic and international information about the monitoring results of Black-faced Spoonbills and to promote habitats, and efforts are required to guide and preserve habitats through regular publications.

IV. Research on the Characteristics of Habitat using Colored Bands and Satellite Tracking Devices

1. Research Method

A. Field Investigation

| Attachment of Colored Bands and Satellite Tracking Devices

- From May to July 2020, when the young spoonbills begin to leave the nest, a colored band was attached to young birds in domestic Black-faced Spoonbills breeding grounds (Namdong Reservoir, Mae-do, Gaksiam, Chilsan-do, etc.), and satellite tracking devices were attached to some of the large individuals.
- Serial numbers and supplementary colored bands were attached to enable identification of individual bird from the distance, while satellite tracking devices were supported by Shenzhen University in China and colored bands by the National Institute of Ecology's Endangered Species Restoration Center to conduct a joint research on the migration path of Black-faced Spoonbills.

B. Analysis of Satellite Tracking Data

| Collecting Data

- A total of 21 satellite tracking devices were attached to the young Black-faced Spoonbills. Location information reception is set at intervals of 1 hour by default, and is set to be collected from one minute to several hours depending on the remaining battery capacity and reception conditions (Figure IV-1).
- Collected GPS coordinates and environmental factor information were used to analyze the habitat use and migration status of Black-faced Spoonbills.



Figure IV-1. Case of tracking device attached to juvenile of Black-faced Spoonbill.

C. Specifications of Colored Bands and Re-observation Method

| Specifications of Colored Bands

- Black-faced Spoonbill individuals are identified using the main and supplementary colored bands
- The main colored band (40 to 45mm in length) is distinguished by country. Korea has a red (or orange) color band (Figure IV-2). The colored band recognizes individuals by combining one capital letter and two digits. In this study, a red band with a serial number was attached to the capital letter Y.

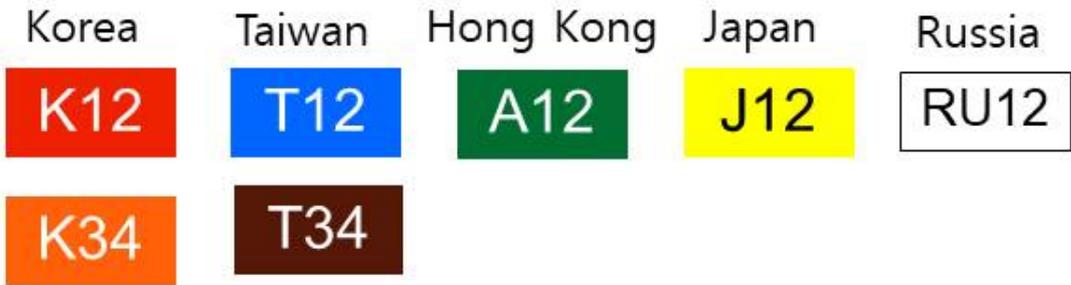


Figure IV-2. Example of each country’s color and combination of main band.

- Supplementary colored bands (14mm in length) were combined with two or three of the six colors (red, yellow, blue, green, white, and orange) and were arranged in different colors from 00 to 99 instead of the main colored band numbers (Figure IV-3).



Figure IV-3. Example of the color combination of the main and secondary bands.

| Re-observation of Colored Bands

- Observation of domestic colored bands utilized data obtained from re-observation during investigation of the breeding grounds and habitats of Black-faced Spoonbills and national monitoring, or collected observation reports from birdwatchers or ordinary citizens.
- For foreign data, in addition to the reports, re-observation record uploaded on the site for sharing observation information of the Black-face Spoonbills was used (e.g. Taiwan Black-Faced Spoonbill Conservation Association <http://bfsn.bfsa.org.tw> and Hong Kong Bird Watching Society <http://www.hkbws.org.hk/BBS/forumdisplay.php?fid=30>, Figure IV-4).

2. Results

A. Attaching Colored Band and Satellite Tracking Device on Black-faced Spoonbills

| Attaching 2020 Colored Band

- In 2020, colored bands were attached to 91 Black-faced Spoonbills in 9 breeding grounds (excluding 5 individuals that are rescued and artificially hatched), and 21 of them (excluding those attached by other organizations) were attached with a satellite tracking device (Druid Technology's Druid Lego model, 20g) (Table IV-1, Figure IV-5, IV-6).

Table IV-1. Sum of Color bands and tracking devices attached on 2020 year to Black-faced Spoonbill.

No.	place	Series of color bands				tracking devices	
		1st	2nd	3rd	sum	no. of color bands	sum
1	Gaksiam	Y11-Y20	Y26-Y30	Y54-Y57, Y61	20	Y16, 19, 28, 54, 55, 56, 61	7
2	Guji-do	Y38-Y46			9		
3	Ei-do	Y04-Y10			7		
4	Hwangseo-do	Y47-Y53			7		
5	Samsan-do	Y74-Y81			8	Y75	1
6	Mae-do	Y01-Y03	Y31-Y37		10	Y31-Y35	5
7	Namdong reservoir	Y58-Y60	Y62-Y73	Y93-Y97	20	Y58, 59, 67, 70, 71, 73	6
8	Noruseom	Y82-Y91			10	Y84, Y87	2
9	Seonduri*	Y21-Y25			5		
Sum of attached color bands					96	Sum of tracking devices	21**

*rescued, or artificially raised juvenile, ** excepted the tracking devices(14) from other institutes



Scenery of breeding island on Namdong reservoir



The bird attached Y59 color band and tracking device on back



The bird attached Y67 color band and tracking device on back

Figure IV-5. Cases attached tracking devices from the breeding island on Namdong reservoir.



Scenery of breeding island, Mae-do



The bird attached Y31 color band and tracking device



The bird attached Y35 color band and tracking device

Figure IV-6. Cases attached tracking devices from the breeding island, Maedo.

| Previously Attached Colored Bands

- From 2002 to 2019, there were 510 Black-faced Spoonbills (including rescued and released individuals, Table IV-2) on 13 islands in Korea which were attached with colored bands. Among them, 10 islands are included in Incheon Metropolitan City, excluding Yuksan-do, Samsan-do and Sasan-do, which are nearby islands of Chilsan-do.

Table IV-2. Sum of color bands from each breeding site of Black-faced Spoonbills during 2002~2019.

year	Sum of color bands on each breeding site														
	sum	Sokdo	Bdo	Suhaem	Gaksiam	Namdong	Gujido	Saemando	Maedo	Sangyeo-bawi	Hwangsado	Yuksando*	Sasando*	Samsando*	rescued
2002	8	4	4												
2004	1														1
2005	16	11	4												1
2006	11	10	1												
2007	15			12	3										
2008	3			3											
2009	8			4	4										
2010	31			9		12	10								
2011	40		4	8	7	7	5	2						5	2
2012	37			7	6	11	4				8				1
2013	51			10	8	9	8	1			7	7			1
2014	52		6	6	6	5	10	4	3	4	5	3			
2015	49			6	5	7	5	5	4	6	10				1
2016	34		4	6	9		5		5				5		
2017	47		3	9	10		7		10				8		
2018	54				13	4	6			11	10		10		
2019	53			6	10		8		9	3	7	5	2	3	
sum	457	25	26	80	71	55	60	12	22	21	10	30	33	5	7

* islands belonging to Chilsan-do islands

B. Observation Record of Colored Band on Black-faced Spoonbills

| Re-observation Rate of Colored Bands in 2020

- Out of the total 544 colored bands attached from 2010 to 2020, a total of 259 colored bands were observed in Korea and wintering sites, accounting for 47.6% re-observation rate of attached colored bands (Table IV-3). There were 201 colored bands re-observed in Korea, accounting for 36.9%. The annual survival rate calculated through re-observation was about 80%, but the survival rate for young individuals is considered to be relatively low.

Table IV-3. Sum of re-sights of color bands attached from Korea in 2020 year.

attached year	sum of color bands	re-sights in Korea	re-sights from wintering area	total re-sights in 2020	ratio of re-sights (%)	assumed survival ratio on each year
2008	3	1	1	1	33.3%	
2010	31	9	7	10	32.3%	89.3%
2011	40	11	9	11	27.5%	86.6%
2012	37	14	10	15	40.5%	89.3%
2013	51	13	12	15	29.4%	84.0%
2014	52	22	17	28	52.8%	89.9%
2015	49	13	11	14	29.2%	78.2%
2016	34	13	11	15	44.1%	81.5%
2017	47	19	16	21	44.7%	76.4%
2018	54	17	23	26	48.1%	69.4%
2019	53	7	26	27	50.9%	50.9%
2020	96	63	33	77	81.9%	
Total	547	202	176	260	47.6%	79.6%

- Among the 176 colored bands re-observed in 2020 in wintering sites, 119 were re-observed in Taiwan (67.6%), 18 in Hong Kong (10.2%), 40 in mainland China (22.7%), and 18 in Japan (10.2%) (Table IV-4). Also, one colored band was re-observed in Macao and Jeju island each. About half (19) of the colored bands observed in China were found in Taiwan (14), Hong Kong (4), and Macau (1). It indicates that Black-faced Spoonbills migrated further southward through China. Mainland China had a relatively large number of young individuals found, and Hong Kong had a large number of older individuals.

- Among the 14 colored bands found in Hong Kong, 12 of them (85.7%) were attached from Incheon and were attached from various breeding grounds such as Guji-do, Namdong Reservoir, Gaksiam, Suhaam, Seoman-do, and Hwangseo-do.

Table IV-4. Sum of re-sights of color bands from wintering area in 2020 year.

attached year	sum of re-sights	Taiwan	Hong Kong	Mainland China	Japan	others
2008	1				1	
2010	7	6			1	
2011	9	5	3	2	1	
2012	10	5	2		3	
2013	12	11	1	1	1	
2014	17	13	4	1		
2015	11	9		1	1	
2016	11	9	1	3		1
2017	16	13		7	1	
2018	23	13	3	6	4	
2019	26	18		12	1	
2020	33	17	4	7	4	1
sum	176	119	18	40	18	2
(ratio)	(100%)	(67.6%)	(10.2%)	(22.7%)	(10.2%)	(1.1%)

Use of Habitats Identified through Colored Band Observation

- Colored bands that were re-observed in Ganghwa region were individuals that reproduced near Ganghwa, such as Gaksiam, Seoman-do, Mae-do, and Sangyeobawi Rock.(Table IV-5). Among them, 30 of the 37 observed colored bands (81.1%) were attached in Gaksiam, accounting for the most, and 4 were from Mae-do (10.8%), and only 1-2 from other areas that were observed.
- Colored bands re-observed in Yeongjong-do area were from Suhaam, Mae-do and Gaksiam. Among the total of 35 colored bands, there were 19 from Suhaam (54.3%), 13 from Mae-do (37.1%), and 3 from Gaksiam (8.6%).
- Colored bands re-observed in Incheon area (including Namdong Reservoir) excluding Ganghwa and Yeongjong-do were from Namdong Reservoir, Gaksiam, Guji-do, Suhaam, Mae-do, Sangyeobawi Rock, and rescued individuals. Among the 41 re-observed colored bands, 32 were from Namdong Reservoir (78.0%), 2 from

Gaksiam (4.9%), 2 from Hwangseo-do (4.9%), and 1 from Guji-do, Suhaam, Mae-do, and Sangyeobawi Rock each. Rescued individuals appear to be native to Namdong Reservoir, and about 20% of the Black-faced Spoonbills tended to be migrated from other breeding grounds.

- A total of 34 re-observed colored bands in Sihwa and Hwaseong wetlands, it was identified that 17 were from Namdong Reservoir (50.0%), 6 from Hwangseo-do (17.6%), 3 from Gaksiam (8.8%), 3 from Mae-do (8.8%). In addition, individuals breeding in relatively diverse areas such as Sasan-do,, Seoman-do, Guji-do, Bi-do were identified.
- There were a total of 10 colored bands re-observed in Seocheon Yubu-do and Saemangeum. Among them, 9 were from Yuksan-do, Sasan-do and Samsan-do (90.0%), which are islands located nearby Chilsan-do, and 1 from Gaksiam (10.0%). In nearby Gochang area, colored band Y80 attached in Samsan-do was also observed, and most of the Black-faced Spoonbills here were highly related to the breeding group on Chilsan-do.
- A total of 15 colored bands were re-observed in Yeonggwang tidal flat (excluding Chilsan-do), of which 9 were identified to be from Sasan-do, Yuksan-do and Samsan-do (60%), which are nearby islands of Chilsan-do. In addition, other individuals breeding in the distance in Bi-do, Guji-do, Namdong Reservoir, Mae-do, and Hwangseo-do, which belong to Incheon City, were identified.
- Only a small number of colored bands were observed on Bi-do and Guji-do, which are closer to North Korea than the coast of Incheon. Most of them are believed to have migrated to the coast of Hwanghaenam-do.
- As a result, Black-faced Spoonbills tend to use habitats that are not far from their breeding grounds, but have also migrated to some distance regions (in the case of migrating from Chilsan-do to Saemangeum). Among the habitats, Sihwa and Hwaseong wetlands, and Yeonggwang tidal flat were areas where individuals breeding in various places were mixed compared to other areas.

Table IV-5. Sum of re-sights of color bands on main sites in Korea, 2020 year.

attached place \ site	coast of Ganghwa	coast of Yeongjongsido	Incheon (including Namdong)	Sihae-Hwaseong wetland	reclaimed area of Saemangeum	coast of Yeonggwang
Gaksiam	30	3	2	3	1	
Mae-do	4	13	1	3		1
Suhaam		19	1			
Namdong reservoir			32	17		1
Seoran-do	2			1		
Sangyeo-bawi	1		1			
Hwangsido			2	6		1
Gujido			1	1		2
Bi-do				1		1
Chilsan-do				2	9	9
rescued			1			
Sum	37	35	41	34	10	15

C. Habitat Use of Black-faced Spoonbills using Satellite Tracking Devices

1) Habitat Use of Black-faced Spoonbills from Namdong Reservoir

- Young Black-faced Spoonbills hatched on artificial islands within Namdong Reservoir used a wide range of Namdong Reservoir adjacent to the breeding ground in the early stage leaving the nest in July. These young individuals frequently used the downstream of Seunggi-cheon as a resting site (Figure IV-7).
- Within one to two months (July to August) after leaving the nest, they gradually dispersed to the surrounding tidal flats, mainly in Song-do Zone 11 Reservoir and Namdong reservoir (Figure IV-7). Efforts to create an alternative wetland in Zone 11 will be important in the future in connection with the Gojan tidal flat.
- Six satellite-traced individuals from Namdong Reservoir have tended to use different locations as their main habitat after August (Table IV-6). One individual (colored band Y71) migrated faraway to Haeju Bay in North Korea and stayed until it migrated to China. Another individual (colored band Y58) flew to Hwaseong wetland in Namyang Bay, about 30 to 35 km away from Namdong Reservoir, and mostly stayed there before the migration in October.

Table. IV-6. Habitat use of individuals attached tracking devices from Namdong reservoir, Incheon.

color band of tracking birds	Main inhabited site	Supplemental site
Y58	Hwaseong wetland (Namyang bay & Hwa-ong lake)	Gojan & Seoshin tidal flat, Daebudo
Y59	Shihwa lake & coast of Daebudo	Gojan tidal flat, Yeongheungdo
Y67	Shihwa lake & coast of Daebudo	Gojan tidal flat, Sacheon bay
Y70	Tidal channel and tidal flat of Songdo (Sorae, Siheung, & Gojan tidal flat)	Namdong reservoir, Yeonan-gun, North Korea
Y71	Haeju bay in North Korea	Gojan tidal flat, Sorae tidal Channel
Y73	Tidal flat and channel of Songdo (Gojan, Sorae, Siheung)	Namdong reservoir, Songdo area

| Colored Band Y59 Individuals

- Y59 mainly used Namdong Reservoir and Gojan tidal flat in July, just after leaving the nest (Figure IV-8).
- From August, Yeongheung-do and Daebu-do were used as main habitats, centering around Sihwa Lake Daesong wetland, which is 15 to 20 km away from the breeding ground.
- In October, southern tidal flat, small islands along the coast, and small reservoirs in Daebu-do were often used as feeding grounds and resting sites during high tide.

| Colored Band Y67 Individuals

- In July, Y67 mainly used the breeding grounds in Namdong Reservoir, Song-do Zone 11, and Gojan tidal flat (Figure IV-9).
- From August, Daebu-do and Sihwa Lake wetland were mainly used as central habitats as with Y59. However, they showed a tendency to use the tidal channel near Songsan Green City on the inner side of Sihwa Lake (Figure IV-9).

