# The avifauna at Chunsoo bay (Seosan A and B area)

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Seosan A, B area is located on 36° 42' of north parallel and 126° 27' of east longitude. It consisted of broad artificial lakes and reclaimed agricultural lands; there is Ganwalho lake in A area and Bunamho lake in B area.

Total birds surveyed four times in 2001 at the A area are 105,580 of 11 orders, 28 families, 89 species. Among them, resident species were 21 species including *Pica pica*. Twenty species including *Cuculus canorus* were summer migrants, and 30 species including *Platalea leucorodia* were winter migrants. Seventeen species including *Limosa limosa* were occasionally species. And *Rostratula benghalensis* was an unconfirmed species. Species diversity index (H') was 0.72; species equally common index (e<sup>H</sup>) was 2.06. In January, maximum observed 102,121 individuals. However in July 52 species were observed most variously.

There were total 81,152 birds observed with 11 orders, 22 families, and 71 species at the B area. Fifteen species including *Falco tinnumculus* were resident species. Summer migrants were 18 species including *Ixobrychus sinensis*. Winter migrants were 25 species including *Ciconia boyciana*. Thirteen species including *Tringa glareola* were occasionally species. Species diversity index (H') was 0.281; species equally common index (e<sup>H</sup>) was 1.325. In January, maximum observed 78,433 individuals. However in July 42 species were observed most variously.

Key words: Avifauna, Chunsoo bay, Migratory bird, Species diversity, Population dynamic, Endemic species

### 1. Introduction

Chunsoo bay, Seosan A and B area, is adequate to bird's living, because of it's diverse environment. In 1984, completion of dike construction made about 5,000 ha artificial lake, damp ground, and farm land at Chunsoo bay. Many sandpipers, plovers and gulls used the vast tideland a stopover or over wintering site before construct of farm land at Seosan A and B area. The over wintering birds such as ducks and geese increase their population after the completion of dike construction.

While other over wintering areas were polluted and destructed during industrialization<sup>1)</sup>. However

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Phone: +82-41-850-8501 E-mail: srcho@kongju.ac.kr formed in Seosan A and B area by reclamation. It is warmer and milder than inland climate. It located on the beach, the route of birds migration. Therefore it could provide condition for relax and foods. Salt concentration of artificial lake was decreased and diverse fresh water fishes and water plant were increased. Also environments, reeds and grassland, provided good hiding places. Therefore about 90 species, including internationally endangered and threatened species such as White storks, Baikal teal, Black-faced spoonbill, Spoonbill, and Hooded crane were observed. Especially in winter, many ducks and wild geese, reproduced at north and preys flew in for over winter.

wide artificial lakes, moors and farm lands were

However there are many obstacles to over wintering birds. Many moors converted to farm lands after reclamation. Farmers have tried to

escape from damage by birds. There are obstacles such as farming during winter, pollution, fishing at fresh water lake, illegal hunting and change of farming by farm land sale to public.

Therefore over wintering site for White stork, Black-faced spoonbill, Spoonbill, and Baikal teal, internationally endangered species, should be protected and it's ecosystem have to be maintained for conservation of global biodiversity. Also development plan, for resources of tourism as people's relax using scenery of a gift of nature, have to be established as soon as possible.

# 2. Study area and methods

Seosan A and B area is located on 36° 42' north latitude, 126° 27' east longitude. There are wide artificial lakes and reclaimed farm lands including A area centered by Kanwol lake, B area centered by Bunam lake (Fig. 1). It is the greatest bird's over wintering site after accomplishment of dike<sup>2)</sup>. Fresh water fishes such as Misgurnus anguillicaudatush, Carassius auratus and Cyprinus carpio, and salt water fish Periophthalmus cantonensis were observed at these lakes, where the salt concentration was decreased after construction of dike<sup>2)</sup>. Main florae are Oryza sativa, Phragamites communis, Typha orientalis, Hydrilla verticillata and Najas graminea<sup>3)</sup>. Florae of reclaimed land are closely related to bird's food, breeding place, and resting place<sup>4)</sup>. Water depth of lakes or streams and salt concentration are also related to bird's feeding and breeding<sup>5)</sup>. Average temperature of the investigated area is higher than inland of same latitude

