

Note

Yubu Island, the Important Waterbird Habitat on the West Coast of Korea and Its Conservation

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Abstract : Yubu Island is located within the estuary of the Geum River, South Chungcheong Province (35°59'N, 126°36'E), Korea. The island is surrounded by a broad and sandy mudflat, which is typical in the west coast of Korea, and is located 4 km off from Gunsan City. Less than 100 humans live on the island, occupying 30 houses. After we discovered that this island was a very important waterbird habitat especially for the East Asian subspecies of the Eurasian oystercatcher, *Haematopus ostralegus osculans*. Waterbirds were monitored once every month from August 1999 to July 2000. The highest number of oystercatchers counted was 3,200 in December 1999, and the birds seemed to remain in the area continuously from September to next February. About 200 breeding and non-breeding birds remained during the breeding season. In August, early migrants returned to the island, with the number reaching 1,060 individuals. This island is also very important for other waterbirds. Endangered or significant species occurring at this site, and their maximum counts were: chinese egret *Egretta eulophotes* (5), black-faced spoonbill *Platalea minor* (17), brant *Branta bernicla* (1), common shelduck *Tadorna tadorna* (8,000), hooded crane *Grus monacha* (2), spoon-billed sandpiper *Eurynorhynchus pygmeus* (7), dunlin *Calidris alpina* (6,500), great knot *Calidris tenuirostris* (24,000), far eastern curlew *Numenius madagascariensis* (2,500), spotted greenshank *Tringa guttifer* (4) and Saunders's gull *Larus saundersi* (1,200). During the 12 month survey period, we observed 52 waterbird species and the total of the maximum counts for the separate species was 73,308, implying that perhaps 150,000 birds could be using the immediate area, if a turnover rate of 2 was assumed.

Key words : Yubu Island, waterbird, migration, mudflat, reclamation.

1. Introduction

A total of 40 bird species are protected as natural monuments among about 400 species recorded in Korea (Won 1998). Most of the natural monuments are waterbirds and birds of prey. However, many waterbirds (including birds of prey observed at wetlands) have declined in the recent decades, and their wetland habitats have been destroyed by reclamation and development (Koh 1999).

Thus, an immediate action of conservation of wetland habitats and waterbirds are needed.

The west coast of Korea is internationally important waterbird habitat because of the broad tidal mudflats and inland wetlands (Scott 1989). Therefore, more than one million waders and two million waterfowls have used these wetlands for feeding, breeding and roosting grounds along the west coast of South and North Korea (Chong 1996; Kim *et al.* 1997, 1999; Long *et al.* 1988; Paek 2000, 2001). One of the most important habitats of waterbirds in the west coast of Korea is Yubu Island and its mudflat,

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located within the estuary of the Geum River. We recognized that this island was a very important waterbird habitat especially for the East Asian subspecies of the Eurasian oystercatcher, *Haematopus ostralegus osculans*. However, this relatively well preserved waterbird habitat is in danger by the reclamation project to construct an industrial area by the Korea Land Corporation (Ministry of Construction 1990). Thus, we surveyed this island once every month to know the population dynamics of waterbirds.

2. Methods

Yubu Island is located at the estuary of Geum River, South Chungcheong Province (35°59'N, 126°36'E; Fig. 1). This island is surrounded by broad and semi-sand mudflat, which is typical in the west coast of Korea. It is 4 km apart from Gunsan City. Less than 100 humans live on the

island, occupying 30 houses. There is no commercial transportation between mainland and Yubu Island. For this poor transportation, the avian fauna of the island and its mudflat has been rarely studied by ornithologists. After we discovered that this island was a very important waterbird habitat especially for the East Asian subspecies of common oystercatcher, *Haematopus ostralegus osculans*, the waterbirds were monitored once a month from August 1999 to July 2000.