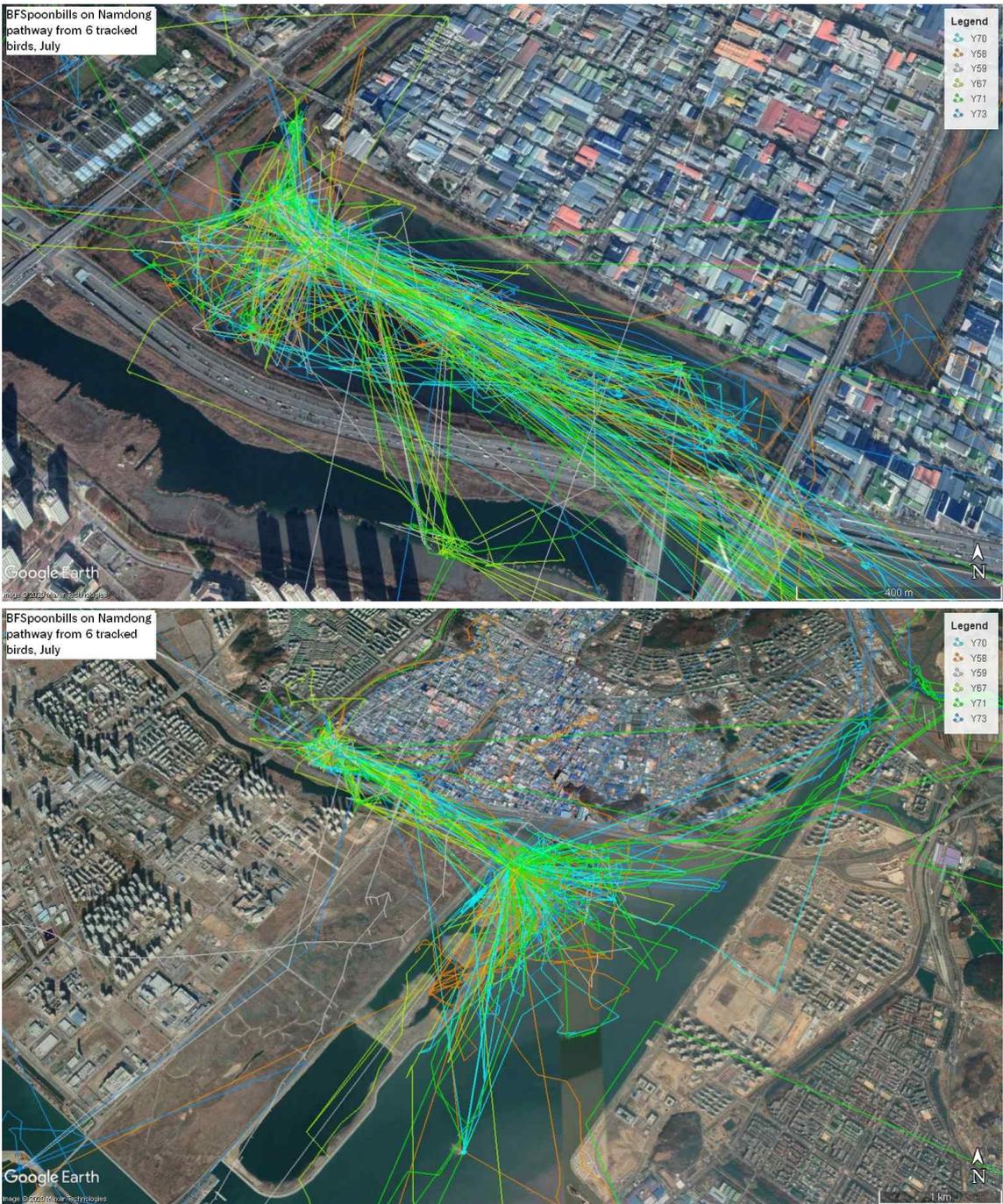


Figure IV-7. Main habitat use of 6 tracking Black-faced Spoonbills in July, attached from Namdong reservoir.

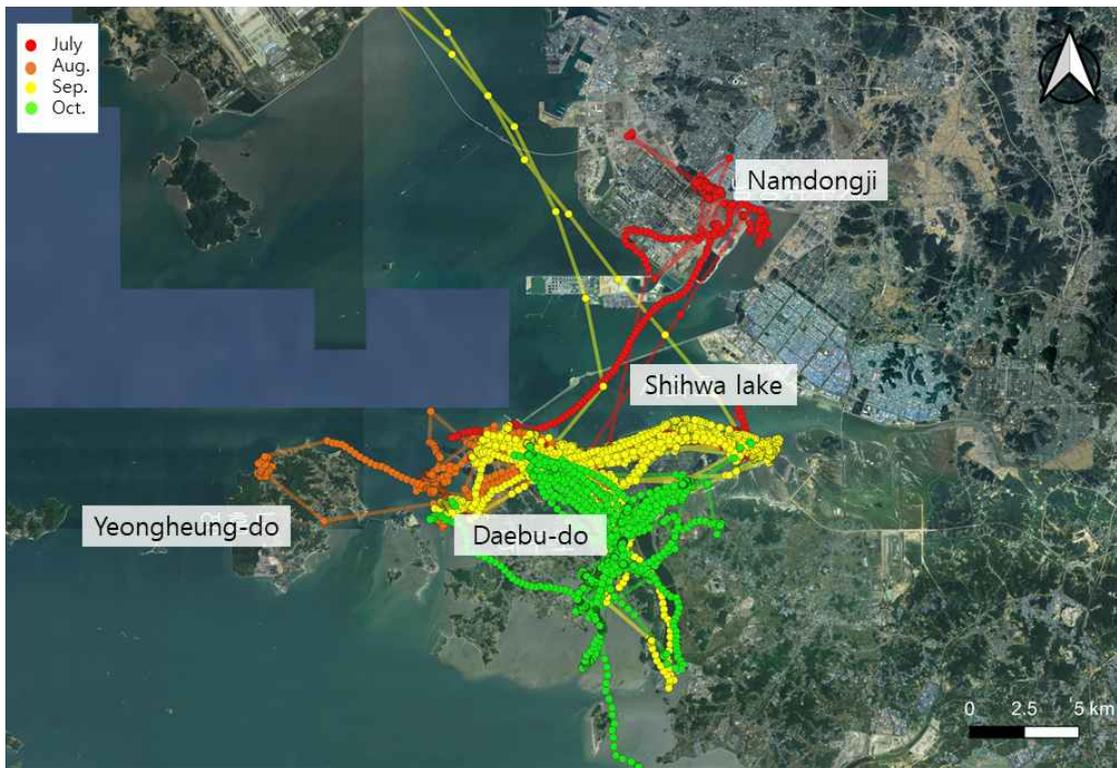


Figure IV-8. Habitat use of color band Y59 after fledged from Namdong reservoir.



Figure IV-9. Habitat use of color band Y67 after fledged from Namdong reservoir.

| Colored Band Y70 Individuals

- In July, Y70 also used Namdong Reservoir and Gojan tidal flat areas (Figure IV-10).
- In August, they migrated to Sihwa Lake in the south, but mainly used Gojan tidal flat. From September to early November, they continued to use Gojan tidal flat and Namdong Reservoir centering around Sorae wetland (Figure IV-10).

| Colored Band Y73 Individuals

- Y73 mainly used the Namdong Reservoir and Gojan tidal flat after leaving the nest, but it was also confirmed that they migrated to the west coast of Song-do (Figure IV-11).
- Even after August, Y73 used Gojan tidal flat as the central habitat and often used Sorae wetland, Namdong Reservoir, and surrounding Song-do areas (Figure IV-11).

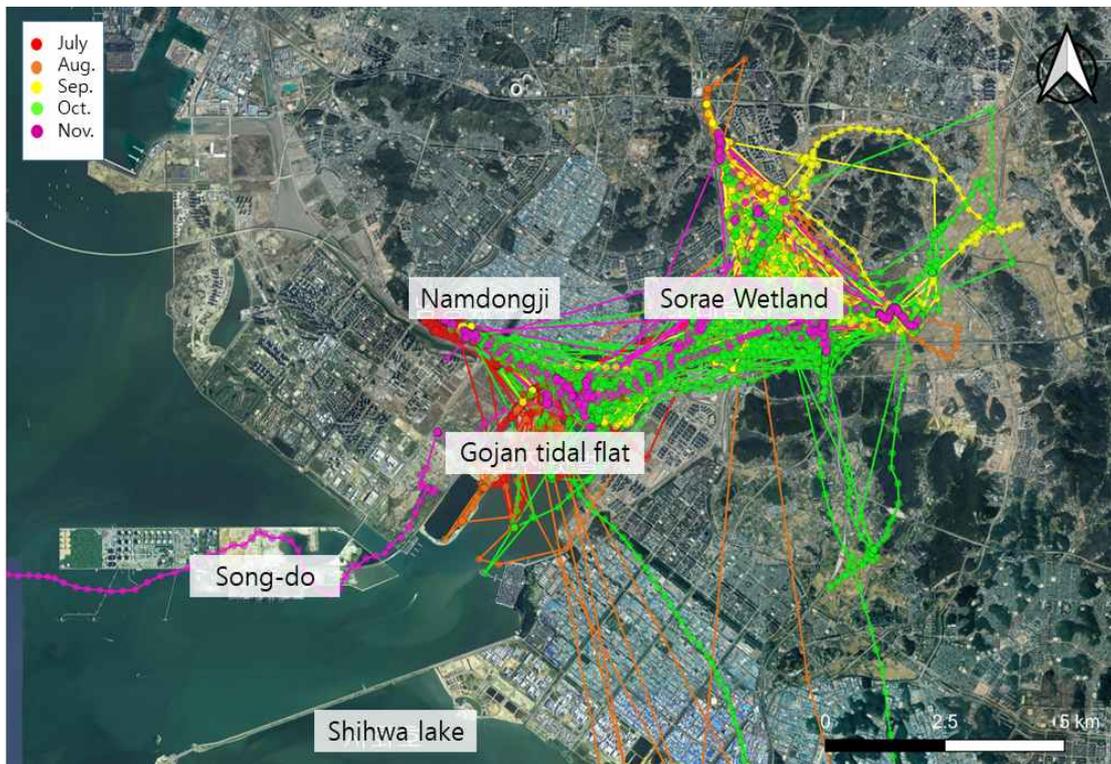


Figure IV-10. Habitat use of color band Y70 after fledged from Namdong reservoir.

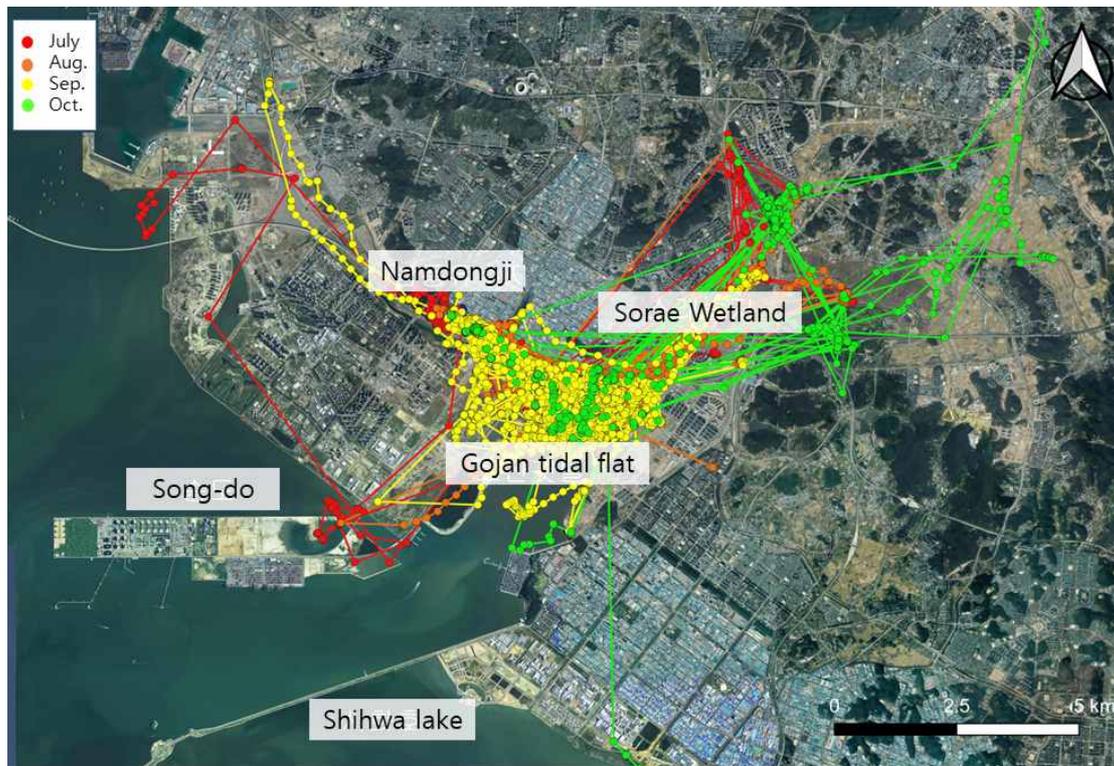


Figure IV-11. Habitat use of color band Y73 after fledged from Namdong reservoir.

2) Habitat Use of Black-faced Spoonbills from Mae-do

- The location-traced individuals of Mae-do in Incheon Seo-gu, used tidal flats adjacent to the breeding grounds of Mae-do in the early stage after leaving the nest, and went out to tidal flat at low tide and rested at Mae-do or the coast at high tide depending on the tide level¹⁾ (Figure IV-12).
- After August, they showed a tendency to not to stay near Mae-do, but gradually migrated to different habitats such as the southeastern tidal flat of Ganghwa-do, Yeongjong-do tidal flat and the surrounding reservoirs (Table IV-7). Among them, two individuals (colored band Y31 and Y34) stayed mainly in the southernmost tidal flats of Ganghwa, while one (colored band Y32) migrated to Yeonan-gun in North Korea. In addition, one individual (colored band Y33) migrated to Daebu-do, and most of the other individuals (colored band Y35) stayed at the southernmost region of Yeongjong-do, where they inhabited in different habitats.