because of influence of oceanic climate. According to local weather reports of Seosan area in 2000, average temperature was 9.9°C and total rainfall was 1,435 mm (Fig. 2). There were abundant remained grains on a vast farmland after harvest, it could be food for water birds such as Baikai teal, over wintering in a great flock<sup>6</sup>). While there have been abundant fishes in lakes and streams, it was a good condition to grebes and egrets inhabitation<sup>7-9)</sup>. There were sand islands on A area fresh water lake in a dry season, A Little terns (Sterna albifrons), Snowy plover (Charadrius alexandrinus), and Oyster catcher (Haematopus ostralegus) used as breeding places. A Water cock (Gallicrex cinerea), Black-winged stilt (Himantopus himantopus), and Painted snipe (Rostratula benghalensis) reproduced on rice paddy<sup>10)</sup>. A Crested lark (Galerida cristata) reproduced at rocky-hill located on west of Ganwol lake. Skylark (Alauda arvensis) and Spot-billed duck (Anas poecilorhyncha) reproduced at broad grassland and around of meadow in B area. A Snowy plover, Little terns, and Skylark reproduced at sandbank near Buseok pavilion. Up streams and branch of Bunam and Ganwol lake were relatively shallow and abundant in food, various migration birds stopped over during migration. Chinese littlebittern (Ixobrychus sinensis), Moorhen (Gallinula chloropus), Oriental great reed warbler (Acrocephalus arundinaceus), and Vinous-throated parrotbill (Paradoxornis webbiana) reproduced at river or lake bank, where reed were overgrown. We analyzed species diversity by MacArthur and MacArthur methods<sup>11)</sup> and equally common species by Shannon and Weaver methods<sup>11</sup>.

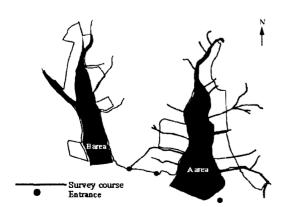


Fig. 1. A map of Seosan A&B reclaimed area.

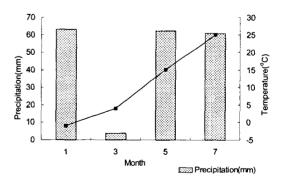


Fig. 2. Climatic data of Seosan A&B reclaimed area, based on Seosan, meteorological station (2000).

## 3. Results and Discussion

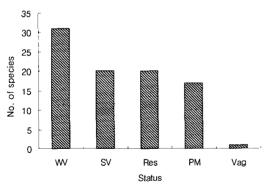
#### 3.1 Birds of A area (Ganwol lake)

According to four investigation at A area in 2001, 105,580 individual birds in 89 species, 28 families, 11 orders were observed (Table 1, 3). Twenty-one resident birds including Pica pica, 20 summer visitors including Cuculus canorus, 30 winter visitors including Platalea leucorodia, 17 passage migrants including Limosa limosa, and a vagrant, Rostratula benghalensis were observed (Fig. 3). Species diversity (H') was 0.72, and equally common species (e<sup>H</sup>) was 2.06, which was relatively high. During the investigation period, the maximum 102,121 birds were observed in January, and the most variably 52 species were observed in July (Table 1). The reason of maximum individual observance in January was over wintering of ducks in flock. The reason of most variable species observance in July may be that this area have had complex environments and provided reproduction places to variable bird species.

