



Characteristics of Birds Community in Jeoksangsan (Mt.) during Breeding Season

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Abstract: This study was conducted between April and July of both 2008 and 2010 at the Jeoksangsan (Mt.) of the Deogyusan National Park to examine the birds community of the region. A total of 730 individuals of 54 species, 27 families and 10 orders were observed during the study period. Dominant species included the *Ardea cinerea* at 148 individuals (29.72%), followed by the *Paradoxornis webbianus* at 93 individuals (12.74%), the *Passer montanus* at 91 individuals (12.47%), the *Streptopelia orientalis* at 33 individuals (4.52%), and the *Hypsipetes amaurotis* at 31 individuals (4.25%). The 2008 study showed a total of 498 individuals of 48 species and the 2010 study showed a total of 567 individuals of 46 species. This showed that the transition from 2008 to 2010 resulted in decrease in the number of species but increase in the number of individuals. Species diversity was higher in 2010, while species richness was slightly higher in 2008. The survey area was divided into forest region (more than 400m above sea level, total distance of 7km) and surrounding region (lower than 400m above sea level, total distance of 10km), and the result of the study of avian fauna in the regions showed a total of 191 individuals of 32 species, 20 families and 7 orders in the forest region and a total of 616 individuals of 44 species, 24 families and 10 orders in the surrounding region. In terms of density per distance, the surrounding region showed a higher level, at 58.67 Ind./km in comparison to the 27.29 Ind./km of the forest region. On the other hand, in terms of species diversity, the forest region showed a much higher level at 3.04, when compared to the 1.95 of the surrounding region, and in terms of the species richness, the surrounding region showed 6.69, a value higher than the 5.90 of the forest region. The dominant species of the two regions differed. This is predicted to be caused by the different habitat structure and food resources distribution resulting from their environmental differences.

Keywords: Avifauna, Dominant Species, Density, Deogyusan National Park

Introduction

A Korea national park is a region which represents the nature or the ecosystem of Korea, which makes it ecologically significant (Kim, 1993). The Deogyusan National Park was designated as a national tourism site in 1969, then designated as a provincial park of Jeollabuk-do in 1971 and then became a national park on February 1st of 1975. The Deogyusan National Park is located towards the center of the Sobaeksan Mountain Range, and is surrounded by Gayasan (Mt.) to the east, Naejangsan (Mt.) to the west, Jirisan (Mt.) to the south and Gyeryongsan (Mt.) and Songnisan (Mt.) to the north. Hyangjeokbong (1,614m above sea level) is the highest peak of the mountain range, and has Seolcheonbong (1,510 m), Dumunsan (1,051 m), Jeoksangsan (1,029 m) and Geochilbong (1,177 m) to the north and the Jungbong (1,593 m), Muryongsan (1,492 m) and Namdeogyusan (1,507 m) to the south. The entire

mountain range is spread over a surface area of 231.650 km² and stretches over 4 countys of Jeollabuk-do and Gyeongsangnam-do (Korea National Parks Authority, 2004). Jeoksangsan (Mt.), the study site, is located between east longitude 127°41'~127°42' and north latitude 35°56' ~35°57' at the northwest part of the Deogyusan National Park. Jeoksangsan also includes Korea's largest pumped storage power plant with a 600,000 KWH capacity facility, which stems from it's the lower part dam (Mujuho; 250 m above sea level) established at the upper part dam (Jeoksangho; 850 m above sea level).