1) Height of sea level according to tide

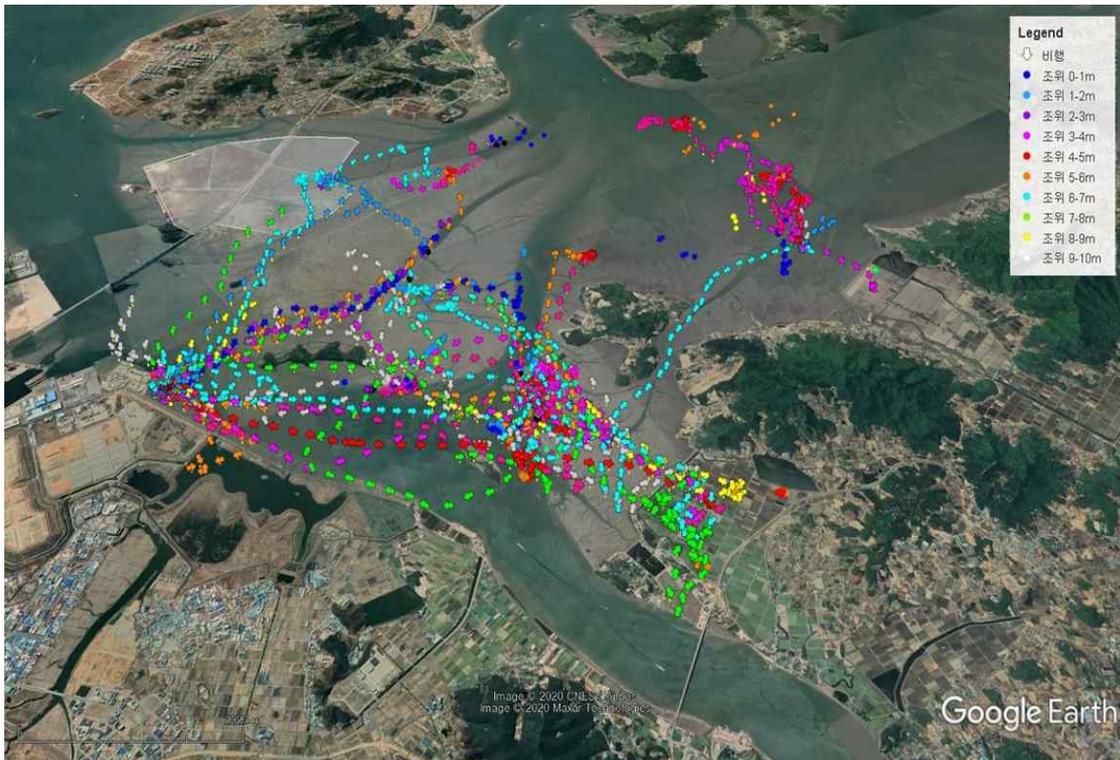


Figure IV-12. Habitat use of Black-faced Spoonbills (color band Y31, Y35) according to tidal heights.

Table IV-7. Habitat use of individuals attached tracking devices from Mae-do, Incheon.

color band of tracking birds	Main inhabited site	Supplemental site
Y31	Ganghwa southern mud flat, and agricultural area	Ganghwa eastern channel, agricultural channel
Y32	Yeonan-gun tidal flat, North Korea	Ganghwa mud flat, Jangbong-do
Y33	area of Daebu-do and Seonjae-do	Seyeo-do, Anam lake, northern part of Yeonjong-do
Y34	Ganghwa southern mud flat	northern part of Yeonjong-do
Y35	Yeongjong-do area	area of Seyeo-do, and Donggeom-do

| Colored Band Y31 Individuals

- Until July, Y31 mainly used tidal flat near Saeco-do, about 1.5 km away from the breeding ground (Figure IV-13).
- In August, they migrated to the tidal flat at the southernmost region of Ganghwa, about 10 km away, and tended to seek food from tidal flat at low tide, and rest at Gaksiam or enter the reservoir in Dongju Farm during high tide.
- In September and October, they mainly used the Yumha Channel and farmland

channel in the east of Ganghwa-do, and migrated to the northern coast of Ganghwa-do (Figure IV-13).

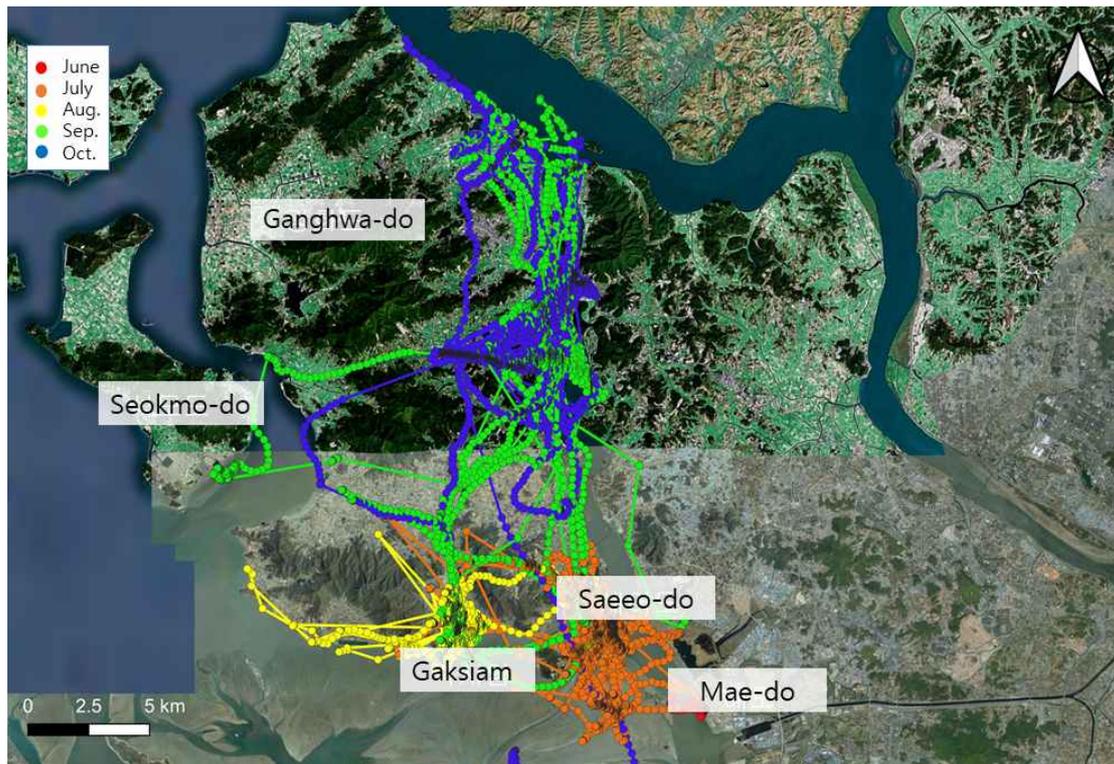


Figure IV-13. Habitat use of color band Y31 after fledged from Maedo.

| Colored Band Y33 Individuals

- In July, Y33 left Mado-do and mainly used the agricultural land in Choji-ri, Gilsang-myeon, Ganghwa and the tidal flat north of Saeo-do (Figure IV-14).
- In August, they expanded their habitat from Saeo-do to northern dredging site and tidal flat in Yeongjong-do. In September, they migrated to Seonjae-do in Ansan and used it as the main habitat. In October, they migrated to and from the southernmost tidal flat and Seonjae-do coast in Bu-do (Figure IV-15).

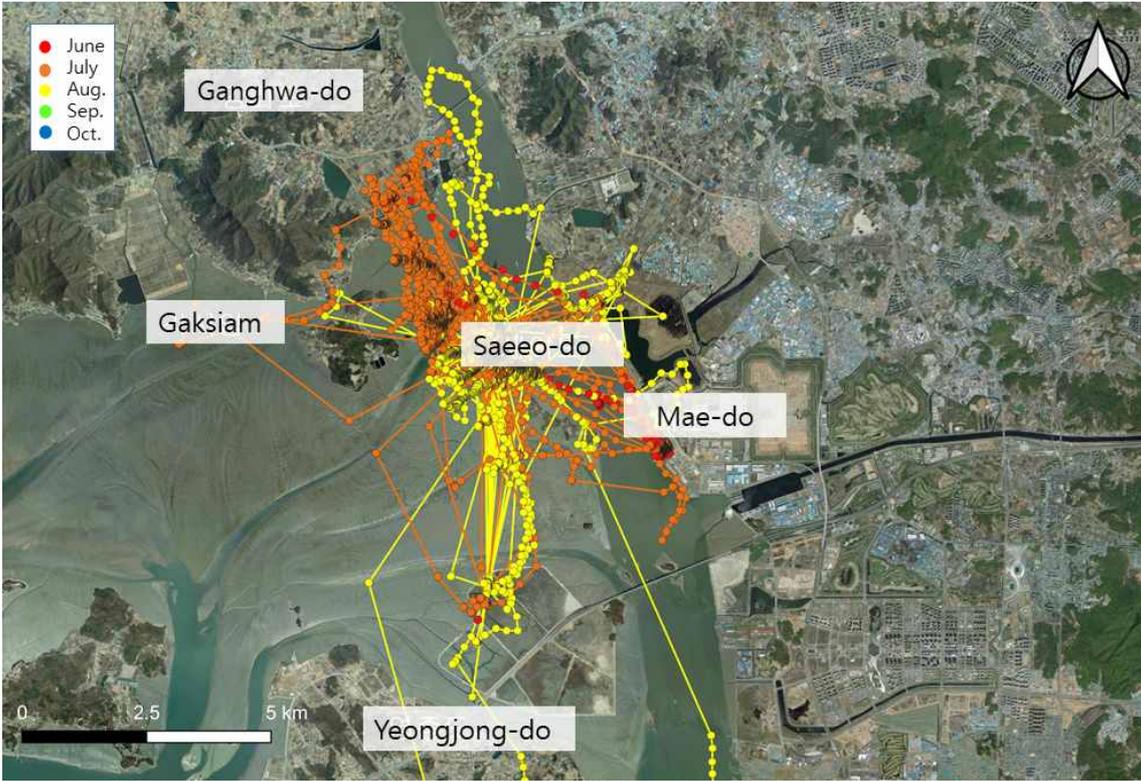


Figure IV-14. Habitat use of color band Y31 after fledged from Maedo (June~August).

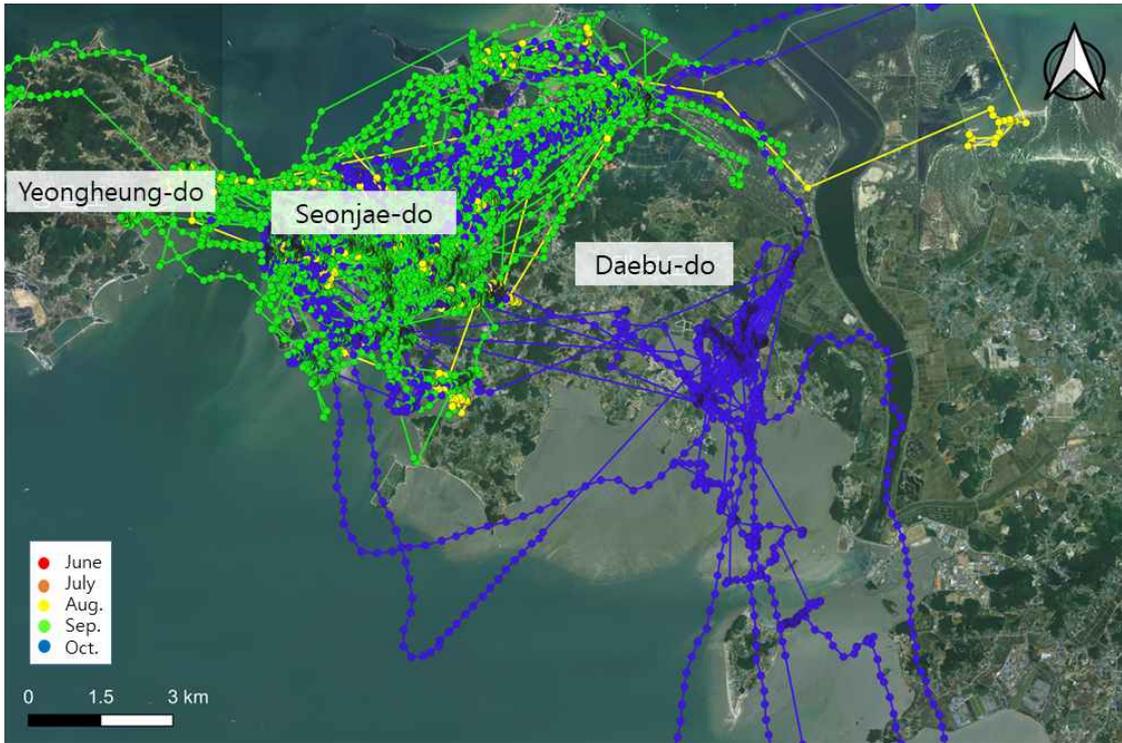


Figure IV-15. Habitat use of color band Y33 after fledged from Maedo (August~October).

| Colored Band Y35 Individuals

- In July, Y35 mainly used the breeding grounds of Mae-do and nearby tidal flats (Figure IV-16).
- From August to October, they left Mae-do and migrated to and from dredging site on the northeast side of Yeongjong-do and the southernmost region of Yeongjong-do. Their activities were mainly focused on Songsan Reservoir and Hongdae waste salt pond (Figure IV-16).

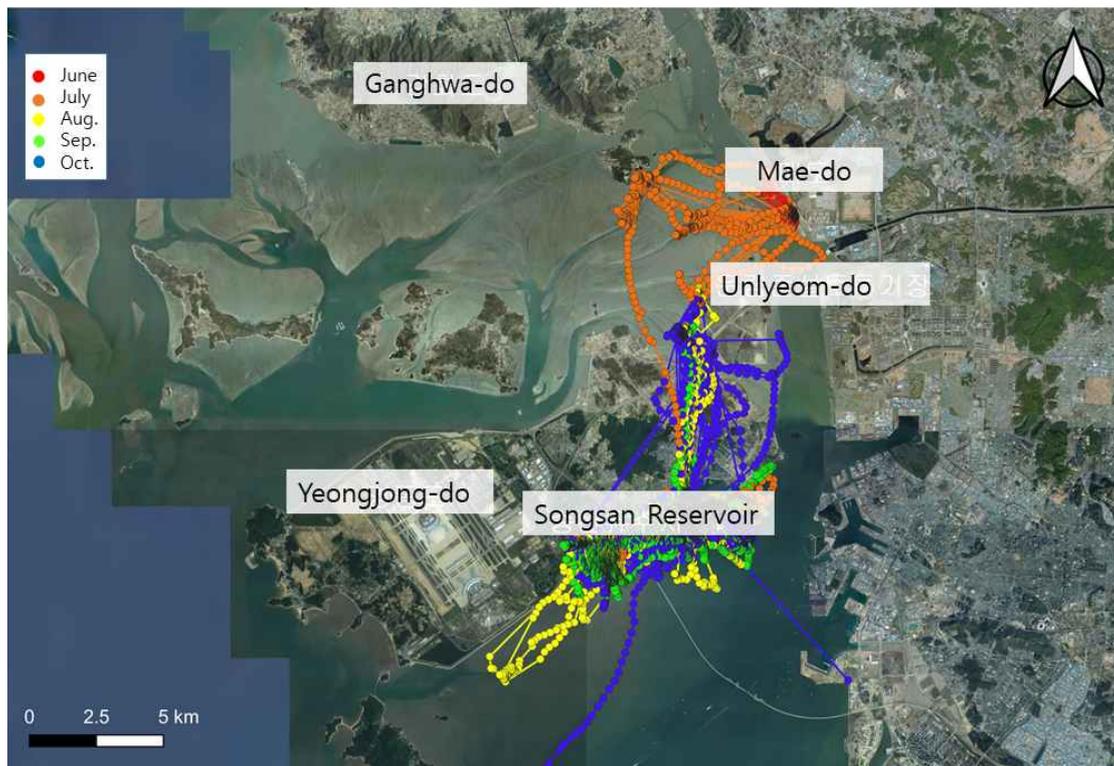


Figure IV-16. Habitat use of color band Y35 after fledged from Maedo (June~Oct.).

3) Habitat Use of Black-faced Spoonbills from Gaksiam

- Most of the location-traced individuals of Gaksiam in Ganghwa-gun did not migrate far, but mainly used the tidal flat and coastal farmland (Dongju Farm) around Gaksiam (Table IV-8).
- During low tide, they went out to the tidal flat and used the tidal channel as the main feeding ground, and during high tide, they mainly rested in Gaksiam, coastal embankment, and agricultural wetland (Figure IV-17).

