

DIFFERENT TYPES OF FOODS FORAGED BY VARIOUS BIRD SPECIES IN PAKOKKU ENVIRONS, MAGWAY REGION

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Abstract

Different types of foods foraged by various birds were investigated in four study sites of Pakokku environs during July 2015 to June 2016. A variety of foods including animal matters and plant matters was consumed by different bird species. The bird fauna in the study area was represented with 69 carnivorous species (54.77%), 53 omnivorous species (42.06%) and four herbivorous species (3.17%) according to the foods taken. The carnivorous birds were predominant due to the abundance of food sources for these birds to forage. The environs of Pakokku provide different food sources that are important for the existence of bird species inhabited in that area.

Keywords: Foods, birds, Pakokku environs

Introduction

Birds are the ideal bio-indicators and useful models for studying a variety of environmental problems (Newton, 1995). Birds are useful ecological indicators by which evaluate successful maintenance of biotic integrity. Birds are sensitive to environment changes, respond rapidly to changes, and are abundant within various landscape classes (Glennon, 2005).

Different birds have different food habits. Birds like parrots and pigeons eat seeds and fruits. Birds like crows and ducks eat both plant and flesh of other animals. Birds like eagles and vultures eat the flesh of other animals.

Birds in their diversity constitute part of the natural environment and play functional roles such as agents of flower pollination and seed dispersal, source of food chain and agents in breaking seed dormancy (David *et al.*, 2015). Seed dispersal is one of the most important ecological processes carried out by birds in tropical forests that have been modified by land-use changes. In some tropical forest up to 90% of tree species are dispersed by animals, mainly mammals and birds. Therefore, loss of seed dispersers, such as frugivorous birds, can affect plant regeneration and impact heavily of forest structure and phenotypic and genotypic characteristics of plant species (Menezes *et al.*, 2016).

In addition to importance as pollinators, birds in their glide, consume hundred of insects, many of which are considered as pests. Hence birds play a critical role in reducing and maintaining populations of insects in natural systems. In a paddy field, the role of birds in pest control is enormous.

Pakokku is located in the western part of the central dry zone, on the west bank of the Ayeyawady River. Pakokku has a mostly flat topography, except for some low mountains in the western area of the township and is characterized by a hot, dry climate. Areas by the river experience floods, which away from the river drought and access to water is a chronic problem.

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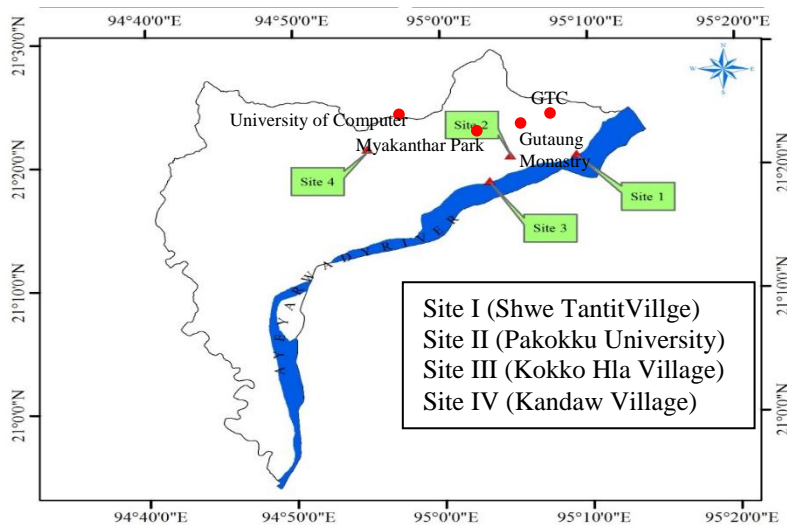
Although Pakokku is located in the central dry zone, some areas are inhabited with trees that grow sparsely in some places and moderately in some habitats. Some areas are agricultural fields and bushes. Some fruiting trees and trees with thick foliage are major food sources for frugivorous and insectivorous birds.