Study on forest avifauna of the Deogyusan National Park included the study by Lee *et al.* (1994), which reported 34 species of 16 families and 5 orders from winter and summer studies, and another by Lee (2003), which reported 69 species through the critical apparatus. In addition, there have also been reports from the Deogyusan National Park natural resources study (Korea National Parks Authority, 2004) and natural resources monitoring (Korea National Parks Authority, 2008), with the majority of these studies been done in relation to the seasons, and in terms of studies on the avian fauna of the Jeoksangsan region, there has only

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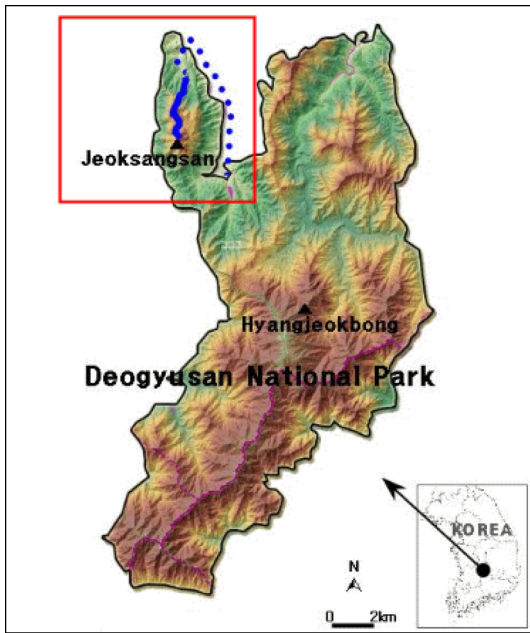


Fig. 1. Map showing the survey area (□) in Deogyusan National Park (survey route: Forest region —, Surrounding region ---).

been resources monitoring by the Korea National Parks Authority (2008).

Therefore, this study was conducted in order to analyze the avian fauna of Jeoksangsansan, located to the northwest part of the Deogyusan National Park, to provide information for the protection and management of the Jeoksangsansan ecosystem.

Materials and Methods

This study was conducted between April and July, breeding season, of 2008 and 2010 over 8 times in the Jeoksangsansan (Mt.) region of the Deogyusan National Park.

Jeoksangsansan (1,029.2 m) is located at easy longitude 127°41'~127°42' and north latitude 35°56'~35°57' and is included in the Deogyusan National Park (Fig. 1). The average temperature of this region is 11.5, with the average temperature of 27.4 in July and 0.1 in February, and the average rainfall is 1,105 mm, with the summer rainfall marking 40% of the total and 20% for the winter season. In terms of the plant flora of the region, the dominant species is the *Quercus mongolica*, followed by the *Pinus densifloa*, *Quercus variabilis* and the *Q. serrata*, as well as the *Carpinus laxiflora*, *Carpinus cordata*, *Fraxinus mandshurica* and the *Cornus controversa* (Kim *et al.*, 2008).

Table 1. Conditions of 2 survey areas

Items	Forest region	Surrounding region
Distance (km)	7.0	10.5
Altitude (m)	>400	<400
District	roadway, slope and valley	roadway, village, farmland, stream and reservoir

Study method included moving along the mountain region, streams and farming areas of Jeoksangsansan using the line transect method by Bibby *et al.* (1992), and the birds were examined using the naked eye, a binocular (10×40), via their cries or flight pattern in order to record their species and count (Table 1; Fig. 1). Furthermore, a GPS (Garmin, GPS map 60CS) was used to record the location of the birds, and they were filmed using a camera (Nikon D300) and a telephoto lens (AF VR-NIKKOR 80~400 mm).

The data collected was organized via volume 25 (Ecosystem of birds) of the Illustrated Encyclopedia of Fauna & Flora of Korea (Won, 1981), the *Birds of Korea* (Lee *et al.*, 2000) and checklist of the birds of Korea (The ornithological society of Korea, 2009).

The equations used for the analysis of the data collected are as follows (Brower *et al.*, 1990; Shannon and Weaver, 1949; Margalef, 1963).