We chose the day of the highest high tide for counting waterbirds because every bird was congregated at small sand spit to avoid incoming tide. The roosting site was a good point to count every waterbird population and easy to compare with the bird population of each months. During the low tide, very broad semi-sand and muddy mudflat was flooded and became a feeding ground of Eurasian oystercatchers and other waterbirds.

The index of maximum species diversity, species diversity and evenness were used to compare the population characteristics of waterbirds, which were observed around the island (Shannon and Weaver 1949). These equations are below.

Species Diversity (H')

$$H' = -\sum (n_i/N) (\log n_i/N)$$

Maximum Species Diversity (H' max)

$$H'_{\max} = \log S$$

Evenness (J')

$$J' = H'/H'_{\max}$$

N : total number of individuals, n_i : number of individuals of a species, S : number of species.

3. Results and discussion

A total of 52 species and at least 73,308 individuals combining of the maximum counts of each species were observed from August 1999 to June 2000 (Table 1). The most dominant species was great knot *Calidris tenuirostris* (33.8%), and followed by common shelduck *Tadorna tadorna* (10.9%), dunlin *Calidris alpina* (8.95%), kentish plover *Charadrius alexandrinus* (5.7%), and spot-billed duck *Anas poecilorhyncha* (5.6%). The largest number of species was observed in April (30 species) and the lowest in June (11 species; Table 1). And also, the largest number of individuals was recorded in April (32,010 birds) during the northbound migration period and the lowest in June (3,349 birds) during the breeding season.

The species diversity and evenness were highest in

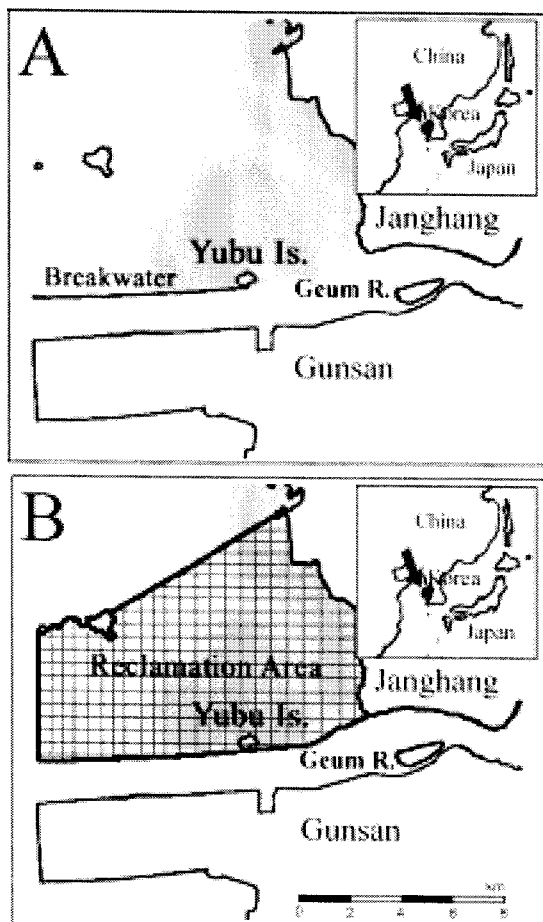


Fig. 1. The location of Yubu Island (A), and the projected reclamation plan (B).

Table 1. A list of waterbirds observed at Yubu Island from August 1999 to July 2000.

