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THE BIRDS OF MUSSOORIE, U.P., INDIA - A DISTRIBUTIONAL AND ECOLOGICAL STUDY

Thesis for the Degree of Ph. D.
MICHIGAN STATE UNIVERSITY
Robert Leland Fleming, Jr.
1967

This is to certify that the

thesis entitled

BIRDS OF MUSSOORIE, U.P., INDIA -

A DISTRIBUTIONAL AND ECOLOGICAL STUDY

presented by

Robert Leland Fleming, Jr.

has been accepted towards fulfillment
of the requirements for

~~Ph.D.~~ degree in ~~ZOOLOGY~~

George J. Wallace
Major professor

Date July 12, 1967

O-169

ABSTRACT

THE BIRDS OF MUSSOORIE, U.P., INDIA -
AN ECOLOGICAL AND DISTRIBUTIONAL STUDY

by. Robert L. Fleming, Jr.

The birds of Mussoorie were studied for the purpose of increasing our knowledge of their ecology and distribution in the western Himalayas. The habitat selections, foraging positions, interspecific associations, altitudinal distributions, seasonal movements, behavior patterns, and zoogeographical affinities of 200 species belonging to 50 families were determined.

The study area, at 30 degrees N latitude and 78 degrees E longitude, was located on the Mahabharata range of the western Himalayas some 200 miles northwest of the border of Nepal and 200 miles southeast of the border of Kashmir. The locality was selected on the basis of topographical and vegetational features and was limited to an altitudinal range of between 5,000 and 9,000 feet. The habitats studied were: stream bed, subtropical hardwoods, ban oak, ban oak scrub, deodar, moru oak, moru oak scrub, fir, chir pine, grassland, cliffs, and cultivations.

More than 2,000 hours were spent observing birds between 6 July 1963 and 21 July 1966. Additional data were obtained from more than 1,000 birds collected in the study area prior

to 1953; these specimens are in the collections of the Field Museum of Natural History, Chicago, and at Albion College, Albion, Michiga. Other specimens are in the research collections of the Michigan State University Museum.

Habitat selections of each species were recorded. No bird occurred in all twelve habitats, but Streptopelia orientalis, Corvus macrorhynchos, and Pericrocotus ethologus were found in nine. Maximum species diversity was found in ban oak scrub (119 species), whereas the fewest birds were along the stream beds (8). Populations in ban oak scrub and ban oak haibtats, with a shared species ratio of 47, were the most similar.

Of the species recorded, 102 species were predominantly insectivorous, 29 were seed eaters, and 20 carnivorous. Food selection and seasonal changes in food preferences of birds in ban oak, grassland, and fir habitats are given in detail.

The feeding level of each bird was also recorded; the greatest number of species(80) were terrestrial feeders. The foraging positions of birds in ban oak, grassland, and fir varied noticeably from habitat to habitat.

The birds of Mussoorie are derived predominantly from the Palearctic and Oriental regions. The Indochinese sub-region of the Oriental exerts a major influence. The center of the Palearctic-Oriental transition zone, according to my data on birds, varied more than 2,000 feet in altitude from summer to winter.

No species occupied exactly the same ecological niche. However, Leucosticte nemoricola and Prunella himalayana seemed to hold identical ecological positions during the winter. Each species is discussed to show how it differs from ecologically similar species.

Latitudinal and altitudinal movements of the birds were observed and dates kept for a three year period. I found that five species move uphill in winter.

The accounts of species include the available data on each bird as follows: the number of times observed, its status, place and altitude where found, movements and dates, habitats, foraging position, food, nesting, behavior, density and supplementary remarks.

THE BIRDS OF MUSSOORIE, U.P., INDIA - A DISTRIBUTIONAL AND ECOLOGICAL STUDY

by

Robert Leland Fleming, Jr.

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Zoology

ACKNOWLEDGEMENTS

While engaged in field studies in India I was assisted by many enthusiastic students of Woodstock School, Mussoorie, U.P., and would especially like to thank the following for bringing to my attention facts of importance to this study: Sephen VanRooy, Norman VanRooy, Paul Siefeldt, John Jantzen, William Friesen, Wendell Pye, Ronald Hess, Kenneth Getter, and Timothy Bauman.

Others who also assisted in reporting birds or nests were: Gordon VanRooy, Timothy Larson, John Larson, David Waldock, Max Marble , Bill Marble, David Bunce, Peter Peterson, James Jantzen, John Whitcomb, Kathryn Getter, Mary Self, John Evans, Carol Evans, Sheryl Rash, Terry Price, John Burkhalter, Harold Gruber, George Taylor, Titus Presler, David McCulloch, Susanna Coapman, Polly Peterson, Shri. Matbar Singh, Shri. R. Kapadia, Gordon Claassen, Eldon Claassen and Bruce Ferguson.

Mr. and Mrs. S. R. Burgoyne of Woodstock School were very kind in their enthusiastic support of my work during this period. While in India, I was teaching under the Methodist Board of Foreign Missions, and would like to thank members of the Board for the opportunity to work in India.

The Ministry of Foreign Affairs, Government of India, granted me permission to enter India. I am also grateful to the officials of the Home Ministry, New Delhi, and the Home Ministry, Uttar Pradesh, in Lucknow, for permission to remain in India during this study.

Professor George J. Wallace of the Department of Zoology, Michigan State University has given me a great deal of encouragement and assistance in the preparation of this report. I would also like to thank Professors Rollin H. Baker, M. M. Hensley, and John L. Lockwood for their helpful comments.

Finally, I am grateful to my father, Dr. R. L. Fleming, for permission to use the field notes he gathered in the Mussoorie area between 1939 and 1953 and for his help and directions during the study.

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INTRODUCTION

A study of the composition of the avian population in relation to its behavior patterns, habitat selection and altitude preference was undertaken near Mussoorie, U.P., India, from 6 July 1963 to 21 July 1966. Various aspects of bird life were studied for the purpose of contributing to the knowledge of avian ecology in the western Himalayas.

During the past 150 years, several investigators have studied the birds of the Himalayas. From 1821 to 1843, Brian Hodgson resided in Kathmandu, Nepal, and his collectors secured many specimens from Nepal and also from the adjoining Darjeeling district. Much information was brought together in the eight volumes on Indian birds by E. C. Stuart Baker (1922-1930). Hugh Whistler (1926 and 1928) investigated birds in parts of India, including Kangra and Simla in the Himalayas, and later published the Popular Handbook of Indian Birds (Whistler, 1941). Salim Ali has worked tirelessly throughout India and has published extensively on Himalayan birds (see Ali, 1947, 1962). Dillon Ripley (1950) collected birds in Nepal and then tied together a great amount of information for his comprehensive work, A Synopsis of the Birds of India and Pakistan (Ripley, 1961). R. L. Fleming has been an active observer in Nepal during the past 18 years. Results of his work have been published in Fieldiana (see Rand and Fleming, 1957; Fleming and Traylor, 1964). B. Biswas also collected birds in central and eastern Nepal and has completed a review of Nepalese birds (Biswas, 1960-1963).

Others who have contributed to the knowledge of Himalayan birds are: Bates and Lowther (1952) on Kashmir birds; Mrs. Proud (1958, 1961) on central Nepalese birds; A. E. Osmaston (1921) on British Gahrwal birds; Briggs (1931) on birds of the Raniketh area; C. Hudson (1930) on Naini Tal birds and A. E. Jones (1947-1948) on birds of the Simla Hills.

Except for some taxonomic notes there has been little published on the birds of the Mussoorie Hills. B. B. Osmaston (1935) completed a report on the birds of the Dehra Dun Valley and included some species found in the adjacent Chakrata and Mussoorie Hills. Other papers dealing with the Dun Valley but not covering Mussoorie were published by Wright (1949) and George (1957).

The objectives of this report are to present data on behavior, habitat selection, foraging position, interspecific relationships, altitudinal distribution , seasonal movements, and zoogeographic considerations concerning the birds found in an altitudinal range of between 5,000 and 9,000 feet near Mussoorie, U.P., India. It is hoped that ideas for further investigation will be suggested by the material presented here and that this may stimulate more study of Indian and Himalayan birds.

MATERIALS AND METHODS

More than 2,000 hours were spent observing birds in the study area during a period from 6 July 1963 to 21 July 1966. Specimens collected are now on deposit in the research collections of the Museum at Michigan State University. Approximately 1,000 additional bird skins taken in the study area between 1931 and 1953 by my father and myself are in the collections at the Field Museum of Natural History, Chicago, and at Albion College, Albion, Michigan.

The selection of a study area was based partly on natural topographical features or ecological divisions and was limited to a section that could be adequately covered. The upper limits of the study area coincided with the Ganges-Jumna watershed ridge, and the lower limits were placed at the zone dividing the temperate and subtropical floras.

Field trips were planned so that each section of the study area could be visited several times during each season. I lived at 6,700 feet at the western edge of the study area. Ninety-six nights were spent camping at points not quickly reached from my residence. Approximately 1,900 miles were covered on foot during the period of the study. The following trips by motorized vehicle were also made: 32 miles by scooter in May 1965; 38 miles by jeep and 30 miles by bus in November 1965; and 40 miles by Landrover in May 1966.

Birds were observed with 7x50 Bushnell binoculars. Specimens were collected with .177 and .22 caliber air rifles,

.410 and .12 gauge shotguns using from #12 to #2 shot, and a .22 caliber rifle with long rifle cartridges. Mist nets were put up in selected valleys but produced relatively few catches.

Density estimates were made only after I had become thoroughly familiar with the terrain and the bird community. Counts of singing males were made whenever possible. Other birds were counted on a transect or total-area basis for species in restricted habitats and counts given are from habitats or places of maximum concentration for each species listed.

The arrangement of families, genera and species follows that given by Ripley (1961) except that his subfamilies of Muscicapidae are elevated to family status. Mammal identifications are based on the recently revised edition of Indian Animals (Prater, 1965). Plant identifications follow Gupta (1928) and Dudgeon (1929).

Data on temperatures were gathered with two maximum-minimum thermometers. Rainfall was measured in a rain gauge constructed from a glass funnel and a glass collecting container. The rain gauge was placed on a slope with an angle of approximately 40 degrees; consequently the funnel was placed parallel to the slope and not in a horizontal position (see Oosting, 1956:136).

Altitude was determined by using a barometric altimeter correlated with known altitudes taken from Survey of India maps with trigonometric determined heights. The Survey of

India map used for altitude correlation was the "Eight Inch - Mussoorie and Landour Guide" (1946) reproduced in the scale of eight inches to one mile. The Survey of India map designated sheet No. 53 J/3 in the scale of 1 inch to 1 mile, and the Army Map Service map NH 44-5, Dehra Dun, India and China, compiled in 1954 in the scale of 1:250,000 were also helpful.

BIOGEOGRAPHICAL CONSIDERATIONS

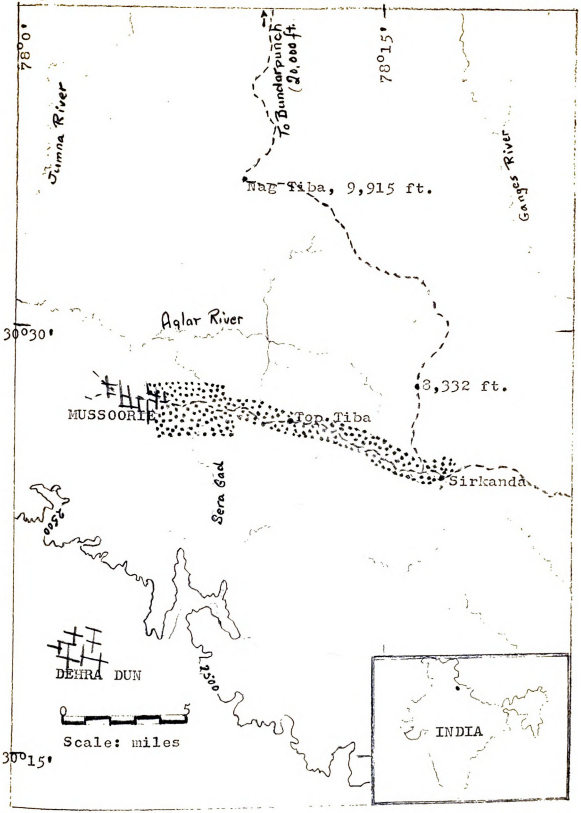
PHYSIOGRAPHY

The study area was located east of Mussoorie at the northern tip of the state of Uttar Pradesh, India (see Fig. 1). It lies entirely within the Mahabharata range of the western Himalayas between 5,000 and 9,000 feet. The map coordinates for the area were from 78° 05' 30" E longitude and 30° 27' 30" N latitude to 78° 17' 30" E longitude to 30° 20' 20" N latitude. The study area included part of the Jumna-Ganges watershed ridge and was located approximately 150 north of Delhi, 60 miles south of the border of China (Tibet), 200 miles southeast of the border of Kashmir and 200 miles northwest of the Nepal border. It was about 15 miles from the edge of the Indo-Gangetic plains.

Human occupation

Human activity is an important ecological factor in the study area. The western part is marked by a large residential section with summer cottages and a transient human population. In spite of numerous houses, many old oak trees remain due to the protection given them ever since the British estates were established in Mussoorie over a hundred years ago. This residential section covers about 0.51 square miles in both ban oak and deodar stands. In other parts of the study

Fig. 1. Map showing parts of Dehra Dun and Tehri Garhwal dists.



KEY: ⌒⌒ = Juman-Ganges watershed ridge; ⊞ = city;
⁘⁘ = study area.