Myanmar is a country rich with diversified bird species. Most researchers concentrate their studies on species composition and occurrence of birds in different areas of Myanmar. The research works relating to the foods of birds are very rare compared to other areas of research. This research aims to fill the gap required in some research areas of bird ecology. This research was conducted to investigate the different kinds of foods foraged by various bird species in Pakokku environs and to determine the feeding habit of birds in Pakokku environs based on the foods taken.

Materials and Methods

Study area

Pakokku is situated about 30 km away from the northwest of Bagan and lies at the sides of Ayeyawady River in Magway Region. Pakokku lies between latitude 20° 20' to 21° 30' North and longitude 94° 40' to 95° 20' East and located in the dry zone of central Myanmar. Four study sites were located in the study area as Shwe Tantit Village environs (Site I), Pakokku University (Site II), Kokko Hla Village environs (Site III) and Kandaw Village environs (Site IV) (Fig. 1). The large woody trees, paddy fields, bushy area, medium and tall trees, cultivated area, garden, wetland with submerged plant, flood plain, Kyi village Dam and some portions of Ayeyawady River were included in Site I. The large woody trees, medium and tall trees, artificial pond, bushy area and buildings were found in Site II. The large woody trees, medium and tall trees, paddy fields, flood plain, horticultural land, Kokko Hla village Dam and nearby Ayeyawady River were occurred in Site III. The less number of large woody trees, medium and tall trees, and bushes, and artificial pond and agricultural fields were contained in Site IV.



Source Google Earth, 2013

Figure 1 A map of Pakokku Township showing the study sites

Study period

The present study was conducted from July 2015 to June 2016.

Study design

In terms of monitoring the foods foraged by different bird species, an appropriate transect lines were drawn in each study site. Birds eating the foods were viewed by a pair of binocular while traversing the transect routes. Observations were taken from 6:30 AM to 10:30 AM. In each occasion of bird watching, bird species and the foods taken were recorded. The photos of birds together with their foods were taken immediately after viewing the birds. Binoculars, camera and note book were used during the field study. Each study site was visited twice per month.

Identification and classification of species

The identification of birds was made by referring to taxonomic descriptions given by Robson (2015; 2016). Classification of birds was followed after Birdlife International (2015).

Different types of foods foraged

Feeding of birds was investigated by viewing with binocular and recording with digital camera. Foraging incidence of birds such as on the ground, tree, in flight, water etc. were recorded. Feeding habit of birds were determined and arranged based on the kind of foods eaten such as carnivorous, omnivorous, and herbivorous.

Results

Site I

In this study site, a total of 102 bird species with different feeding habits was recorded. Among the bird species recorded, 49 species were carnivorous, 49 species were omnivorous and four species were herbivorous. (Table 1, 2, 3 and Plate 1)

In carnivorous species, 28 species were terrestrial birds and 21 species were water birds. In omnivorous group, 34 species were terrestrial species and 15 species were water birds. All herbivorous species were terrestrial species. (Table 3)

Site II

In Site II, a total of 64 bird species with different feeding habits was observed. Among them, 33 species were carnivorous, 29 species were omnivorous and two species were herbivorous. (Table 1 and Plate 1)

In carnivorous species, 31 species were terrestrial birds and two species were water birds. In omnivorous group, all 29 species recorded were terrestrial species and all herbivorous species found were terrestrial species. (Table 3)

Site III

In the case of Site III, a total of 86 bird species with different feeding habits was recorded. Among the avifaunal group in this site, 47 species were carnivorous, 37 species were omnivorous and two species were herbivorous. (Table 1 and Plate 1)

In carnivorous species, 32 species were terrestrial birds and 15 species were water birds. In omnivorous group, 28 species were terrestrial species and nine species were water birds. All herbivorous species were terrestrial species. (Table 3)

