



Avifauna of Bangtaesan Mountain, Gangwon-do, Korea

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Abstract: An investigation on avifauna of the Bangtaesan Mountain was carried out from February until November, 2010 and it drew the results as follow. The number of birds observed in the whole Bangtaesan Mountain region was 989 individuals of 51 species (Maximum counts). Considering the results from literature research in addition, at least 90 species 1,000 individuals are thought to live in this region. In result, dominant species proved to be Yellow-throated Bunting (*Emberiza elegans*), Marsh Tit (*Parus palustris*), Azure-winged Magpie (*Cyanopica cyana*), Eastern Crowned Willow Warbler (*Phylloscopus coronatus*), Varied Tit (*Parus varius*), and more. Most of birds breeding in the forest of Korea were found to constitute these dominant bird species. Entire species diversity index appeared to be 3.35 relatively a high level; 3.34 in the south slopes while 3.22 in the north slopes showing relatively a high level in the south. Of them, 12 species including Mandarin Duck (*Aix galericulata*) were the Protected Birds species nominated and protected by the Cultural Heritage Administration or the Ministry of Environment, while 10 and 6 species were the natural monument species and endangered species level, respectively. Should further consistent surveys be carried out, a broader range of species would be found to breed, and therefore the Bangtaesan Mountain region including the area where the protected species are observed is believed to need a conservation and management through protected area designation.

Keywords: Southern slope, Northern slope, Protected species

Introduction

Large-sized mountains in Korea are generally nominated as the National Park and properly protected. The mountains of high sea level or excellent scenery besides these national parks are nominated as Provincial Park or County Park and tend to be protected. Although the Bangtaesan Mountain (1,444 m) is not designated as a national park or any other park for preservation, it maintains relatively a sound condition of forest vegetation.

Avifauna of the Bangtaesan Mountain was reviewed in the short-term researches by Goo and Woo (1995) on Fauna and Flora in the North Slopes area and by Woo and Paek (1996) on Fauna and Flora in the South Slopes area sponsored by the Korean Association for Conservation of Nature, and the studies conducted by the Ministry of Environment (1997, 2007) as part of natural environment research. In addition, there was a study on the Bangtaesan Mountain as part of the exploration and survey of the area having excellent ecological scenery by the Ministry of Environment (2009). Investigations made several times up

to now, however, were made up of temporary surveys that were conducted once in summer (Koo and Woo, 1995; Woo and Paek, 1996) and rough studies to find out the current status only (Ministry of Environment, 1997; 2007). Exceptionally a study conducted by the Ministry of Environment (2009) was made up of relatively numerous surveys by seasons.

Therefore, this study is aimed at precisely investigating the Bangtaesan Mountain during wintering, breeding, and migration seasons, analyzing the data concerning the results on avifauna of the Bangtaesan Mountain listed in the previous studies, and providing basic data for the conservation and management of the Bangtaesan Mountain that has plentiful biological diversity and still successfully preserves natural resources although it is not designated as a park area.

Materials and Methods

Study areas

The Bangtaesan Mountain, having Jueokbong Peak as its main peak standing at 1,440 m, marks the boundary among Girin-myeon, Sangnam-myeon (Inje-gun), and Nae-myeon (Hongcheon-gun) in Gangwon-do. In addition, it is adjacent to Gaeinsan Mountain (1,342 m) and Eungboksan Mountain (1,156 m), and bordered on the north by

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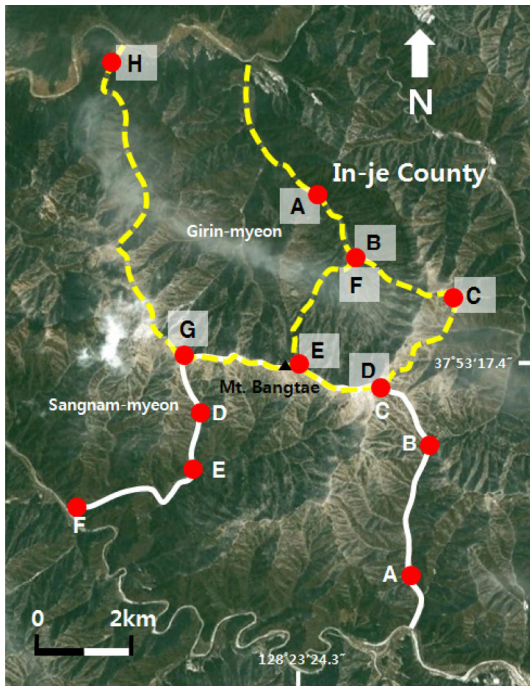


Fig. 1. Map of survey route (- - - : North slope, ——— : South slope).

Bangtaecheon Stream and on the south by Naerincheon Stream. Bangtaesan Mountain Recreational Forests lie in the center of the mountain, while the Bangdongyaksu Fountain containing carbonated water is situated in the north (Fig. 1).