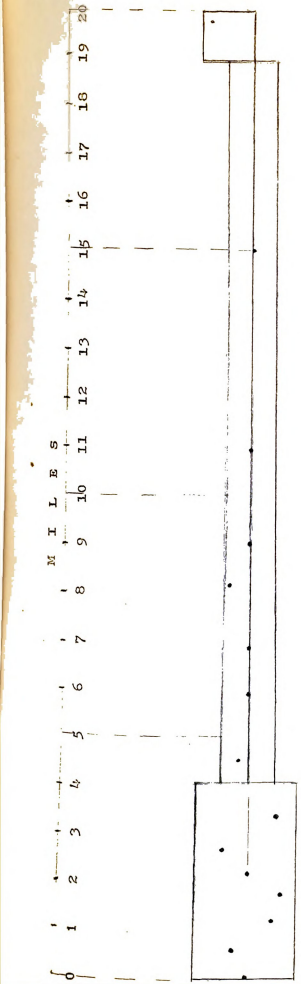
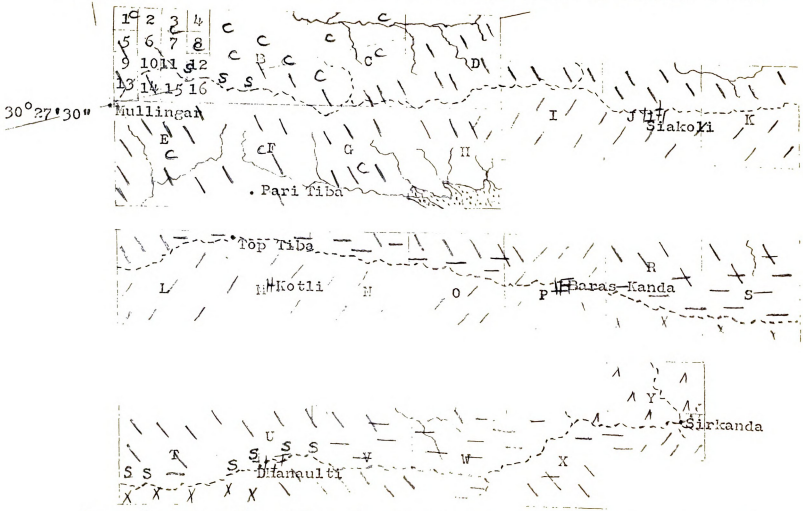


Fig. 2. Diagram showing positions and altitudes of places mentioned in text.

Fig. 3. Vegetation map of study area showing section localities mentioned in text. Tehri road cuts through center of sections I - K.



Key: ⌒ = ridge; ⊞ = village; ⌒ = stream; C = chir pine; \\ = ban oak; ⌒ = moru oak; // = grassland; Λ = fir; S = deodar; X = unsurveyed; ⌒ = below 5,000 feet.

area the ban oak forest has been greatly disturbed by villagers lopping off leaves for water buffalo fodder.

Further human influence is exerted through small settlements and neighboring cultivations scattered throughout the area. Besides the residential Landour section, both Siakoli and Dhanaulti are villages with permanent houses. Jhalki, Kotli, Bara Kanda and Masrani (see Fig. 2) have some older houses which are falling apart and only a few rebuilt structures exist. Other villages and cultivated sections cover approximately 0.98 square miles here. With the exception of Landour, the human density in the study area is estimated to be about 10 persons per square mile.

One fair-weather road connecting Mussoorie with Tehri city runs beneath the crest of the ridge and offers access to parts of the study area. The road increases human movement but also provides nesting sites for some species and offers semi-level foraging ground for others. The road varies in altitude from 6,600 feet in Landour to 8,050 feet at the base of Sirkanda and passes through ban oak, ban oak scrub, grassland, deodar and moru oak forests. The road is open to mule travel the entire year and to light vehicular traffic during dry weather. Fair weather traffic intensity varies from two to six vehicles per day.

GEOLOGY

Geologically, the Himalayas have been most thoroughly investigated in Kashmir, in the Garhwal Himalayas and in

Fig. 4. The study area, looking west from Sirkanda.

Fig. 5. Near the top of Sirkanda showing the abrupt edge of the fir forest on the right.

Fig. 6. Ban oak (Quercus incana) forest with summer cottage and chir pine (Pinus roxburghii), section F-1.

Fig. 7. Open grasslands with cultivations at bottom right, southern slope, sections I, J and K.

Fig. 8. Deodar (Cedrus deodara) stand with dense nettle (Urtica) undergrowth, section U-7.

Fig. 9. Moru oak (Quercus dilitata) forest along Mussoorie-Tehri road, section W-11.

Fig. 10. Gypaetus barbatus landing to recover dropped food (vertebral column), section Y-7.

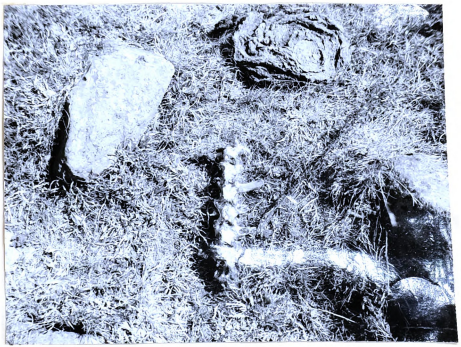


Fig. 11. Vertebral column dropped by bird photographed in Fig. 10, section Y-7.

Fig. 12. Fir (Abies webbiana) forest with Berberis in foreground, section Y-8.

the Everest region. These mountains have fascinated geologists for more than a hundred years but considerable exploration and interpretation remains to be done. The Himalayas are thought to have formed through massive tectonic movements beginning in the Upper Cretaceous, extending into Recent times, and may well be continuing today (see Wadia, 1932; Puri, 1960). The mountains apparently formed along a weak crust line between the massive blocks of central Asia and the Indian peninsula. The rocks of the study area are of sedimentary origin with some metamorphic inclusions. The main axis of the Himalayas, however, contains large igneous intrusions which are thought to have been forced upwards during the mid-Miocene.

Mussoorie is located on a rock system, of unknown depth, of slates and limestones known as the Krol limestone series (Puri, 1960:498-499). The rocks of the study area are largely non-fossiliferous limestones which were probably formed during pre-Cambrian times in the ancient Tethys sea. In section I, recently exposed limestone sheets clearly show ancient wave ripple marks. Other formations here are sandstones and shale. Metamorphic rocks are primarily quartzite and some slates. Several black-appearing strata occur in the limestone cliffs in section I and apparently represent the infra-Krol slaty-shale seams.

Pleistocene glaciation has definitely affected the present plant distribution in the interior of the far western Himalayas (Mohan et al., 1957) but apparently

did not have as much effect on the study area which is on an outer range. A point of interest is the fact that the top of Sirkanda (9,100 feet) is quite rounded and broad, whereas Top Tiba and ridges below 8,600 feet are sharp and narrow. Nag Tiba at 10,000 feet and north along the same watershed ridge is also rounded. Above 12,000 feet the ridge is broad and rolling. Presumably the top of Sirkanda has been modified by non-human agencies, possibly by ice during the Pleistocene. Constant weathering of the lower ridge line has produced razor sharp crests rather than rounded tops. Consequently, it is possible that ice action may have affected the topography on hills down to about 9,000 feet in this area, but may have stopped short of the 8,000 foot elevations on these outer ranges.

Soils

Soil types have been described elsewhere in the Himalayas, for Chakrata (Puri and Maini, 1957), for Chaubattia in Kumoan (Mukerji and Das, 1940) and for the Bashahar Himalayas (Mohan et al., 1955). The Himalayan soils are largely brown earths, podsols and gleys types. The most common type in the study area proved to be brown earths which are characterized as having a brown B horizon with a moderate amount of organic matter at the surface (Mukerji and Das, 1940), a high degree of saturation of the A horizon, a lack of accumulations of sesquioxides in the B horizon and a low pH value (Taylor et al., 1936). Podsols

apparently do not develop completely since immature podsol types occur under chir pines, whereas more mature podsols are found where the run off is more forceful. Puri and Gupta (1951) found that the chir pine soils (4,000 to 5,000 feet) have a pH of 6.9, whereas the deodar soils (5,000 to 7,000 feet) have a pH of 6.34 This would indicate a trend towards brown earths under the deodar which have the more acid soil type.

Earthquakes

The Himalayas are in an earthquake belt still subject to considerable orogenic pressures. Destructive earthquakes hit northern India on the average of once in every 5 or 6 years (Puri, 1960:617). I detected five tremors during the study but only one was thought to have been a factor in a landslip. Earthquakes of major intensity would have a direct effect on nesting birds if they struck during the breeding season and might have a greater and more lasting effect on the bird population if they altered the topography to any great extent.

CLIMATE

The study area falls within the influence of the summer monsoons which last from the end of June through the middle of September. Approximately 100 inches of rain falls during this period. The winter monsoons pass unnoticed in this region because of the dry winds.

Average monthly rainfall for Mussoorie is given in table 1. A summary of the 1964 monsoons is found in table 2. The first rain began on 27 June. The official average starting date for Mussoorie is 25 June. The rains continued for 85 days, ending on 19 September. The total official rainfall at the end of 19 September was 1,882 mm (74.1 inches) as compared to 3,218 mm (126.5 inches) that fell in the study area. The heaviest rainfall for a 24 hour period came during the interval ending at 8:00 AM on 5 August. The official gauge recorded 317 mm (12.5 inches) for this period but unfortunately the study gauge overflowed at 160 mm. The longest period with rain every day was from 15 August to 30 August - 16 days. There were 19 days during the monsoon when no rain fell. The wettest month according to the study data was July (1,194 mm), followed by August (1,184 mm). The longest period of continuous diurnal rain came during a post-monsoon storm which dropped 10.2 inches of rain over 48 hours of 25 and 26 September.

Cloud cover during the monsoon was not uniform (see table 3). Usually the clouds built up in a definite pattern which lasted over a period of about six days. During this time rain usually fell at about the same hour each day; then a shift might occur. No attempt was made to distinguish between nocturnal and diurnal rainfall, but probably more rain fell during the night than during the daylight hours.

Temperatures were relatively mild at 7,000 feet (see tables 1 and 4). The minimum reading in the shade on a

Table 1. Monthly rainfall in inches and temperatures in degrees F. at Mussoorie. Taken from Dudgeon and Kenoyer (1925).

Month	Rainfall	Temperature	
		Maximum	Minimum
January	2.73	48.9	37.6
February	3.01	50.1	37.7
March	1.99	60.6	45.1
April	1.10	72.4	54.0
May	2.25	78.0	58.2
June	9.01	76.7	60.7
July	29.74	71.0	60.6
August	31.85	69.1	59.9
September	9.99	68.6	57.5
October	0.84	64.9	51.5
November	0.33	57.6	45.4
December	1.00	51.4	40.2
Total	93.84	Av. 64.1	Av. 50.7
Percent, June- Sept.	85.90		
Percent, Oct.- May	14.10		

Table 2. Rainfall in mm. for the summer of 1964 at Mussoorie.

Date	Fleming	Official	Date	Fleming	Official
June 25	0	-	Aug. 10	0	0
26	0	-	11	0	1
27			12	62	26
28	25	3	13	23	-
29			14	0	-
30	86	61	15	160 of	71
			16	25	7
July 1	8	3	17	29	17
2	152 of*	118	18	69	6
3	0	0	19	32	-
4	45	32	20	16	6
5	18	17	21	5	-
6	32	12	22	64	36
7	58	16	23	7	14
8	10	5	24	160	89
9	18	8	25	26	6
10	40	14	26	87	27
11	60	25	27	17	-
12	39	missing	28	49	29
13	59	20	29		
14	160	80	30	33	7
15	48	-	31	0	4
16	27	27			
17	14	6	Sept. 1	126	25
18	0	0	2	53	23
19	7	0	3	56	25
20	0	0	4	37	-
21	0	0	5	0	0
22	0	0	6	0	0
23	0	2	7	0	
24	75	65	8	0	
25	184	89	9	17	
26			10	12	
27			11		
28	56	48	12	66	
29			13		
30	84	-	14		
31	0	0	15	52	
			16	43	
Aug. 1	0	0	17	20	
2	0	0	18	0	
3	0	0	19	14	
4	19	2			
5	160 of	317	25	116	
6	87	-	26	145	
7	5	2	27	25	
8	18	-			
9	32	7			

* of = overflow

Table 3. Cloud cover, 7 AM to 7 PM, summer 1964 at Mussoorie.

Date		0-25%	25-75%	75-99%	100%
July	24	0	0	0	12
	25	0	0	0	12
	26	0	0	0	12
	27	0	0	0	12
	28	0	0	0	12
	29	0	2	1	9
	30	0	3	2	7
	31	1	4	4	3
August	1	1	2	2	7
	2	1	2	2	7
	3	1	2	2	7
	4	1	2	2	7
	5	0	1	2	9
	6	0	0	0	12
	7	2	1	5	4
	8	2	2	4	4
	9	2	2	4	4
	10	2	1	1	8
	11	1	1	3	7
	12	0	0	3	9
	13	0	1	3	8
	14	0	1	2	9
	15	0	0	0	12
	16	0	0	2	10
	17	0	0	1	11
	18	0	0	1	11
	19	0	0	2	10
	20	0	0	2	10
	21	1	1	3	7
	22	0	0	0	12
	23	1	2	1	8
	24	1	2	1	8
	25	1	1	2	8
	26	2	2	2	6
	27	3	2	2	5
	28	0	1	2	9
	29	0	0	2	10
	30	0	0	1	11
	31	0	0	3	9
Sept.	1	0	0	1	11
	2	0	0	2	10
	3	1	3	1	7
	4	0	0	4	8
	5	2	2	2	6
	6	3	2	2	5
	7	2	1	2	7
	8	1	1	2	8
	9	0	0	0	12

Table 4. Temperatures (° F) at 6,700 feet, southern exposure, Mussoorie.

Date	Maximum	Minimum	Variation
Feb. 21	58	38	20
22	50	39	11
23	70	47	23
24	70	47	23
25	70	52	18
26	71	47	24
27	56 rain	45	11
28	56 "	42	14
Mar. 1	66	49	17
2	68	53	15
3	70	51	19
4	65	42	22
5	56	40	16
6	62	45	17
7			
8			
9	64	47	17
10	67	52	15
11	67	50	17
12			
13	67	50	17
14	67	52	15
15			
16	68	54	14
17	74	60	14
18			
19	67	40	27
20	67	44	23

southern exposure at 6,700 feet for the 1965-1966 winter was 37° F. The summer maximum at the same place was 80° F. in 1965 and 84° F. for 1966. The usual daily temperature fluctuation throughout the year was near 20 degrees. The temperature range for the entire year of 1965-1966 was only 47° F. (84-37).

The temperature varied according to altitude and exposure; northern faces at higher altitudes experienced harsher conditions than at lower heights. At 7,000 feet on a northern slope the night temperature fell below freezing from mid-November until early March. Southern exposures above 8,000 feet developed frost by mid-November and this continued until early February.

Snow conditions varied considerably from year to year. In January 1945 a record storm brought four feet of snow at 7,000 feet. The records of snow at 7,000 feet during the study period are as follows: July 1963 to December 1964 - none; 7 and 8 December 1964 - 3 inches fell but melted quickly; 1-2 April 1965 - 7 inches fell but melted quickly; January to July 1966 - none. The snow line on mountains north of the study area descends to about 8,000 feet on southern slopes from a 16,000 foot summer level. The snow that fell in the study area remained on northern slopes at 9,000 feet until mid-March and in patches in shaded ravines at 7,000 feet until late February.

Spring thunderstorms occurred regularly from April to June. The mean monthly frequency of thundershowers recorded

in Simla over a period of 67 years was: April - 7.1, and June - 13.5 (Puri, 1960:401).