Site IV

Regarding with Site IV, a total of 58 bird species with different feeding habits was recorded. Among the bird species, 28 species were carnivorous, 28 species were omnivorous and two species were herbivorous. (Table 1 and Plate 1)

In carnivorous species, 26 species were terrestrial birds and two species were water birds. In omnivorous group, 27 species were terrestrial species and only one species was water bird. All herbivorous species were terrestrial species. (Table 3)

Pakokku environs

When consideration was made on the whole study area, a total of 126 bird species with different feeding habits was recorded. Among the bird species recorded, 69 species were carnivorous, 53 species were omnivorous and four species were herbivorous. (Table 1 and Plate 1)

Among them, one piscivorous, two avivorous and 36 insectivorous birds were recorded. These birds and the rest of the species that ate different animal matters are included in carnivorous group. Among the bird species group that ate different animal matters, nine species feeding on fish and insect, two species on fish, insect and worm, one species on fish and tadpole, three species on fish, insect and tadpole, two species on rat, fish and insect, six species on mollusk and insect, one species on insect and worm, one species on lizard and insect, three species on rat and insect and two species on mollusk, fish and insect were recorded. (Table 2 and Plate 1)

Among the omnivorous group that prefer different diets, one species feeding on mollusk, vegetation and fish, one species on mollusk, vegetation, fish and insect, five species on mollusk, vegetation and insect, one species on vegetation, grain and insect, one species on grain, mollusk, insect and worm, two species on vegetation and insect, five species on grain, vegetation and insect, four species on insect and fruit, one species on worm, vegetation and insect, 11 species on insect and nectar, six species on insect, nectar and fruit, two species on dead animal, insect, fruit, grain and disable bird, one species on dead animal, seven species on grain and insect, four species on grain, insect, nectar and fruit and one species on grain, insect and fruit were recorded. (Table 2 and Plate 1)

Among the herbivorous group feeding on fruits and grains or seeds, one species of frugivorous and three species of granivorous were recorded. (Table 2 and Plate 1)

In Pakokku environs, the bird fauna was represented with 54.77% carnivorous birds, 42.06 % omnivorous birds and 3.17 % herbivorous birds. (Fig. 2)

According to the different feeding habits, omnivorous birds eat insects, young bird, fish, molluscs, dead animal, nectar, seed and fruit. Carnivorous birds eat fish, worm, rat, lizard, young bird, tadpole, molluscs and insect (cricket, bee, ant, locust, butterflies, moth, flies, termite and beetle). Herbivorous birds feed on nectar, leaves, fruit, seed, flower, sunflower, wildflower, grass, weed seed, rice, barley, corn and millet. (Table 1)

Table 1 Feeding habit of bird species in Pakokku environs during July 2015 to June 2016