Methods

Survey was conducted over five times in February, April, May, October, and November in 2010, intensively during wintering season, breeding season, and migration season. Bangtaesan Mountain was broadly divided into the south slopes and the north slopes where the birds were observed within 100 m at both sides by means of visual, binocular (8×40 Nikon), and sound checking methods with the researchers walking along the trails and forest roads at the speed of 1~2 km/hour. The south slopes were sub-divided into Woldungyo ~ Control Post (A) ~ Woldun Hill (B) ~ Guryongdeokbong (C) and Gitdaebong ~ Gaeinyaksu (D) ~ Yaksusanjang (E) ~ Sogaieindonggyo (F), while the north slopes into Recreational Forest Entrance ~ Guryonggyo (A) ~ Forked Road (B) - Maebongnyeong (C) ~ Guryongdeokbong (D) ~ Jueokbong (E) ~ Forked Road (F) and Jueokbong ~ Gitdaebong (G) ~ Oryudong (H). Guryongdeokbong, Jueokbong, and Giddaebong course that falls under the ridge of the peak was, however, put in the north slopes to avoid duplication with the south slopes.

Scientific names and common names of the birds observed were collected from the Ornithological Society of Korea (2009), and the classification of them was conducted in accordance with Lee Woo-sin *et al.* (2000). In order to

identify the Protected Bird Species such as the natural monument bird species nominated by the Cultural Heritage Administration, Endangered Species designated by the Ministry of Environment, etc., the Standards of the Cultural Heritage Administration (2003, 2005) and the Ministry of Environment (2005a, b) were referred to. In the comparison of relative species density in the course of analyzing the respective data observed, relative species density (RD) from the Brower *et al.* (1990) was adopted. In order to derive species diversity, H' (Index of Shannon diversity) was used (Shannon and Weaver, 1949). The formula used in the analysis is as follow:

$$R.D. = ni/N \times 100 (\%)$$

ni: Number of individuals of species

N: Number of the whole individuals

$$\text{Index of Shannon diversity (H')} = -\sum (ni/N) \ln(ni/N)$$

ni: Number of individuals of species

N: Number of the whole individuals in the area

Results and Discussion

Avifauna

In the Bangtaesan Mountain area in 2010, total 989 individuals of 51 species were observed, which mainly consisted of the birds breeding in the mixed forest and valley. Dominant bird species appeared to be Yellow-throated Bunting (108 individuals, 10.9%), Marsh Tit (79 individuals, 8.0%), Azure-winged Magpie (72 individuals, 7.3%), Eastern Crowned Willow Warbler (66 individuals, 6.7%), and Varied Tit (60 individuals, 6.1%) (Fig. 2). Besides, many of Eurasian Nuthatch (*Sitta europaea*), Brown-eared Bulbul (*Hypsipetes amaurotis*), Jungle Crow (*Corvus macrorhynchos*), Long-tailed Tit (*Aegithalos caudatus*) and more, were also observed, which are found to form a group in the forest after breeding is finished (Table 1).

In the south slopes, total 545 individuals of 47 species

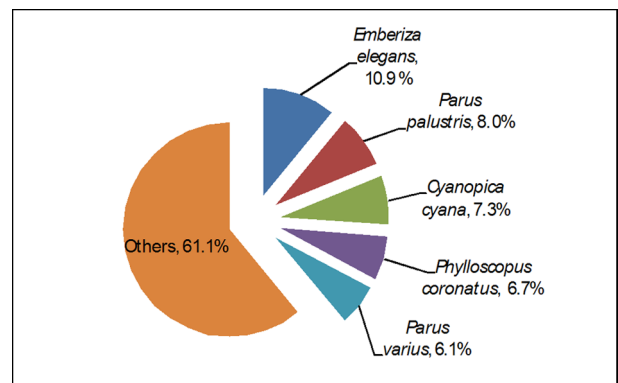


Fig. 2. Dominance species of Mt. Bangtaesan.