(1) Dominance

$$RD=(ni/N)\times 100$$

ni: number of individuals at *i* species
 N: total number of individuals

(2) Species diversity

$$H'=-\sum(ni/N)\times \ln(ni/N)$$

ni: number of individuals at *i* species
 N: total number of individuals at survey area

(3) Species richness

$$Da=(s-1)/\ln(N)$$

s: total number of species
 N: total number of individuals at survey area

(4) Density

$$D=P/S$$

P: higher number of individuals observed in survey area
 S: distance of each survey area (Km)

Results and Discussion

Avifauna

A total of 730 individuals of 54 species, 27 families and 10

Table 2. The number of species, density, species diversity and species richness by month for survey areas in Jeoksangsan (Mt.)

Items	2008				Total	2010				Total	Sum total
	Apr	May	Jun	Jul		Apr	May	Jun	Jul		
NS	25	27	29	23	48	28	36	34	20	46	54
NI	173	307	223	163	498*	353	374	300	221	567*	730*
H'	2.69	2.06	2.73	2.59	2.90	2.56	2.91	2.99	2.56	3.12	3.08
Da	4.66	4.54	5.18	4.32	7.57	4.60	5.91	5.79	3.52	7.10	8.04

*Peak count, NS: number of species, NI: number of individuals, H': species diversity
Da: species richness

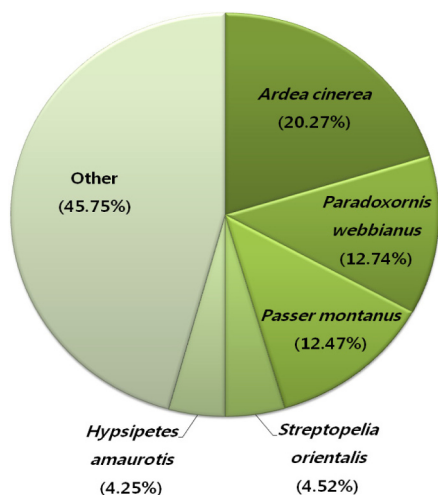


Fig. 2. Dominance of bird species in the Jeoksangsan (Mt.) during survey period.

orders were observed during the study period in the Jeoksangsan (Mt.) area (Table 2). The most dominant species was the *Ardea cinerea* at 148 individuals (29.72%), followed by the *Paradoxornis webbianus* at 93 individuals (12.74%), the *Passer montanus* at 91 individuals (12.47%), the *Streptopelia orientalis* at 33 individuals (4.52%) and the

Hypsipetes amaurotis at 31 individuals (4.25%) (Fig. 2). In the lower altitude areas, including the reservoirs and streams of Jeoksangsan area, dominant species included agricultural forest birds, such as the *Ardea cinerea*, *Paradoxornis webbianus*, *Streptopelia orientalis* and the *Passer montanus*, and the *Ardea cinerea* was observed to do breeding in the pine tree colonies of Mujoho lake (Fig. 2).

A total of 498 individuals of 48 species were observed in the 2008, while a total of 567 individuals of 46 species were observed in the 2010. This showed that the number of species increased between 2008 and 2010, but the number of individuals decreased during this time. With the exception of the *Larus canus* and the *Emberiza tristrami* recorded in 2008, species which appeared each year seem to be quite similar. In terms of species diversity, 2010 showed a higher value at 3.12, compared to the 2.90 of 2008, and in terms of species richness, 2008 showed a slightly higher level at 7.57, compared to the 7.10 of 2010 (Table 2).

In terms of the months, May (2010) and June (2008) showed higher number of species than April, with decrease in July, and May of 2008 and 2010 showed the highest number of individuals before decreasing (Fig. 3). Lee *et al.*