Sr. No.	Scientific Name	Foraging incidence	Type of foods	Feeding habits			Sites			
				Carni.	Omni.	Herbi.	I	II	III	IV
1.	<i>Dendrocygna javanica</i> *	Sh	Moll./Veg./Fish		+		+		+	
2.	<i>Tadorna ferruginea</i> *	Sh/W	Moll./Veg./Fish/Insc.		+		+		+	
3.	<i>Anas zonorhyncha</i> *	Sh	Moll./Veg./Insc.		+		+		+	
4.	<i>Tachybaptus ruficollis</i> *	Sh/W	Fish/Insc.	+			+			+
5.	<i>Anastomus oscitans</i> *	Sh/G	Fish/Insc.	+			+		+	
6.	<i>Plegadis falcinellus</i> *	Sh/G	Fish/Insc.	+			+		+	
7.	<i>Ixobrychus sinensis</i> *	Sh	Fish/Insc.	+			+			
8.	<i>Ixobrychus cinnamomeus</i> *	Sh	Fish/Insc.	+			+			
9.	<i>Ardeola grayii</i> *	Sh/G	Fish/Insc.	+			+		+	
10.	<i>Ardeola bacchus</i> *	Sh/G	Fish/Insc.	+			+	+	+	
11.	<i>Bubulcus coromandus</i> *	Sh/G	Fish/Insc./Worm	+			+	+	+	+
12.	<i>Ardea cinerea</i> *	Sh/G	Fish/Tad.	+			+		+	
13.	<i>Ardea purpurea</i> *	Sh/G	Moll./Fish/Insc.	+			+			
14.	<i>Ardea alba</i> *	Sh/G	Fish/Insc./Tad.	+						
15.	<i>Mesophoyx intermedia</i> *	Sh/G	Fish/Insc./Worm	+			+		+	
16.	<i>Egretta garzetta</i> *	Sh/G	Fish/Insc.	+			+		+	
17.	<i>Phalacrocorax niger</i> *	Sh	Fish/Insc.	+			+		+	
18.	<i>Phalacrocorax carbo</i> *	Sh	Fish (Pisci.)	+			+		+	
19.	<i>Falco tinnunculus</i>		Rat/ Insc.	+				+		
20.	<i>Elanus caeruleus</i>	F/T	Rat/Fish/Insc.	+			+			
21.	<i>Butastur teesa</i>	T	Rat/Fish/Insc.	+			+			
22.	<i>Buteo buteo</i>	F/T	Dis.birds (Avivo.)	+					+	
23.	<i>Aquila nipalensis</i>	F/T	Dead animal		+		+			
24.	<i>Gallirallus striatus</i> *	Sh/G	Veg./Gra./Insc.		+		+			
25.	<i>Amaurornis phoenicurus</i> *	Sh/G	Gra./Moll./Insc./Worm		+		+		+	
26.	<i>Porzana pusilla</i> *	Sh/G	Insc.	+			+			
27.	<i>Porzana fusca</i> *	Sh/G	Moll./Veg./Insc.		+		+			
28.	<i>Gallinula cinerea</i> *	Sh/G	Moll./Veg./Insc.		+		+			
29.	<i>Porphyrio poliocephalus</i> *	Sh/G	Moll./Veg./Insc.		+		+		+	
30.	<i>Gallinula chloropus</i> *	Sh/W/G	Moll./Veg./Insc.		+		+		+	
31.	<i>Fulica atra</i> *	Sh/W	Veg./Insc.		+		+		+	
32.	<i>Himantopus himantopus</i> *	Sh/G	Gra./Veg./Insc.		+		+		+	+
33.	<i>Vanellus cinereus</i> *	Sh/G	Moll./Insc.	+			+		+	
34.	<i>Vanellus indicus</i> *	Sh/G	Veg./Insc.		+		+		+	
35.	<i>Charadrius hiaticula</i> *	Sh/G	Insc./Worm	+			+		+	
36.	<i>Charadrius dubius</i> *	Sh/G	Moll./Insc.	+			+		+	
37.	<i>Rostratula benghalensis</i> *	Sh/G	Gra./Veg./Insc.		+		+			
38.	<i>Gallinago gallinago</i> *	Sh/G	Worm/Veg./Insc.		+		+			
39.	<i>Tringa ochropus</i> *	Sh/G	Moll./Fish/Insc.	+			+		+	
40.	<i>Tringa stagnatilis</i> *	Sh/G	Moll./Insc.	+			+			
41.	<i>Columba livia</i>	G	Gra./Veg./Insc.		+		+	+	+	+
42.	<i>Streptopelia orientalis</i>	G	Gra. (Grani.)			+	+			
43.	<i>Streptopelia decaocto</i>	G	Gra. (Grani.)			+	+	+		+
44.	<i>Streptopelia chinensis</i>	G	Gra. (Grani.)			+	+	+	+	+
45.	<i>Treron phoenicopterus</i>	T	Fruit (Frugi.)			+	+		+	
46.	<i>Clamator jacobinus</i>	T	Insc.	+				+		+
47.	<i>Cuculus canorus</i>	F	Insc.	+			+	+	+	+
48.	<i>Cacomantis merulinus</i>	T	Insc.	+			+	+	+	+
49.	<i>Cacomantis sepulcralis</i>	T	Insc.	+			+	+		
50.	<i>Centropus sinensis</i>	T	Insc./Fruit		+		+			
51.	<i>Centropus bengalensis</i>	T	Insc.	+			+	+	+	+
52.	<i>Tyto alba</i>	T	Rat (Avivo.)	+				+		+
53.	<i>Athene brama</i>	F/G	Rat/Insc.	+				+	+	+
54.	<i>Coracias benghalensis</i>	F/G	Liz./Insc.	+			+	+	+	
55.	<i>Halcyon smyrnensis</i>	F/Sh	Fish/Tad./Insc.	+			+	+	+	+
56.	<i>Alcedo atthis</i>	F/Sh	Fish/Tad./Insc.	+			+		+	