Wind was a mild climatic feature in the area. Most winds were estimated to be less than 10 miles per hour. The strongest were experienced at the top of Sirkanda where winds gradually build up during the day to reach a peak in the late afternoon. Between 3 and 5 PM they were estimated at about 30 miles per hour. In general winds were noted to be the strongest along the ridge top and lessened at lower levels.

VEGETATION

Vegetational analyses are difficult in mountainous areas due to the great variation in topographic, edaphic and climatic factors that occur within relatively narrow spacial limits. There is the advantage, however, that one does not have to cover great distances in order to see variations in the vegetational patterns. Currently there is some discussion regarding the dynamics of plant succession (see Oosting, 1956; Puri, 1960), but if one assumes that an equilibrium in a plant population can be reached under optimum mesic conditions on a given soil, the semantic differences between polyclimax and monoclimax theories are less important.

The birds studied were between 5,000 and 9,000 feet in the following habitats: stream bed, subtropical hardwoods, chir pine, ban oak, ban oak scrub, deodar, moru oak, moru oak scrub, fir, grassland, cliffs and cultivations. Champion (1936)

described the various forest types found in India and his system with some adaptations is largely followed in India today. The following listing correlates the study habitats (except the cultivations and cliff categories) with the forest types given by Puri (1960:95-96):

Montane Temperate Forest

Himalayan Moist Temperate Forest

middle oak-coniferous belt

fir habitat

moru habitat

moru scrub habitat*

grassland habitat*

lower oak-coniferous belt

deodar habitat

ban habitat

ban scrub habitat*

grassland habitat*

Montane Subtropical Forest

subtropical hardwoods habitat

stream bed habitat

Himalayan Subtropical Pine Forest

chir pine habitat

* biotically induced

The study area was composed largely of two oak levels - the ban oak from 5,000 to 7,500 feet and the moru oak from 7,500 to 9,000 feet. The oak forests were

considered to be climax types at these levels. However, due to considerable disturbance the ban oak level presents a greatly diversified picture. Undisturbed ban oak stands are not present in the area but the least disturbed forest is in the Landour sections where trees measuring some 80 feet tall and up to four feet in diameter attest to some forest conservation. In order of increasing disturbance the following forest types were noted at the ban oak level: oak scrub, secondary temperate scrub, chir pine and grassland.

Ban habitat

The ban oak (Quercus incana) forest and the ban oak scrub forest cover approximately 9.69 square miles of the study area, half of which could be classed as scrub. Ban oaks grow from 5,000 feet (somewhat lower out of the study area) to about 7,500 feet; a few are seen up to 8,000 feet. This oak grows on both northern and southern slopes but at the higher elevations it is restricted to southern exposures. On the lower northern faces, the oaks grow to a maximum height on spurs while other trees invade the ravines. Pure, but not extensive, stands of ban oaks are seen on relatively dry, southern exposures. Other trees commonly found with the ban oaks are Rhododendron arboreum and Acer oblongum. On northern slopes Pieris ovalifolia occurs with the oaks. Other trees found with oaks and which apparently invade a lightly disturbed oak forest are: Pyrus pashia, Prunus padus, Aesculus indica, Rhus cotinus, Litsea consimilis, Cornus macrophylla, Cornus capitata, Cornus oblonga and Euonymus

pendulus (for seasonal availability of fruit see table 5).

The secondary level beneath the ban oaks is well developed; some species noted are: Coriaria nepalensis, Viburnum cotinifolium, Debregeasia hypoleuca, Lonicera angustifolia, Ficus nemoralis, Daphne cannabina, Arundinaria flacata, Rhamnus virgatus, Berberis aristata, Roschata nipalensis, Symplocus crataegoides, Rubus paniculatus, Rubus ellipticus, Rubus lasiocarpus, Hypericum lysimachioides, Rosa moschata, and Desmodium floribundum.

A great many smaller plants occur at the ground level in the oak forests; some of them are: Artemesia parviflora, Gerbera lanuginosa, Erigeron multicaulis, Solidago vignaaurea, Bidens wallichii, Senecio nudicaulis, Lactuca macrorhiza, Arisaema helleborifolium, Gonotanthus sarmentosus, Thalictrum saniculaeforme, Fragaria vesca, Platysterma violoides, Polygonum amplexicaule, Begonia anoena, Boenninghausenia albida, Geranium nepalensis, Impatiens scabrida, Dicliptera bupleuroides, Strobilanthes alatus, Plectranthus striatus, and Hedychium acuminatum.

There are also a number of ferns and more primitive plants in the oak forests. Some of the ferns are: Leucostegia pseudocystopteris, Chilanthes albomarginata, Dryopteris marginata, Polystichum squarrosum, Polypodium simplex and Asplenium alternans.

The grasses were not identified in this study but Mohan et al.(1955) listed a number of species for the ban oak and deodar forests of the Punjab Himalayas.

Table 5. Seasonal availability of ripe woody plant fruits, ban oak forest.

Species	Month 1	2	3	4	5	6	7	8	9	10	11	12
Hedra helix	———	———	———	———	———	———						
Vitis capreolata										———	———	
Vitis semicordata								———	———			
Vitis sp.	———	———	———									
Coriaria nipalensis				———	———	———						
Rosa moschata					———	———						
Quercus incana	———	———								———	———	———
Prunus cornuta							———	———	———	———		
Prunus armeniaca					———	———						
Viburnum cotinifolium							———	———	———	———	———	———
Viburnum nervosum				———	———	———	———	———				
Crataegus crenulata							———	———				
Cornus capitata											———	———
Cornus oblonga	———	———	———									
Cornus macrophylla						———	———	———				
Debregeasia hypoleuca				———	———	———	———	———	———	———		
Ilex dipyrena											———	———
Ficus nemoralis	———	———	———	———	———	———	———	———	———	———	———	———
Berberis petiolaris				———	———	———						
Berberis chitra							———	———	———			
Berberis lycium					———	———	———	———				
Mahonia nipalensis					———	———	———	———	———	———		
Rubus lasiocarpus								———	———	———		
Rubus ellipticus				———	———	———	———	———	———			

Ban oak scrub habitat

Scrub oak communities varied with the amount of human interference and the topography. In disturbed ravines are stands of Cedrella serrata and Populus ciliata with Salix wallichiana. On open slopes greatly disturbed portions are covered with Berberis spp., Desmodium, Cotoneaster, Buddleia and Plectranthus (Puri, 1960:133). Stunted and greatly deformed oaks are seen in these areas. Northern, moist slopes are covered with Rubus and Rosa growths.

Chir habitat

Chir pine (Pinus roxburghii or longifolia) grows from an elevation of about 2000 feet (outside the study area) to about 7,300 feet on exposed slopes and covers approximately 1.83 square miles within this study area. Curiously, the blue pine (Pinus excelsa) was represented by only a few introduced trees.

The chir pine forests are subjected to annual fires during May and June and might be considered pyric climax stands. Otherwise Puri (1960) has pointed out that this species is an edaphic climax type on quartzite slopes. However, chir pine may well be disclimax or preclimax to the ban oak forests and as conditions retreat from xeric, one would expect ban oaks to take over. At places in the study area there is some interningling of pine and ban oak which results in stunted ban oaks growing near the pine trees.

The secondary level under the chir pine canopy is poorly developed; occasionally a stunted oak is seen in a moist ravine and scattered barberry bushes also manage to survive. A few ferns that flourish during the monsoon are: Onychium japonicum, Chilanthes farinosa, Dryopteris cochleata and Dryopteris crenata.

Grass stands are sparse but Mohan et al.(1955) does list a few species for the Punjab chir pine forests.

Moru habitat

The moru oak (Quercus dilitata) forests develop here primarily on northern faces between 7,500 feet and 8,500 feet and cover about 1.87 square miles of which a tenth is scrub oak. The lowest tree seen was growing at 6,500 feet others straggle up to 8,900 feet. The transition zone between the ban and moru oak is quite abrupt on northern slopes but on southern faces these two species intermingle through a zone of about 500 feet. The moru oak forest here includes some very large trees that reached about 120 feet high and 6 feet in diameter but pure stands are not extensive. Mohan and Puri (1955) found that this oak usually joined other broad-leaved trees to form seral communities on moist soils. This is partly the case in this study area, but all the larger trees in section U, for example, are moru oaks and virtually no other tree participated in the topmost canopy. Beneath the highest trees are several smaller trees and woody shrubs of which some are Acer cultratum, Acer caudatum,

Cornus capitata, Viburnum stellulatum, Viburnum coriaceum, Rhododendron arboreum, and Rosa macrophylla.

Smaller plants grow profusely in the moist soil; some of these are: Boenninghausenia albiflora, Geranium wallichianum, Cannabis sativa, Arisaema spp. Galium, Desmodium tiliaefolium, Indoigofera, Primula denticulata and Rosa moschata.

Numerous ferns also occur in the moist soil - especially in ravines - and some of these are: Asplenium ebenipes, Adiantum venustum, Dryopteris levingii, Drynaria mollis (usually epiphitic), and Pteris longipinnula.

Deodar habitat

Deodars (Cedrus deodara) grow from 6,500 to 7,800 feet and cover about 0.30 square mile of the study area. This species is introduced and judging by size, some of the trees in the Landour area might be more than a hundred years of age. The stands survive only on northern "dip" slopes near the crest of the main ridge and since the majority of trees are young they were probably planted after 1900 A.D. The deodar apparently does best on soil disturbed by glaciation and it grows as an edaphic climax on flood plains deposited by the last ice age (Puri, 1960:243). The deodar seems to be spreading slightly in the study area as I found three trees already about 30 feet tall in the fir forest on Sirkanda where they were probably not planted. Puri (1960:311) noted that in Mussoorie the deodars that have grown to 60 or 70 feet in height develop flattened tops, but he offered no explanation

as to why this occurs.

The secondary tree or bush level in the dense deodar stands is not well developed. Numerous stinging nettle plants (Urtica) were observed growing under the trees with barberry and raspberry bushes along the edges. Rosa moschata and Viburnum cotinifolium grow in more open stands. Puri (1960: 134) noted in another area that Desmodium tiliaefolium was the only shrub under deodar, although he found several smaller plants (Fragaria, Galium, Geranium, Strobilanthes, Viola and Anemone). During the current study the following ferns were seen under deodar: Dryopteris marginata, Onychium, Pteridium and Pteris quadraaurita.

Fir habitat

The firs (Abies pindrow) grow from 8,000 to 9,100 feet on Sirkanda and cover about 0.64 square miles of the study area. This forest contains numbers of very large trees and at the time of this study some were well beyond their prime. Numerous seedlings were also present.

The fir forest might be considered post climax to Quercus semicarpifolia or perhaps a topographical climax on steep northern slopes near the tops of peaks. At the same altitude further north there are very few firs and Q. semicarpifolia dominates. The steep slope and northern exposure, combined with the high moisture retention, probably stablilizes the fir forest on Sirkanda in either a climax or long sub-climax type.

The secondary bush level beneath the firs is fairly well developed with Viburnum sp. and Rosa macrophylla especially abundant. Smaller plants found at the ground level are Rosa sericea, Ribes glaciale, Strobilanthes atropurpureus, Polygonum speciosum and Fragaria vesca.

A number of ferns also grow on the exposed rocks or in the moist soil, including Leucostegia pulchra, Woodsia, Chilanthes dalhausia, Polystichum illicifolium, Oleander wallichii and Dryopteris wallichiana.

Subtropical Hardwoods habitat

Another habitat type is the subtropical hardwood forest which is largely confined to the valley floors and does not extend for more than 50 yards up the sides of the ravines. This forest type grows in valleys to about 5,800 feet (above which Quercus incana, Acer oblongum, Cedrella serrata and Ilex dipyrena appear) and covers about 0.10 square miles of my study area.

The major trees of this habitat are Daphniphyllum himalayense, Bauhinia retusa, Cinnamomus tamala, Ilex oderata, Coriaria nipalensis and Salix oxycarpa.

A fairly open secondary level in these valleys is characterized by Berberis, Desmodium, Inula rubricaulis and numerous smaller plants, including Dicliptera, Jasminium humile, Coelogyne cristata, Primula floribunda, Viola serpens, Fragaria indica, Pochmeria platyphylla, and Impatiens cristata.

Grassland habitat

In areas where there is a great deal of human interference or where the soil may be unsuitable for the growth of large trees, grasslands develop. This "forest" type is called the "Himalayan Thach Parkland" by Puri (1960:255) and results from overgrazing, overlopping and burning of the secondary vegetation. About 6.8% square miles over the entire altitudinal range of the study area are covered by this habitat type.

Although human activities may have initiated the development of grasslands, the slope angle and exposure are probably predominant factors in retaining it since it is almost entirely restricted to southern slopes in the study area. Greatly disturbed northern slopes did not develop grassland to any great extent.

Trees are virtually non-existent here. Chir pine and stunted ban oaks grow along the fringes while the secondary bush level is sparsely represented by Berberis, Cotoneaster and Desmodium.

The grasses are luxurious and numerous species were identified for this habitat type in the Punjab by Mohan et al.(1955). Some of the genera they mention are Festuca, Bromus, Oryzopsis, Poa, Eriophorum, Muehlenbergia and Tripogon.

CHARACTERISTICS OF THE AVIFAUNA

ANATIDAE

Geese (Anser sp.)

Number of observations: 9

Status: migrant over study area.

Altitude: 5,000 feet (1)*; 6,500 feet (1); over 7,500 feet (7).

Localities: observed over F-1; E-4; H-16.

Movements and Dates: 4 March 1964, 8:30 PM over F-1, apparently heading NE (data gathered from calling geese); clear with stars. 11 March 1964, 8:30 PM over F-1, apparently heading NE; clear with stars. 7 March 1965, 10:30 AM over F-1, 9 geese flapping vigorously. First flying ENE, then veered NNE in tight "V"; cloudy with light drizzle. At estimated altitude of 8 -9,000 ft. 9 March 1965, Mr. A. Powell reported flock of 5 geese approaching section E-13, flying NE at about 6,000 ft. They appeared "tired" (slow wingbeats) and were observed to wheel and head back down for the dun.
27 Feb. 1966, 9:30 AM, over E-4, 15 birds flying NW in a loose "V"; clear. Estimated altitude: 9000 ft.
28 Feb. 1966, 9:10 AM over F-1, 7 birds flying NW; clear. Estimated altitude: 8,500 feet.

* Numbers in parentheses refer to frequency of observations.

28 Feb. 1966, 11:00 PM over F-1, apparently heading NE; clear.

3 March 1966, 7:45 PM, over F-1, apparently heading NE; bright stars, no moon. Flying so low that wing-beats were clearly audible. Estimated altitude: between 7,500 feet and 8,000 feet.