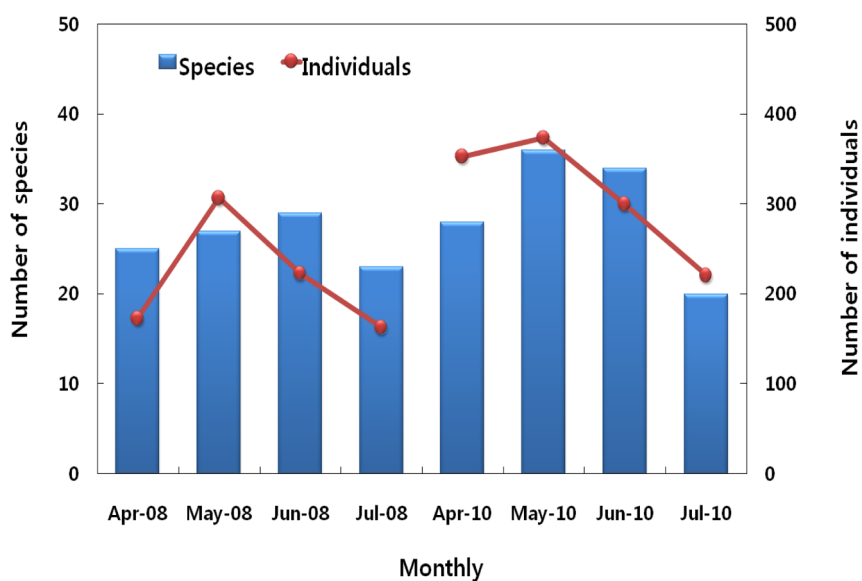


Fig. 3. Monthly variation of the number of species and individuals in the Jeoksangsan (Mt.) from April to July, 2008 and 2010.

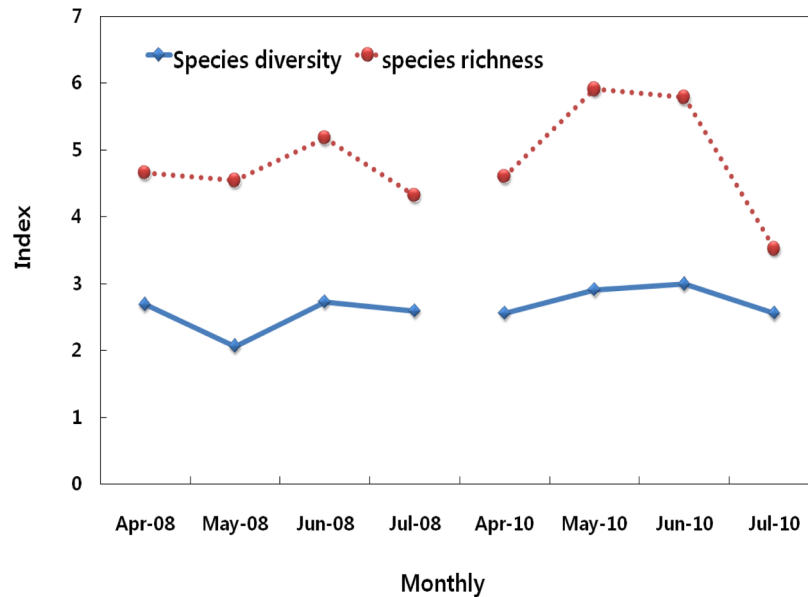


Fig. 4. Monthly variation of the species diversity and species richness in the Jeoksangsan (Mt.) from April to July, 2008 and 2010.

(1993) has reported that spring showed the highest number of species as it is breeding season, that such numbers decrease afterwards with the migration of summer migratory birds during the fall and that the number of species is the lowest during the winter due to decreased food resources and worsening weather. The results of studies on Deogyusan (Yu *et al.*, 2010), Gayasan (Lee *et al.*, 1989), Odaesan (Lee *et al.*, 1996), Seoraksan (Rhim *et al.*, 2002) and Juwangsang (Chung and Lee, 2005), all mountains included in the study area, reported that spring time showed the highest number of species and individuals during the spring. Such pattern is hypothesized to also be due to the increase in bird activities as a result of trying to find healthy mates for successful breeding during mating season (Lack, 1966; Rhim *et al.*, 2002).

Species diversity showed the highest level in June of 2008 at 2.73 and June of 2010 at 2.99, and species richness was the highest in June of 2008 at 5.18 and May of 2010 at 5.91 (Fig. 4). In terms of the months, number of species, bird count, species diversity and species richness were generally the highest in May and June and low in April and July.