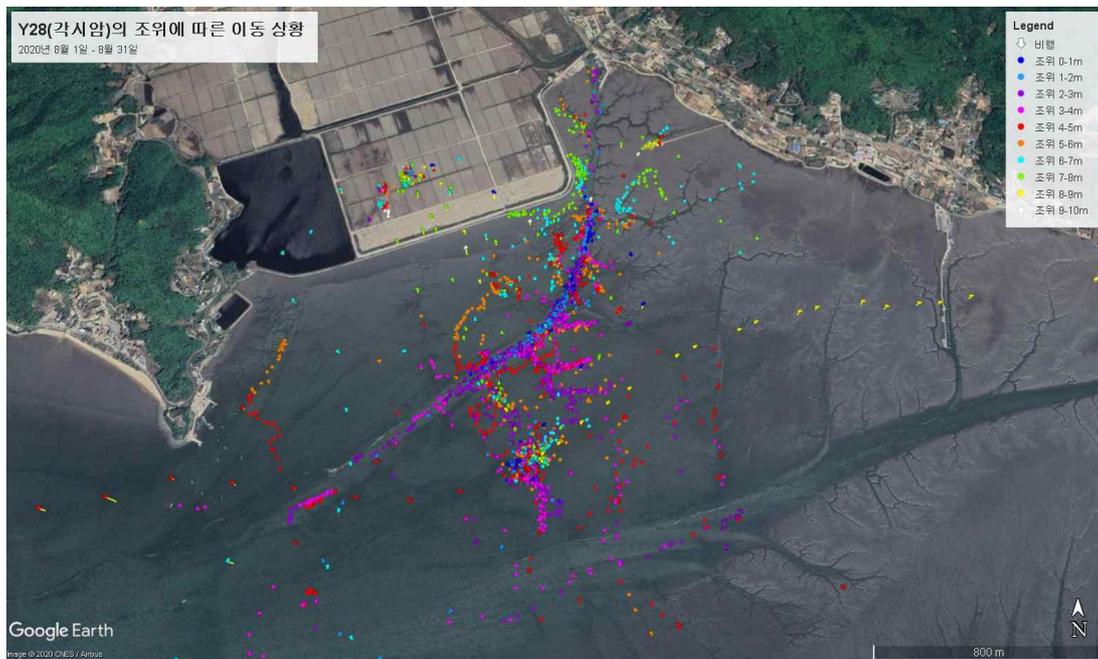


Figure IV-17. Case of habitat use by color band Y28 from Gaksiam according to tidal heights (August).

Table IV-8. Habitat use of individuals attached tracking devices from Gaksiam, Ganghwa.

color band of tracking birds	Main inhabited site	Supplemental site
Y16	Gaksiam	death before fledged
Y19	Ganghwa southern mud flat, agricultural channel	
Y28	Ganghwa southern mud flat, agricultural channel	Northern part of Yeongjong-do, Jangbong-do, and eastern channel of Ganghwa
Y54	Ganghwa southern mud flat	Northern part of Yeongjong-do, Shin-do area
Y55	Ganghwa southern mud flat	Elgeum-do, Shian (death by collision to electric wire)
Y56	Ganghwa southern mud flat	Northern part of Yeongjong-do
Y61	Ganghwa southern mud flat	

| Colored Band Y19 Individuals

- Y19 focused on using the tidal flat at the southernmost region of Ganghwa and the waterways of Dongju Farm adjacent to the breeding ground before migrating to wintering sites after leaving the nest, and tended to have a narrower home range

than the individuals breeding in other breeding grounds (Figure IV-18).

- In July and August, they mainly used a breeding ground Gaksiam and nearby tidal flat. At low tide, tidal flat was used as their feeding ground, and at high tide, Gaksiam was used as their resting site.
- In September and October, the use rate of waterways and wetland of Dongju Farm increased along with the tidal flat (Figure IV-18).

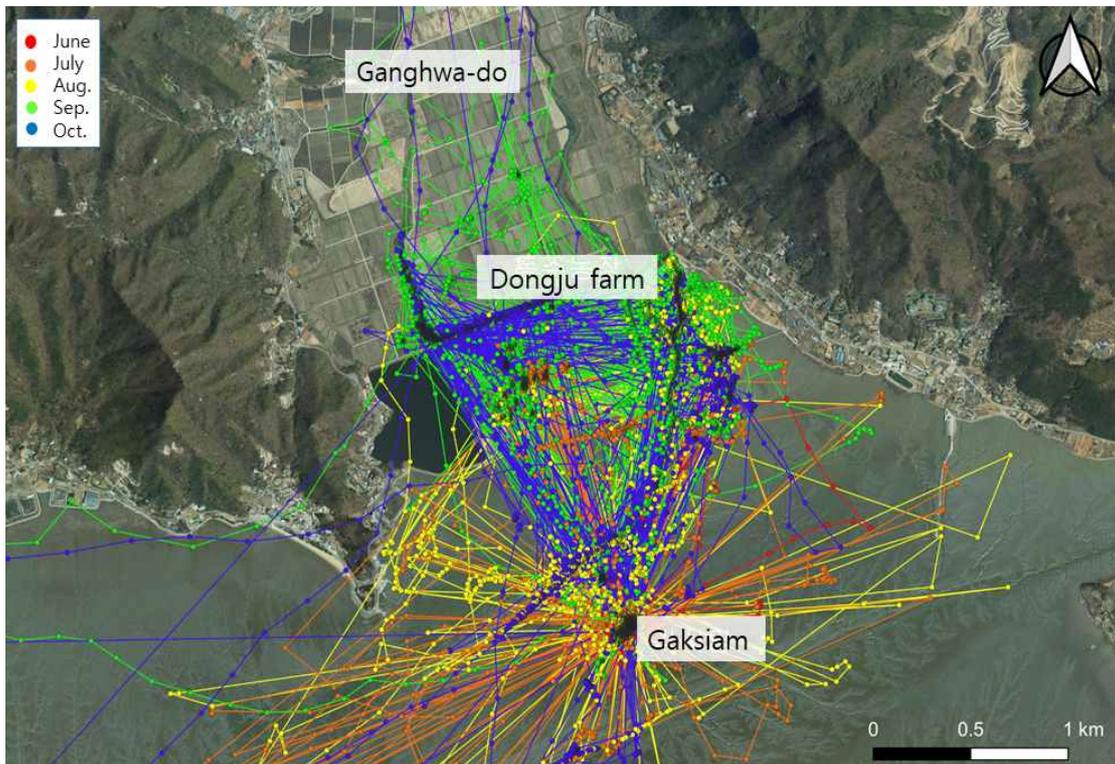


Figure IV-18. Habitat use of color band Y19 after fledged from Gaksiam.

| Colored Band Y28 Individuals

- Until August, Y28 mainly used the tidal flat around Gaksiam and wetland of Dongju Farm after leaving the nest (Figure IV-19).
- In September, the range was expanded to the Yumha Channel and agricultural waterways in the east of Ganghwa-do, and the reservoir in the dredging site in the north of Yeongjong-do. In October, the northern coast of Jangbong-do in Ongjin-gun was also used as a habitat (Figure IV-19).

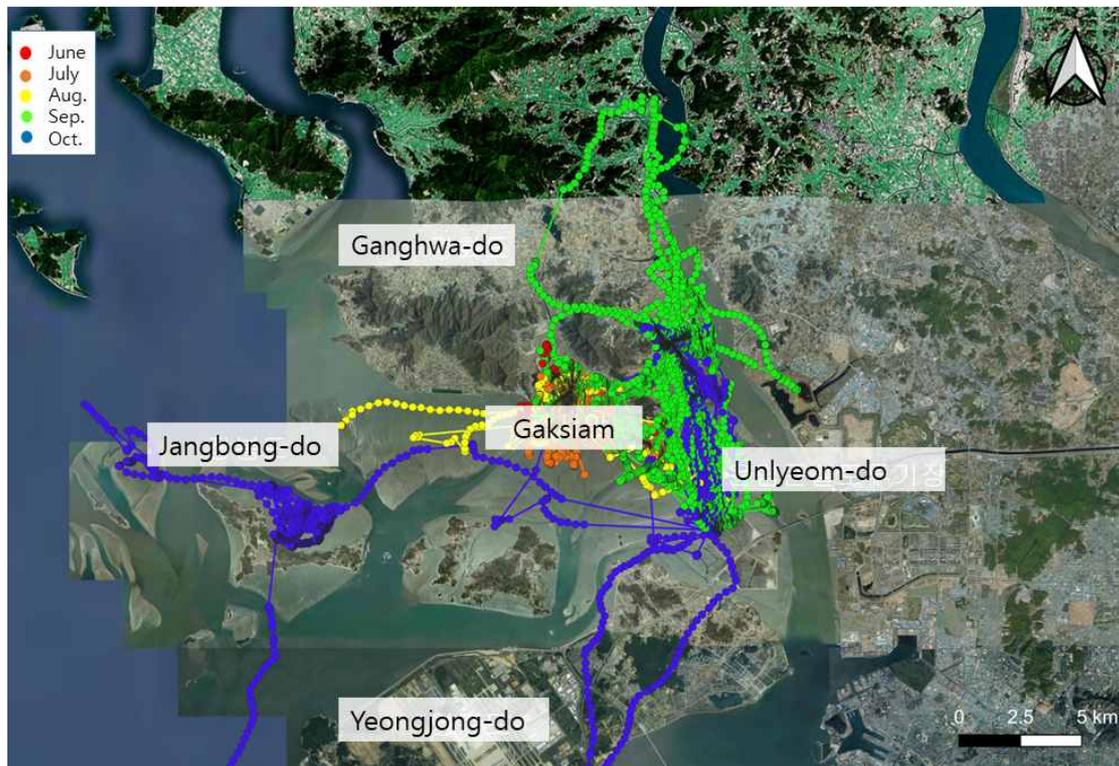


Figure IV-19. Habitat use of color band Y28 after fledged from Gaksiam.

| Colored Band Y54 Individuals

- From July to August, Y54 mainly used the breeding ground Gaksiam and nearby tidal flat (Figure IV-20).
- From September to October, the tidal flat at the southernmost region of Ganghwa was used as the main habitat, but extended the range to the reservoir of the dredging site in the north of Yeongjong-do, the southwest region of Ganghwa, and the entire Sin-do region (Figure IV-20).

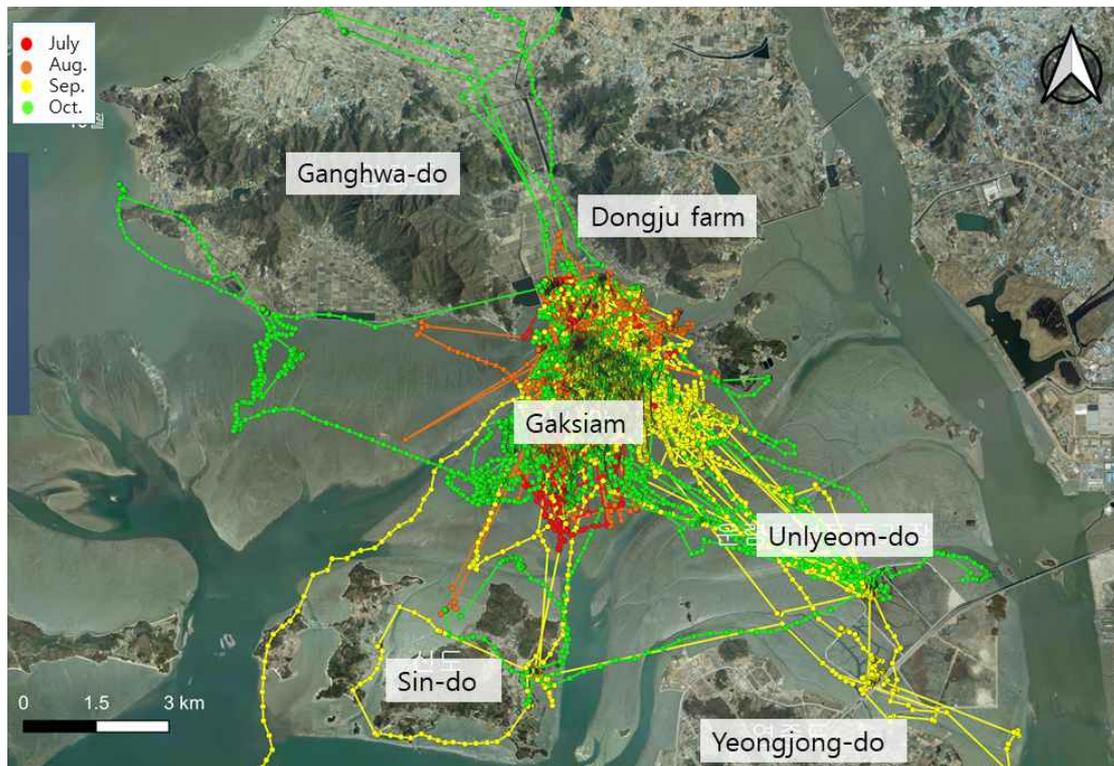


Figure IV-20. Habitat use of color band Y54 after fledged from Gaksiam.

4) Habitat Use of Black-faced Spoonbills outside of Incheon

- Breeding individuals from Chilsan-do in Yeonggwang-gun (Samsan-do, particularly) and Noru island in Seocheon-gun, which are regions outside of Incheon Metropolitan City, showed a tendency to use nearby tidal flat (Table IV-9). Among them, Black-faccd Spoonbills from Chilsan-do (Y75) continued to use the nearby Yeonggwang tidal flat, one of the two individuals from Noru island (Y84) stayed on the Yubu-do and Seocheon coast, and the other (Y87) migrated to Saemangeum.

Table IV-9. Habitat use of Black-faced Spoonbills tracked from outside of Incheon, Korea.

color band of tracking birds	Main inhabited site	Supplemental site
Y75	mud flat of Yeonggwang-gun	Chilsando, saltpan & agricultural area of Yeonggwang
Y84	tidal flat of Yubu-do	tidal flat of Seocheon-gun
Y87	tidal flat of Yubu-do	Saemangeum reclaimed area (signals stop)

Colored Band Y75 Individuals

- In July, Y75 mainly used the tidal flat of Baeksu-eup in Yeonggwang-gun near the breeding ground after leaving the nest, and often visited the breeding ground in Chilsan-do (Figure IV-21).
- From August, they have inhabited mainly in Yeonggwang Baeksu tidal flat, and in September, they have widely used as far as Yeomsan-myeon in Yeonggwang.
- After October, they used Yeonggwang Yeomsan-myeon, Hasa-ri in Baeksu-eup, and nearby salt pond reservoirs before migrating to wintering sites. It is believed that they migrated away from wind power generation on the coast (Figure IV-21, 22).

Colored Band Y84 Individuals

- Y84, with a tracking device attached from Noru island in Seocheon, mainly stayed in the breeding ground until July, but migrated to the nearby Yubu-do in August and used it as the main habitat until September (Figure IV-23).
- In October, the habitat was expanded to Seocheon Beein Beach (Figure IV-23).