English name	Scientific name	99-8-30	99-9-28	99-10-25	99-11-24	99-12-23	00-1-22	00-2-20	00-3-22	00-4-19	00-5-20	00-6-18	00-7-17	Maximum Dominance (%)
Black-throated Diver	<i>Gavia arctica</i>													0
Great Crested Grebe	<i>Podiceps cristatus</i>						1	5	1					5
Temminck's Cormorant	<i>Phalacrocorax filamentosus</i>				1		14	9						14
Night Heron	<i>Nycticorax nycticorax</i>		20	3			2							20
Eastern Large Egret	<i>Egretta alba modesta</i>		44	200	3	1				3	4	13		200
Intermediate Egret	<i>Egretta intermedia</i>			3										3
Little Egret	<i>Egretta garzetta</i>			80								30		80
Chinese Egret	<i>Egretta eulophotes</i>		5	5						1	5			5
Grey Heron	<i>Ardea cinerea</i>		79	40	19	10	1	5	1	3	38	59	28	79
Black-faced Spoonbill	<i>Platalea minor</i>			17										17
Brent	<i>Branta bernicla</i>						1							1
Bean Goose	<i>Anser fabalis</i>							11						11
Common Shelduck	<i>Tadorna tadorna</i>					6,750	8,000	900	72					8,000
Mallard	<i>Anas platyrhynchos</i>			60	320	51	850	78						850
Spot-billed Duck	<i>Anas poecilorhyncha</i>		10	140	950	2,450	4,100	1,250	850	330	285	13		4,100
Teal	<i>Anas crecca</i>			30										30
Wigeon	<i>Anas penelope</i>							2						2
Pintail	<i>Anas acuta</i>			45	5	20								45
Shoveler	<i>Anas clypeata</i>			1										1
Goosander	<i>Mergus merganser</i>			3	3	8	15	2						15
Hooded Crane	<i>Grus monacha</i>							2						2
Eurasian Oystercatcher	<i>Haematopus ostralegus</i>		1,060	2,600	1,400	2,200	3,200	2,800	1,700	690	179	118	87	3,200
Kentish Plover	<i>Charadrius alexandrinus</i>		2,500	4,200	1,400				1,500	110	280	27	1,900	4,200
Mongolian Plover	<i>Charadrius mongolus</i>		500	150						200	280	50		500
American Golden Plover	<i>Pluvialis dominica</i>		1							4				4
Grey Plover	<i>Pluvialis squatarola</i>		1,300	280	40	20	250	540	750	990	2,800	320	80	2,800
Turnstone	<i>Arenaria interpres</i>		25	1			1			52	20			52
Red-necked Stint	<i>Calidris ruficollis</i>		3	200						100	23	31		200
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>									3				3
Dunlin	<i>Calidris alpina</i>		500	4,000	5,500	350	1,600	3,000	3,120	2,040	4,000	59		6,500
Knot	<i>Calidris canutus</i>		2							10	300			300
Great Knot	<i>Calidris tenuirostris</i>		2,400	200						24,800	1,610			24,800
Sanderling	<i>Crocebia alba</i>		300	150	84					36	140			300

Table 1. Continued.

English name	Scientific name	99-8-30	99-9-28	99-10-25	99-11-24	99-12-23	00-1-22	00-2-20	00-3-22	00-4-19	00-5-20	00-6-18	00-7-17	Maximum Count	Maximum Dominance (%)
Spoon-billed Sandpiper	<i>Eurynorhynchus pygmaeus</i>		7											7	<0.5
Broaded-billed Sandpiper	<i>Limicola falcinellus</i>		2											2	<0.5
Greenshank	<i>Tringa nebularia</i>	82	180	80						2	32			180	<0.5
Spotted Sandpiper	<i>Tringa guttifer</i>									4				4	<0.5
Asian Wandering Tattler	<i>Tringa brevipes</i>										14			14	<0.5
Common Sandpiper	<i>Tringa hypoleucos</i>		2							2	56			56	<0.5
Terek Sandpiper	<i>Xenus cinereus</i>	370	50	1						21	130			370	0.5
Black-tailed Godwit	<i>Limosa limosa</i>		14											14	<0.5
Bar-tailed Godwit	<i>Limosa lapponica</i>		15						120	1,037	3,000			3,000	4.1
Common Curlew	<i>Numenius arquata</i>	2,800	2,150	800	1,100	1,200	1,200	1,220	1,250	450		20	150	2,800	3.8
Far Eastern Curlew	<i>Numenius madagascariensis</i>	205	600	30					1,360	153	350	1,010	2,500	2,500	3.4
Whimbrel	<i>Numenius phaeopus</i>	14								75	300			300	<0.5
Red-necked Phalarope	<i>Phalaropus lobatus</i>				2									2	<0.5
Herring Gull	<i>Larus argentatus</i>	20	300	350	600	850	300	3,530	1,900	1,230	1			3,530	4.8
Slaty-backed Gull	<i>Larus schistisagus</i>					6								6	<0.5
Common Gull	<i>Larus canus</i>									1				1	<0.5
Black-tailed Gull	<i>Larus crassirostris</i>	1,400	1,200	40	8	36	100	500	300	10	2,500	1,322	1,200	2,500	3.4
Saunders's Gull	<i>Larus saundersi</i>							1,200	2	3				1,200	1.6
Little Tern	<i>Sterna albifrons</i>									160	310	482	350	482	0.7
No. of Species		22	28	17	15	14	14	16	17	30	23	11	13	52	
No. of Individuals		13,671	16,791	10,777	7,140	15,943	20,925	14,293	15,713	32,010	16,588	3,349	6,551	73,308	
Maximum Species diversity		3.09	3.33	2.83	2.71	2.64	2.64	2.77	2.83	3.40	3.14	2.40	2.56		
Species Diversity		2.22	2.11	1.58	1.61	1.63	1.72	2.06	1.89	1.02	2.16	1.51	1.59		
Evenness		0.72	0.63	0.56	0.59	0.62	0.65	0.74	0.67	0.30	0.69	0.63	0.62		