Table 1. Total numbers and species of birds at Seosan A area (2001)

		Dat	e				
	30 Jan	26 Mar	28 May	30 Jul	Total	Η̈́	e <sup>H</sup>
Species (No.)	41 (102,121)	30 (511)	28 (815)	52 (2,133)	89 (105,580)	0.723	2.060

<sup>\*</sup>Species Diversity (H) = -  $\sum_{i} P_{i} \log P_{i}$  ( $P_{i} = n_{i}/N$ )
\*Equally common species =  $e^{(-\sum_{i} P_{i} \log P_{i})}$ 



\*WV (Winter visitor), SV (Summer visitor), Res (Resident), PM (Passage Migrant), Vag (Vagrant)

Fig. 3. Ecological type of birds at Seosan A area(2001).

### 3.2 Birds of A area (Bunam lake)

At Seosan B area in 2001, 81,152 individual birds, 71 species, 22 families, 11 orders were observed (table2, 3). Fifteen residents including Falco tinnumculus, 18 summer visitors including Ixobrychus sinensis, 25 winter visitors including Ciconia boyciana, and 13 passage migrants including Tringa glareola were observed (Fig. 4). Species diversity (H') was 0.281 and equally common species (e<sup>H</sup>) was 1.325, which was higher than that of A area. The maximum 78,433 birds were observed in January and most variably 42 species were observed in July. These were due to same reasons considered in A area. However there were less individual birds and species observed compare to those of A area.

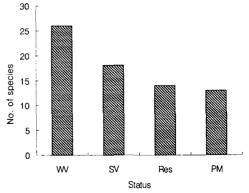
#### 3.3 Birds can be reproduced

A area is mostly consisted of farm land centered by Ganwol lake and B area is consisted of meadow and farm land centered by Bunam lake. A area, Ganwol lake, has branch streams

Table 2. Total numbers and species of birds at Seosan B area (2001)

	······································	Da	ite		_		
_	30 Jan	26 Mar	28 May	30 Jul	Total	Η̈́	e <sup>H</sup>
Species (No.)	33 (78,433)	25 (431)	21 (190)	42 (2,098)	71 (81,152)	0.281	1.325

<sup>\*</sup> Species Diversity (H) = -  $\sum_{i} P_{i} \log P_{i}$  ( $P_{i} = n_{i}/N$ ) \* Equally common species =  $e^{(-\sum_{i} P_{i} \log P_{i})}$ 



\* WV (Winter visitor), SV (Summer visitor), Res (Resident), PM (Passage Migrant)

Fig. 4. Ecological type of birds at Seosan B area (2001).

Table 3. The avifauna of Seosan A area (Jan~Jul, 2001)

Scientific name A В Total Remark Podicipedidae Podiceps ruficollis 25 99 124 Res Podiceps nigricollis 3 16 19 PM 13 51 WV Podiceps cristatus 64 Ardeidae 5 4 Ixobrychus sinensis 9 SV Nycticorax nycticorax 191 102 293 SV Butorides stariatus 3 2 5 SV Bubulcus ibis 126 164 290 SV Egretta alba modesta 227 172 399 SVEgretta intermedia 22 5 27 SVEgretta garzetta 113 103 216 SV Ardea cinerea 196 223 419 SV Ciconiidae 1 Cionia boyciana 1 WV Threskiornithidae Platalea leucorodia 31 31 WV Platalea minor 3 3 PM Anatidae 1,308 WV Anser albifrons 4,317 5,625 Anser fabalis 8,733 5,117 13,850 WV Anser caerulescens 1 WV Tadorna ferruginea 326 242 568 wv 462 8 470 WV Tadorna tadorna 12,036 55,098 wv 43,062 Anas platyrhynchos Anas poecilorhyncha 15,467 16,388 31,855 WV 1,755 369 2,124 WV Anas crecca 28,000 43,000 71,000 WV Anas formosa 49 49 WV Anas strepera Anas penelope 35 35 WV Anas falcata 4 4 WV 12 23 Anas acuta 11 WV 10 Anas clypeata 36 46 WV 46 14 WV Aythya ferina 60 Aythya fuligula 5 WV 5 Mergus albellus 3 14 17 WV 49 Mergus merganser 22 71 WV Accipitridae Accipiter soloensis 1 1 SVButeo buteo 3 4 WV Circus cyaneus 2 3 WVFalconodae Falco peregrinus 2 3 5 Res 5 Falco tinnunculus 5 10 Res Phasianidae Coturnix coturnix 3 2 5 WV