Miscellaneous reports: Mr. R. Kapadia, a well-known hunter, reported a flock of 4 geese approached him up the Sera Gad valley (H-16) at 5,000 feet. About 200 yards from him they veered north, climbed rapidly, and probably crossed the ridge at about C-15. He had a good look at the birds and identified them as the graylag goose, Anser anser (Linnaeus). Late afternoon of spring of 1961.

Ducks

Number of observations: 1.

Status: migrant over area.

Altitude: between 6,500 feet and 7,000 feet.

Localities: over F-1.

Movements and Dates: 22 March 1964, 1:00 AM.

Notes: A small flock of unidentified ducks flying E to W about 500 ft. below top of Landour ridge noted from the whistling of wings and subdued "quak, quak."

ACCIPITRIDAE

Milvus migrans (Boddaert)

Number of observations: 1000

Status: resident.

Localities: Gliding over several sections but seen perched only in A, B, E and F.

Altitude: from 5,500 feet to 8,500 feet.

Movements and Dates: Highest altitude records made on 21 and 22 Nov. at 8,500 feet.

Habitat: ban oak scrub, ban oak, over chir pine, grasslands and deodar.

Foraging position: terrestrial.

Food: domestic chicks attacked by kite (3); circling over carcass(2); feeding on monkey killed by panther (1); around garbage dumps (all other records).

Nesting: Three nests located between 6,200ft. and 6,300 ft. in chir pine trees. Nests contructed of twigs and branches and contain several rags, bits of paper, bones and twine.

Density: 3 nests in about 0.5 square miles.

Remarks: Competing with the kite for food scraps are domestic dogs, cats, jungle crows (Corvus macrorhynchos), scavenger vultures (Neophron percnopterus), and sometimes lammergeiers (Gypaetus barbatus). The mammals are dominant and take what they want before any of the birds close in. Compared to other birds, the kite relies on its agility, speed and boldness to move in

on food before others can get to it. Moreover, the kite often carries its food away to eat at leisure and consequently can approach to within inches of humans to secure scraps.

Haliastur indus (Boddaert)

Number of observations: 1.

Status: summer visitor.

Localities: over C-1.

Altitude: 6,000 feet.

Movements and Dates: 26 June 1964 at 6:30 PM.

Habitat: single bird circling slowly in updraft over a side valley of Aglar, a tributary to the Jumna. Some 30 miles by river from the Dun.

Remarks: Baker (1928) makes no mention of any Himalayan penetration by this kite but it has been seen up to 1,000 feet (Ripley, 1961:44). I have another record, not from the study area, of one circling at 5,000 feet over a tributary of the Ganges.

Accipiter gentilis (Linnaeus)

Numbers of observations: 4.

Status: winter visitor.

Localities: A-12; W-9,10,15.

Altitude: 7,300 feet and 8,100 feet.

Movements and Dates: 26 -28 Nov. in W-9,10,15. 15 March in A-12.

Habitat: in moru oak forest; over ban oak forest.

Foraging position: probably in trees and terrestrial.

Behavior: single birds seen perched in moru oaks (2). Shy - attempt to collect one failed.

Accipiter nisus (Linnaeus) and A. virgatus (Temminck)

Number of observations: 11.

Status: uncertain.

Localities: D-16; E-4; F-1-4; H-3; Y-11,12.

Altitude: from 5,700 feet to 9,200 feet.

Movements and Dates: 10 March at 6,800 feet; 16 March at 7,400 feet; 24 Feb. at 5,700 feet and 7,400 feet; 21 April at 9,100 feet; 4 May at 6,800 ft.; 2 Oct. at 9,200 ft.; 24 Nov. at 8,000 ft.

Habitat: ban oak forest, chir forest, and grasslands.

Foraging position: primarily terrestrial; also bushes and trees Sightings over grassy slope (8); oak forest (2); chir (1).

Behavior: a pair noted on 2 Oct.; other observations were of single birds. On 4 May a bird in a medium-sized ban oak in thick oak forest was attentively watching the leaf-covered floor and showed little concern of humans that stood 20 yards away.

Identifications: Difficult to identify to species when flying at some distance. Two birds collected by RLF Sr. on 19 and 20 Nov. at 7,000 feet were A. nisus. Other birds with mesial stripes were identified as A. virgatus.

Buteo rufinus (Cretzschmar) and B. buteo (Linnaeus)

Number of observations: 12.

Status: winter visitors or transients.

Localities: B-9; C-9,13,14; D-16; I-5; O-6; X-6,8.

Altitude: from 6,700 feet to 8,200 feet.

Movements and Dates: 14 Nov. at 8,200 feet; 17 Nov. at 6,700 feet; 29 Nov. at 7,000 feet; Jan. at 7,200 feet; Feb. at 7,300 feet; March at 7,000 ft (4 records), last 16 March.

Habitat: cultivations; scrub oak, moru oak edge. Perched on Prunus armenica (2); moru oak (1); ban oak (1); Pyrus malus (3) and on top of chir pine (2), RLF Sr.

Foraging position: terrestrial in open areas.

Behavior: only single birds seen. Sluggish with no vigorous flying noted.

Identifications: B. rufinus collected from top of ban oak at 7,200 feet in Jan. by G. VanRooy.

Buteo buteo burmanicus collected on 17 Nov. at 6,700 ft. and on 29 Nov. at 7,000 feet by RLF Sr. A third secured in Feb. at 7,300 feet by S. VanRooy.

Food: Crop and stomach of one bird full of small yellow wasps.

Aquila nipalensis (Hodgson)

Number of observations: 4.

Status: migrant over area.

Localities: over C-10,14; I-7; H-4.

Altitudes: from 7,500 to estimated 8,500 feet.

Movements and Dates: 3 March at 8,500 ft. heading E; 15 Oct. at 7,500 ft. heading W; 31 Oct. at 7,500 ft. heading S.

Habitat: over open grasslands

Foraging position: terrestrial.

Food: A female collected by RLF Sr. was feeding on a swarm of insects at 7,300 feet. One flying W at 7,500 ft. over C-10 had what looked to be a strip of meat in its talons. While under observation, the eagle dropped the strip but caught it again in mid-air.

Behavior: solitary (3); three birds (once).

Spizaetus nipalensis (Hodgson)

Number of observations: 12.

Status: resident.

Localities: A-6; D-2; F-1,9; W-9,10.

Altitude: from 6,500 feet to 8,100 feet.

Movements and Dates: 29 Sept. at 6,700 ft.,; 14 Oct. at 6,500 feet; 18 Nov. at 6,700 ft. and at 7,200 ft.; 19 21, and 27 Nov. at 8,000 ft.; 4 Jan. at 7,200 ft.

Habitat: ban oak forest, moru oak forest.

Foraging position: terrestrial; aerial (to catch pheasants).

Food: seen chasing kalij pheasant (Lophura) in fast dive (twice). On 18 Nov. a bird collected by RLF Sr. had pheasant meat in crop. Seen chasing domestic chickens on 4 Jan. in A-6.

Behavior: only single birds seen. Noted perched in ban oak (5);

moru oak (2); chir pine (1). Perched on main trunk (45 degree angle) of large oak (1). Unusual call: a high squeak resembling an immature thrush call or perhaps a large rat. Call given once every 10-15 sec. over period of 30 min. while bird was under observation. The bird remained motionless in leafy oak in thick forest. A call to bring up prey? Date: 29 Sept.

Remarks: The hawk-eagle overlaps in altitude with the black and serpent eagles. However, the hawk-eagle hunts by sitting quietly and waiting for prey rather than by circling. It is strictly a forest bird; the other two are often found in open country. Of the raptores only the hawk-eagle was seen pursuing large birds. The hare, Lepus nigricollis F. Cuvier, a reported favorite food of this bird, was extremely rare here with only one sight record in three years.

Ictinaetus malayensis (Temminck)

Number of observations: 10.

Status: resident.

Localities: B-9,10; F-9; G-5,6,15; H-2,3; R-11; Y-7,8.

Altitude: from 5,800 feet to 9,500 feet.

Movements and Dates: 8 March at 6,800 feet; 11 March at 7,400 ft.; 30 March at 7,300 ft.; 14 May at 8,200 ft.; 27 Sept. at 6,400 ft.; 29 Sept. at 6,300 ft.; and 2 Oct. at 9,500 ft.

Habitat: over scrub ban oak, ban oak, grassland, moru oak,

and fir forest. Seen perched in ban oaks (2); flying over grassy slopes (4); over ban oak forest (2); moru oak forest (1); over fir forest (1).

Foraging position: terrestrial.

Behavior: only single bird seen. Flying low over hill slope (7); high (about 400 feet) over ridge (1). Bird at 9,500 feet was gliding E, then it turned and with slightly bent wings rapidly disappeared NW. Another bird watched for 15 min. dropped to within five feet of ground six times but never caught anything.

Remarks: Previous reports place this eagle from the foothills up to 6,000 feet (Ripley, 1961:54; Baker, 1928:83) or between ca.1,000 feet and 6,500 feet in Sikkim (Ali, 1962:10), but it ranged up to 9,500 feet here. Both black eagles and serpent eagles circle over open areas, the black just off the ground and the serpent much higher.

Torgos calvus (Scopoli)

Number of observations: 50.

Status: resident.

Localities: over sections A, B, E, F and along main ridge to Y-8.

Altitude: noted from 6,000 feet to 9,200 feet.

Movements and Dates. Birds remain fairly high even for the winter (8,200 ft. on 28 Nov., 7,500 ft. on 20 Feb.).

Habitat: over most forested and grassland sections. Observed

perched in moru oak trees (6) in heavy oak forest.

Foraging position: terrestrial scavenger.

Food: Carrion. A report by students of a large black bird with some white on it hovering over an immobile fox at 9,100 feet was probably of this species. Most likely both the bird and fox were interested in some third object not noticed by the students.

Behavior: noted in pairs (2); all other observations of single birds.

Never seen on the garbage dumps of Landour.

A fox carcass placed in an abandoned field in W-9 was first discovered by crows and in 2.5 min. by a single black vulture. In 7.5 min. griffon vultures appeared. The black landed several times only to be frightened off by us; the griffons circled. Landing attempts always initiated by black. At one point 1 black vulture, 16 griffons, and 1 lammergeier circled.

Remarks: Neither Ripley nor Baker mention that the black vulture ascends into the Himalayas. Ali (1962:11) met them up to ca.3,000 feet, but here they regularly ranged up to 9,200 feet over Sirkanda. This vulture overlaps in altitude with the lammergeier, Himalayan griffon and the scavenger vulture, but the black is never seen around garbage dumps nor near areas of human concentration. In open country, the black is the boldest of the three common vultures. Apparently it rests and roosts in forests rather than on cliffs.

Gyps himalayensis Hume

Number of observations: 1000.

Status: resident.

Localities: over all sections of the study area.

Altitude: throughout the study area.

Habitat: over all habitats. Roosting and nesting on cliffs.

Foraging position: terrestrial scavenger. To locate food birds usually glide above ridge and rarely more than 1,000 feet below crest of main ridge. Frequently play follow-the-leader as bird after bird approaches in single file, each one heading in the same direction on the same flight plan.

Behavior: usually single when foraging but up to 42 birds counted near carcass.

Diurnal and rarely seen in early morning. One record of a bird on the wing about 15 min. after sunrise. A flock of 13 birds watched in Y-8, 8,900 ft. On evening of 19 May birds on cliff by 6:40 PM (sunset at 7;30 PM). On 20 May sunrise at 5:30 and sun hit birds on cliff at 5:40 AM, but birds began to leave cliff at 6:30 AM.

Birds rest on rocks and cliffs and rarely in trees.

Density: relative frequency griffon vs. lammergeier is about 1:1 to 10:1. Griffons vs. black vultures is about 15:1 to 30:1.

Max. nesting density of 8 nests in 3 acres of cliffs.

Remarks: The Himalayan griffon is the most abundant vulture here and outnumbers other species by about 30:1 on carcasses. It is never seen on garbage dumps in residential sections but will come to a carcass near a small village.

Gyps bengalensis (Gmelin)

Number of observations: 2.

Status: rare summer visitor.

Localities: C-1; F-4.

Altitude: noted from 5,500 feet to 6,800 feet.

Movements and Dates: 3 April at 5,500 ft.; 18 April at 6,800 ft.

Habitat: open grassy slopes and chir pine.

Foraging position: terrestrial scavenger

Behavior: Four birds near panther kill in F-4 closely associated with 16 griffons. When approached, the griffons "flushed" at 75 yards, the white-backed vultures at 50 yards.

Remarks: The white-backed vulture has not been reported previously over 4,500 feet (Ripley, 1961:58) and 5,000 feet (Baker, 1928:20), but wandered up to 6,800 feet here. It appeared to be more tolerant of human approach than did the griffons.

Neophron percnopterus (Linnaeus)

Number of observations: 300.

Status: summer visitor.

Localities: primarily over sections A, B, E, and F and occasionally over other sections up to Y-8.

Altitude: noted from 5,500 feet to 9,500 feet.

Movements and Dates: first seen on 8 March 1964 at 6,800 ft.; 15 March 1965 at 7,300 ft.; 11 March 1966 at 6,800 ft. Depart in Sept. and last seen on 28 Sept. at 6,800 ft.

Habitat: around residential areas - especially near garbage dumps.

Foraging position: terrestrial scavenger.

Behavior: occur in pairs and parties of up to 4 birds. A maximum count of 7 birds circling together at 7,000 ft. While flying these birds exhibit a distinct "wobble" which differs considerably from the other "steady" vultures that are (perhaps) more adapted to soaring.

Remarks: The race of the scavenger vulture in the study area is presumably intermediate between N.p. ginginianus and N. p. percnopterus (see Baker, 1928:24) but the former is a plains bird and does not ascend the hills, while the latter breeds to 8,000 feet in suitable mountains. Birds in the study area range up to 9,500 feet and are almost always associated with areas of human concentration.

Gypaetus barbatus (Linnaeus)

Number of observations: 500.

Status: resident.

Localities: over most sections of the study area.

Altitude: throughout the study area

Habitat: Roost and nest on cliffs.

Foraging position: terrestrial scavenger. To locate food the birds usually glide close the the slope (within 100 to 300 ft. off ground). If griffon and lammergeier in same field of view the griffon flying higher in 9 out of 10 times. The lammergeier apparently has a distinct foraging pattern as individuals often seen flying over same route many times. A single bird noted on 32 trips over a two week period, following a pattern that included circling over dump in E-4, then scanning the hills while losing altitude until reaching F-5,6 where it caught an updraft to gain height and then heading either W or SW until out of sight.

Behavior: usually single or in pairs. Once 5 birds noted circling together at 8,000 ft., 23 Nov.