Table 1. Birds observed at each slope of Mt. Bangtaesan

No.	Scientific name	Korean name	Southern slope	Northern slope	Total	R.D.
1	<i>Aix galericulata</i>	원앙		2	2	<0.5
2	<i>Accipiter nisus</i>	새매		1	1	<0.5
3	<i>Accipiter gentilis</i>	참매	1	1	2	<0.5
4	<i>Buteo buteo</i>	말뚱가리	1		1	<0.5
5	<i>Bonasa bonasia</i>	들꿩	3	1	4	<0.5
6	<i>Tringa ochropus</i>	빽빽도요	1		1	<0.5
7	<i>Streptopelia orientalis</i>	멧비둘기	9	6	15	1.5
8	<i>Cuculus fugax</i>	매사촌	2	2	4	<0.5
9	<i>Cuculus micropterus</i>	검은등빼꾸기	4	5	9	0.9
10	<i>Cuculus canorus</i>	빼꾸기	1		1	<0.5
11	<i>Cuculus saturatus</i>	병어리빼꾸기	2	6	8	0.8
12	<i>Dendrocopos kizuki</i>	쇠딱다구리	4	8	12	1.2
13	<i>Dendrocopos leucotos</i>	큰오색딱다구리		2	2	<0.5
14	<i>Dendrocopos major</i>	오색딱다구리	4	1	5	0.5
15	<i>Motacilla cinerea</i>	노랑할미새	14	8	22	2.2
16	<i>Motacilla alba leucopsis</i>	알락할미새	2		2	<0.5
17	<i>Microscelis amaurotis</i>	직박구리	28	16	44	4.4
18	<i>Lanius bucephalus</i>	때까치	4	1	5	0.5
19	<i>Cinclus pallasii</i>	물까마귀	4	3	7	0.7
20	<i>Troglodytes troglodytes</i>	굴뚝새	6	8	14	1.4
21	<i>Luscinia sibilans</i>	울새	3		3	<0.5
22	<i>Luscinia cyane</i>	쇠유리새	6	6	12	1.2
23	<i>Tarsiger cyanurus</i>	유리딱새	2	1	3	<0.5
24	<i>Phoenicurus aureoreus</i>	딱새	12	2	14	1.4
25	<i>Saxicola torquatus</i>	검은딱새	2		2	<0.5
26	<i>Turdus hortulorum</i>	되지빠귀	2	2	4	<0.5
27	<i>Turdus pallidus</i>	흰배지빠귀	13	11	24	2.4
28	<i>Turdus naumanni eunomus</i>	개똥지빠귀		1	1	<0.5
29	<i>Paradoxornis webbiamus</i>	붉은머리오목눈이	2	10	12	1.2
30	<i>Phylloscopus inornatus</i>	노랑눈썹솔새	3	7	10	1.0
31	<i>Phylloscopus borealis</i>	쇠솔새	16	17	33	3.3
32	<i>Phylloscopus coronatus</i>	산솔새	27	39	66	6.7
33	<i>Regulus regulus</i>	상모솔새	8	3	11	1.1
34	<i>Ficedula mugimaki</i>	노랑딱새	2		2	<0.5
35	<i>Cyanoptila cyanomelana</i>	큰유리새	5	7	12	1.2
36	<i>Aegithalos caudatus</i>	오목눈이	21	20	41	4.1
37	<i>Parus palustris</i>	쇠박새	41	38	79	8.0
38	<i>Parus ater</i>	진박새	14	11	25	2.5
39	<i>Parus major</i>	박새	15	20	35	3.5
40	<i>Parus varius</i>	곤줄박이	32	28	60	6.1
41	<i>Sitta europaea</i>	동고비	16	30	46	4.7
42	<i>Emberiza rustica</i>	쭈새	25	2	27	2.7
43	<i>Emberiza elegans</i>	노랑턱멧새	64	44	108	10.9
44	<i>Carduelis sinica</i>	방울새	14		14	1.4
45	<i>Uragus sibiricus</i>	긴꼬리홍양진이	2		2	<0.5
46	<i>Carpodacus roseus</i>	양진이	13	6	19	1.9
47	<i>Passer montanus</i>	참새	8		8	0.8
48	<i>Garrulus glandarius</i>	어치	18	14	32	3.2
49	<i>Cyanopica cyana</i>	물까치	40	32	72	7.3
50	<i>Pica pica</i>	까치	4	5	9	0.9
51	<i>Corvus macrorhynchos</i>	큰부리까마귀	25	17	42	4.2
No. of species			47	41	51	
No. of individuals			545	444	989	
Species diversity(H')			3.34	3.22	3.35	

were observed. Dominant bird species appeared to be Yellow-throated Bunting (64 individuals, 11.7%), Azure-winged Magpie (40 individuals, 7.3%), Varied Tit (32

individuals, 5.9%), Brown-eared Bulbul (28 individuals, 5.1%), and Eastern Crowned Willow Warbler (27 individuals, 5.0%). In the north slopes, total 444 individuals of 41

Table 2. Birds observed in Mt. Bangtaesan from Feb. to Nov. 2010

No.	Scientific name	Korean name	Feb.	Apr.	May	Oct.	Nov.	Max.
1	<i>Aix galericulata</i>	원앙		2				2
2	<i>Accipiter nisus</i>	새매				1		1
3	<i>Accipiter gentilis</i>	참매		1			1	1
4	<i>Buteo buteo</i>	말뚱가리					1	1
5	<i>Bonasa bonasia</i>	들꿩		4				4
6	<i>Tringa ochropus</i>	빽빽도요			1			1
7	<i>Streptopelia orientalis</i>	멧비둘기			3	14		14
8	<i>Cuculus fugax</i>	매사촌			4			4
9	<i>Cuculus micropterus</i>	검은등뺨꾸기			9			9
10	<i>Cuculus canorus</i>	뺨꾸기			1			1
11	<i>Cuculus saturatus</i>	병어리뺨꾸기		1	7			7
12	<i>Dendrocopos kizuki</i>	쇠딱다구리	4	1	2	5	4	5
13	<i>Dendrocopos leucotos</i>	큰오색딱다구리		1	1			1
14	<i>Dendrocopos major</i>	오색딱다구리	5					5
15	<i>Motacilla cinerea</i>	노랑할미새		16	14			16
16	<i>Motacilla alba leucopsis</i>	알락할미새			2			2
17	<i>Microscelis amaurotis</i>	직박구리	7	4	10	35	31	35
18	<i>Lanius bucephalus</i>	때까치	3	1		1		3
19	<i>Cinclus pallasii</i>	물까마귀		3	3	4	1	4
20	<i>Troglodytes troglodytes</i>	굴뚝새		14	1		2	14
21	<i>Luscinia sibilans</i>	울새			3			3
22	<i>Luscinia cyane</i>	쇠유리새			12			12
23	<i>Tarsiger cyanurus</i>	유리딱새		3				3
24	<i>Phoenicurus aureoreus</i>	딱새		11	6	10	2	11
25	<i>Saxicola torquatus</i>	검은딱새			2			2
26	<i>Turdus hortulorum</i>	되지뺨귀			4			4
27	<i>Turdus pallidus</i>	흰배지뺨귀		11	18	3		18
28	<i>Turdus naumanni eunomus</i>	개뚝지뺨귀		1				1
29	<i>Paradoxornis webbiamus</i>	붉은머리오목눈이			2		10	10
30	<i>Phylloscopus inornatus</i>	노랑눈썹솔새			3	9		9
31	<i>Phylloscopus borealis</i>	쇠솔새		6	33			33
32	<i>Phylloscopus coronatus</i>	산솔새		19	66			66
33	<i>Regulus regulus</i>	상모솔새	4				7	7
34	<i>Ficedula mugimaki</i>	노랑딱새				2		2
35	<i>Cyanoptila cyanomelana</i>	큰유리새			12			12
36	<i>Aegithalos caudatus</i>	오목눈이	20	2		21	12	21
37	<i>Parus palustris</i>	쇠박새	43	58	11	29	45	58
38	<i>Parus ater</i>	진박새	4	10	6	9	1	10
39	<i>Parus major</i>	박새	6	12	28	4	6	28
40	<i>Parus varius</i>	곤줄박이	12	46	24	14	6	46
41	<i>Sitta europaea</i>	동고비	7	30	2	33	20	33
42	<i>Emberiza rustica</i>	쭈새	25				2	25
43	<i>Emberiza elegans</i>	노랑턱멧새	14	83	10	53	24	83
44	<i>Carduelis sinica</i>	방울새	14					14
45	<i>Uragus sibiricus</i>	긴꼬리홍양진이	2					2
46	<i>Carpodacus roseus</i>	양진이		1			18	18
47	<i>Passer montanus</i>	참새	8					8
48	<i>Garrulus glandarius</i>	어치	6	10	2	18	12	18
49	<i>Cyanopica cyana</i>	물까치	12	21	2		66	66
50	<i>Pica pica</i>	까치	4				5	5
51	<i>Corvus macrorhynchos</i>	큰부리까마귀	21	10	13	11	11	21
No. of species			20	28	33	19	22	51
No. of individuals			221	382	317	276	287	779
Species diversity(H')			2.68	2.64	2.90	2.54	2.51	