Phasianus colchicus

Res

10

Table 3. Continued

Scientific name	A	В	Total	Remark
Gruidae				
Grus monacha	7	36	43	WV
Rallidae				
Gallinula chloropus	8	10	18	SV
Fulica atra	1	23	24	Res
Rostratulidae				
Rostratula benghalensis	2		2	Vag
Haematopodidae				
Haematopus ostralegus	2		2	WV
Charadriidae				
Charadrius alexandrinus	23	48	71	SV
Pluvialis squatarola	1	3	4	PM
Vanellus vanellus	2	1	3	WV
Scolopacidae				
Calidris ruficollis	181	77	258	PM
Calidris subminuta	5		5	PM
Calidris alpina	65	41	106	PM
Tringa erythropus	44	9	53	PM
Tringa stagnatillis	6	3	9	PM
Tringa nebularia	7		7	PM
Tringa ochropus	8		8	PM
Tringa glareola	218	127	345	PM
Tringa hypoleucos	18	20	38	PM
Xenus cinereus	7	4	11	PM
Limosa limosa	506	142	648	PM
Numenius phaeopus		1	1	PM
Gallinago gallinago	3		3	PM
Recurvirostridae				
Himantopus himantopus	34	5	39	PM
Laridae				
Larus ridibundus	256	142	398	WV
Larus argentatus	74	40	114	WV
Larus crassirostris	215	89	304	Res
Sterna albifrons	14		14	SV
Columbidae				
Streptopelia orientalis	69	68	137	Res
Cuculidae				
Cuculus canorus	1	2	3	SV
Alcedinidae				
Halcyon pileata	1		1	sv
Alcedo atthis	7		7	SV
Alaudidae				
Alauda arvensis	8	141	149	Res
Hirundinidae				
Riparia riparia		4	4	SV
Hirundo rustica	37	175	212	SV

Table 3. Continued

Scientific name	A	В	Total	Remark
Motacillidae				
Motacilla flava	1	1	2	PM
Motacilla cinerea		2	2	SV
Motacilla alba leucopsis	1	1	2	SV
Motacilla alba lugens	4	2	6	WV
Anthus hodgsoni	1		1	PM
Anthus spinoletta	3		3	PM
Pycnonotidae				
Hypsipetes amaurotis	1	1	2	Res
Laniidae				
Lanius bucephalus	2		2	Res
Muscicapidae				
Phoenicurus auroreus	1	3	4	Res
Saxicola torquata	4		4	SV
Paradoxonis webbiana	78	43	121	Res
Acrocephalus arundinaceu	s 46	32	78	SV
Cisticola juncidis		14	19	SV
Paridae				
Parus major	3		3	Res
Emberizidae				
Emberiza elegans	7	1	8	Res
Emberiza pallasi	1		1	WV
Emberiza schoeniclus	2	2	4	WV
Ploceidae				
Passer montanus	256	237	493	Res
Corvidae				
Garrulus glandarius			3	Res
Pica pica	36	38	74	Res
Corvus frugilegus	11		11	PM
Corvus corone	1		1	Res
No. of Species	89	71		
No. of Individual	05,580	81,152	186,732	

<sup>\*</sup> Note SV: Summer visitor, WV: Winter visitor, Res: Resident, PM: Passage migrant

such as Hemi, Gobuk and Waryong stream etc., and there are thickly grown reeds on the bank of each streams. Oriental great reed warbler (Acrocephalus arundinaceus), Vinous-throated parrotbill (Paradoxonis webbiana), Moorhen (Gallinula chloropus), and Chinese little-bittern (Ixobrychus sinensis) etc., were reproduced at these reeds. Black-winged stilt reproduced every year at the rice paddy near upstream of Hemi stream in A area. Crested lark (Galerida

cristata), and fan-tailed warbler etc., reproduced at the quarry south-west of A area. There is wide sandy beach near Buseok pavilion in B area.