Sr. No.	Scientific Name	Foraging incidence	Type of foods	Feeding habits			Sites			
				Carni.	Omni.	Herbi.	I	II	III	IV
57.	<i>Merops orientalis</i>	F	Insc.	+			+	+	+	+
58.	<i>Merops philippinus</i>	F	Insc.	+			+	+	+	+
59.	<i>Upupa epops</i>	T/G	Insc.	+			+	+	+	+
60.	<i>Megalaima haemacephala</i>	T	Insc./Fruit		+		+	+	+	+
61.	<i>Dendrocopos analis</i>	T	Insc.	+				+		
62.	<i>Oriolus chinensis</i>	T	Insc./Nect./Fruit		+		+	+		
63.	<i>Artamus fuscus</i>	T	Insc.	+			+	+	+	+
64.	<i>Argithina tiphia</i>	T	Insc.	+			+	+	+	+
65.	<i>Dicrurus macrocercus</i>	T/F	Insc./Nect.		+		+	+	+	+
66.	<i>Dicrurus leucophaeus</i>	T/F	Insc./Nect.		+		+	+	+	+
67.	<i>Dicrurus aeneus</i>	T/F	Insc./Nect.		+		+		+	+
68.	<i>Dicrurus remifer</i>	T/F	Insc./Nect.		+			+		+
69.	<i>Corvus splendens</i>	G	De an./ Insc./ Fruit/Gra./Dis.birds		+		+	+	+	+
70.	<i>Corvus macrorhynchos</i>	G	De an./ Insc./Fruit/Gra/ Dis.birds		+		+	+	+	+
71.	<i>Lanius cristatus</i>	T/F	Insc.	+			+	+	+	+
72.	<i>Lanius collurioides</i>	T/F	Insc./Fruit		+		+	+		+
73.	<i>Lanius schach</i>	T/F	Rat/Insc.	+				+	+	+
74.	<i>Cinnyris asiaticus</i>	T	Insc./Nect.		+		+	+	+	+
75.	<i>Cinnyris jugularis</i>	T	Insc./Nect.		+			+		
76.	<i>Ploceus manyar</i>	T	Gra./Insc.		+		+		+	
77.	<i>Ploceus philippinus</i>	T	Gra./Insc.		+		+		+	+
78.	<i>Amandava amandava</i>	T	Gra./Insc.		+		+			
79.	<i>Lonchura punctulata</i>	T/G	Gra./Insc.		+		+	+	+	+
80.	<i>Passer domesticus</i>	T/G	Gra./Insc./Nect./Fruit		+		+	+	+	+
81.	<i>Passer flaveolus</i>	T/G	Gra./Insc./Nect./Fruit		+		+	+	+	+
82.	<i>Passer montanus</i>	T/G	Gra./Insc./Nect./Fruit		+		+	+	+	+
83.	<i>Anthus hodgsoni</i>	G	Insc./Gra.		+		+	+	+	
84.	<i>Anthus rufulus</i>	G	Insc./Gra.		+		+	+	+	+
85.	<i>Anthus similis</i>	G	Insc./Gra.		+		+			
86.	<i>Motacilla alba</i>	G	Insc.	+			+	+	+	+
87.	<i>Motacilla cinerea</i>	G	Moll./Insc.	+			+		+	+
88.	<i>Motacilla flava</i>	G	Moll./Insc.	+			+			
89.	<i>Motacilla citreola</i>	G	Moll./Insc.	+			+		+	
90.	<i>Acridotheres grandis</i>	T	Insc./Nect.		+			+		
91.	<i>Acridotheres fuscus</i>	T/G	Gra./Insc./Nect./Fruit		+		+	+	+	+
92.	<i>Acridotheres tristis</i>	T/G	Insc./Nect./Fruit		+		+	+	+	+
93.	<i>Acridotheres burmannicus</i>	T/G	Insc./Nect./Fruit		+		+	+	+	+
94.	<i>Gracupica nigricollis</i>	T	Gra./Insc./Fruit		+		+			
95.	<i>Sturnus malabaricus</i>	T	Insc./Nect./Fruit		+		+	+	+	
96.	<i>Sturnus vulgaris</i>	T	Insc./Fruit		+				+	
97.	<i>Luscinia calliope</i>	T	Insc.	+					+	
98.	<i>Luscinia svecica</i>	T	Insc.	+			+			
99.	<i>Phoenicurus frontalis</i>	T/G	Insc.	+			+	+	+	+
100.	<i>Saxicola ferreus</i>	T/G	Insc.	+			+	+	+	+
101.	<i>Saxicola maurus</i>	T	Insc.	+			+		+	
102.	<i>Saxicola caprata</i>	T/G	Insc.	+			+	+	+	+
103.	<i>Eumyias thalassinus</i>	F	Insc.	+					+	
104.	<i>Ficedula albicilla</i>	T/G	Insc.	+				+		+
105.	<i>Copsychus saularis</i>	F/G	Insc.	+				+	+	+
106.	<i>Mirafra assamica</i>	G	Gra./Insc./veg.		+		+	+	+	+
107.	<i>Mirafra microptera</i>	G	Gra./Insc./veg.		+		+	+	+	+
108.	<i>Pycnonotus blanfordi</i>	T/G	Insc./Nect./Fruit		+		+	+	+	+
109.	<i>Pycnonotus brunneus</i>	G	Insc.	+				+		
110.	<i>Pycnonotus cafer</i>	T	Insc./Nect./Fruit		+			+	+	+
111.	<i>Hirundo rustica</i>	F	Insc.	+				+		+