species were observed. Dominant bird species appeared to be Yellow-throated Bunting (44 individuals, 9.9%), Eastern Crowned Willow Warbler (39 individuals, 8.8%), Marsh Tit

(38 individuals, 8.6%), Azure-winged Magpie (32 individuals, 7.2%), and Eurasian Nuthatch (30 individuals, 6.8%).

In comparison of the number of species and individuals

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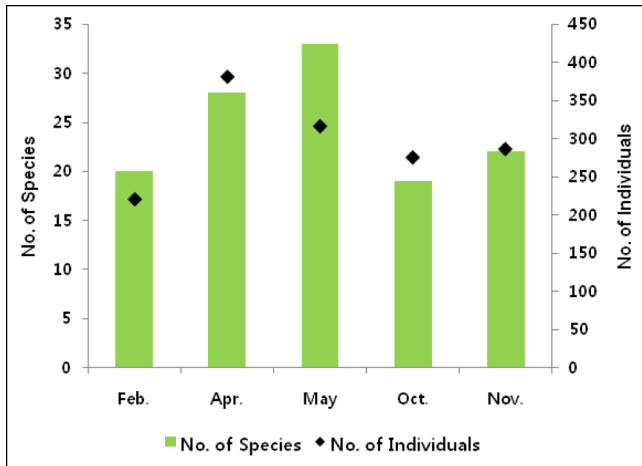


Fig. 3. The number of species and individuals along with survey time.

observed in both slopes, the south slopes were shown at higher level; 47 species, 545 individuals in the south while 444 individuals of 41 species in the north. The number of species observed in the south slopes only was 10 including Common Buzzard (*Buteo buteo*) while the number of species observed in the north slopes only was four such as Mandarin Duck, Eurasian Sparrowhawk (*Accipiter nisus*), White-backed Woodpecker (*Dendrocopos leucotos*), and Dusky Thrush (*Turdus naumanni*). In the case of Mandarin Duck, only a couple was observed in the valley of the north slopes, which is thought to breed in the hole of old and large trees with large diameter of breast that grow naturally in the valley of this area.

According to the status of appearance by seasons, 20 species 221 individuals in February (wintering season), 28 species 382 individuals in April (migration season), 33 species 317 individuals in May (breeding season), 19 species 276 individuals in October (migration season), and 22 species 287 individuals in November (Table 2) were observed. The largest number relating to species was 33 observed in May, while the largest number relating to individuals was 382 observed in April (Fig. 3). These results are possibly because only the wintering birds and resident birds in part live in the forest during wintering season other than breeding season. Lee *et al.* (1993) and Yu *et al.* (2010) reported on the seasonal change in the temperate zone bird community that the maximum number of species is shown in spring–breeding season, which gradually decreases as it becomes summer, autumn, and winter as it gets closer to the wintering season. Similar tendency was found in this study, too.

Species diversity index was relatively at a high level indicating 3.35; 3.34 in the south slopes and 3.22 in the north slopes from the aspect of slope direction (Table 1). According to Yu *et al.* (2010) that reported on Deogyusan Mountain, no difference was found in the composition of

species at the same height between the east slopes and the west slopes, although some difference was found at different height. In this study that observed the south slopes and the north slopes, the number of species and individuals was found higher in the south, but there was no characteristic that any specifically classified group is distributed between two areas. There was some difference in the species between low-level ridge and high-level ridge, but it is deemed necessary to continue research and survey in future. Species diversity index by seasons were found to be 2.68 in February, 2.64 in April, 2.90 in May, 2.54 in October, 2.51 in November, where the highest level was shown in May - the breeding season when the number of species are normally evenly distributed (Table 2).