August and lowest in April (Table 1), because various species in different taxa inhabited on the mudflat during the early southbound migration, and some breeders in the Yellow Sea areas still remained in this area. Even though, the highest number of species was recorded in April, the population of great knot was too high to reduce the species diversity.

The East Asian subspecies of Eurasian oystercatcher, *Haematopus ostralegus osculans*, was isolated geographically from three other subspecies, *H. o. ostralegus*, *H. o. longipes* and *H. o. finschi* (del Hoyo *et al.* 1996). The birds are living only in East Asia and breed in Far Eastern Russia, Korea and China, but their breeding and wintering sites are rarely known. It was suggested that the total population of *H. o. osculans* should be less than ten thousands (Rose and Scott 1997). Until recently, the status of *H. o. osculans* was a rare breeder in the Korean Peninsula and rare migrant in spring and fall (Won 1981). However, we discovered the birds densely congregated and wintered on the mudflat of Yubu Island located at Geum River Estuary in Korea. Additionally, more than 30 pairs bred on Yubu Island and its associated unpopulated islets. Thus, the mudflat of Yubu Island is the most important habitat for the *H. o. osculans* in East Asia.

We counted the birds every month for one year during the highest high tide period when the birds congregated at

remaining sand spit (Fig. 2). The highest number was 3,200 in December 1999, and the birds seemed to remain constantly from September to February (Fig. 3). Then, the birds left for their breeding ground except about 200 birds, which remained during the breeding season until June. In August, early migrants arrived at this island and the numbers reached to 1,060 individuals.

This island is also a habitat for various waterbirds including endangered or significant species (BirdLife International 2000; Table 2), and their maximum counts were: Chinese egret *Egretta eulophotes* (5), black-faced spoonbill *Platalea minor* (17), brant *Branta bernicla* (1), common shelduck (8,000), hooded crane *Grus monacha*

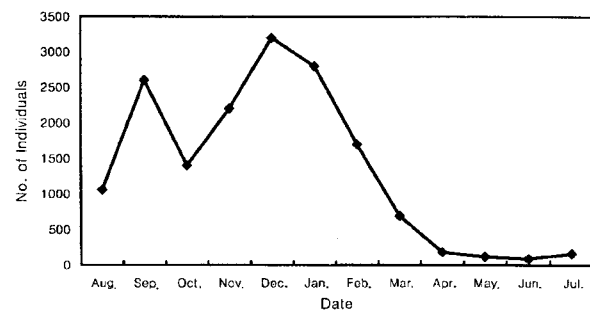


Fig. 3. Numbers of eurasian oystercatchers recorded at Yubu Island from August 1999 to July 2000.