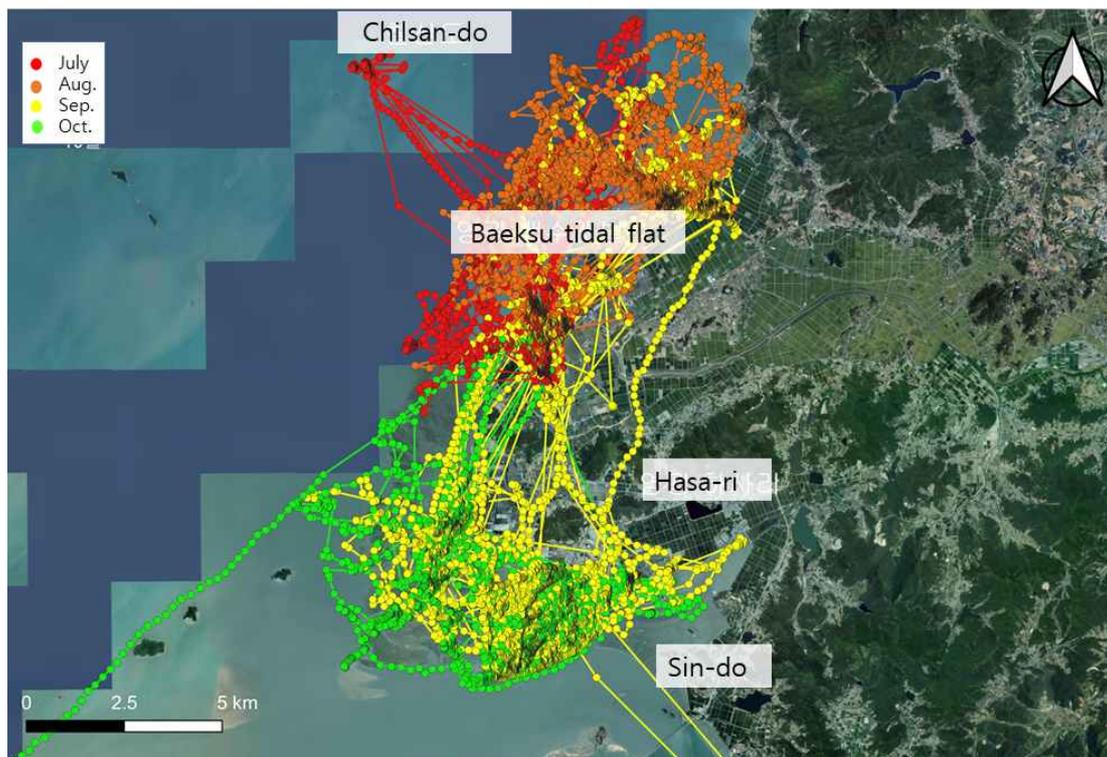


Figure IV-21. Habitat use of color band Y75 after fledged from Chilsan-do (Samsan-do).



Figure IV-22. Roosting site of color band Y75 fledged from Chilsand and wind turbines.

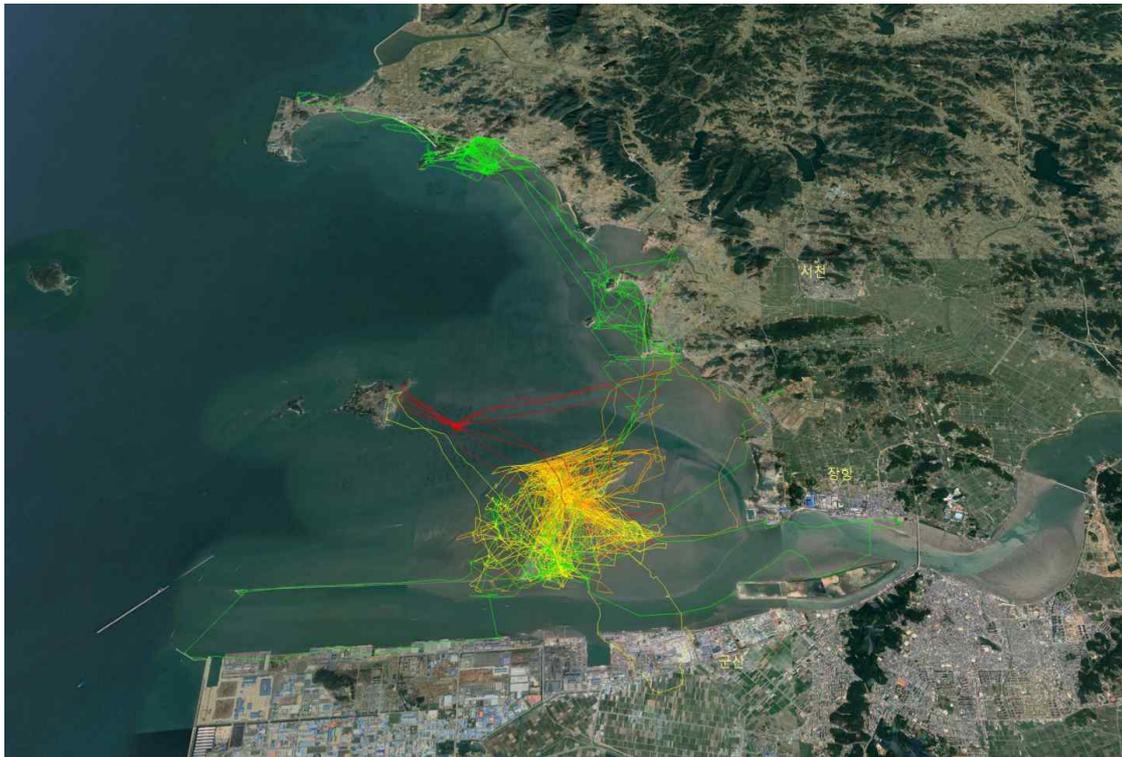


Figure IV-23. Habitat use in Yubu-do and coast of Seocheon by color band Y84 fledged from Noruseom (July~October).

5) Characteristics of Habitat Use for Black-faced Spoonbills

- Each location-traced Black-faced Spoonbill tended to have slightly different habitat use characteristics (Figure IV-24). Black-faced Spoonbills from Gaksiam had a strong tendency to find food in the tidal channel depending on the tide level, but some spoonbills had strong dependence on coastal farmland waterways, agricultural land, and reservoirs.
- Black-faced Spoonbills from Namdong Reservoir were highly dependent on tidal flat, but depending on the individuals, some of them went deep into the narrow tidal channel and used them as their main habitat, and some often used rice paddy wetland inside the reclaimed land.
- They often used waste salt ponds, reservoirs, and stone mound embankments on the coast as resting sites, and sometimes wandered around because they could not find a suitable resting site during the maximum high tide (Figure IV-24).
- It is considered that the existence of an area where Black-faced Spoonbills can rest without being disturbed during high tide is one of the important factors in the habitat of spoonbills.



roosting site on Yeochari wetland,
Ganghwa



roosting site on abandoned saltpan,
Yeongjong-do



reclaimed reservoir for dredge,
Yeongjong-do



Tidal reservoir on southern Yeongjong-do



tide roosting site at high tide on Baeksu
mud flat, Yeonggwang



roosting site on reservoir of saltpan,
Yeonggwang



feeding area of Gojan tidal flat near
Namdong reservoir



roosting site on southern tidal flat of
Daebudo

Figure IV-24. Main habitat scenery of position tracked Black-faced Spoonbills.

D. Migration of Black-faced Spoonbills to Wintering Site

1) Distance of Migration

- From October to December 2020, migration routes to wintering sites for a total of 16 individuals were identified. The earliest known migration date was October 15th and the latest was November 9th (Table IV-10).
- Even after migration, some individuals migrated southward until the end of November, and as of mid-December, 2 individuals migrated and stayed in southern Korea, 2 in Japan, 10 in mainland China, and 2 in Taiwan (Table IV-9).

Table IV-10. Migration start date and migrated distance to the wintering place of satellite tracking Black-faced Spoonbills.

No	breeding site	band no.	starting date of migration	stopover and wintering place	distance* (km)
1	Namdong reservoir	Y58	2020. 11. 02	Gogeum-do, Jeonnam province, Korea	430
2	Namdong reservoir	Y59	2020. 10. 23	Wenzhou, Zhèjiāng, China	1,374
3	Namdong reservoir	Y67	2020. 10. 15	Kuramoto - Kagoshima, Kyushu, Japan	1,823
4	Namdong reservoir	Y70	2020. 10. 28	Dongtai, Jiāngsū, China	1,254
5	Namdong reservoir	Y71	2020. 10. 24	Jiāngsū, China - Yúnlín, Taiwan	2,260
6	Namdong reservoir	Y73	2020. 10. 22	Kyushu, Japan - Jeonnam, Korea - Shàn Tóu, Guǎngdōng, China	4,287
7	Mae-do	Y31	2020. 10. 28	Hángzhōu bay, Zhèjiāng, China	1,224
8	Mae-do	Y33	2020. 10. 20	Httsuse river, Myazaki, Japan	1,786
9	Mae-do	Y35	2020. 10. 30	Dānzhōu, Hǎinán, China	2,808
10	Gaksiam	Y19	2020. 10. 29	Nántōng, Jiāngsū - Zhōushān, Zhèjiāng, China	1,140
11	Gaksiam	Y28	2020. 10. 29	Shànghǎi - Yánchéng - Rúdōng, Jiāngsū, China	2,142
12	Gaksiam	Y54	2020. 10. 25	Mǎ'ānshān, Ānhuī, China	1,219
13	Gaksiam	Y55	2020. 11. 09	Bgeum-do, Jeonnam, Korea	382
14	Gaksiam	Y61	2020. 10. 23	Hǎifēng, Guǎngdōng, China	2,767
15	Samsan-do	Y75	2020. 10. 18	Ānpíng, Táinán, Taiwan	2,396
16	Nruseom	Y84	2020. 10. 29	Liányúngǎng, Jiāngsū, China	929

* distance by actual movement to wintering site

-
- Colored band Y35, which was born in Mae-do, migrated the longest distance to Hainan Province, China with a straight distance of 2,500 km, and the actual distance traveled was 2,808 km. However, Y73 from Namdong Reservoir descended to Kyushu Kagoshima in Japan, and then went north to Korea, then migrated to Shantou City in Guangdong Province, China, where it flew a total distance of 4,287 km. The shortest distance traveled individual was colored band Y55 from Gaksiam, where it traveled 382 kms to Bigeum-do in Sinan (Table IV-10).

2) Migrating Routes

| Migrating Routes of Black-faced Spoonbills from Namdong Reservoir

- Colored band Y58 migrated relatively late from Hwaseong wetland on November 2nd along the west coast, stayed in Gangjin Bay until the end of November, and tried to migrate to the vicinity of Jeju island, but failed and returned to Gangjin (Figure IV-25). After that, it could not migrate further and predated by a wildcat and died on December 20th during wintering in Gogeu-do, Wando-gun.
- Colored band Y59 departed Daebu-do on October 23rd and stayed at Pyeongtaek Port and Saemangeum for a while before crossing the West Sea along the sea of Sinan-gun, and descended to Wenzhou City in Zhejiang Province, China (Figure IV-25). However, it is believed that it died in an accident with a fishing line or net during wintering.
- Colored band Y67 departed Daebu-do on October 15th, descended to Busan and returned to Sacheon to make a stopover. On October 25th, he left Sacheon and stayed in Kumamoto, Japan for a month. On November 24th, it migrated to Kagoshima Prefecture for wintering (Figure IV-25).
- Oddly, colored band Y70 migrated north from Incheon to the coast of Yeonan-gun in North Korea on November 7th, stayed there for few days, and then moved south on November 11th. After arriving on the coast of Dongtai, Jiangsu Province in China on November 12th, it had been wintering without further activity (Figure IV-25).
- Colored band Y71 departed Haeju Bay, North Korea on October 24th, stayed on

the coast of Dongtai in Jiangsu Province. It migrated south again on November 7th and arrived in Yunlin County in Taiwan on November 12th (Figure IV-25). However, the signal was cut off during wintering in December due to unknown cause.

- Colored band Y73 migrated from Song-do in Incheon along the west coast to Kagoshima Prefecture in Japan on October 22nd, but returned to Jangheung on the south coast of Korea and stayed for a month. Then, it began relocating again on November 24th, migrating to Shantou, China for a long distance (Figure IV-25).

▮ Migrating Routes of Black-faced Spoonbills from Mae-do

- Colored band Y31 departed Ganghwa-do on October 28th, stayed for a while at the northernmost region of Yeongjong-do, Hwaseong wetland, and Anjwa-do in Sinan, then crossed the West Sea and arrived in Ningbo City, Hangzhou Bay in China on October 31st and passed the winter (Figure IV-26).
- Colored band Y33 departed Daesong wetland in Ansan on October 20th, stayed in Saemangeum, and tried to migrate its way to southwest but returned to Saemangeum on October 21st. The next day, it turned southeast and migrated to Kagoshima in Japan without a break, and then migrated again to Miyazaki Prefecture on October 25th and passed the winter (Figure IV-26).
- Colored band Y35 departed its habitat on Yeongjong-do on October 30th, crossed the West Sea, passed through Huzhou, Zhejiang Province in China and Hong Kong, and arrived in Hainan in the distance on November 2nd and passed the winter (Figure IV-26). On November 24th, it is believed to have died in a contaminated reservoir.

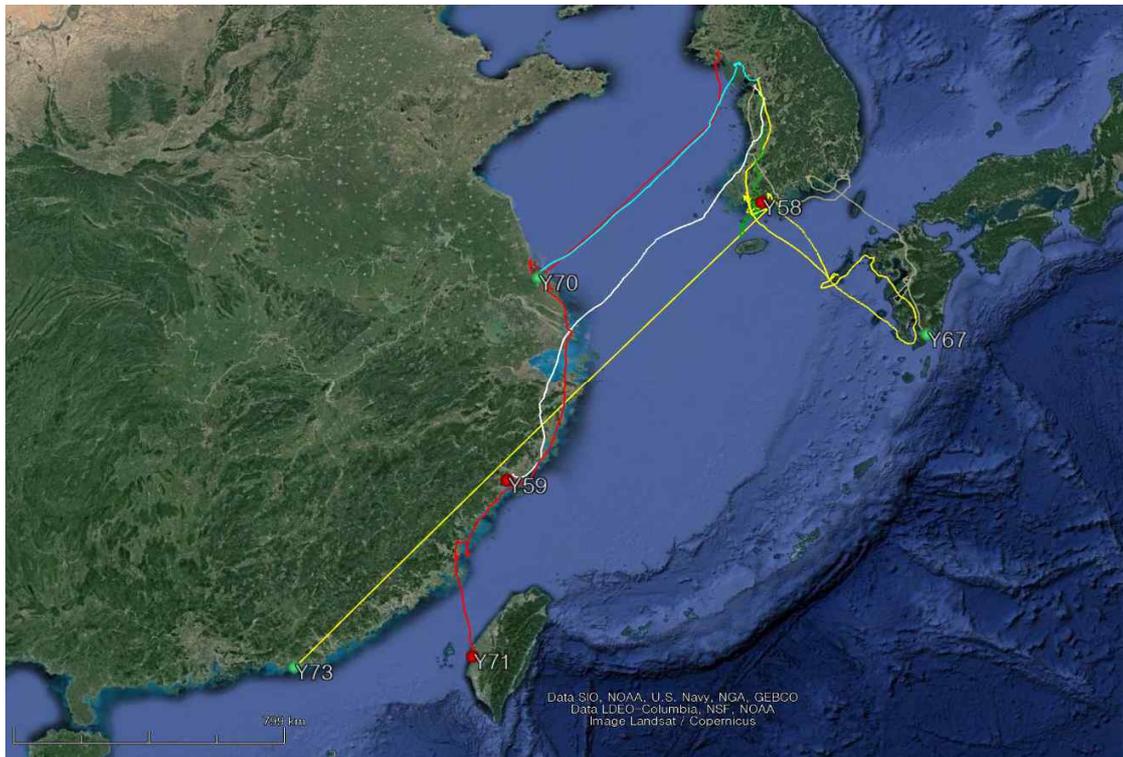


Figure IV-25. Migration routes of 6 tracking birds fledged from Namdong reservoir.