Comparison of references

There was a numerous number of surveys on avifauna of the Bangtaesan Mountain, which include Koo and Woo (1995) on Fauna and Flora of the north slopes area, Woo and Paek (1996) on Fauna and Flora of the south slopes, and the surveys conducted by Ministry of Environment (1997, 2007, 2009). Of them, only the survey by Ministry of Environment was made up of relatively numerous surveys by seasons, while the others were conducted over a short time only. In the whole Bangtaesan Mountain region, 90 species including those reported in the previous literature are found to breed. Number of species surveyed by the Korean Association for Conservation of Nature was 48, while that by the Ministry of Environment was 77. The number of species not reported in the previous literature but observed additionally in this study was 6 including Goshawk (*Accipiter gentilis*). Therefore, should there be a repeated survey as well as conservation and management, it would be possible for more diverse species to breed in this region.

According to Koo and Woo (1995), the birds observed in the whole north slopes area of the Bangtaesan Mountain were 31 species 240 individuals, which were less than 41 species 444 individuals observed in this study. In addition, according to Woo and Paek (1996), the birds observed in the whole south slopes area were 40 species 264 individuals, which were less than 47 species 545 individuals observed in this study. Total species and individuals of the birds were 48 species 500 individuals, which were also less than 51 species 989 individuals that were recorded in this study. These results are deemed because of difference in survey period and time as the previous literature have been resulted from the survey once made in summer or autumn while this study was made up of 5 times in total.

The data recorded by the Ministry of Environment in 1997 and 2007 were derived from the surveys conducted in summer and autumn, which showed 55 species in 1997 and 64 species in 2007 representing the larger number of

Table 3. The birds checklist recorded at Mt. Bangtaesan

No.	Scientific name	Korean name	A*	B	C	D	E
1	<i>Ardea cinerea</i>	왜가리			●	●	1
2	<i>Egretta alba modesta</i>	중대백로			●	●	3
3	<i>Egretta garzetta</i>	쇠백로			●	●	2
4	<i>Butorides striatus</i>	검은댕기해오라기		21	●	●	3
5	<i>Aix galericulata</i>	원앙	2		●	●	8
6	<i>Anas poecilorhyncha</i>	흰뺨검둥오리			●	●	6
7	<i>Butastur indicus</i>	왕새매		1			
8	<i>Circus cyaneus</i>	갯빛개구리매				●	
9	<i>Accipiter soloensis</i>	붉은배새매		1	●	●	
10	<i>Accipiter nisus</i>	새매	1	1			
11	<i>Accipiter gentilis</i>	참매	2				
12	<i>Buteo buteo</i>	말뚱가리	1			●	
13	<i>Falco tinnunculus</i>	황조롱이				●	5
14	<i>Falco subbuteo</i>	새홀리기					1
15	<i>Bonasa bonasia</i>	들꿩	4	13	●	●	5
16	<i>Phasianus colchicus</i>	꿩		6	●	●	14
17	<i>Charadrius dubius</i>	꼬마물떼새			●		
18	<i>Tringa ochropus</i>	빽빽도요	1				
19	<i>Actitis hypoleucos</i>	갸작도요		2			3
20	<i>Streptopelia orientalis</i>	멧비둘기	15	9	●	●	47
21	<i>Cuculus fugax</i>	매사촌	4				
22	<i>Cuculus micropterus</i>	검은등뺨꾸기	9		●	●	2
23	<i>Cuculus canorus</i>	뺨꾸기	1	6	●	●	4
24	<i>Cuculus saturatus</i>	병어리뺨꾸기	8	2	●	●	2
25	<i>Cuculus poliocephalus</i>	두건		2	●		
26	<i>Otus scops</i>	소쩍새			●	●	2
27	<i>Strix aluco</i>	올빼미		1	●		
28	<i>Caprimulgus indicus</i>	속독새			●		1
29	<i>Alcedo atthis</i>	물총새		1	●		1
30	<i>Halcyon pileata</i>	청호반새		3	●	●	1
31	<i>Eurystomus orientalis</i>	파랑새			●	●	8
32	<i>Upupa epops</i>	후투티		2		●	2
33	<i>Dendrocopos kizuki</i>	쇠딱다구리	12	4	●	●	6
34	<i>Dendrocopos leucotos</i>	큰오색딱다구리	2			●	2
35	<i>Dendrocopos major</i>	오색딱다구리	5	4	●	●	3
36	<i>Dryocopus martius</i>	까막딱다구리					1
37	<i>Picus canus</i>	청딱다구리			●	●	7
38	<i>Hirundo rustica</i>	제비			●	●	
39	<i>Motacilla cinerea</i>	노랑할미새	22	17	●	●	7
40	<i>Motacilla alba leucopsis</i>	알락할미새	2	2	●	●	6
41	<i>Motacilla grandis</i>	검은등할미새				●	3
42	<i>Microscelis amaurotis</i>	직박구리	44	20	●	●	42
43	<i>Lanius bucephalus</i>	매까치	5	5	●	●	4
44	<i>Cinclus pallasii</i>	물까마귀	7	14	●	●	2
45	<i>Troglodytes troglodytes</i>	굴뚝새	14	4	●	●	2
46	<i>Luscinia sibilans</i>	울새	3				
47	<i>Luscinia cyane</i>	쇠유리새	12	2			
48	<i>Luscinia svecicus</i>	흰눈썹울새				●	
49	<i>Tarsiger cyanurus</i>	유리딱새	3				3
50	<i>Phoenicurus aureoreus</i>	딱새	14	7	●	●	10
51	<i>Saxicola torquatus</i>	검은딱새	2		●		3
52	<i>Turdus dauma</i>	호랑지빠귀		1	●	●	3
53	<i>Turdus hortulorum</i>	되지빠귀	4				
54	<i>Turdus pallidus</i>	흰배지빠귀	24	15	●	●	7
55	<i>Turdus naumanni eunomus</i>	개똥지빠귀	1			●	
56	<i>Paradoxornis webbiana</i>	붉은머리오목눈이	12	75	●	●	115
57	<i>Cettia diphone</i>	휘파람새		16	●	●	
58	<i>Urosphena squameiceps</i>	숲새		8		●	4