Fig. 2. Roosting eurasian oystercatchers and common curlews on the sand spit of Yubu Island.

Table 2. Significant waterbirds observed at Yubu Island from August 1999 to July 2000.

English name	Scientific name	Estimated No. in flyway (Max.)	1% of flyway Pop.	Maximum count	Proportion in flyway(%)	Conservation status	Peak time
Great Knot	<i>Calidris tenuirostris</i>	300,000	3,000	24,800	8.3		April
Common Shelduck	<i>Tadorna tadorna</i>	60,000	600	8,000	13.3		January
Dunlin	<i>Calidris alpina</i>	130,000	1,300	6,500	5.0		March
Kentish Plover	<i>Charadrius alexandrinus</i>	100,000	1,000	4,200	4.2		September
Eurasian Oystercatcher	<i>Haematopus ostralegus</i>	10,000	100	3,200	32.0	N, S	December
Grey Plover	<i>Pluvialis squatarola</i>	16,000	160	2,800	17.5		May
Common Curlew	<i>Numenius arquata</i>	100,000	1,000	2,800	2.8		August
Far Eastern Curlew	<i>Numenius madagascariensis</i>	21,000	210	2,500	11.9	S	July
Black-tailed Gull	<i>Larus crassirostris</i>	160,000	1,600	2,500	1.6		May
Saunders's Gull	<i>Larus saundersi</i>	7,000	70	1,200	17.1	S	February
Black-faced Spoonbill	<i>Platalea minor</i>	600	6	17	2.8	N, E	October
Spoon-billed Sandpiper	<i>Eurynorhynchus pygmeus</i>	6,000	60	7	0.1	E	September
Chinese Egret	<i>Egretta eulophotes</i>	2,500	25	5	0.2	N, E	August
Spotted Sandpiper	<i>Tringa guttifer</i>	1,000	10	4	0.4	E	April
Hooded Crane	<i>Grus monacha</i>	8,300	83	2	0.0	N, S	March
Brent	<i>Branta bernicla</i>	6,700	67	1	0.0	N, S	January

N: Natural Monument, E: Endangered Species, S: Specially Protected

(2), spoon-billed sandpiper *Eurynorhynchus pygmeus* (7), dunlin (6,500), Great Knot (24,000), far eastern curlew *Numenius madagascariensis* (2,500), spotted greenshank *Tringa guttifer* (4) and Saunders's gull *Larus saundersi* (1,200).

In the fall, the dominant species in this area were common curlew *Numenius arquata*, Eurasian oystercatcher and kentish plover, and total populations of waterbirds were as many as 16,000 individuals (Table 1). From November, waders were replaced by wintering ducks such as spot-billed ducks and common shelduck. The majority of ducks remained in this area until February. Then, spring wader migrants arrived and fed on the mudflat. The dominant waders in the spring were dunlin, great knot, grey plover *Pluvialis squatarola* and far eastern curlew. Among the waders, Eurasian oystercatchers, common curlew and dunlin also wintered, and their wintering populations were as many as 3,200, 1,220, and 3,120, respectively.

During the 12 months surveying period, we observed 52 waterbird species and their maximum count numbers was 73,308. It means that at least 73,000 waterbirds came and used the Yubu mudflat, and approximately 150,000 birds if it was calculated by applying turnover rate 2.

4. Conservation of Yubu tidal flat

The surrounded tidal flat of Yubu Island is under the

reclamation plan by Korea Land Corporation supported by the Ministry of Construction and Transportation. The construction plan was established on the basis of poorly surveyed Environment Impact Assessment (Ministry of Construction 1990). If the reclamation project will be completed, the every place of Yubu Island tidal flat will be disappeared and it will be converted to industrial land (Fig. 1). The reporters of the wildlife section of the Environment Protection Assessment had never visited and surveyed the mudflat of Yubu Island. Thus, they did not recognize or ignored the importance of the avian diversity of Yubu tidal flat. Fortunately, construction of the embankment for the reclamation has been delayed due to the restricted budget and economic crisis of Korea. However, the government and Korea Land Corporation might start again the construction work if they can get support from national revenue.