Sr. No.	Scientific Name	Foraging incidence	Type of foods	Feeding habits			Sites			
				Carni.	Omni.	Herbi.	I	II	III	IV
112.	<i>Cecropis daurica</i>	F	Insc.	+			+	+	+	
113.	<i>Chrysomma sinense</i>	T	Insc./Nect.		+		+	+	+	
114.	<i>Turdoides gularis</i>	F/G	Insc.	+				+	+	
115.	<i>Phylloscopus borealis</i>	T	Insc.	+				+		
116.	<i>Phylloscopus armandii</i>	T	Insc.	+			+	+	+	
117.	<i>Locustella certhiolar</i>	F	Insc.	+			+		+	
118.	<i>Megalurus palustris</i>	T	Insc.	+			+			
119.	<i>Orthotomus ruficeps</i>	T	Insc.	+				+	+	
120.	<i>Orthotomus sutorius</i>	T	Insc./Nect.		+		+	+	+	
121.	<i>Cisticolar juncidis</i>	F	Insc.	+			+		+	
122.	<i>Prinia rufescens</i>	T	Insc.	+					+	
123.	<i>Prinia hodgsonii</i>	T	Insc./Nect.		+		+	+	+	
124.	<i>Prinia flaviventris</i>	T	Insc.	+					+	
125.	<i>Prinia inornata</i>	T	Insc./Nect.		+		+	+	+	
126.	<i>Prinia polychroa</i>	T	Insc.	+					+	
Total number of species				69	53	4	102	64	86	58