Snowy plover (Charadrius alexandrinus), Little tern (Sterna albifrons), Skylark (Alauda arvensis), and Fan-tailed warbler (Cisticola juncidis) etc., reproduced at there. Sandy islands were appeared upstream of lake in dry season of spring. Snowy plover (Charadrius alexandrinus), Little tern (Sterna albifrons), and Black-winged stilt (Himantopus himantopus) etc., reproduced at there. Black-crowned night heron, striated heron, Little egret (Egretta garzetta), Intermediate egret (Egretta intermedia), Great egret (Egretta alba modesta), and Grey heron (Ardea cinerea) etc., reproduced at O-nam dong and Galmari near reclaim land. Black-faced spoonbill (Platalea minor), Spoonbill (Egretta europhotes), and Oyster catcher (Haematopus ostralegus) etc., also reproduced at uninhabited island at sea. Among birds observed in A and B areas in 2001, 28 species reproduced and 9 species can reproduce. Eighteen species reproduced near A and B areas (Table 4).

# 3.4 Important species observed in Seosan A and B area and their distribution

Seosan A and B area are reclaim farm lands by construction of dike, therefore it's environment has changed rapidly since 1984. Once beaches converted to farm lands and salt water converted to fresh water. Therefore variable organism, which adapted to this environment, inhabited. And variable birds, which use these organism as food, flocked. Also it is good condition to reproduce, variable birds flocked to reproduce. As variable birds flocked, important or rare species frequently observed. The Natural monuments observed in Seosan A and B area presented on Table 5.

Seven species recorded on Red data book, ICBP<sup>13)</sup>, such a White stork, Baikal teal, Steller's sea eagle, Hooded crane, White- naped crane, Spotted Greenshank (*Tringa guttifer*) and Saunder's gull (*Larus saundersi*) were observed

Saunder's gull (Larus saundersi) were observed (Table 6). Thirteen species recorded on Red data book, ICBP (1988) such as Chinese egret, White stork, Black-faced spoonbill, Mandarin duck, Baikal teal, White-tailed sea eagle,

Table 4. The checklist of breeding birds at Seosan AB area (2001)