From international criteria of Ramsar Convention supporting of more than 1 % of regional species population, 11 waterbird species exceeded this criteria, which are Eurasian oystercatchers (32.0 %), grey plovers (17.5 %), Saunders gulls (17.1 %) and seven other species (Rose and Scott 1997; Table 2). In addition, five avian species of Natural Monument were observed during the survey. Moreover, four and five waterbirds in this area were considered endangered and specially protected species of the Department of Environment, respectively. Also, the number of waterbirds inhabited in Yubu tidal flat was far

exceeded the criteria of Ramsar Convention. The total number of maximum count was more than 70,000, which was well above the guideline of 20,000 waterbirds by the convention criteria. Thus, this area is very important stopover and wintering sites of many waterbirds which migrates between northern breeding ground and southern wintering grounds.

The loss of Yubu Island tidal flat might cause severe treats to the survival of the waterbirds along East Asia-Australasian flyway. It will be cause great reduction of the feeding and roosting ground and the survival of some vulnerable waterbirds. Therefore, this area has to be nominated as wildlife sanctuary and have to cancelling the reclamation plan. After cancel the reclamation plan, this area can be used for good researching and ecotourism sites as well as the sustainable fishing and clamming ground for local people.

References

- BirdLife International. 2000. Treated birds of the world. Lynx Edicions, Barcelona.
- Chong, J. 1996. Waterbirds and wetlands conservation in the Democratic People's Republic of Korea. Conservation of migratory waterbirds and their habitats in the East Asian - Australasian flyway.
- del Hoyo, J., A. Elliot, and C.E. Shannon. 1996. Handbook of the birds of the world. Vol. 3. Hoatzin to auks. Lynx Edicions, Barcelona.
- Kim, J.H., J.Y. Park, and J.Y. Yi. 1997. Spring and autumn avifauna of western coastal mudflat in Korea. *J. Kor. Biota*, 2,183-205 (In Korean).
- Kim, J.H., J.Y. Park, J.Y. Yi, B.H. Yoo, and K.C. Lee. 1999. The migration route and monitoring on the migratory birds in Korea. National Institute of Environmental Research (In Korean).
- Koh, C. 1999. The Korean tidal flat, a brief introduction to geomorphology, reclamation and conservation, National NGO wetlands report: Ramsar 1999. Korean Wetlands Alliance.
- Long, A.J, C.M. Poole, M.I. Eldridge, P.O. Won, and K.S. Lee. 1988. A survey of coastal wetlands and shorebirds in South Korea spring 1988. Asian Wetland Bureau, Kuala Lumpur.
- Ministry of Construction. 1990. Development plan of Gunsan and Janghang industrial complex: Environmental impact assessment. Seoul (In Korean).
- Paek, W.K. 2000. Monitoring avian Natural Treasures wintered at major wetlands in Korea. Cultural Properties Administration (In Korean).
- Paek, W.K. 2001. Monitoring avian Natural Treasures wintered at major wetlands in Korea II. Cultural Properties Administration (In Korean).
- Rose, P.M. and D.A. Scott. 1997. Waterfowl population estimates. Wetland International Publ. 44. Wageningen, The Netherlands.
- Scott, D.A. 1989. A directory of Asian wetlands. IUCN.
- Shannon, C.E. and W. Weaver. 1949. *The Mathematical Theory of Communication*. Univ. Illinois Press, Urbana.
- Won, P.O. 1981. The fauna and flora of Korea. V. 25. Avian Ecology. Department of Education (In Korean).
- Won, P.O. 1998. Birds of the sky. Joongang Ilbo, Seoul (In Korean).

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