+ Present * Water bird

Carni. = Carnivorous Omni.= Omnivorous Herbi.= Herbivorous Insc. = Insect F = in flight

T = Tree W = Water G = Ground Nect. = Nectar Sh = Shallow water

Pisci = Piscivorous Liz. = Lizard Frugi = Frugivorous Dis. birds = Disable birds Veg. = Vegetable

Avivo = Avivorous Moll. = Molluscs Grani = Granivorous De. an. = Dead animal Tad. = Tadpole

Table 2 Number of bird species in different feeding habits of birds in Pakokku environs

Sr. No.	Feeding habit	Food types	Number of bird species		
1.	Carnivorous	Fish, insect	9		
		Fish, insect, worm	2		
		Fish, tadpole	1		
		Fish, insect, tadpole	3		
		Rat, fish, insect	2		
		Disable bird (Avivorous)	1		
		Insect (Insectivorous)	36		
		Mollusc, insect	6		
		Insect, worm	1		
		Lizard, insect	1		
		Rat, insect	3		
		Rat (Avivorous)	1		
		Mollusc, fish, insect	2		
		Fish (Piscivorous)	1		
		2.	Omnivorous	Mollusc, vegetation, fish	1
				Mollusc, vegetation, fish, insect	1
Mollusc, vegetation, insect	5				
vegetation, grain, insect	1				
Grain, mollusc, insect, worm	1				
Vegetation, insect	2				
Grain, vegetation, insect	5				
Insect, fruit	4				

Sr. No.	Feeding habit	Food types	Number of bird species
		Worm, vegetation, insect	1
		Insect, nectar	11
		Insect, nectar, fruit	6
		Dead animal, insect, fruit, grain, disable bird	2
		Dead animal	1
		Grain, insect	7
		Grain, insect, nectar, fruit	4
		Grain, insect, fruit	1
3.	Herbivorous	Fruit (Frugivorous)	1
		Grain (Granivorous)	3

Table 3 Different feeding habit of bird species in each study site

Species	Study sites				
	I	II	III	IV	All
Carnivorous	49	33	47	28	69
- terrestrial bird species	28	31	32	26	48
- water bird species	21	2	15	2	21
Omnivorous	49	29	37	28	53
- terrestrial bird species	34	29	28	27	38
- water bird species	15	-	9	1	15
Herbivorous	4	2	2	2	4
- terrestrial bird species	4	2	2	2	4
- water bird species	-	-	-	-	-

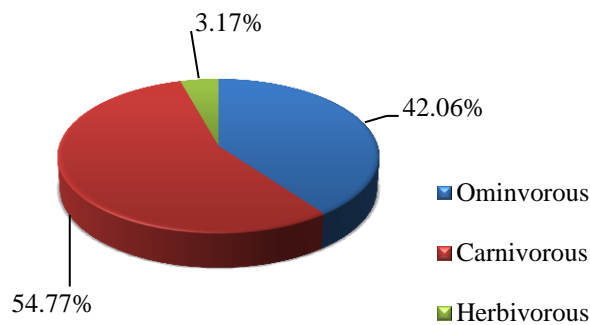


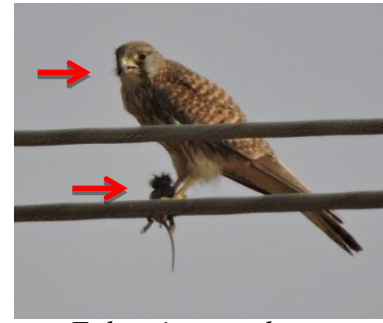
Figure 2 Different feeding habits of birds in Pakokku environs during July 2015 to June 2016



Bubulcus coromandus
eating worm



Egretta garzetta
foraging cricket



Falco tinnunculus
having rat



Phoenicurus frontalis
taking insect



Upupa epops
eating insect



Acridotheres burmannicus
taking nectar



Acridotheres fuscus
having fruit



Pycnonotus blanfordi
eating fruit



Cinnyris asaticus
taking nectar



Columba livia
having leaves



Treron phoenicopterus
eating fruit



Streptopelia chinensis
taking grain

Plate 1 Different types of food foraged by various birds recorded in the study area

Discussion

Throughout the study period from July 2015 to June 2016, a total of 126 bird species having different feeding habits were identified and recorded from four study sites in the environs

of Pakokku. Among them, 53 species were omnivorous, 69 species were carnivorous and four species were herbivorous. Feeding habits were determined based on the kinds of foods taken.