		Division				Division	
Scientific name	Breeding at survey area		Breeding near survey area	Scientific name	Breeding at survey area		Breeding near survey area
Podicipedidae				Strigidae			
Podiceps ruficollis	•			Otus scops			•
Ardeidae				Ninox scutulata		•	
Ixobrychus sinensis	•			Caprimulgidae			
Ixobrychus eurhythmus	•			Caprimulgus indicus	•		
Ixobrychuscinnamomeus		•		Alcedinidae			
Nycticorax nycticorax			•	Halcyon pileata			•
Butorides stariatus			•	Alcedo atthis			•
Bubulcus ibis			•	Upupidae			_
Egretta alba modesta			•	Upupa epops			•
Egretta intermedia			•	Picidae			_
Egretta garzetta			ě	Dendrocopos kizuki			
Egretta europhotes			•	Alaudidae			
Ardea cinerea			•	Galerida cristata			
Anatidae				Alauda arvensis			
Anas poecilorhyncha				Hirundinidae			
Accipitridae	•			Hirundo rustica			
Accipiter soloensis				Motacillidae			
Falco tinnunculus				1.5			
Phasianidae				Motacilla alba leucopsis  Muscicapidae			
Coturnix coturnix	_			Phoenicurus auroreus			
Phasianus colchicus				1			
Rallidae	•			Saxicola torquata Monticola solitarius			
Porzana fusca				Paradoxonis webbiana			
Gallinula chloropus Fulica atra				Acrocephalus bistrigiceps			
Gallicrex cinerea				Acrocephalus arundinaceus			
Rostratulidae	•			Cisticola juncidis			
				Aegithalidae			
Rostratula benghalensis Charadriidae	•			Aegithalos caudatus			•
Charadrius dubius				Paridae			
Charadrius alexandrinus				Parus palustris			
	· •			Parus ater			
Charadrius placidus	•			Parus varius			
Charadrius mongolus				Parus major			•
Calidris ruficollis		•		Emberizidae			_
Tringa hypoleucos	•			Emberiza cioides			•
Gallinago gallinago		•		Emberiza elegans			•
Recurvirostridae	_			Fringillidae			
Himantopus himantopus	•			Carduelis sinica			•
Glareolidae		_		Ploceidae	_		
Glareola pratincola		•		Passer montanus	•		
Laridae	_			Sturidae			_
Sterna albifrons	•			Sturnus cineraceus			•
Columbidae			_	Oriolidae			_
Streptopelia orientalis			•	Oriolus chinensis			•
Cuculidae	_			Corvidae			
Cuculus canorus				Pica pica			

Table 5. A List of Avian Natural Monuments, Korea

Scientific name	Number	Designated Date
Ciconia boyciana	199	1968, 5. 30
Cygnus columbianus, C. cygnus, C. olor	201	1968, 5. 30
Grus vipio	203	1968, 5. 30
Platalea minor, P. leucorodia	205	1968, 5. 30
Grus monacha	228	1970. 10. 30
Haliaeetus pelagicus, H. albicilla	243	1973. 4. 12
Accipiter gentilis, A. soloensis Circus cyaneus, Falco tinnunculus, F. peregrinus	323	1982. 11. 4
Branta bernicla Anser cygnoides	325	1982. 11. 4
Haematopus ostralegus	326	1982. 11. 4
Aix galericulata	327	1982. 11. 4
Egretta europhotes	361	1988. 8. 23
N0. of Species	_	20

Table 6. A Bird's List of Red data book, ICBP, in Korea

Scientific name	Remark				
Ciconia boyciana	No. of Natural Monument, 199				
Grus vipio	No. of Natural Monument, 203				
Grus monacha	No. of Natural Monument, 228				
Haliaeetus pelagicus	No. of Natural Monument, 243				
Anas formosa					
Tringa guttifer					
Larus saundersi					
No. of Species	7				

Steller's sea eagle, Imperial eagle, Peregrine falcon, Hooded crane, White-naped crane, Greenshank, and Saunder's gull were observed (Table 7). It was also affirmed that crested lark, an endemic species in Korea reproduced in A area (Table 8). It was firstly reported that blackwinged stilt, a vagrant, reproduced in Korea<sup>10)</sup>.

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Table 7. A Rare species of birds, ICBP, in Korea

Scientific name	Remark				
Aix galericulata	No. of Natural Monument, 327				
Ciconia boyciana	No. of Natural Monument, 199				
Grus vipio	No. of Natural Monument, 203				
Grus monacha	No. of Natural Monument, 228				
Haliaeetus pelagicus	No. of Natural Monument, 243				
Haliaeetus albicilla	No. of Natural Monument, 243				
Haliaeetus pelagicus	No. of Natural Monument, 243				
Anas formosa					
Tringa guttifer					
Larus saundersi					
Egretta europhotes	No. of Natural Monument, 360				
Platalea minor	No. of Natural Monument, 205				
Falco peregrinus	No. of Natural Monument, 323				
No of Species	13				

Table 8. An endemic species of birds in Korea

Scientific name	Remark			
Galerida cristata	Endemic Species in Korea			
No of Species	1			

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