Table 3. Continued

No.	Scientific name	Korean name	A*	B	C	D	E
59	<i>Phylloscopus proregulus</i>	노랑허리솔새					2
60	<i>Phylloscopus inornatus</i>	노랑눈썹솔새	10				6
61	<i>Phylloscopus borealis</i>	쇠솔새	33	2			
62	<i>Phylloscopus coronatus</i>	산솔새	66	15	●	●	4
63	<i>Regulus regulus</i>	상모솔새	11			●	
64	<i>Ficedula zanthopygia</i>	흰눈썹황금새		1			2
65	<i>Ficedula mugimaki</i>	노랑딱새	2				
66	<i>Cyanoptila cyanomelana</i>	큰유리새	12		●	●	3
67	<i>Aegithalos caudatus</i>	오목눈이	41	8	●	●	49
68	<i>Parus palustris</i>	쇠박새	79	31	●	●	21
69	<i>Parus ater</i>	진박새	25	10	●	●	5
70	<i>Parus major</i>	박새	35	29	●	●	29
71	<i>Parus varius</i>	곤줄박이	60	7	●	●	7
72	<i>Sitta europaea</i>	둥고비	46	39	●	●	3
73	<i>Emberiza cioides</i>	멧새		24		●	3
74	<i>Emberiza tristrami</i>	흰배멧새			●	●	
75	<i>Emberiza rustica</i>	쑥새	27			●	
76	<i>Emberiza elegans</i>	노랑턱멧새	108	21	●	●	34
77	<i>Emberiza rutila</i>	꼬까참새		12			
78	<i>Emberiza spodocephala</i>	축새		2			
79	<i>Carduelis sinica</i>	방울새	14		●	●	18
80	<i>Uragus sibiricus</i>	긴꼬리홍양진이	2				
81	<i>Carpodacus roseus</i>	양진이	19			●	
82	<i>Coccothraustes coccothraustes</i>	콩새				●	
83	<i>Passer montanus</i>	참새	8		●	●	52
84	<i>Sturnus cineraceus</i>	찌르레기			●	●	15
85	<i>Oriolus chinensis</i>	피꼬리		1	●	●	11
86	<i>Garrulus glandarius</i>	어치	32	14	●	●	10
87	<i>Cyanopica cyana</i>	물까치	72	14	●	●	92
88	<i>Pica pica</i>	까치	9	2	●	●	26
89	<i>Corvus corone</i>	까마귀		3	●	●	20
90	<i>Corvus macrorhynchos</i>	큰부리까마귀	42			●	56
No. of species			51	48	55	64	62
No. of individuals			989	500	-	-	819

*A: This study (2010), B: Sum of maximum count by Koo and Woo (1995), Woo and Paek (1996), C: Ministry of Environment (1997), D: Ministry of Environment (2007), E: Ministry of Environment (2009), C and D indicate the results on whether it appeared or not.

species compared with that in this study. This is deemed because the surveyed territory was broader although the frequency of survey was less. As for the number of individuals, it was impossible to directly compare as the survey recorded whether the bird appeared or not only. In the study in 2009 (Ministry of Environment), 62 species 819 individuals were observed, representing larger number of species and individuals compared with those reported in this study. This is deemed because the previous literature conducted the survey against broader range during three seasons of spring, summer, and autumn.

Protected birds

Protected Birds amounting to 12 species including Mandarin Duck were found in this study, which included 10 species of the natural monument bird species nominated by the Cultural Heritage Administration and 6 species Endangered Birds Species Level birds designated by the

Ministry of Environment (Table 3). According to the status of appearance of Protected Bird Species, they were observed to breed in a variety of environment such as open land, flat terrain, dense broad-leaved forest as well as valley, which means the Bangtaesan Mountain is the habitat for a variety of birds and therefore is of high ecological value in that sense. Although not reported in the previous literature, Goshawk was found to breed in this study. Three species of Mandarin Duck, Eurasian Sparrowhawk, and Common Buzzard were found in both previous literature and this study. Eight species of Hen Harrier (*Circus cyaneus*), Chinese-Sparrowhawk (*Accipiter soloensis*), Common Kestrel (*Falco tinnunculus*), Eurasian Hobby (*Falco subbuteo*), Lesser Cuckoo (*Cuculus poliocephalus*), Eurasian Scops Owl (*Otus scops*), Tawny Owl (*Strix aluco*), and Black Woodpecker (*Dryocopus martius*) were found in the literature search only, which is deemed because of the variation in the range of survey. The