Different bird species foraged on various foods available in each study site. The number of foraging species varied among the study sites relating to habitats. In Site I of Shwe Tantit village environs and Site III of Kokko Hla village environs where a variety of microhabitats with land and water sources available are found more number of terrestrial birds and water birds than other sites. Carnivorous birds are species which feed on animal matters. Sixty-nine species of carnivores were found in the study area. Among them, one piscivorous, two avivorous and 36 insectivorous species were included. These birds and the rest of species that ate different animal matters are included in carnivorous group. Carnivorous birds ate fish, worm, rat, lizard, young bird, tadpole, mollusks and insect (cricket, bee, ant, locust, butterflies, moth, flies, termite and beetle) in the study area. Insectivorous birds are included in the category of carnivores.

Erwin (1982) stated that the correlation of insectivores was positive relationship under closed canopy, where the vegetation was dense; with higher tree density and higher basal area. This could be due to abundant insects as a result of moist conditions and dense foliage. In the present study area, due to occurrence of many tree species, 36 species of insectivorous birds were recorded and they are dominant in the foraging groups.

Chettri *et al.* (2005) stated that the omnivores were significantly related to open canopy habitat as well as habitat with better stratification where resource availability (insects, seeds, fruits and small mammals) was high. In the study area, 53 bird species were recorded as omnivorous. Omnivorous birds ate insects, young bird, fish, mollusks, dead animal, nectar, seed and fruit in the study area.

Moreover, due to seasonal availability of fruiting trees and vegetative matters in the study area, four species of herbivorous birds were observed. Among them, one species was frugivorous and three species were granivorous. Herbivorous birds fed on nectar, leaves, fruit, seed, flower, sunflower, wildflower, grass, weed seed, rice, barley, corn and millet in the study area.

According to the bird diet types, there are 12 different types of dietary habits in the world bird fauna. Among them, seven types of feeding habits are recognized in different foraging bird species in pakokku environs during study period.

Fruiting trees provided and attracted different insect species and fruit eating birds. Similarly, flowering trees also produced diverse flowers that attracted nectarivore bird species to nip the nectar and prey on insects. In addition, the occurrence and richness of food resources such as nectar, leaves, fruits, seeds, insects (locust, moths, butterflies, crickets, flies, ants, termites, and beetles), reptiles (lizards and snake), mammals (rats), amphibians and birds are also a key factor that affects diversity and richness of bird species.

The species richness of birds is mainly due to the occurrence of many insectivorous and omnivorous birds, with a few species of herbivorous birds. Plant species richness is the most important determinants and however positive effect for many insectivorous. In the present study, insectivorous birds dominated in the bird community. Pakokku environs with a variety of microhabitats support the diverse bird species.

Conclusion

The avifauna of Pakokku environs was represented with different feeding habits mostly of carnivorous and omnivorous because of availability of food sources in the area. Pakokku environs is crucial alternative habitat for diverse population of water and terrestrial birds and therefore promote high species diversity and density due to their wide diversity of habitat characteristics and increased food availability.

Acknowledgements

First, I am greatly indebted to Dr. Thet Lwin, Acting Rector and Dr. Nyo Nyo Tun, Pro-rector, Pakokku University, for their encouragement. Thanks are also due to Dr. Htwe Htwe, Professor and Head and Dr. Win Win Myint, Professor, Department of Zoology, Pakokku University, for their helps in preparing this paper.

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