Bone dropping observed 5 times. All drops were on 14 Nov. 1964 between 12:45 and 2:15 PM. On drop approach the bird circled around (apparently selecting a target) and then dipping slightly it let the bone go. Approximate height above ground when drops occurred was 75ft.(1); 100 ft.(3); 125 ft. (1). Area where bones landed was stony with little grass (2); grassy slope with limestone boulders (3). Two dropped objects were recovered. One was a vertebral column which measured 10 inches long and contained 6 vertebrae (possibly of a goat) and the other a pelvic girdle (possibly goat).

Remarks: In over five hundred sightings of the lammergeier, bone dropping was seen only five times. Possible explanations of this behavior are: (1) food is obtained when marrow is exposed if bones split, (2) bones separate so they can be swallowed, and (3) it may be a form of play. Bones I recovered did not have enough marrow to sustain birds for long. Bones in small pieces are probably swallowed but sharp edges and splinters might be hazardous to a bird. Bone dropping occurs so infrequently that it may be a form of play. However, an observation of two birds engaged in a fight violent enough to loosen feathers would not support a play theory. Bone dropping may be a part of a courtship pattern or territory defense as it occurred in mid-November. However, after the bones are dropped, the birds descend to the ground to pick at them and it appears to me that the vultures may well retrieve bits of gristle and meat previously lodged between the bones.

Spilornis cheela (Latham)

Number of observations: 60.

Status: resident.

Localities: over most sections up to 8,100 feet.

Altitude: noted from 5,000 feet to 8,100 feet.

Movements and Dates: at 8,100 feet on 26 Nov.

Habitat: over grassy slopes, ban oak forest, ban oak scrub,

Foraging position: terrestrial. Recorded hovering over grassy ridge (for 5 minutes with shifting positions) at 7,500 ft. Perched on bush (1); chir pine (1); ban oak (7). Often seen circling high over head and calling loudly.

Remarks: Previous reports place the serpent eagle up to 7,000 feet (Ripley, 1961:61; Baker, 1928:98; Ali, 1962: 16) but here it regularly moved up to 8,000 feet. It occasionally hovers over grassy slopes and frequently occurs in forests, thus falling between the black and hawk-eagles in foraging position. In terms of numbers this is the most successful eagle in the study area.

FALCONIDAE

Falco tinnunculus Linnaeus

Number of observations: 200.

Status: resident.

Localities: over grasslands and light forest sections.

Altitude: throughout the study area.

Habitat: grasslands, cliffs, light forest. Noted perching on deodar (11); ban oak (ca.30); rocks (7) fir (2).

Foraging position: primarily terrestrial; rarely in trees. Often hovering over slopes. Of 21 records ave. hovering time without changing position was 13 sec., and max. 28 sec.

Food: terrestrial insects and smaller vertebrates (skinks). One attack on bird observed. A kestrel caught a phylloscopid on outer branch of a 35 ft. high ban oak

No noise or squeaks. Other birds in hunting party did not raise an alarm. Elapsed time for approach, attack and departure was between 2 and 3 sec.

Nesting: S. and N. VanRooy reported two nests in A-7 at 6,900 feet located within 10 feet of each other. Both had young on 5 March.

Remarks: This is the most abundant falcon in the parts of the Himalayas I visited. Success is possibly due partly to its ability to hover - allowing a careful search for prey - and partly to its varied diet. Donald (1930: 300) points out that small birds are not part of the kestrel's food for passerines do not sound an alarm even with a kestrel nearby. This is only partly true for if a kestrel's flight is directly over the birds, I have heard them utter sharp alarm calls. Occasionally kestrels do catch small birds

PHASIANIDAE

Alectoris graeca (Meisner)

Number of observations: 60.

Status: resident.

Localities: C-14; G-2; D-15,16; H-3,3,8; I-5,6,7,9,12; J-9, 13; K-11,12; L-6,9,10; O-6,11; V-12; W-12,16; Y-12.

Altitude: from 6,500 feet to 9,100 feet.

Habitat: on open grassy slopes; slopes dotted with a few stunted oaks; often in or near fields in open country.

Foraging position: terrestrial.

Behavior: a covey disturbed at 12;30 AM while roosting on the ground. Occur in flocks of 3-6 birds; 8 birds maximum noted; in pairs during breeding season.

Density: Suspected nestings of four pairs in H-3,4; I-13,14 in 0.5 square mile.

Remarks: The chukor partridge overlaps in altitude and habitat with the chir pheasant. However, the former is noted much more frequently but this may not reflect a normal situation since the chir is under more hunting pressure than the chukor. Villagers who own muzzleloaders hesitate to shoot birds as small as partridges but feel that the chir is worthwhile game. Therefore, the chukor is more apt to survive in areas where man has penetrated.

Francolinus francolinus (Linnaeus)

Number of observations: 20.

Status: summer visitor.

Localities: C-1; E-8; F-15; I-10; J-11; L-9.

Altitude: from 5,500 feet to 6,900 feet.

Movements and Dates: first heard calling on 16 April at 6,400 ft.; heard through July with the last date at 6,500 feet 19 July.

Habitat: barberry scrub and rocky outcroppings (3); in fields (7); calling near fields (10).

Foraging position: terrestrial.

Behavior: occur in pairs or single (males usually seen).

Density: 5 birds calling in 4 square miles (not all suitable habitat).

Remarks: The black partridge overlaps in altitude with the chukor partridge, but the former is restricted to the neighborhood of cultivations, while the latter is not. To reach these fields, the black partridge has to pass through territory occupied by kalij pheasants and hill partridges. Although once heard from a forest frequented by kalij it seems likely that the black would not remain in forests long. The race in the Mussoorie Hills (Francolinus francolinus asiae) previously has been recorded up to 4,000 feet (Ripley, 1961:73) but ranges up to 7,000 feet here.

Arborphila torqueola (Valenciennes)

Number of observations: 300.

Status: resident.

Localities: sections of heavy forest throughout the study area.

Altitude: from 5,500 feet to 9,100 feet.

Habitat: in or near ravines in thick forests of ban oak, moru oak, deodar and fir where plenty of leaf mulch available.

Foraging position: terrestrial with much scratching and scraping of the leaf litter. Hundreds of scratchings noted in leaf mulch.

Behavior: occur in parties of 3 - 6 birds; max. of 12 birds noted (1). In pairs in breeding season.

Often fly uphill when flushed (chukor partridge usually flies downhill) and after landing do not freeze but sneak away through the bushes.

Density: In C-5 four groups noted (3,2,4,2) giving 10 birds in 0.06 square mile. In S-9 two groups (4,4) giving 8 birds in 0.06 sq. mi. In W-14 one groups of 12 birds in 2 acres. In W-13 three groups (9,7,4) giving 20 birds in 0.06 sq. mi.

Remarks: The hill partridge, the most abundant partridge in the study area, differs from the other two partridges by inhabiting forests rather than open country. The hill partridge overlaps with the kalij in altitude and habitat, but the former selects shady ravines in forests and does not range as far from these as does the latter. The partridge is more abundant on northern faces, whereas the pheasant is relatively common on both northern and southern slopes. At higher elevations the hill partridge overlaps with the koklas pheasant, but the former is noted deep in valleys and not up on the slopes or in minor valleys near the crest of the ridge as is the koklas.

Lophophorus impejanus (Latham)

Number of observations: 9.

Status: resident.

Localities: W-15; X-5; Y-8,11.

Altitude: noted from 8,000 feet to 9,100 feet.

Movements and Dates: seen at the lower heights (ca.8,000 ft.) by 17 Nov. By March the birds have moved up on Sirkanda and are not seen below 8,000 ft.

Habitat: on steep rocky or grassy slopes (6); fir forest (3).

Foraging position: Terrestrial with some digging for roots with bill.

Behavior: single male (1); single bird in female plumage (2); pair (1); two in female plumage (2) and four (1). Adapted to open steep areas for when flushed birds catapult down slope, curve around ridge and land out of sight. In forest birds flush into trees and later shoot down slope. Regain altitude by walking and jumping up slope. One flock (4 birds) flushed from the middle of open grassy space just at dusk and well after sunset so may roost in open.

Density: An estimated four pairs in 0.25 sq. mi. on Sirkanda.

Remarks: The large monal pheasants are restricted to the Sirkanda region although reports from the early 1800's indicate that they extended westwards along the watershed ridge in places where they have since become extirpated. The birds here comprise a relatively isolated "island" population for the only connection they have with the main Himlayan range is along the Lurntzu-Nag Tiba ridge (with saddles down to 7,000 feet) across which they would be likely to wander only by chance during a severe winter.

Monals were seen near koklas pheasants, but the

former occupies cliffs and grassy slopes while the latter frequent the ground under the fir trees.

Tragopan melanocephalus (J.E.Gray)

Number of observations: 1.

Status: resident.

Localities: X-7.

Altitude: at 8,500 feet.

Habitat: thick moru oak and fir forest.

Notes: on 2 Oct. S. and G. VanRooy flushed bird (not actually seen) from moru oak forest and found a single feather. Villagers living along the borders of heavy forest state that a large red pheasant is sometimes seen along the ridge. Some years ago I found feathers of this species in a ravine below Khaudia (5 miles E of the study area) at 6,000 feet altitude.

Remarks: The status of the tragopan pheasant is open to question as I saw none here. It probably does survive in small numbers in densely forested areas along the northern slopes of the ridge both in the Sirkanda region and further north. Interaction with birds of the main Himalayan range may well occur as this pheasant descends to at least 6,000 feet and the ridge saddles are at 7,000 feet.

Lophura leucomelana (Latham)

Number of observations: 500.

Status: resident.

Localities: most forested sections excluding chir and fir.

Altitude: noted from 5,000 feet to 8,300 feet.

Habitat: ban oak, ban oak scrub, moru oak, edges of cultivations, edges of deodar stands. Invariably seen near ravines with oak or mixed tree cover and considerable leaf mulch. Occasionally in semi-open barberry bush country.

Foraging position: terrestrial with some scratching; low bushes where they pick off berries (barberry); small trees where they can gain a foothold and also secure berries (Coriaria).

Food: berries; terrestrial invertebrates; seeds in horse manure; human feces.

Behavior: occur in small flocks with max. of 10 birds noted. During breeding season single males often seen. Flocks usually of mixed sexes but one exception of 7 males noted on 6 Nov. at 6,700 feet.

When approached by humans the birds crouch, then flush suddenly and dive screaming downhill. This rapid escape may be main reason for the success (in numbers) of this pheasant in this area. Also seen reacting vociferously to approach by black bears, leopards, and pine martins and in these cases the birds usually fly up into trees.

Density: maximum count gave 19 birds in transet of 1.5 mi. (area covered about 0.25 sq. mi.) in F-11,12; G-7,9,11 and made in late October.

Remarks: The kalij pheasant overlaps in altitude and habitat

with the hill partridge,but the latter is restricted to shady ravines while the former is not. Despite severe hunting pressure, the kalij is the most abundant pheasant here. At upper altitudes it overlaps with the koklas pheasant, but the former is usually along the edges of cultivations or in light forest while the latter occupies dense forests.

Gallus gallus (Linnaeus)

Number of observations: 8.

Status: summer visitor.

Localities: F-5,15,16; C-1.

Altitude: noted at 6,000 ft. (2); 6,300 ft. (1); 6,400 ft.(4); 6,600 ft. (1).

Movements and Dates: Crowing at 6,400 ft. on 17 April. However, no birds seen in same area during careful search on 20-30 April. Also heard on 20 Aug. in C-1.

Habitat: recorded from edge of cultivation in mixed ban oak and bushes and heavy ban oak mixed with other hardwoods.

Behavior: solitary male (2); female with young (1).

Nesting: John Jantzen reported a female with young that could fly on 23 April at 6,300 ft.

Remarks: Previously the red junglefowl has been recorded rarely to 7,000 feet (Ripley, 1961:89) and normally to 6,000 feet (Ali, 1962:22) but in the study area it is rare above 5,000 feet. It overlaps in habitat with both the kalij pheasant and the hill partridge and the presence of these two species may well account for the rarity of

the red junglefowl above 5,000 feet here.

Pucrasia macrolopha (Lesson)

Number of observations: 50.

Status: resident.

Localities: B-12; C-10; I-5; J-1; M-4; N-1-4; W-9,11,13-15; Y-4,7,8.

Altitude: from 6,900 feet to 9,100 feet.

Movements and Dates: No birds recorded at 9,000 feet during counts on 2,3,4 October. However, counts on 18 and 22 Nov. at 9,000 feet gave 15 birds in same area.

Habitat: recorded from chir forest near ban oaks and rhododendrons in ravines (3); ban oak forest (5); primarily from moru oak, edge of deodar forest and fir forest.

Foraging position: terrestrial; not many scratchings noted on Sirkanda.

Food: fresh grass blades, moru oak acorns, some moss and small stones found in crop and gizzard.

Behavior: usually occur in small flocks of up to 7 birds; single (5).

Somewhat fearless and easy to shoot. Often will crouch until hunter is within 15 feet, then after short flight may alight and continue running.

Nesting: used nests located on Top Tiba (8,400 ft.) and Sirkanda (9,000 ft.). Young captured on Top Tiba at 8,000 ft. on 10 June (RLF Sr.).

Density: maximum count gave 15 birds in 0.12 sq. mi. at 9,000 ft.

Remarks: The koklas pheasant is the common phasianid from 8,000 to 9,000 feet where it overlaps with the hill partridge. The latter does a great deal of scratching in the leaf mulch, whereas the former feeds on grassblades and acorns that are secured without much scratching. The koklas is tame and easily shot but since it inhabits forests it often freezes and eludes the hunter.

Catreus wallichii (Hardwicke)

Number of observations: 6.

Status: resident.

Localities: C-10; G-1; I-6,10; N-7; W-16.

Altitude: noted from 7,000 feet to 8,100 feet.

Habitat: recorded in grassy areas with rocks; grassy slopes with scrub oaks.

Foraging position: terrestrial.

Behavior: single (4); pair (2). Shy, and when flushed will dive straight down steep slope.

Nesting: A nest with six eggs located by S. Coapman at 7,400 ft. on 15 June 1965. In shallow depression on floor of recessed semi-cave on steep grassy slope in C-14.

Remarks: The rare chir pheasant overlaps with the chukor partridge in habitat and altitude and comes under severe hunting pressure.

RALLIDAE

Porzana pusilla (Pallas)

Number of observations: 3.

Status: migrant over study area.

Localities: recovered in A-16; E-8; F-1.

Altitudes: recovered from 6,300 feet to 6,700 feet.

Movements and Dates: found dead on 22 May at 6,600 ft. (RLF Sr.); 2 May in E-8 at 6,300 ft.; 27 April in A-16 at 6,700 ft.