Table 4. The list of protected birds recorded at Mt. Bangtaesan

No.	Scientific name	Korean name	A*	B	C	D	E	F	G
1	<i>Aix galericulata</i>	원앙	●		●	●	●	327	
2	<i>Circus cyaneus</i>	갯빛개구리매				●		323-6	II
3	<i>Accipiter soloensis</i>	붉은배새매		●	●	●		323-2	
4	<i>Accipiter nisus</i>	새매	●	●				323-4	
5	<i>Accipiter gentilis</i>	참매	●					323-1	II
6	<i>Buteo buteo</i>	말뚱가리	●			●			II
7	<i>Falco tinnunculus</i>	황조롱이				●	●	323-8	
8	<i>Falco subbuteo</i>	새홀리기					●		II
9	<i>Cuculus poliocephalus</i>	두견		●	●			447	
10	<i>Otus scops</i>	소쩍새			●	●	●	324-6	
11	<i>Strix aluco</i>	올빼미		●	●			324-1	II
12	<i>Dryocopus martius</i>	까막딱다구리					●	242	II
No. of species			4	4	5	6	5	10	6

*A: This study(2010), B: Koo and Woo(1995), Woo and Paek(1996), C: Ministry of Environment(1997), D: Ministry of Environment(2007), E: Ministry of Environment(2009), F: Number of natural monument, G: Grade of endangered species.

previous literature is the result obtained from the survey against relatively a broad territory centered on the Bangtaesan Mountain, while this study was targeted at the south/north slopes of the Bangtaesan Mountain only, which might have resulted in a difference more or less in the range of surveyed area and inhabiting environment.

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Appendix 1. The birds checklist recorded at south slope of Mt. Bangtaesan

No.	Scientific name	Korean name	A*	B	C	D	E	F	Total	R.D.
1	<i>Accipiter gentilis</i>	참매					1		1	< 0.5
2	<i>Buteo buteo</i>	말뚝가리						1	1	< 0.5
3	<i>Bonasa bonasia</i>	들꿩		2	1				3	0.6
4	<i>Tringa ochropus</i>	빽빽도요	1						1	< 0.5
5	<i>Streptopelia orientalis</i>	멧비둘기		2			4	3	9	1.7
6	<i>Cuculus fugax</i>	매사촌						2	2	< 0.5
7	<i>Cuculus micropterus</i>	검은등뺨꾸기	1	1	1			1	4	0.7
8	<i>Cuculus canorus</i>	뺨꾸기	1						1	< 0.5
9	<i>Cuculus saturatus</i>	병어리뺨꾸기		1				1	2	< 0.5
10	<i>Dendrocopos kizuki</i>	쇠딱다구리	1	1				2	4	0.7
11	<i>Dendrocopos major</i>	오색딱다구리	2	2					4	0.7
12	<i>Motacilla cinerea</i>	노랑할미새	4	2			6	2	14	2.6
13	<i>Motacilla alba leucopsis</i>	알락할미새	2						2	< 0.5
14	<i>Microscelis amaurotis</i>	직박구리	7	5	2	2	4	8	28	5.1
15	<i>Lanius bucephalus</i>	때까치	1	2				1	4	0.7
16	<i>Cinclus pallasii</i>	물까마귀	1	1			1	1	4	0.7
17	<i>Troglodytes troglodytes</i>	굴뚝새		2		1	3		6	1.1
18	<i>Luscinia sibilans</i>	울새	1	2					3	0.6
19	<i>Luscinia cyane</i>	쇠유리새	2	3			1		6	1.1
20	<i>Tarsiger cyanurus</i>	유리딱새		2					2	< 0.5
21	<i>Phoenicurus aureoreus</i>	딱새	2	3			2	5	12	2.2
22	<i>Saxicola torquatus</i>	검은딱새	2						2	< 0.5
23	<i>Turdus hortulorum</i>	되지뺨꾸	1			1			2	< 0.5
24	<i>Turdus pallidus</i>	흰배지뺨꾸	3	3		2	2	3	13	2.4
25	<i>Paradoxornis webbiana</i>	붉은머리오목눈이	2						2	< 0.5
26	<i>Phylloscopus inornatus</i>	노랑눈썹솔새						3	3	0.6
27	<i>Phylloscopus borealis</i>	쇠솔새		5	2	2	1	6	16	2.9
28	<i>Phylloscopus coronatus</i>	산솔새	4	9	4	2	1	7	27	5.0
29	<i>Regulus regulus</i>	상모솔새				2	2	4	8	1.5
30	<i>Ficedula mugimaki</i>	노랑딱새		2					2	< 0.5
31	<i>Cyanoptila cyanomelana</i>	큰유리새	1	2				2	5	0.9
32	<i>Aegithalos caudatus</i>	오목눈이		6		4	7	4	21	3.9
33	<i>Parus palustris</i>	쇠박새	7	10	4	4	8	8	41	7.5
34	<i>Parus ater</i>	진박새		2	2	2	4	4	14	2.6
35	<i>Parus major</i>	박새	4	3	2	2	2	2	15	2.8
36	<i>Parus varius</i>	곤줄박이	2	14	2	2	8	4	32	5.9
37	<i>Sitta europaea</i>	동고비	1	4	2	2	4	3	16	2.9
38	<i>Emberiza rustica</i>	쑥새	20					5	25	4.6
39	<i>Emberiza elegans</i>	노랑턱멧새	22	14	4	3	10	11	64	11.7
40	<i>Carduelis sinica</i>	방울새	14						14	2.6
41	<i>Uragus sibiricus</i>	긴꼬리홍양진이						2	2	< 0.5
42	<i>Carpodacus roseus</i>	양진이		4	9				13	2.4
43	<i>Passer montanus</i>	참새	8						8	1.5
44	<i>Garrulus glandarius</i>	어치	4	2	2	3	3	4	18	3.3
45	<i>Cyanopica cyana</i>	물까치	35					5	40	7.3
46	<i>Pica pica</i>	까치	4						4	0.7
47	<i>Corvus macrorhynchos</i>	큰부리까마귀	15	1	2	2	1	4	25	4.6
No. of species			31	30	14	16	21	29	47	
No. of individuals			175	112	39	36	75	108	545	