Characteristics of distribution by survey regions

The results of studying the forest region and the surrounding region of the study area showed a total of 191 individuals of 32 species, 20 families and 7 orders in the forest region and a total of 616 individuals of 44 species, 24 families and 10 orders in the surrounding region. This showed that the surrounding region showed higher number of species and individuals when compared to the forest region. In terms of the density (Ind./km), the surrounding region showed a higher value of 58.67 Ind./km in comparison to the 27.29

Ind./km of the forest region. On the other hand, the forest region showed a higher level of species diversity at 3.04 when compared to the 1.95 of the surrounding region, and the surrounding region showed a higher level of species richness at 6.69, compared to the 5.90 of the forest region (Table 3). Lee *et al.* (2004) has reported that mountain forest birds are found frequently in the region between forest centers, which experiences the edge effect, and this is predicted to correlate to the finding by this study that the number of species and density were high in the surrounding region than in the forest region.

Dominant species in the forest region, with dominance of over 5%, included forest species, in the order of, the *Parus palustris*, *Paradoxornis webbianus*, *Turdus pallidus*, *Aegithalos caudatus*, *Emberiza elegans*, *Hypsipetes amaurotis* and the *Sitta europaea*. In the surrounding region, such species included the *Ardea cinerea*, *Paradoxornis webbianus*, tree *Passer montanus* and the *Streptopelia orientalis*, which are inhabitants of streams, reservoirs and farming grounds (Table 3). In terms of the species composition of the dominant species, with the exception of the *Paradoxornis webbianus*, species showed differences in the composition in both the forest region and the surrounding region. This is assessed to be caused by the differences in habitation and food resources distribution as a result of varying environmental factors in the study area. Especially species such as the *Ardea cinerea*, *Egretta alba modesta*, *Egretta garzetta*, *Butorides striatus*, *Anas platyrhynchos*, *Anas poecilorhyncha*, *Alcedo atthis*, *Montacilla alba* and the *Montacilla grandis*, which live in streams or near reservoirs, were observed only in the low-altitude surrounding region. Over two pairs of the *Aix galericulata*, which is a permanent resident species, were found in the forest near the farming ground

Table 3. Characteristics of bird community by survey regions in Jeoksangsan (Mt.)