Remarks: All finds of Baillon's crake were of spring birds and may indicate that they fly far enough to exhaust themselves before they reach the main Himalayan range.

CHARADRIIDAE

Scolopax rusticola Linnæus

Number of observations: 9.

Status: migrant through area.

Localities: A-11; E-8; F-5; W-14; Y-8,9.

Altitude: noted from 6,200 feet to 9,000 feet.

Movements and Dates: noted on 21 March, 5, 9 April and 26,27 Nov.

Habitat: all birds flushed from beneath heavy cover of ban oak, moru oak and fir.

Foraging position: terrestrial with probing in soil and leaf litter.

Food: one caught in a rice-baited trap.

Remarks: The habitat selection of the woodcock overlaps with that of the hill partridge whose abundance may help to explain the rareness of woodcocks at this level.

COLUMBIDAE

Treron sphenura (Vigors)

Number of observations: 50.

Status: summer visitor.

Localities: B-6,11; C-2,4,6; D-1-4; E-11,12,15; F-4,11,12, 16; G-9,11,16; V-4; W-1.

Altitude: from 5,000 feet to 7,000 feet.

Movements and Dates: first heard calling on 18 April at 6,300 ft.

Habitat: subtropical hardwoods; moru-ban transition (1).

Foraging position: arboreal. Never seen on ground and rarely noted on the outside of a tree.

Food: noted eating berries of Coriaria, Cornus and Ficus.

Behavior: noted in pairs or single; max. 3 birds together.

Nesting: Nest with 2 eggs found on 2 July at 6,000 feet. Nest placed 35 feet up in large leafy tree.

Density: One nest and another pair thought nesting in F-11, 12 in area of 0.12 sq. mi.

Remarks: The wedge-tailed green pigeon does not overlap with other pigeons but shares fruiting trees with barbets, bulbuls, parakeets, scimitar babblers, and laughing thrushes. It arrives at 6,000 feet by mid-April. After late June it stops calling. I have only a few sight records for July and August so I could not tell for sure when the bird left the area.

Columba leuconota Vigors

Number of observations: 6.

Status: winter visitor.

Localities: C-1; L-10; V-12; W-15.

Altitude: from 5,500 ft. to 8,100 ft.

Movements and Dates: earliest arrival date 17 Nov. at 8,000 ft.
Last date 3 April at 5,500 ft.

Habitat: recorded from steep limestone cliffs (3); in or near fields(2); steep grassy hillsides with rocks (1).

Foraging position: terrestrial in grassy areas and fields.

Food: gizzard examined had grass seeds and pebbles.

Behavior: noted in flocks of 75 birds (1); 30, 11, 14, 8, 6 (all once).
Flock close together and roost together on open cliffs.
Attract some hunting pressure from villagers.

Density: maximum noted was 75 birds roosting on one cliff.

Remarks: The wintering snow pigeon overlaps with the wood pigeon in altitude but the former remains in open country and eats seeds while the latter occurs in forests and eats berries. Snow pigeons apparently set up "headquarters" for an entire winter season and may return to the same cliffs for each winter.

Columba livia Gmelin

Number of observations: 1.

Status: wandering flock.

Localities: flying over W-16.

Altitude: 8,000 feet.

Movements and Dates: 18 Nov. 1965.

Habitat: flying E over a steep grassy slope some 150 ft. off ground.

Behavior: a flock of 8 birds noted.

Remarks: The blue rock pigeon is extremely rare in the study area and although previously reported to 9,000 feet in suitable country (Ripley, 1961:160), the lack of stony conditions here apparently restricts its occurrence.

Columba hodgsonii Vigors

Number of observations: 5.

Status: Irregular winter visitor.

Localities: A-8; G-9,12; W-11,12.

Altitude: noted from 5,500 feet to 8,300 feet.

Movements and Dates: 15 Nov. at 8,300 feet; 23, 25 Feb., 6 and 12 March at 6,500 feet.

Habitat: in heavy forest; large bushes in oak scrub (1).

Foraging position: recorded only from the lower tree story.

Behavior: noted in flocks of c25, 12, 21, 6 and 4 birds. Mobile flocks that were not seen in one location for more than two days at a time.

Streptopelia orientalis (Latham)

Number of observations: 300.

Status: summer visitor.

Localities: most sections of study area.

Altitude: from 5,000 feet to 9,100 feet.

Movements and Dates: first seen on 7 March 1964 at 7,000 ft.; 10 March 1965 and 11 March 1966 at 7,200 ft. In the fall

depart the study area by late Oct., none seen on count in first week of Nov.

Habitat: recorded from subtropical hardwoods; ban oak; moru oak, deodar; fir; and edges of cultivation.

Behavior: noted in pairs; single occasionally; rarely in loose flock of 3-5 birds.

Density: one nest and two other pairs suspected nesting in F-11 in 0.06 sq. mi. In F-16 four pairs counted in April in 40 acres. On edge of fir forest, three pairs in 40 acres of Y-11,12. In deodar forest 7 birds seen in 20 acres of V-15 (max. count on 18 April).

Remarks: The turtle dove does not overlap with other columbids. Both this species and the kalij pheasant pick at feces of horses and mules.

Streptopelia decaocte (Frivaldszky)

Number of observations: 3.

Status: summer visitor.

Localities: F-4; G-10; S-2.

Altitude: from 5,800 feet to 7,000 feet.

Movements and Dates: noted on 7 April, 7 May and 18 Sept.

Habitat: a pair courting in ban and moru oak transition at 7,000 feet. Also near cultivation in mixed scrub and barberry bushes.

Behavior: noted in pairs (2) and single.

Remarks: Previously the ring dove has been recorded up to 8,000 feet (Ripley, 1961:165) but not noted here above 7,000 feet and rarely above 5,000 feet. At the upper

elevations it may overlap with the rufous turtle dove, but the ring dove appears to prefer the vicinity of cultivations and is not seen in the forests as is the latter. A record of a pair courting in a small valley at 7,000 feet near both rufous turtle doves and green pigeons is unusual.

PSITTACIDAE

Psittacula himalayana (Lesson)

Number of observations: 300.

Status:resident.

Localities: sections up to 7,500 feet except in chir pine and grass; Y-7.

Altitude: from 5,000 feet to 9,000 feet.

Movements and Dates: upward movement in winter (into upper ban oak belt).

Habitat: noted flying over grass, chir pine and fir forests. Recorded perched in subtropical hardwoods; light and heavy ban oak forest.

Foraging position: arboreal. During winter birds usually in upper third of ban oak trees, usually towards distal end of branch. Also feed on berries in bushes.

Food: Ban oak acorns, Cornus and Viburnum berries.

Behavior: in spring noted in small flocks of 3 birds(5), 4 (2) 8 (2) and 10 (1). Single and paired during breeding season. In late and post-monsoon season gather into large flocks with max. size noted of ca. 50 birds.

Density: max. count around Vibrunum bushes in August gave ca. 50, 25 and 20 birds in G-3,4 or 95 birds in 0.12 sq. mi.

Remarks: The slaty- headed parakeet has previously been recorded to 8,000 feet (Ripley, 1961:172; Ali, 1962:48). During the nesting season they are usually confined to valleys below 6,000 feet but move upwards into the viburnums after the monsoons and into ban oaks for winter. The acorns are also consumed in quantities by the langur monkey, Presbytis entellus (Dufresne), and the black bear, Selenarctos thibetanus (G. Cuvier), but the mammals leave acorns out on branch tips which the parakeets locate.

CUCULIDAE

Cuculus sparverioides Vigors

Number of observations: 11.

Status: summer visitor.

Localities: G-13; W-10,11; Y-8,9.

Altitude: from 6,300 feet to 9,000 feet.

Movements and Dates: first heard on 29 April and last heard on 21 May.

Habitat: recorded from light ban oak forest on 29 April at 6,300 ft. (on migration). Other records are from moru oak and fir forest.

Behavior: only single birds seen.

Usually calls only before sunrise and after sunset.

Nesting: a bird sitting quietly in birch tree in fir forest

was attended by agitated male chestnut-bellied rock thrush and later joined by a white-tailed nuthatch.

Density: max. count of calling birds gave 3 birds in one sq. mi.

Remarks: The hawk-cuckoo is a forest bird but ranges higher than the Indian or the Himalayan cuckoos for during the summer it is found only in moru oak and fir forests.

Cuculus micropterus Gould

Number of observations: 60.

Status: summer visitor.

Localities: valleys up to 7,000 feet; A-11; U-12.

Altitude: from 5,000 feet to 7,500 feet in U-12.

Movements and Dates: first heard calling on 17 April 1964; 17 April 1965; and on 12 April 1966, all at 6,200 feet. On 14 May at 7,500 feet. Calling ceased by 1st week of June.

Habitat: subtropical hardwoods along streams, light ban oak.

Behavior: only single birds noted.

Density: a maximum count of calling birds gave 3 birds in 2 sq. mi. of sections F and G.

Cuculus canorus Linnaeus

Number of observations: 50.

Status: summer visitor.

Localities: from south faces of I through P; north faces of P; Y-16.

Altitude: from 6,800 feet to 8,100 feet.

Movements and Dates: first heard calling on 11 April 1964 at

7,200 ft.; 16 April 1965 at 7,200 ft.; 9 April 1966 at 8,100 ft. None heard in June.

Habitat: recorded from open grassy slopes with rocks and a few scattered scrub oaks.

Foraging position: of 18 records in May, bird on ground (11), in trees (7).

Behavior: noted in pairs or single.

Nesting: a stone chat (Saxicola torquata) vigorously protested cuckoo's presence. One noted perched some 6 feet from entrance of jungle myna's nest.

Density: a transect count on 14 May gave in section K (pair); L(single); M (pair); N (single); O (single) or a total to 7 birds (possibly 5 pairs represented) in five linear miles.

Remarks: The European cuckoo is an open-country bird and thus differs from the other three cuculids. Birds of comparable size in open tracts are the jungle myna and the kestrel and these might overlap with the cuckoo in food selection.

Cuculus saturatus Blyth

Number of observations: 100.

Status: summer visitor.

Localities: valleys up to 6,500 feet.

Altitude: from 5,000 feet to 7,800 feet.

Movements and Dates: first heard on 4 April at 6,400 ft.; 11 April 1965 at 6,500 ft.; 2 April 1966 at 6,000 ft.

Habitat: recorded in subtropical hardwoods; ban oak forest. Also noted in deodar (2); chir pine (1).

Foraging position: all birds seen in trees.

Behavior: only single birds seen. Usually heard rather than seen. Bird seen at close range in C-13 at 7,000 feet on 25 Sept.1965 thought to be this species. Silent after May but evidently remain until at least late Sept.

Density: max. count of calling birds gave 3 birds in one sq. mi. Relative frequency of the three cuckoos (taken from calling birds) was Indian cuckoo(11), European cuckoo (10), and Himalayan cuckoo (33).

Remarks: The Himalayan cuckoo was noted at a higher altitude than the Indian cuckoo, but neither species was seen as high as recorded by other observers - the Indian to 9,000 feet and the Himalayan to 10,000 feet (Ripley, 1961: 176,178). After June the cuckoos stop calling and records of their movements are scarce. One cuckoo seen on 25 Sept. at 7,000 feet thought to be the Himalayan. Both species select forested areas, but the Himalayan is usually seen on northern slopes and in conifers, whereas the Indian is partial to light forest and sub-tropical hardwoods along the streams.

STRIGIDAE

Otus spilocephalus (Blyth)

Number of observations: 500.

Status: resident.

Localities: sections of ban oak forest.

Altitude: from 5,000 feet to 8,000 feet.

Movements and Dates: 7 May at 8:00 PM at 8,000 ft.

Habitat: ban oak forest; ban oak and deodar.

Behavior: usually single with max. of 3 birds in loose flock. Entirely nocturnal. Ventriloquistic habit well known: bird seems far down the hillside and then gradually approaches until seemingly directly in front of observer. Purpose?

Density: closest calling birds 50 yards apart (16 Oct.) in F-11. Max. calling count gave 3 birds in F-4,8;G-1-5 in 0.25 sq. mi. and 4 birds in F-9,10,13,14 in 0.25 sq. mi.

Remarks: The nocturnal spotted scops owl overlaps with other small owls in the study area, but apparently avoids the territories of both the pigmy owlets and the barred owlets. The spotted scops owls usually call from a lower elevation than the other small owls. Occasionally it called from a forest section occupied by barred owlets but not for more than three nights in succession. The spotted scops has previously been reported up to 6,000 feet (Ripley, 1961:187),but it moved up to 8,000 feet here.

Otus bakkamoena Pennant

Number of observations: 10.

Status: resident.

Localities: D-13; U-7; W-10,11; Y-7.

Altitude: from 6,700 feet and 8,800 feet.

Movements and Dates: heard on 3 Nov. 1964 in D-13; 14 Nov. 1964 in U-7; W-10,11; 15 Nov. 1964 in Y-7; 14-28 Nov. 1965 in W-10,11.

Habitat: thick oak forest (5); deodar (3); fir (2).

Behavior: single birds noted, pair once.

Heard calling only after dark and birds never seen. Call recorded here was a note that was slightly longer (than the single part of the O. spilocephalus call) and slightly lower in pitch. The interval between calls averaged 3.5 sec. (measured 10 times). Besides a single "phew" a sequence of three and four "phews" noted.

Notes: a female, CMNH 221739, collected by RLF Sr. Labelled Mussoorie, but may not have been in study area. Taken on 6 Jan. 1948.

Remarks: The collared scops owl has been recorded up to 7,000 feet (Ripley, 1961:189) but reached 8,800 feet here. It was heard only on northern slopes , usually in conifers. Identification was based on calls (a single "phew" or a series of 3 or 4 "phews") and one specimen. Apparently it selects a higher altitude than the spotted scops owl.

Glaucidium brodiei (Burton)

Number of observations: 300.

Status: resident.

Localities: oak forests up to 8,000 ft.

Altitude: noted from 5,000 feet to 8,200 feet.

Habitat: oak forests - usually on ridges with chir pine intrusions.

Food: one male with two skinks in gizzard; another with three grasshoppers.

Behavior: noted as single or in pairs; family parties of up to four birds.

Heard calling during the night and at all hours of the day. Occasionally seen perched in trees during early morning hours (often in sunshine on cool mornings).

Density: max. count of three pairs in F-1,2,5,6 or 0.25 sq. mi.