*A: Woldungyo-Control Post, B: Control Post-Woldun Hill, C: Woldun Hill-Guryongdeokbong, D: Gitdaebong-Gaeinyaksu, E: Gaeinyaksu-Yaksusanjang, F: Yaksusanjang-Sogaedonggyo

Appendix 2. The birds checklist recorded at north slope of Mt. Bangtaesan

No.	Scientific name	Korean name	A*	B	C	D	E	F	G	H	Total	R.D.
1	<i>Aix galericulata</i>	원앙		2							2	0.5
2	<i>Accipiter nisus</i>	새매				1					1	< 0.5
3	<i>Accipiter gentilis</i>	참매							1		1	< 0.5
4	<i>Bonasa bonasia</i>	들꿩					1				1	< 0.5
5	<i>Streptopelia orientalis</i>	멧비둘기	2		1					3	6	1.4
6	<i>Cuculus fugax</i>	매사촌	1							1	2	0.5
7	<i>Cuculus micropterus</i>	검은등빼꾸기			2		1	1		1	5	1.1
8	<i>Cuculus saturatus</i>	병어리빼꾸기		1	2		2	1			6	1.4
9	<i>Dendrocopos kizuki</i>	쇠딱다구리	2	2	1	1		1		1	8	1.8
10	<i>Dendrocopos leucotos</i>	큰오색딱다구리			1			1			2	0.5
11	<i>Dendrocopos major</i>	오색딱다구리						1			1	< 0.5
12	<i>Motacilla cinerea</i>	노랑할미새	4	2						2	8	1.8
13	<i>Microscelis amaurotis</i>	직박구리	3	3	2			2		6	16	3.6
14	<i>Lanius bucephalus</i>	때까치	1								1	< 0.5
15	<i>Cinclus pallasii</i>	물까마귀	2							1	3	0.7
16	<i>Troglodytes troglodytes</i>	굴뚝새	2	2	2			1		1	8	1.8
17	<i>Luscinia cyane</i>	쇠유리새	2		3			1			6	1.4
18	<i>Tarsiger cyanurus</i>	유리딱새		1							1	< 0.5
19	<i>Phoenicurus aureoreus</i>	딱새	2								2	0.5
20	<i>Turdus hortulorum</i>	되지빠귀			2						2	0.5
21	<i>Turdus pallidus</i>	흰배지빠귀	2		2	2	1	3		1	11	2.5
22	<i>Turdus naumanni eunomus</i>	개똥지빠귀			1						1	< 0.5
23	<i>Paradoxornis webbiana</i>	붉은머리오목눈이						10			10	2.3
24	<i>Phylloscopus inornatus</i>	노랑눈썹솔새			3		3		1		7	1.6
25	<i>Phylloscopus borealis</i>	쇠솔새	2	2	3		2	3	2	3	17	3.8
26	<i>Phylloscopus coronatus</i>	산솔새	6	2	11	1		10		9	39	8.8
27	<i>Regulus regulus</i>	상모솔새								3	3	0.7
28	<i>Cyanoptila cyanomelana</i>	큰유리새	2					3		2	7	1.6
29	<i>Aegithalos caudatus</i>	오목눈이	5	5	5			5			20	4.5
30	<i>Parus palustris</i>	쇠박새	4	2	9	2	9	6	2	4	38	8.6
31	<i>Parus ater</i>	진박새	4				4	1	2		11	2.5
32	<i>Parus major</i>	박새	2		6	4	2	2	2	2	20	4.5
33	<i>Parus varius</i>	곤줄박이	4	4	12	2	2	2		2	28	6.3
34	<i>Sitta europaea</i>	둥고비	3	4	6	4	6	4	1	2	30	6.8
35	<i>Emberiza rustica</i>	쭈새								2	2	0.5
36	<i>Emberiza elegans</i>	노랑턱멧새	10		12	3		8	2	9	44	9.9
37	<i>Carpodacus roseus</i>	양진이					1			5	6	1.4
38	<i>Garrulus glandarius</i>	어치	2		2	2	2	2	2	2	14	3.2
39	<i>Cyanopica cyana</i>	물까치	6					21		5	32	7.2
40	<i>Pica pica</i>	까치						3		2	5	1.1
41	<i>Corvus macrorhynchos</i>	큰부리까마귀	3		2	3	3	2	2	2	17	3.8
No. of species			24	13	22	11	14	24	10	24	41	
No. of individuals			76	32	90	25	39	94	17	71	444	

*A: Recreational Forest Entrance-Guryonggyo, B: Guryonggyo-Forked Road, C: Forked Road-Maebongnyeong, D: Maebongnyeong-Guryongdeokbong, E: Guryongdeokbong-Jueokbong, F: Jueokbong-Forked Road, G: Jueokbong-Giddaebong, H: Gitdaebong-Oryudong