No.	Scientific name	Korean name	Forest region (7km)		Surrounding region (10.5km)	
			Density (Ind./km)	Dom.	Density (Ind./km)	Dom.
1	<i>Ardea cinerea</i>	왜가리			14.10	24.03
2	<i>Egretta alba modesta</i>	중대백로			0.48	0.81
3	<i>Egretta garzetta</i>	쇠백로			0.19	0.32
4	<i>Butorides striatus</i>	검은댕기해오라기			0.86	1.46
5	<i>Aix galericulata</i>	원앙	0.29	1.05	1.62	2.76
6	<i>Anas platyrhynchos</i>	청둥오리			0.19	0.32
7	<i>Anas poecilorhyncha</i>	흰뺨검둥오리			0.48	0.81
8	<i>Accipiter soloensis</i>	붉은배새매			0.10	0.16
9	<i>Buteo hemilasius</i>	큰말똥가리	0.29	1.05		
10	<i>Falco tinnunculus</i>	황조롱이	0.14	0.52		
11	<i>Phasianus colchicus</i>	평	0.14	0.52	0.29	0.49
12	<i>Larus camus</i>	갈매기			0.19	0.32
13	<i>Streptopelia orientalis</i>	멧비]둘기	0.29	1.05	3.14	5.36
14	<i>Cuculus micropterus</i>	검은등뺨꾸기			0.38	0.65
15	<i>Cuculus canorus</i>	뺨꾸기			0.10	0.16
16	<i>Cuculus saturatus</i>	병어리뺨꾸기	0.14	0.52		
17	<i>Alcedo atthis</i>	물총새			0.10	0.16
18	<i>Eurystomus orientalis</i>	파랑새			0.29	0.49
19	<i>Dendrocopos kizuki</i>	쇠딱다구리	0.14	0.52	0.19	0.32
20	<i>Dendrocopos leucotos</i>	큰오색딱다구리	0.14	0.52		
21	<i>Picus canus</i>	청딱다구리	0.29	1.05	0.19	0.32
22	<i>Motacilla cinerea</i>	노랑할미새	0.14	0.52	0.86	1.46
23	<i>Motacilla alba</i>	알락할미새			1.24	2.11
24	<i>Motacilla grandis</i>	검은등할미새			0.19	0.32
25	<i>Hypsipetes amaurotis</i>	직박구리	1.71	6.28	1.81	3.08
26	<i>Lanius bucephalus</i>	매까치			0.19	0.32
27	<i>Troglodytes troglodytes</i>	굴뚝새	0.14	0.52		
28	<i>Luscinia cyane</i>	쇠유리새	0.29	1.05		
29	<i>Phoenicurus aureoreus</i>	딱새	0.57	2.09	1.05	1.79
30	<i>Saxicola torquata</i>	검은딱새			0.38	0.65
31	<i>Turdus hortulorum</i>	되지빠귀	0.14	0.52		
32	<i>Turdus pallidus</i>	흰배지빠귀	2.57	9.42	0.67	1.14
33	<i>Paradoxornis webbianus</i>	붉은머리오목눈이	2.86	10.47	8.86	15.10
34	<i>Urosphena squameiceps</i>	숲새	0.57	2.09		
35	<i>Phylloscopus borealis</i>	쇠솔새	0.57	2.09		
36	<i>Phylloscopus coronatus</i>	산솔새	1.14	4.19	0.19	0.32
37	<i>Cyanoptila cyanomelana</i>	큰유리새	0.29	1.05	0.10	0.16
38	<i>Aegithalos caudatus</i>	오목눈이	2.00	7.33	0.48	0.81
39	<i>Parus palustris</i>	쇠박새	3.14	11.52	1.14	1.95
40	<i>Parus ater</i>	진박새	1.00	3.66	0.19	0.32
41	<i>Parus major</i>	박새	1.14	4.19	1.62	2.76
42	<i>Parus varius</i>	근줄박이	1.29	4.71	1.05	1.79
43	<i>Sitta europaea</i>	동고비	1.43	5.24		
44	<i>Emberiza cioides</i>	멧새	0.57	2.09	0.67	1.14
45	<i>Emberiza tristrami</i>	흰배멧새			0.19	0.32
46	<i>Emberiza elegans</i>	노랑턱멧새	1.86	6.81	1.43	2.44
47	<i>Passer montanus</i>	참새			8.67	14.77
48	<i>Sturnus cineraceus</i>	찌르레기			0.67	1.14
49	<i>Oriolus chinensis</i>	피꼬리	0.43	1.57	0.76	1.30
50	<i>Garrulus glandarius</i>	어치	1.00	3.66	0.67	1.14
51	<i>Cyanopica cyana</i>	물까치			1.14	1.95
52	<i>Pica pica</i>	까치			0.76	1.30
53	<i>Corvus corone</i>	까마귀			0.19	0.32
54	<i>Corvus macrorhynchos</i>	큰부리까마귀	0.57	2.09	0.67	1.14
Number of species			32		44	
Sum of density			27.29		58.67	
Species diversity			3.04		1.95	
species richness			5.90		6.69	

and small stream of Chimok-ri, and a single pair was found breeding in the valley area of the forest region. The *Accipiter soloensis*, *Falco tinnunculus* and the *Buteo hemilasius*, all birds of prey, were observed near the farming ground of the surrounding region and the high-altitude peaks of Jeoksangsan (Mt.). The *Larus canus* was found temporarily in April of 2008 in Mujuh lake.

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