Remarks: The pigmy owlet overlaps in altitude with the barred owlet and the scops owls. Its habitat preference differs slightly from that of the barred for it is found on ridges where chir pines have intruded into ban oak forest, while the barred owlet occurs in homogenous ban oak stands. Furthermore, the barred was never noted away from the residential Landour area, whereas the pigmy was noted in both residential areas and less disturbed sections. Baker (1927:445) reported that the barred owlet is the most diurnal of the Himalayan owls, but I found it to be crepuscular and consider the pigmy owlet, which vocalizes at any hour of the day, as more diurnal. The stomach contents (grasshoppers and skinks) of the pigmy owlet point to its diurnal habits.

The pigmy owlet has previously been recorded up to 7,000 feet (Ripley, 1961:193) but it penetrated up to 8,200 feet here.

Glaucidium cuculoides (Vigors)

Number of observations: 500.

Status: resident.

Localities: most sections of A, B, E, and F.

Altitude: from 6,000 feet to 7,400 feet.

Habitat: recorded from ban oak forest only in areas of human activity.

Foraging position: primarily terrestrial.

Food: terrestrial invertebrates and smaller vertebrates

Behavior: noted as single, in pairs or family parties of up to 5 birds.

Most vociferous at dawn and dusk in Feb. and March. Virtually silent by late April. Seen flying in understory of oaks during the day (9).

Nesting: one nest located in oak tree at 6,700 ft. Branch ca. 14 inches in diameter at nest hole and ca.30 feet off ground. First flight of young from nest on 3 March. Must be double brooded as about half grown young brought to me on 7 August 1965. Three birds barely able to fly noted on 13 July 1964 at 6,600 feet.

Notes: Bird faces hazards during daytime. A stuffed specimen wired to branch of oak was demolished by crows. Other birds approached within inches of owl but did not attack.

Density: one nest and another suspected in F-6,12,15 in 0.25 sq. mi.

Remarks: The crepuscular barred owl was seen only up to 7,400 ft. here but it has previously been reported up to 8,000 ft.

(Ripley, 1961:194). Curiously, it is not seen in ban oak stands outside the residential Landour area. Perhaps commensal living with humans protects it from such predators as the jungle crow. A mounted barred owlet wired to a branch was quickly destroyed by jungle crows.

Strix aluco Linnaeus

Number of observations: 12.

Status: resident.

Localities: B-11; C-6; E-8,12; G-9; N-6; W-6.

Altitude: noted from 5,400 feet to 8,000 feet.

Movements and Dates: Heard calling on 30 March at 6,200 ft.; 2 April at 5,800 ft.; 7 May at 7,900 ft.; 14 Nov. at 8,000 ft.; and 27 Nov. at 6,400 ft.

Habitat: recorded from subtropical hardwoods; ban oak; moru oak; and open grassy hillsides with stunted oaks.

Behavior: flushed from thickly wooded ravines in E-12 and G-9 but otherwise not seen during the day. Heard calling once 1 hr. before sunset in W-6 (moru oak forest) on 7 May 1965. Calls: 2,3 and 4 syllables heard.

Density: appeared to be a resident individual (or pair?) in section E and another bird (or pair?) in section F or possibly two pairs in 2 sq. mi.

Remarks: The tawny wood owl was seen only in thick forests and was usually flushed from a densely foliaged ravine. However, it is not restricted to forests for it was heard calling in open grassland habitat. It overlaps in altitude with the hawk-eagle and might also be expected

to eat large birds and small mammals. The closely related Strix leptogrammica was not heard here.

Asio otus (Linnaeus)

Number of observations: 2.

Status: transient.

Localities: I-6; W-9.

Altitude: noted at 7,200 feet and 8,000 feet.

Habitat: grassy slopes and steep cliffs.

Movements and Dates: noted on 21 March 1965 at 7,200 ft., and on 23 Nov. 1965 at 8,000ft.

Habitat: over grassy slopes and cliff area.

Foraging position: noted flying low over grassy slope and apparently feeds on the ground.

Notes: students J. Larson and D. Waldock found a dead bird in I-6 at 6:00 AM. It had a head injury and the stomach was empty. A female with ovaries slightly enlarged.

Remarks: The rare long-eared owl found dead on 21 March was apparently the first record for the State of Uttar Pradesh (Ripley, 1961:199). However, Vaurie (1964) has examined specimens from Kumoan. Several ova were slightly enlarged and may indicate that this species breeds in the higher hills of Garhwal.

CAPRIMULGIDAE

Caprimulgus indicus Latham

Number of observations: 200.

Status: summer visitor.

Localities: clearings up to 9,000 feet.

Altitude: from 5,500 feet to 9,100 feet.

Movements and Dates: first heard calling on 4 March 1964 at 6,000 feet; 29 March 1965 at 6,000 feet; 4 March 1966 at 6,400 feet.

Habitat: noted from steep rocky slopes with grass covering in or near forests; ban oak scrub; chir pine; moru oak forest and in fir forest (in clearings). Selects both north and south faces.

Foraging position: aerial feeders.

Behavior: only single birds seen.

Start calling 15-20 min. after sundown. Calling ceases by late May. Calling frequency (of 38 records): 6-8PM (24); 8-10 PM (7); 4-6AM(7).

Notes: nightjars seen several times but not positively identified to this species.

27 Aug. a bird flushed from quartzite-covered road at 11:30 PM at 7,100 feet.

19 Sept. a single bird seen hawking close to ground at 7:200 feet.

12 Oct. a bird noted flying N over a deep valley at dusk, 6,000 ft. in section F-12.

Remarks: The Indian nightjar, a higher altitude species than the long-tailed nightjar, is not frequently seen around cultivations for it forages in forest clearings. Nightjars stop calling by the end of May and they become difficult to follow. However, I continued to see

nightjars (probably the Indian) up to 12 Oct. at 6,000 feet. Then I have no records until March and this lack of sightings supports the idea that nightjars do move downhill in winter and are not merely being overlooked (see Ali, 1962:69).

Caprimulgus macrurus Horsfield

Number of observations: 100.

Status: summer visitor.

Localities: in sections with cultivations up to 6,500 feet.

Altitude: from 5,000 feet to 6,500 feet.

Habitat: recorded from around cultivations (both used and unused fields) or in light ban oak forest near cultivations. Birds seen perched in oaks (7); others(1).

Behavior: start calling about 5 min. before preceding species. Calling frequency: 6-8PM (15); 8-10 PM(4); 4-6 AM (2).

Density: 6 birds calling from E and F in 2 sq. mi.

APODIDAE

Collocalia brevirostris (McClelland)

Number of observations: 4.

Status: resident.

Localities: over F-12; Y-7,8.

Altitude: from 6,300 feet to ca.9,300 feet.

Movements and Dates: 1 to 3 Oct.at 9,000 feet; 12 Oct. at 6,300 feet.

Habitat: over forested areas and grassy slopes.

Behavior: Birds at 6,300 feet passed over rapidly flying E. Birds at 9,300 feet were circling over and around Sirkanda in the company of A. pacificus and D. urbica.

Remarks: The edible-nest swiftlet passes though the study area in October and appears to travel leisurely as a flock of about 30 birds was seen around Sirkanda in Y-7,8 on three consecutive days.

Apus melba (Linnaeus)

Number of observations: 10.

Status: transients over area.

Localities: noted over sections E, F, N, R, and Y.

Altitude: seen from 6,800 feet to 8,600 feet.

Movements and Dates: 30 March at 7,300 feet; 14 May at 7,900 feet; 21 May at 8,600 feet; 22 to 26 Sept. around 7,000 ft.

Habitat: appeared high over deep valleys and along grassy slopes, usually below the crest of the ridge. Over oak forests.

Foraging position: usually above 100 feet from the ground.

Behavior: noted in pairs(2); flocks of 8 birds (1), 10 to 15 birds (7).

Remarks: The alpine swifts pass through the study area and hawk insects in areas covered by the house swift. However, the former remain high in the air and rarely dive to within 100 feet of the ground while the latter appear to prefer hunting over a ridge and often come to within 10 feet of the tree tops.

Apus pacificus (Latham)

Number of observations: 5.

Status: summer visitor.

Localities: L-6; M-4; Y-7,8; W-9.

Altitude: noted from 7,500 feet to 9,300 feet.

Movements and Dates: recorded from L-6 and M-4 in April and May; W-9 on 14 May; Y-7,8 on 1 to 3 Oct. 1965.

Habitat: over grassy slopes near cliffs. Not seen near habitations.

Behavior: noted with house martins and edible-nest swiftlets. Noted in small flocks of 3 to 8 birds.

Density: estimated 10 pairs nesting in cliffs in L-6 at 8,000 ft.

Remarks: The white-rumped swift nests in cliffs some distance from human activity, whereas the house swift nests under the roofs of houses

Apus affinis (J.E. Gray)

Number of observations: 100.

Status: summer visitor.

Localities: over most parts of sections A, B, E, F and C-10,14.

Altitude: from 5,800 feet to 7,500 feet.

Movements and Dates: had arrived by 25 Feb. 1965 in A-13. Arrived on 2 March 1966. Leave in late October.

Habitat: recorded from inhabited sections. Usually seen hawking over ridges, especially ridges in southern half of F.

Foraging position: to within 10 feet of trees on ridges. In tight flock high in air during early evening.

Density: 9 nests in one building in A-13; 3 nests destroyed

by residents of building in E-4.

Remarks: The house swift has previously been seen up to 7,000 feet (Ripley, 1961:211) and to 6,500 feet in Sikkim (Ali, 1962:73). Although it is seen here up to 7,500 feet, it remains at a lower altitude than the white-rumped. The two were not seen together.

ALCEDINIDAE

Alcedo atthis (Linnaeus)

Number of observations: 2.

Status: rare summer visitor.

Localities: E-14,15; G-15,16.

Altitude: noted from 5,000 to 5,800 feet.

Movements and Dates: 17 April at 5,000 feet (RLF Sr.) in G-15,16; 23 April in E-14,15(Classen, Kenoyer and Getter).

Habitat: the immediate vicinity of running stream.

Food: minnows and tadpoles available in pools up to ca.6,000 ft.

Notes: the white-breasted kingfisher, Halcyon smyrnensis (Linnaeus), was seen up to 4,900 feet along the Sera Gad just below the study area (RLF Sr.).

Remarks: Other records show that the common kingfisher reaches 14,000 feet in suitable areas (Ripley, 1961:216) but due to the small size of the streams in the study area, it is rare over 5,000 feet.

UPUPIDAE

Upupa epops Linnaeus

Number of observations: 13.

Status: transient through study area.

Localities: A-11,12,16; B-15,16; C-1; I-4,7; Y-11.

Altitude: seen from 5,500 feet to 9,000 feet.

Movements and Dates: first spring record on 20 March at 6,500 ft.; 3 April at 5,500 feet. Also noted on 18 May at 7,300 ft. In the fall first seen on 22 Aug. 1964 at 7,300 ft.; 7 Aug. 1965 at 7,000 feet. Last noted on 23 Sept. at 6,000 feet.

Habitat: open ridges; oak forest; grassy and rocky slopes; edges of fir forest.

Foraging position: seen feeding only on the ground.

Food: gizzard contained 24 moth larvae (in one bird from 5,500 feet.).

Behavior: shy and do not allow a close approach as hoopoes on the plains do. May stay in one place from some time while on migration for one bird seen in same locality for 5 days.

Remarks: The hoopoe is rare here which contrasts with another report that it commonly nested around Naini Tal at 7,000 feet in May (Briggs, 1939:1077). Moreover it apparently was common in Raniketh at 6,500 feet where it arrived on 5 April and departed by the end of Sept. (Hudson, 1930:817). Apparently two races occur in the study area. Single birds and an occasional pair noted at 9,000 feet were likely the high altitude race (U. e. saturata) while a bird taken at 5,500 feet on 3 April proved to be U. e. epops.

CAPITONIDAE

Megalaima virens (Boddaert)

Number of observations:300.

Status: resident.

Localities: in forested sections up to 9,000 feet, excluding chir pine.

Altitude: noted from 5,000 feet to 9,000 feet.

Movements and Dates: remain in valleys during breeding season but tend to move upwards in winter for food.

Habitat: subtropical hardwoods; ban oak; moru oak and rhododendrons.

Foraging position: arboreal. Never seen on ground but often seen feed on berries in trees and rarely in bushes.

Food: berries of Vitis, Hedra, Viburnum.

Behavior: noted as single, or pairs. In winter flocks of up to 25 birds noted (A report of c40 birds by N. Van Rooy). After uphill flights birds perch with bill wide open.

Density: Max. count of calling birds gave 3 birds in G-9-16 in 0.50 sq. mi. in April.

Remarks: The Himalayan barbet is rarely seen over 6,500 feet during the summer but it concentrates in large flocks around available berry supplies up to 7,500 feet in February. The barbets share these fruiting trees with crows, magpies, jay, laughing thrushes, thrushes and parakeets.

Megalaima asiatica (Latham)

Number of observations: 7.

Status: resident.

Localities G-15,16; H-12.

Altitude: from 5,000 feet to 5,500 feet.

Movements and Dates: Recorded on 23 Feb. at 5,000 ft.; 18 April at 5,500 ft.; 7 May at 5,200 ft.; and 2 June at 5,100 ft.

Habitat: subtropical hardwoods

Behavior: only single birds noted.

Density: 3 birds calling on 7 May from G-16 in 0.06 sq. mi.

Remarks: The blue-throated barbet did not reach the maximum height noted for this species (6,000 feet by Ripley, 1961:234 and 6,500 feet by Ali, 1962:85). Blue-throated barbets are at a lower level than the Himalayan barbets.

PICIDAE

Jynx torquilla Linnaeus

Number of observations: 1.

Status: migrant through area.

Localities: G-1.

Altitude: at 7,100 feet.

Movements and Dates: 26 April 1965.

Habitat: perched in low Viburnum bush in light oak forest.

Behavior: quiet and inactive. Single bird seen.

Notes: specimen collected by R. Hess and D. McCulloch

Remarks: This record of the wryneck is one of the first of a migrant at medium heights in the Himalayas.

Picumnus innominatus Burton

Number of observations: 6.

Status: resident.

Localities: A-16; E-11,12; F-1; H-16.

Altitude: from 6,000 feet to 7,200 feet.

Habitat: recorded from subtropical hardwoods; ban oak scrub; ban oak forest. Usually in bushes, especially masuri and honeysuckle.

Foraging position: arboreal. Along small, outer branches of oaks and in bushes down to within four feet of the ground.

Behavior: single birds noted (5); small flock of three birds (1). With hunting party (2); alone (4). Strong pecks at 7/sec.(nuthatch has weak pecks at 2/sec.).

Remarks: Previous records place the speckled piculet up to 6,000 feet (Ripley, 1961:238; Ali, 1962:87) but it ranged up to 7,200 feet here. Occasionally the piculet hunts with nuthatches. In this case the latter work over the main trunk and branches while the former remains out near the tips of the branches. The piculet covers less area than the nuthatch but it has a strong peck and would be able to find food deep in bark crevices. Thus the two species remain ecologically distinct.