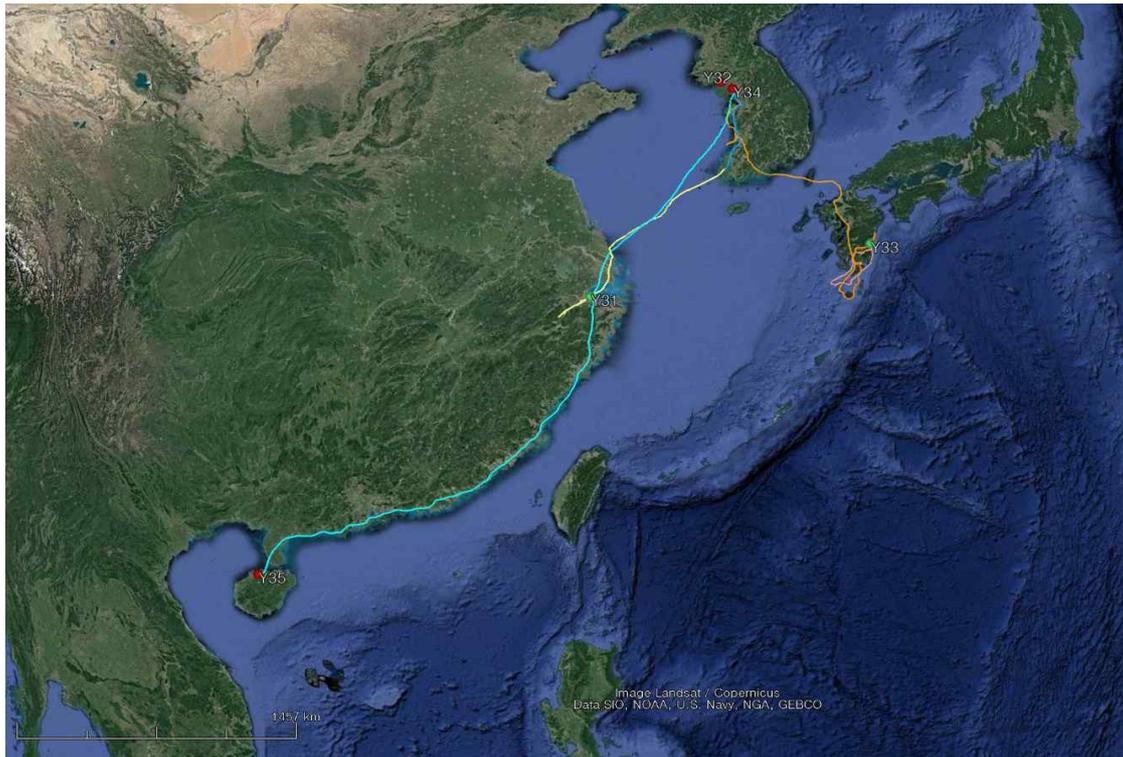


Figure IV-26. Migration routes of 3 tracking birds fledged from Mae-do.

| Migrating Routes of Black-faced Spoonbills from Gaksiam

- Colored band Y19 departed from the southernmost region of Ganghwa-do on October 29th, arrived at the coast of Dongtai City in Jiangsu Province, China, and stayed for about a month. On November 28th, it traveled south again and migrated to Daishan County in Zhoushan City, Zhejiang Province and passed the winter. (Figure IV-27).
- Colored band Y28 departed Jangbong-do on October 29th and stayed on the coast of Yancheng City in Jiangsu Province, China for two weeks. On November 13th, it traveled south to Shanghai again, but on December 5th, it migrated north to Ludong coast in Zhejiang Province (Figure IV-27). However, it is believed that it died on December 24th by accident.
- Colored band Y54 departed from the northernmost region of Yeongjong-do on October 25th and migrated to Shiju Lake in Ma'anshan City, Anhui Province, which is an inland area, and passed the winter (Figure IV-27).
- Colored band Y55 departed from the southernmost region of Ganghwa on November 9th, passed along Saemangeum, arrived at Bigeum-do in Sinan-gun and stayed there. On December 1st, it died here after crashing into electric wire.
- Colored band Y61 departed from the northernmost region of Yeongjong-do on October 23rd and stayed on the coast of Taizhou in Zhejiang Province, China for 20 days. On November 12th, it traveled south again, passed through Huzhou, and arrived in Shantou in Guangdong Province on the 18th, and passed the winter (Figure IV-27).

| Migrating Routes of Black-faced Spoonbills outside of Incheon

- Colored band Y75 departed Yeonggwang coast on October 18th, traveled to Wenzhou City, Zhejiang Province in China without a break and stayed for few days. Then again, on October 23rd, it traveled south, passed through Budai in Taiwan and migrated to Anping District in Tainan on October 31st, where it passed the winter (Figure IV-28).
- Colored band Y84 departed Seocheon coast on October 29th and traveled to the

West Sea, but was unable to travel properly due to the wind, and stayed on the island for a moment while flying irregularly on the Sinan sea. On October 31st, it arrived at Lianyungan in Jiangsu Province, China, where the latitude is high (Figure IV-28). On December 14th, it is believed to have been killed by predator.

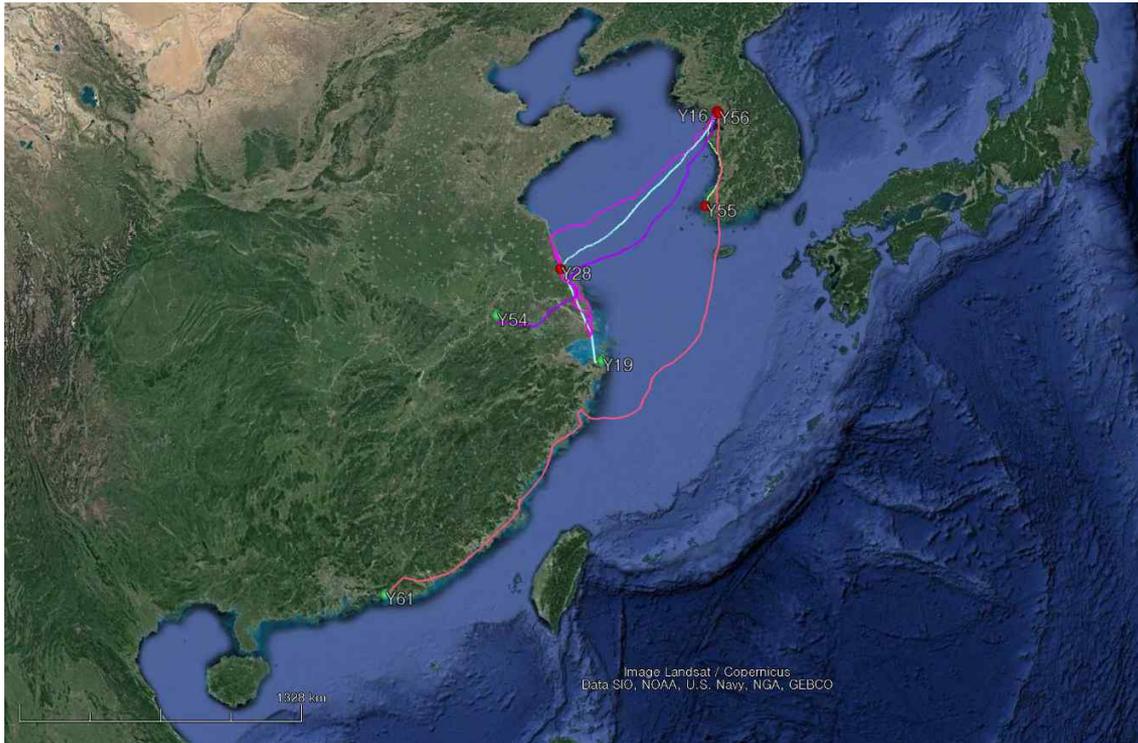


Figure IV-27. Migration routes of 5 tracking birds fledged from Gaksiam.

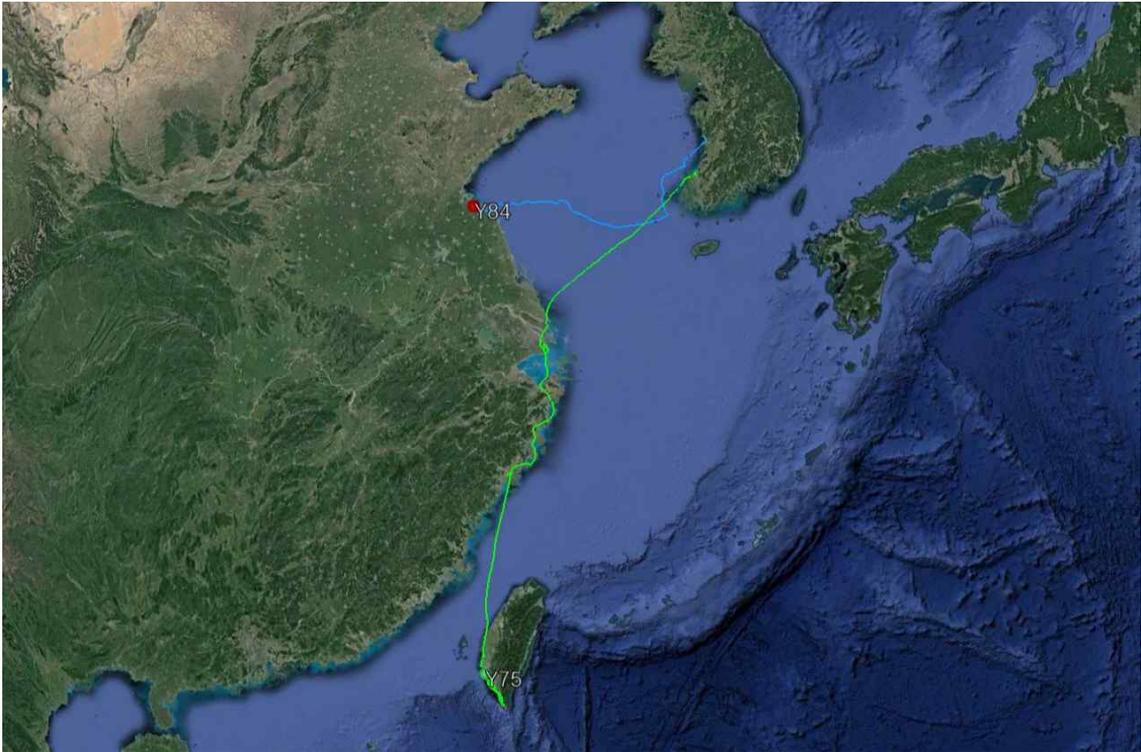


Figure IV-28. Migration routes of 2 tracking birds fledged from outside of Incheon.

3. Considerations

A. Important Habitats of Black-faced Spoonbills

| Common Properties of Important Habitats

- Black-faced Spoonbills preferred areas where tidal flats, freshwater wetlands, and reservoirs were combined. Many of the places where a large number of Black-faced Spoonbills were observed in the national monitoring generally satisfied the above conditions.
- Black-faced Spoonbills especially needed a resting site and feeding ground with little human disturbance and interference.
- The properties of important habitats of the Black-faced Spoonbills were as follows.

A) Ganghwa, southernmost Region – It was a place where hundreds of Black-faced Spoonbills could inhabit due to the combination of tidal flats with little human interference, rice paddy wetlands with no interference from the coast, Gaksiam breeding grounds, coastal embankment resting areas, and farmland waterways (Figure IV-29).

B) Yeongjong-do Area – The reservoir in the dredging site on the north side of Yeongjong-do, where there is little human access, functioned as both a resting site during high tide and a feeding ground. Also, there is a wide tidal flat in the southern part of Yeongjong-do where there is little human interference and the feeding conditions on these regions were favorable. There were places for many Black-faced Spoonbills could inhabit because they could rest safely in waste salt pond and Songsan Reservoir during high tide (Figure IV-30).



Figure IV-29. Black-faced Spoonbills on rice paddy in Ganhwa (main feeding site in summer).



Figure IV-30. Black-faced Spoonbills on Suhaam (upper), and reclaimed reservoir for abandoned dredging soil on north of Yeongjong-do (lower, suitable for Black-faced Spoonbills in a few human disturbances with shallow water level).

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- C) Namdong Reservoir and Song-do Tidal Flat - Namdong Reservoir had little interference and an artificial island acted as a breeding ground, Gojan tidal flat had almost no access from humans, Sorae and Siheung tidal flats connected to the brackish water, and stable resting sites such as the embankment on the coast and Hwangsaeabawi Rock (Okgwido), all provided an inhabitable condition for Black-faced Spoonbills (Figure IV-31).
- D) Sihwa Lake Daesong Wetland and Daebu-do - It was a place where many Black-faced Spoonbills could inhabit because of the wide tidal flats along the southwest coast of Daebu-do, wide freshwater wetland and rice paddy wetland within Sihwa Lake, and shallow reservoirs were combined in this region.
- E) Hwaseong Wetland - This region was advantageous for the habitat of Black-faced Spoonbills, as there were shallow reservoir within Hwaong Lake with limited human access, rice paddy wetland and long natural waterways, wide tidal flats in Namyang Bay, and waste salt pond with little human access in the area (Figure IV-32).
- F) Yubu-do Region - The wide tidal flats in the Yubu-do region, small island rest areas hardly approached by people, tidal flat along the Seocheon coast, Geumran-do reservoir, and waste salt pond were combined (Figure IV-33).
- G) Yeonggwang Tidal Flat - The wide tidal flats of Baeksu-eup and Yeomsan-myeon, salt ponds that are rarely accessed by people, waste fish farms, river waterways, and rice paddy wetlands were mixed, making it a good place for many Black-faced Spoonbills to inhabit.



Figure IV-31. Resting sites of Namdong reservoir and Song-do for Black-faced Spoonbills (comfortable place without human approach).



Figure IV-32. Resting sites on Hwaseong wetland for Black-faced Spoonbills (comfortable place with few human disturbances).



Figure IV-33. Resting sites on tidal flat of Yubu-do and small island for Black-faced Spoonbills.

B. Characteristics of Black-faced Spoonbill Migration and Threat Factors

| Migration Characteristics of Black-faced Spoonbills in the West Coast

- Of the 16 satellite tracking individuals that migrated, 8 showed the characteristics of temporarily staying on the southwestern coast of Korea when they migrated from their autumn habitat to wintering sites (Figure IV-34). Unlike the individuals who directly crossed the Yellow Sea to China, they migrated slowly and tended to have a short migration distance.
- There were also examples of migration patterns of turning directions randomly or showing relatively irregular routes on the west coast and returning back. This is believed to be due to the fact that they were separated with the mother birds and did not know the directions to migrate (Figure IV-34).
- Two individuals with slow migration (Colored band Y55, Y58) tended to pass the winter on the south coast of Korea, and both died in December (electric wire collision, predated by wildcat).



Figure IV-34. Migration routes of 8 Black-faced Spoonbills passing through west coast of Korea followed by satellite tracking devices.

Migration Characteristics of Black-faced Spoonbills passing through West Coast

- 8 individuals that quickly traveled to China instead of staying on Korea's west coast tended to migrate further south, such as Taiwan and Hainan, compared to those stayed on the west coast (Figure IV-35). They also tended to stay in a few places before finally migrating to wintering sites.
- However, 3 of these 8 did not travel further south and stayed at the destination.

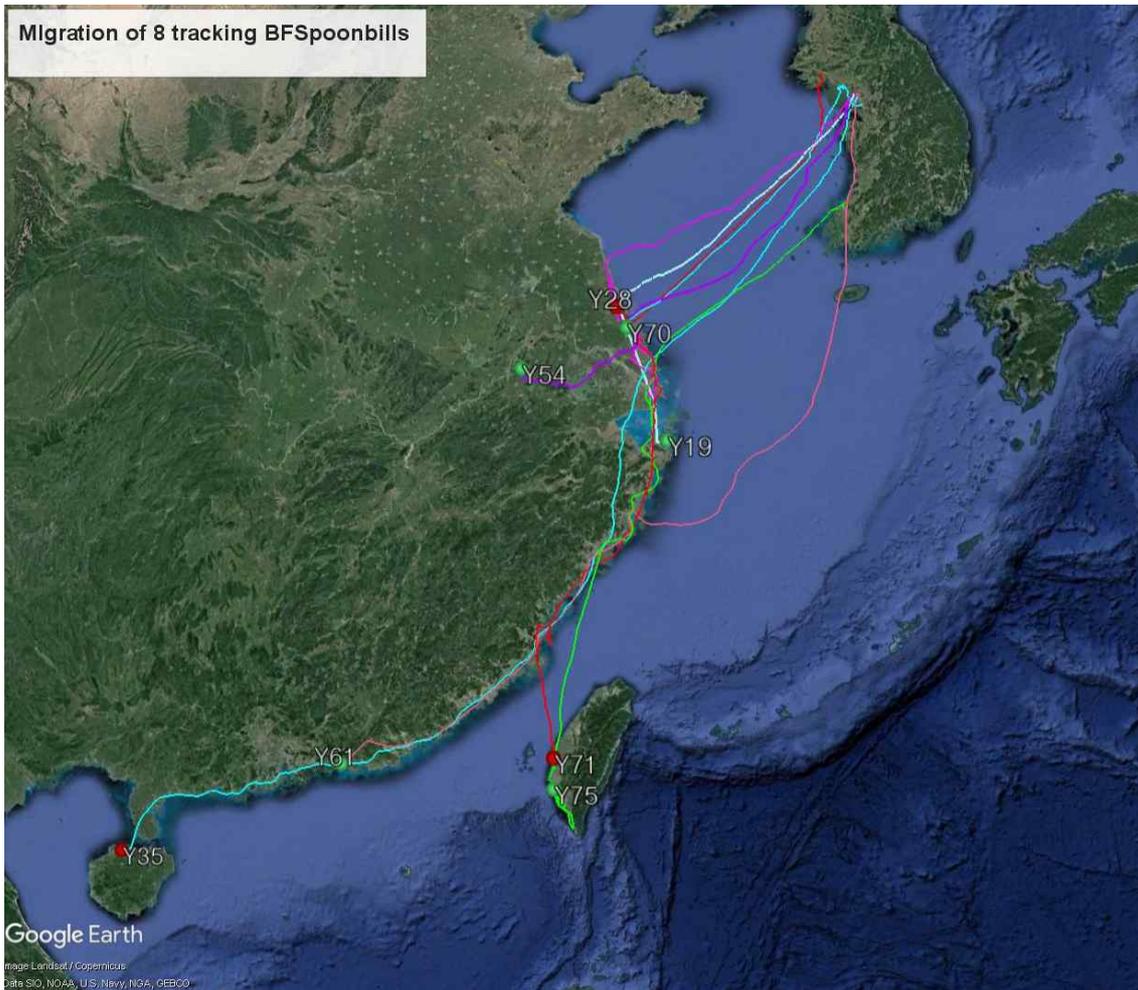


Figure IV-35. Migration routes of 8 tracked Black-faced Spoonbills without stopping on the west coast of Korea.

Threat Factors according to Migration Tendency

- In the fall of 2020, the migration tendency of Black-faced Spoonbills tended to stay at higher latitudes than in the past. 10 out of 16 individuals stayed above 30°N north latitude, exceeding 60% (Figure IV-36). The tendency of more spoonbills to stay at high altitudes is similar in the past three years and is believed to be related to climate change.
- Since major Black-faced Spoonbill wintering grounds are located below 30°N north latitude, this would mean that young birds (all birds attached with satellite tracking device are young birds) migrate slower than adult birds and tend not to travel far. Young birds are believed to have a higher mortality rate than their mothers due to

poor habitat conditions and winter cold (4 out of 10 individuals died in December).

- However, among the individuals who migrated farther to the wintering grounds, 3 died and the mortality rate was rather high at 50%. It is assumed that unlike the north, the southern wintering grounds also has many other unfavorable factors such as waterborne infectious diseases.
- Threat factors during the migration of Black-faced Spoonbills are likely to vary from predators, collisions, entanglement of fishing lines or nets, diseases caused by contamination in the water, other coastal development, lack of food, and climate factors.

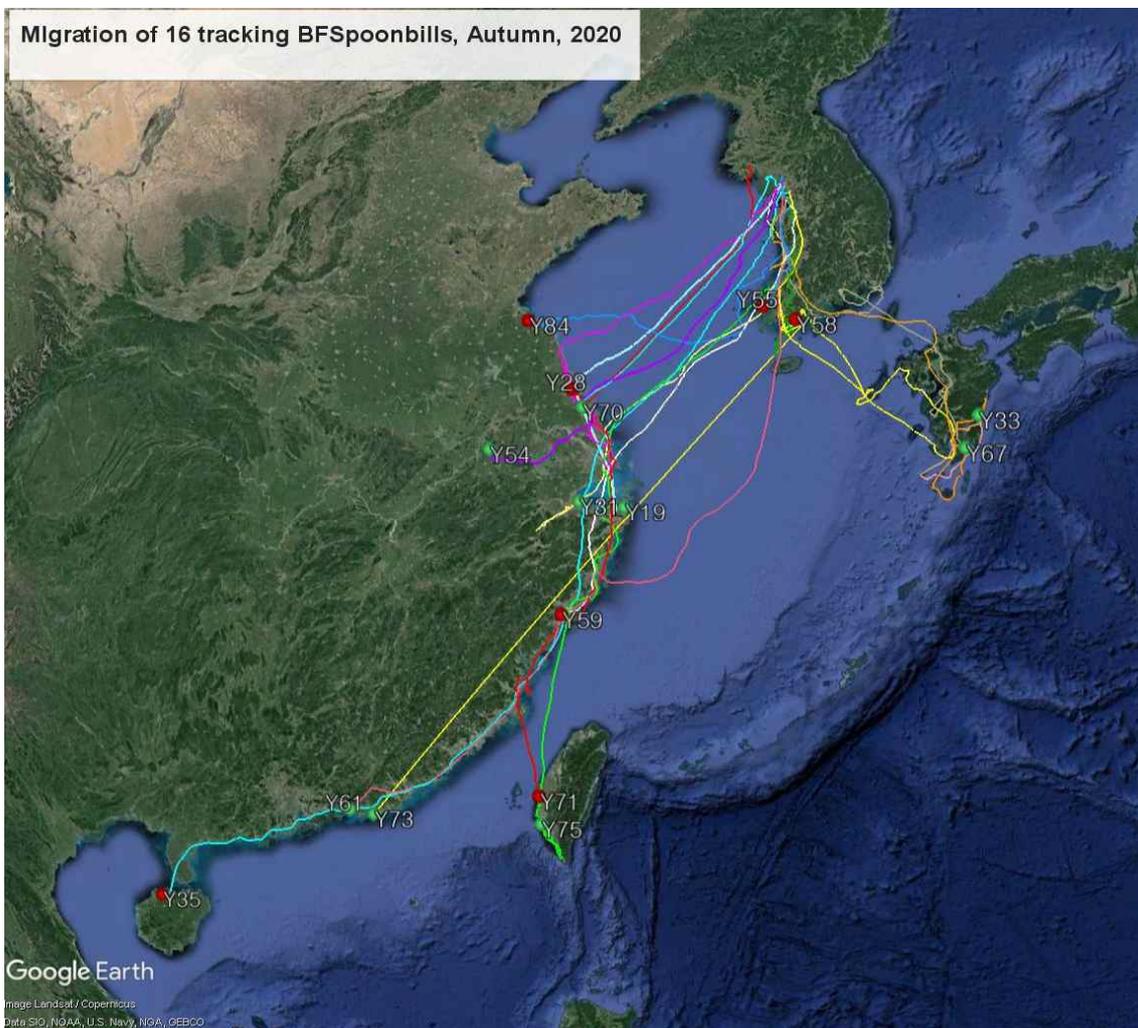


Figure IV-36. Migration routes of 16 Black-faced Spoonbills (line) and the wintering sites(circle).

| Influence of Wind Farm on Habitat

- As a result of satellite tracking of colored band Y75 individual, the tidal flat of Baeksu-eup near Chilsan-do was mainly used from July to August, but from September to October when the wind was strong, it showed a tendency to traveled to the tidal flat of Yeomsan-myeon to avoid wind turbines (Figure IV-37, IV-38). Wind power generation is considered to have a negative impact by limiting the use of rice paddies and rivers.

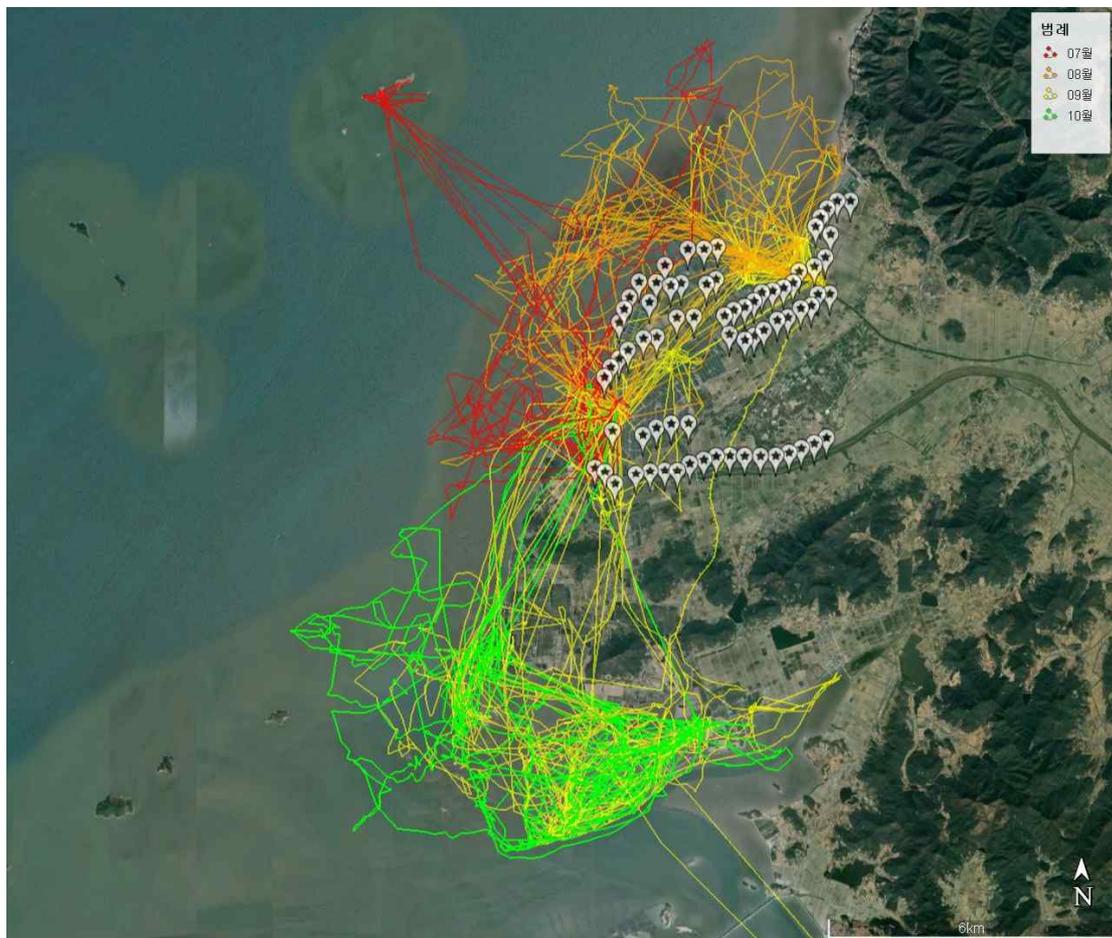


Figure IV-37. Monthly movements of color band Y75 (line), and the influence of wind power generators (star marker) on Yeonggwang.



Figure IV-38. Coastal wind farm in the habitat of Black-faced Spoonbills on Baesu-up, Yeonggwang.

| Influence of Disturbance Factors

- Fishing and other activities greatly disturbed the places where Black-faced Spoonbills often used as resting sites (Figure IV-39). Seondu-ri stonework in Ganghwa was important as a resting site for Black-faced Spoonbills during high tide, but was often disturbed by fishing. The habitat in Sorae and Siheung tidal channels were also greatly influenced by fishing in the fall season. Efforts such as restricting fishing and access to major resting sites were needed.



Figure IV-39. Disturbance by fishing on the stone embankment which is the roosting site of Black-faced Spoonbills at high tide.

4. Suggestions

A. Review of Protected Area Designation

- The number of surviving Black-faced Spoonbills is gradually increasing, but there is a possibility that it will decrease again in the future due to continuous habitat damage and development, thus continuous protection and habitat management are required. Black-faced Spoonbills disperse near the breeding grounds after breeding, but may migrate to more distant regions, which requires efforts in habitat conservation.
- Some Black-faced Spoonbill breeding grounds and habitats are designated and protected as natural monuments, specific islands, and wetland protected areas, but most of the major Black-faced Spoonbill manifested areas are excluded from the protected areas, thus it is necessary to prepare measures to protect these areas.

| Breeding Grounds of Black-faced Spoonbills

- Currently, Bi-do in Ganghwa-gun and Chilsan-do in Yeonggwang are designated as natural monuments and protected as the breeding grounds of Black-faced Spoonbills. Seoman-do and Guji-do are designated as specific islands and are prohibited entry from the public (Table IV-11).
- However, many breeding grounds such as the Mae-do, Namdong Reservoir, and Gaksiam are not legally protected. These breeding grounds are small rocky islands located on the coast, where many birds breed densely compared to their small areas, and even a slight disturbance can seriously affect the entire breeding. Therefore, it is necessary to designate these breeding grounds as protected areas first. Since most of the islands are located on the coast of Incheon, efforts are needed to designate protected areas by related agencies and organizations including the city of Incheon, which is the main body of the management.

| Habitats of Black-faced Spoonbills

- Among the major habitats of Black-faced Spoonbills, five regions, including

Ganghwa Seodo-myeon, Gyodong-do and some areas of the southernmost regions of Ganghwa, Han river estuary, and Nakdong river estuary, are designated as natural monuments. In addition, Song-do, Suncheon Bay, and Yubu-do are designated as wetland protection areas (Table IV-12).

- However, the regions of Yeongjong-do, Sihwa Lake and Daebu-do, and Yeonggwang tidal flats, where more than hundreds of Black-faced Spoonbills were observed in national monitoring and were identified as major habitats from satellite tracking studies, are not legally protected.
- The regions of Yeongjong-do, Sihwa Lake, and Daebu-do have been disturbed by the leisure activities of tourists and anglers, and Yeonggwang tidal flat is considered to be the largest habitat for Black-faced Spoonbills. These regions are also considered to be designated and managed as protected areas.

▮ Designating Network Sites

- Among the habitats for Black-faced Spoonbills, two regions of Song-do tidal flat and Suncheon Bay are designated as Ramsar sites, and together with these regions, a total of seven regions including Namyang Bay, Yubu-do tidal flat, and Han river estuary are designated as EAAFP network sites (Table IV-12).
- However, since it is not a designated site for the conservation of Black-faced Spoonbills, the regions where Black-faced Spoonbills mainly inhabit are excluded, and there are only a few number of Black-faced Spoonbills observed in other areas except Song-do tidal flat.
- Therefore, it is necessary to consider designating a network site centered on the major habitat of Black-faced Spoonbills. The southernmost region and the northeastern ends of Yeongjong-do, Sihwa Lake and Daebu-do region, Ganghwa-do southernmost tidal flats, Yeonggwang tidal flats and waste salt ponds were identified in this research as major habitats during the breeding season and after Black-faced Spoonbills left their nests. These regions are also the habitats of various waterbirds including snipes and plovers, it is considered suitable for the listing as the network sites.

- However, listing of new network sites and designation of protected areas may affect local development or cause public complaints related to the development. Therefore, sufficient discussions with local government officials should be preceded in advance to register as new network sites.

B. Using the Satellite Tracking Study Results

- Until now, the designation of protected areas has been mostly made using the results of bird monitoring. Such investigation methods have difficulty in tracking accurate habitat use and establishing appropriate protected areas in the case of wide tidal flats and wetlands that are difficult to observe visually.
- Through simultaneous national monitoring and satellite tracking study conducted in this research, it was possible to understand the distribution and population status of Black-faced Spoonbills, and to identify major habitat areas and habitat usage patterns.
- Therefore, it is necessary to appropriately utilize the results of the use of the Black-faced Spoonbill habitat identified in this research for the establishment of the basis in the designation of the protected area and the establishment of the protected areas.

Table IV-11. State of legal protection management for major breeding sites of Black-faced Spoonbills in 2020.

No.	Breeding site	National monument by CHA*	Specially designated island by MOE**	note
1	Yo-do			locating on DMZ
2	Bi-do	○	○	National Monument no. 419 (Ganghwa mud flat and breeding sites)
3	Gaksiam			
4	Sangyeo-bawi			
5	Suhaam			
6	Mae-do			
7	Namdong reservoir			
8	Guji-do		○	
9	Hwangseo-do			
10	Seomand-do		○	
11	Baekryung-do			
12	Okgwi-do			
13	Noruseom			
14	Ilsan-do***	○		National Monument no. 389 (Yeonggwang Chilsan-do)
15	Yisan-do***	○		
16	Samsan-do***	○		
17	Sasan-do***	○		
18	Yuksan-do***	○	○	
Sum		6 islands (2 sites)	4 islands	

*Culture and Heritage Administration, **Ministry of Environment, ***islands belonging to Chilsan-do

Table IV-12. State of management to major sites of Black-faced Spoonbills

No.	sites	National Monument	Wetlands Conservation Area	RAMSAR site	EAAFP network site
1	Kyodong-do, Ganghwa	○ ¹⁾			
2	Seodo-myeon, Ganghwa	○			
3	South mud flat, Ganghwa	○ ¹⁾			
4	Bukdo-myeon, Ongjin		○ ²⁾		
5	Han river estuary	○	○		○
6	Seo-gu, Incheon				
7	Yeongjong-do				
8	Song-do, Incheon		○	○	○
9	Hwaseong wetland				○
10	Shwa lake & Daebu-do				
11	Asan bay				
12	Cheonsu bay				○
13	Yubu-do, Seocheon		○		○
14	Saemangeum				
15	Gochang mud flat		○ ²⁾		
16	Yeonggwang mud flat				
17	Shinan mud flat		○ ²⁾		
18	Suncheon bay		○	○	○
19	Nakdong river estuary	○			○
20	Seongsanpo & Hadori, Jeju-do				
Sum		5 sites	7 sites	2 sites	7 sites

1) 강화 서측과 서도면, 교동도 남단 일부만 천연기념물 포함, 2) 일부 지역만 해양습지보호구역

C. Management and Improvement of Habitat Environment

- Namdong Reservoir is a place where the depth of water varies greatly depending on the situation for flood control. If the depth of the water is deep or too shallow, it is difficult for Black-faced Spoonbills to inhabit, thus appropriate management of water level for Black-faced Spoonbills was required.
- In the case of Songsan Reservoir in Yeongjong-do, it was necessary to manage facilities such as access control or block access because the road was adjacent and people could easily enter the tidal flat. Stone embankment of Seondu-ri, which is used as a resting ground for Black-faced Spoonbills in Ganghwa-do, also required human access control during high tide.

D. Expanding Study on Colored Bands and the Use of Habitats

- There is still a lack of research on the ecology of Black-faced Spoonbills. Over the past decade, more than 500 colored bands have been attached to conduct investigations, but it has been difficult to observe and record the colored bands because it is centered on a small number of researchers. Colored band can provide various information such as survival rate, lifespan, and habitat use of Black-faced Spoonbills. It can also contribute to the promotion of awareness by inducing interest and participation of citizens in Black-faced Spoonbills.
- It will be possible to induce interest of citizens in protecting Black-faced Spoonbills through the establishment of a sharing site for colored bands and satellite tracking information and through utilization of related information in the public education (Figure IV-40).



Figure IV-40. Example of field education for citizens about the ecology of Black-faced Spoonbills.

V. References

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| Web search

<https://bfsn.bfsa.org.tw/>

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VI. Appendix

1. Results of monthly Black-faced Spoonbills national monitoring.

Appendix 1. Results of National Monitoring for Black-faced spoonbills in August 2020.

Nb	Place	no. of individuals	Date	Researchers	Colored rings
1	Baekryeong-do, Ongjin	1	Aug. 22	JW Park	
2	Yeonpyeong-do, Ongjin	0	Aug. 23	JY. Shin	
3	Gyodong-do, Ganghwa	116	Aug. 20	I.K Kwon, SY. Yoo	
4	Seodo-myeon, Ganghwa	66	Aug. 21	SK Yeo	
5	Seokmo-do, Ganghwa	39	Aug. 21	SR Choi	S69
6	Ganghwa-do, Incheon	403	Aug. 21	Y.H Jung, T.H Seol, I.K Kwon, J.S Tak	S06, S46, S95, V03, V04, V39, Y19, Y20, Y23, Y29, Y30, Y31, Y34, Y56
7	Seo-gu, Incheon	9	Aug. 21	SY. Yoo, I.K Kwon	
8	Han river estuary	1	Aug. 21	KQ Cho, JY. Shin	
9	Yeongjong-do, Incheon	499	Aug. 21	JK Kim, SS Hong	V75, T88, Y37, H77, K79, H71
10	Bukdo-myeon, Ongjin	177	Aug. 21	KS Lee, KQ Cho	
11	Aam-do, Yeosu-gu	10	Aug. 22	HJ. Lee, MY. Kim	
12	Namdong reservoir	227	Aug. 22	S.J. Nam, HM Kim	Y94, Y97, H01, E92, Y64, Y90, A42
13	Gojan tidal flat	34	Aug. 22	S.J. Nam, HJ. Shim	Y93
14	Sorae Wetland	35	Aug. 22	EH Song, HJ. Cho	Y70, Y69, Y72
15	Hwangsae-bawi	35	Aug. 22	HB Hb	
16	Sihwa Lake	99	Aug. 22	Kyesuk Lee, Jason Lee	H64, V50, E37, X97, Y71, Y47, Y60
17	Daebu-do	95	Aug. 23	JH Park	Y67, V86
18	Hwaseong wetland	221	Aug. 22	KS Lee, Vivian Fu, MY. Choi	X99, S16, S88, T84, V00, Y58
19	Asan Bay	27	Aug. 23	IS. Ji, MW Han	
20	Cheonsu Bay-Boryeong	0	Aug. 22	KS Park	
21	Seocheon, Yubu-do	249	Aug. 21	ES Kim, Y.S. Lee, YG Joo	H02, Y83, Y84
22	Saemangeum area	101	Aug. 21-23	DP. Oh and others	A43
23	Gomso Bay	35	Aug. 22	YG Joo	Y80
24	Yeonggwang tidal flat	736	Aug. 22	I.H Cha, SH Lee	E76, Y81, H89, T56, S84, S81, E76, V17, S17, E72, S85
25	Muan-Sinan tidal flat	2	Aug. 23	Eco Horizon Inst.	
26	Sunchon Bay	16	Aug. 23	I.C. Kim and others	
27	Nakdong river estuary	6	Aug. 23	JR Park and others	
Total		3,239		40	63

Appendix 2. Results of National Monitoring for Black-faced spoonbills in September 2020.

No.	Place	no. of individuals	Date	Researchers	Colored rings and comments
1	Baekryeong-do, Ongjin				no survey
2	Yeonpyeong-do, Ongjin	0	Sep. 16	J.Y. Shin	
3	Gyodong-do, Ganghwa	75	Sep. 18	I.K. Kwon, S.Y. Yoo	T75
4	Seodo-myeon, Ganghwa	164	Sep. 20	SK Yeo	
5	Seokmo-do, Ganghwa	25	Sep. 19	SR Choi	
6	Southwest of Ganghwa-do	76	Sep. 19	Y.H. Jung, T.H. Seol	
7	South of Ganghwa-do	104	Sep. 19	I.K. Kwon, J.S. Tak	E27, E80, S55, V05, V39, Y20, Y36, Y54, Y28
8	Seo-gu, Incheon	6	Sep. 19	S.Y. Yoo, I.K. Kwon	
9	Han river estuary	5	Sep. 18	K.O. Cho, J.Y. Shin	
10	Yeongjong-do, Incheon	671	Sep. 19	J.K. Kim, S.S. Hong	K01, S04, V30, Y02, H70, S95, H90, S39, S97, S58, H66, E96
11	Bukdo-myeon, Ongjin	72	Sep. 19	WC Kim	
12	Aam-do, Yeosu-gu	19	Sep. 20	H.J. Lee, M.Y. Kim	
13	Namdong reservoir	138	Sep. 20	H.M. Kim, N.Q. Ehn, J.H. Kim	Y73
14	Gojan tidal flat	50	Sep. 20	S.J. Jam, S.Y. Kim, S.B. Lee	
15	Hwangsae-bawi, Sorae Wetland	37	Sep. 20	E.H. Song, H.J. Cho	Y95
16	zone 11, Song-do	3	Sep. 20	H.B. Hb, H.J. Shim	
17	Sihwa Lake	98	Sep. 18	Kyesuk Lee, Jason Lee	S50, Y59, E37, X97
18	Daebu-do	113	Sep. 20	J.H. Park	
19	Hwaseong wetland	277	Sep. 18	KS Lee and others	V00, A42, S66, S16, T84, X99
20	Asan Bay	216	Sep. 20	I.S. Ji, S.S. Kim	
21	Cheonsu Bay-Boryeong	8	Sep. 18	KS Park	
22	Seocheon, Yubu-do	190	Sep. 20	Y.S. Lee, Y.G. Joo, KS Lee, J.K. Kim, J.M. Jeong et al.	H02, Y83, Y84 Yubu-do (168), Seocheon (22)
23	Saemangeum	135	Sep. 19-20	DP. Oh and others	
24	Gomsu Bay	64	Sep. 19	Y.G. Joo	
25	Yeonggwang tidal flat	688	Sep. 19-20	SH Lee, I.H. Cha, J.H. Park	H73, S14, T56, S86
26	Muan-Sinan tidal flat	7	Sep. 18-20	J.K. Hwang, Eco Horizon Inst.	
27	Sunchen Bay	19	Sep. 19	I.C. Kim and others	
28	Gwangyang bay	54	Sep. 20	H.G. Han	
29	Nakdong river estuary	1	Sep. 20	J.R. Park and others	
30	Jeju-do	0	Sep. 20	CW Kang, N.J. Ji	
31	Others (Tae-an)	12	Sep. 20	Y.S. Park, SM Kim, HH Kim	
Total		3,327		40+	32

Appendix 3. Results of National Monitoring for Black-faced spoonbills in October 2020.

Nb.	Place	no of individuals	Date	Researchers	Colored rings
1	Gyodong-do, Ganghwa	53	Oct. 16	SY. Yoo	
2	Seodo-myeon, Ganghwa	96	Oct. 17	SK Yeo	
3	Seokmo-do, Ganghwa	40	Oct. 16	SR Choi	
4	South part of Ganghwa-do	163	Oct. 17	SY. Yoo, YH Jung, J.S Tak	
5	Seogu, Incheon	0	Oct. 17	SY. Yoo,	
6	Han river estuary	30	Oct. 18	KO. Cho	
7	Yeongjong-do, Incheon	437	Oct. 17	JK Kim, SS Hong, KO Cho	H90, HB6, K91, V25, K00, Y30, Y22, HB8, Y57, RGR, WRW, GRQ, WY
8	Bukdo-myeon, Ongjin-gun	73	Oct. 17	IK Kwon	H54
9	Zone 11, Song-do	2	Oct. 17	S.J. Nam, H.J. Shim, HB Ch	H01
10	Namdong reservoir	4	Oct. 17	S.J. Nam, H.J. Shim, HB Ch	E90
11	Gojan tidal flat	65	Oct. 17	S.J. Nam, H.J. Shim, HB Ch, GB Lee	
12	Sorae Wetland	0	Oct. 17	EH Song, H.J. Cho	
13	Hwangsae-bawi Rock, Songdo (11zone)	9	Oct. 17	S.J. Nam, H.J. Shim, HB Ch, EH Song	
14	Sihwa Lake	52	Oct. 16	Kyesuk Lee, Jason Lee	GW
15	Daebu-do	100	Oct. 16	JH Park	Y48, Y51
16	Hwaseong wetland	214	Oct. 15	KS Lee and others	Y07, E33, Y48-불확실, Y58
17	Asan Bay	54	Oct. 18	IS Ji, SS Kim	V85, Y95
18	Cheonsu Bay-Boryeong	4	Oct. 16	IS Kim	
19	Seocheon, Yubu-do	140	Oct. 16	ES Kim, Y.S. Lee	
20	Saemangeum area	72	Oct. 17	DP. Ch and others	GW
21	Gomso Bay	41	Oct. 17	YG Joo	
22	Yeonggwang tidal flat	545	Oct. 19	YG Joo, IH Cha	H87, H73, S18, S86
23	Muan-Sinan tidal flat	9	Oct. 17	JK Hwang, S.J. Lee, Eco Horizon Inst.	
24	Sunchen Bay	15	Oct. 18	IC Kim and others	
25	Nakdong river estuary	5	Oct. 17	JR Park and others	
26	Jeju-do	12	Oct. 18	CW Kang, NJ Ji	
total		2,235		50	24

Appendix 4. Results of National Monitoring for Black-faced spoonbills in November and December 2020 (included in Winter Waterbird Census of Korea, National Institute of Biological Resources).

No.	Place	November counts	December counts	Researchers	Colored rings
1	Gyodong-do, Ganghwa	5		KS Lee, KO Jo	
2	Seodo-myeon, Ganghwa				
3	Seokmo-do, Ganghwa				
4	South part of Ganghwa-do	20		KS Lee, Jason Lee, SY. Yoo	
5	Seogu, Incheon				
6	Han river estuary	7	1	KS Lee, KO Cho National Winter survey(NBR)	
7	Yeongjong-do, Incheon	11		SS Hng	Y22 (Nov.)
8	Bukdo-myeon, Ongjin-gun				
9	Aam-do, Zone 11, Songdo				
10	Namdong reservoir	7		KS Lee	
11	Gojan tidal flat				
12	Sorae tidal flat				
13	Hwangsaeabawi Rock, Zone 10				
14	Sihwa Lake		1	National Winter survey(NBR)	
15	Daebu-do		2	National Winter survey(NBR)	
16	Hwaseong Tidal Flat				
17	Asan Bay				
18	Cheonsu Bay-Boryeong				
19	Seocheon, Yubu-do	3	3	KS Lee (Nov.) National Winter survey(NBR)	
20	Saemangeum area	3		D.P. Oh, National Winter survey(NBR)	
21	Gomso Bay				
22	Yeonggwang tidal flat	7	4	Y.G. Joo (Nov.) National Winter survey(NBR)	Y78 (Nov.)
23	Muan-Sinan tidal flat		32	National Winter survey(NBR)	
24	Sunchen - Gwangyang Bay	1	2	HG Han, I.H Cha National Winter survey(NBR)	Y58 (Nov.)
25	Nakdong river estuary	1	1	National Winter survey(NBR)	
26	Jeju-do	34	37	National Winter survey(NBR)	
Total		99	83		3

2. Photos on surveyed area



Feeding area in Song-do (Gojan tidal flat)



Feeding area in Song-do



Resting site in Namdong reservoir



Resting site in geumran-do, Han river



Resting site in Yeonggwang



Feeding area in Yeonggwang tidal flat



Resting site in Hasa-ri, Yeonggwang



Black-faced spoonbills in Nakdong river estuary



Resting site in Yeongjong-do



resting in abandoned salt field



Gaksiam: breeding site and resting site



resting on stonework in Seondu-ri, Ganghwa



The fisherman interfering with the resting



resting in abandoned salt field in Seosin-myeon, Hwaseong



feeding area in Gongneung River Estuary



Resting site at High tide in Han River Estuary



Black-faced Spoonbills at wetland
in Daebu-do



Resting site at High tide in Jangbong-do



Tidal flat Feeding area in Jangbong-do



Feeding area in Yubu-do, Seocheon



Roosting site at High tide in Yubu-do, Seocheon

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