Picus squamatus Vigors

Number of observations: 300.

Status: resident.

Localities: forest sections excluding chir pine.

Altitude: noted from 5,000 feet to 9,000 feet.

Habitat: subtropical hardwoods; ban oak forest; moru oak; deodar; and fir forest.

Foraging position: often recorded on ground, also from all tree heights but usually on main trunk or large branches.

Food: two gizzards examined were full of large black ants.

Nesting: one nest hole in horizontal branch of Acer oblongum ca. 25 feet from ground and infested with stinging red ants. Another nest in oak tree on edge of deodar forest.

Behavior: single birds and pairs seen.

Density: one nest and three others suspected in 1.0 sq. mi. of section F.

Remarks: The scaly-bellied woodpecker has been seen up to 8,000 feet (Ripley, 1961:240) but it penetrates up to 9,000 feet here. This woodpecker occurs at higher altitudes than the black-naped for it is infrequently seen below 6,000 feet, whereas the black-naped is not noted above 8,000 feet.

Picus canus Gmelin

Number of observations: 200.

Status: resident.

Localities: forests up to 8,000 feet.

Altitude: noted from 5,000 to 8,000 feet.

Movements and Dates: seen at 8,000 feet as late at 16 Nov.

Habitat: subtropical hardwoods; ban oak forest; open slopes (steep and with light oak scrub).

Foraging position: frequently seen on the ground. Also recorded from trunks of trees (usually the lower 2/3 of

the tree).

Food: one gizzard yielded fly larvae ca7mm long, one large red ant, two seeds and a barberry (bird shot by John Jantzen).

Behavior: perches on rocks in open country.

Nesting: nest with eggs found on 23 April at 6,000 feet.

Density: one nest found and one other suspected in 0.25 sq. mi.

Remarks: The black-naped woodpecker overlaps in altitude with the scaly-bellied green woodpecker but the former selects subtropical hardwoods, ban oaks and open slopes, whereas the latter is often recorded in coniferous stands. Both these woodpeckers forage on the ground in contrast to the other picids here.

Picus chlorolophus Vieillot

Number of observations: 4.

Status: resident.

Localities: D-7; F-7,15; H-2.

Altitude: from 6,000 feet to 7,200 feet.

Movements and Dates: 12 March at 6,000 ft.; 6 June at 6,200 ft.; 7 Aug. at 7,100 ft.; and 30 Sept. at 7,200 ft.

Habitat: subtropical hardwoods; ban oaks; ban oak - deodar.

Foraging position: In upper half of tree (3); lower half (0); in bushes (1).

Behavior: only single birds seen.

Noted with variegated laughing thrushes in low bush (coincidental?); on same tree with two brown-fronted pied woodpeckers. Pecking weak (recorded 5 times and

averaged 6 pecks / sec.).

Hypopicus hyperythrus (Vigors)

Number of observations: 6.

Status: resident.

Localities: D-10; E-12; F-11; Y-8.

Altitude: noted from 6,200 feet to 9,100 feet.

Movements and Dates: 15 March at 6,200 ft.; 12 March at 6,300 ft.; 14 May at 9,100 ft.; 2 Oct. at 9,000 feet; 6 Nov. at 6,400 ft.

Habitat: ban oak; ban oak with chir pine intrusions; fir forest (usually on the birch trees).

Foraging position: all records are of birds in top half of tree.

Behavior: only single birds seen.

Remarks: The rufous-bellied woodpecker, a high altitude species, contrasts with the Himalayan pied woodpecker for the former was noted only in the top half of the trees, whereas the Himalayan pied often worked at a lower level. In the fir forests the rufous-bellied forages on birch trees while the scaly-bellied woodpecker works over the firs.

Dendrocopos himalayensis (Jardine and Selby)

Number of observations: 200.

Status: resident.

Localities: sections containing oak forests above 7,000 feet.

Altitude: noted from 6,800 feet to 8,500 feet.

Movements and Dates: slight downward movement in winter into

the 7,000 to 7,500 foot zone.

Habitat: ban oak forest; ban oak - deodar; moru oak.

Foraging position: recorded on rotting logs on ground (4) but never actually on the soil; small bushes near ground (3); usually on trunk and branches of dying oaks.

Food: insects and grubs; walnuts (will peck opening of about 10 X 20 mm into nuts on trees, report by B. Fergusen).

Behavior: often in pairs.

Density: a transect count in May in section V-W gave 5 birds in 2 mi.

Remarks: The Himalayan pied woodpecker was recorded in the study area up to 8,500 feet but on Nag Tiba, just north of Sirkanda, it commonly reaches 10,000 feet. Ripley (1961:249) points out that the eastern race (D. h. himalayensis), which ranges westward from Simla, penetrates up to 8,500 feet, whereas the western race reaches up to 10,000 feet. It appears from data here that both races move up to 10,000 feet. In the winter the Himalayan pied overlaps with the brown-fronted pied. However, the latter forages in the top half of the trees and the former ranges into both halves. The Himalayan selects conifers and northern faces as opposed to the ban oak inhabiting brown-fronted pied which prefers ban oak s on southern slopes. Contrary to Baker (1927:34) the Himalayan pied occurs in low bushes and even feeds on fallen logs (but never actually on the ground).

Dendrocopos auriceps (Vigors)

Number of observations: 500.

Status: resident

Localities: all sections of ban oaks.

Altitude: from 5,000 feet to 8,000 feet.

Habitat: ban oak forest; moru oak; deodar; rarely in chir pine (6).

Foraging position: recorded from the top half of the trees, both on outer branches and towards the trunk.

Food: insects and berries (observed eating waterwood and masuri berries). Food items brought to nest included caterpillers (7 trips), spiders (5), beetles (1), and unidentified (7). One gizzard full of small unidentified insect parts and small seed-like particles.

Behavior: usually alone or in pairs; family party of four birds(3). During non-breeding season usually associated with hunting party.

Nesting: nests found in oaks stump (1); chir pine (1); large oak trees (7) medium oak trees (2).

Density: max. count was 3 nests found and 2 suspected in F-1, 2,5,6 to give five nests in 0.25 sq. mi. (one nest found by Paul Smyres).

Remarks: The brown-fronted pied woodpecker is the most abundant picid in the study area and overlaps in altitude with several other woodpeckers.

EURYLAIMIDAE

Psarisomus dalhousiae (Jameson)

Number of observations: 1.

Status: vagrant above 5,000 feet.

Localities: F-1, E-8.

Altitude: 6,700 feet and 6,200 feet.

Movements and Dates: 20 July at 6,700 feet. 27 July a young bird found in E-8 and brought to me.

Habitat: noted only in ban oak forest with chir pine intrusions.

Foraging position: recorded only in top half of trees.

Behavior: in flock of five birds. Flight straight and swift. Passed rapidly through area and disappeared down hill.

Remarks: Mussoorie is at the western edge of the range of this bird which has been recorded to 6,000 feet (Ripley, 1961:257). During my encounter with these birds they did not appear sluggish, as is often reported of broadbills, but passed quickly while uttering a piercing call resembling the cry of a hawk.

HIRUNDINIDAE

Hirundo rupestris Scopoli

Number of observations: 4.

Status: migrant over area.

Localities: recorded over F-16; C-1,14,15.

Altitude: noted from 5,500 feet to 7,300 feet.

Movements and Dates: 3 March at 7,300 feet; 27 March at 6,500 feet; 3 April at 5,500 feet.

Habitat: noted flying over ban oak on migration, circling and feeding over open grassy slopes with adjacent cliffs.

Foraging position: observed feeding close to surface of steep grassy slope and darting around cliffs.

Behavior: single (2), pair (1), flock of c25 birds (1). Birds noted passed over ridge without pausing or circling.

Nesting: a mud nest plastered to the roof of a 5.5 foot high cave at 6,000 feet was lined with a few feathers. Not in use when examined but VanRooy brothers were sure it had been used in 1964 by a "dull, brown bird." However, not positively a crag martin nest.

Hirundo daurica Linnaeus

Number of observations: 50.

Status: summer visitor.

Localities: H-3; D-16; I-10; S-10; U-9,11; W-13.

Altitude: from 6,500 feet to 8,100 feet.

Movements and Dates: first seen 3 March 1965; 24 Feb. 1966 both at 7,300 feet. Last seen on 28 Nov. at 6,800 ft.

Habitat: recorded over grassy slopes; along roads in moru oak forest; over canyon; hear houses. Often near puddles of water.

Foraging position: feeds close to the ground and over narrow, deep canyons.

Behavior: in pairs (c25); 3(6); 4(3); 6(1); 10 (1). Noted perched on ground around pools; on wires in village.

Nesting: two nests located in eaves of houses in Dhanaulti.

Density: a transect count in May gave max. of 11 birds in 13 mi.

Remarks: The striated swallows are often seen circling over and settling near puddles of water and they appear to be drinking rather than catching trapped insects. Curiously, the barn swallow, Hirundo rustica Linneaus, was not seen here although it has been reported breeding up to 9,000 feet from Baluchistan to Burma.

Delichon urbica (Linnaeus)

Number of observations: 4.

Status: migrant over area.

Localities: C-14; W-13; Y-3,4.

Altitude: from 6,500 feet to 8,500 feet.

Movements and Dates: 15 Oct. at 7,500 feet; 1 to 3 Oct. at 8,500 feet; 20 Nov. at 6,500 feet. Dead bird picked up at 9,000 feet on 14 April.

Habitat: seen over canyons with adjacent steep cliffs; over fir forest with nearby cliffs.

Behavior: noted in flocks of 10 birds (2); ca30 birds (1); ca45 birds(1).

Seen with swifts and striated swallows.

ORIOLIDAE

Oriolus oriolus (Linnaeus)

Number of observations: 2.

Status: rare in summer above 5,000 ft.

Localities: F-11; H-16.

Altitude: from 5,000 feet to 6,000 feet.

Movements and Dates: 2 June at 6,000 ft.; 1 July at 5,000 ft.

Habitat: subtropical hardwoods

Density: estimated 5 pairs in study area if one pair to every suitable valley below 6,000 ft.

Remarks: The golden oriole, rare in the study area, was seen only twice. However, in Kashmir it is common in the Vale (at 5,000 feet) and has been recorded breeding up to 11,500 ft.(Ripley, 1961:284).

Oriolus traillii (Vigors)

Number of observations: 7.

Status: summer visitor.

Localities: B-15; C-11; D-9; E-12; H-12; V-8.

Altitude: noted from 6,000 feet to 7,500 feet.

Movements and Dates: 16 April at 6,900 feet to 26 June at 6,000 ft.

Habitat: subtropical hardwoods; ravine in ban-moru oak transition.

Foraging position: in the top half of trees (6); lower half of trees (1).

Behavior: pairs (5); single birds (2).

Density: closest pairs seen were about one mile apart.

Remarks: Previously the maroon oriole has been recorded up to 6,000 feet (Ripley, 1961:286) but it ranged up to 7,500 ft. here.

DICRURIDAE

Dicrurus leucophaeus (Vieillot)

Number of observations: 400.

Status: summer visitor.

Localities: sections up to c8,000 feet except chir pine and grassland.

Altitude: noted from 5,000 feet to 8,100 feet.

Movements and Dates: first seen on 20 March 1964 at 6,600 ft.; 20 March 1965 at 6,000 feet; 15 March 1966 at 6,000 ft. and 21 March 1966 at 7,000 feet. Last seen on 16 Oct. at 7,000 feet.

Habitat: subtropical hardwoods; ban oak; moru oak; deodar; edge of cultivations; scrub oaks.

Foraging position: aerial. Usually fly upwards to catch insects. Often perched on top of tree and occasionally on branch hanging below main canopy. Not seen on wires. Will pursue insect and may wrestle with it on the ground.

Food: insects including wasps and cicadas.

Behavior: occasionally in small flocks of 3 to 7 birds; usually in pairs or single.

Nesting: 3 nests located. One in deodar c50 feet from ground (found by Kathy Getter and Bette Larson); in Cornus 20 feet from ground; in Acer 15 feet up. Apparently avoid nesting in oaks.

Density: closest nests were about 200 yards apart and would give a density of approx. 64 nests / sq. mi. Density in deodar forest was one nest found and three others suspected in one linear mile to give 32 nests per sq. mi.

Remarks: Previously the ashy drongo has been noted up to 7,000 feet (Ripley, 1961:289) but it moved up to 8,100 feet here. Other flycatching birds overlap in altitude with the drongo but they are smaller and were not seen to catch insects as large as cicadas. Although the black drongo, Dicrurus adsimilis (Bechstein), has been reported up to 7,000 feet (Ripley, 1961:287), a careful search between 5,000 and 6,000 feet failed to locate it here.

STURNIDAE

Acridotheres tristis (Linnaeus)

Number of observations: 400.

Status: summer visitor.

Localities: A-6,7,9-16; B-9-11,13-16; C-13-15; E-1-4,8,12; F-1-4,5,6,9,10; K-9; U-7.

Altitude: from 5,000 feet to 7,600 feet.

Movements and Dates: 16 March 1964 at 6,800 ft.; 8 March 1965 at 6,200 feet; 3 March 1966 at 6,400 feet. Depart by 21 July.

Habitat: restricted to the immediate vicinity of human activity in inhabited sections. Recorded from ban oak forest; deodar forest and ban oak scrub.

Foraging position: terrestrial around garbage dumps, fields, near houses, on ground beneath oaks and deodars. Also arboreal for fruit in bushes and trees.

Food: terrestrial insects (grasshoppers, crickets, beetles); berries; garbage scraps.

Behavior: usually in small flocks of up to 8 birds. Seen with jungle myna but no conflicts noted. Also noted with jungle crows on garbage dumps and with brown-fronted pied woodpecker in berry bush.

Nesting: nests in holes in trees (3); holes in walls (8); in holes under eaves of houses (12). All nests close to places of human activity.

Density: closest nests were 100 yards apart in F-1, A-16 to give 40 nests per 100 acres.

Remarks: The common myna arrives at 7,000 feet a month ahead of the jungle myna but both leave the study area in late July. Previous records place the common myna to 9,000 feet (Ripley, 1961:301),but it was not seen that high here. The jungle myna is very similar to the common myna both in appearence and behavior. However, although I recorded numerous intraspecific fights no interspecific aggression was seen. In fact both species feed together on similar foods. The common myna differs from the jungle in remaining close to houses and usually nesting under eaves of houses while the jungle myna ranges from residential areas through forests to grassy slopes far from settlements.

Acridotheres fuscus (Wagler)

Number of observations: 500.

Status: summer visitor.

Localities: same as those for A.tristis with the addition of F-11,12; G-9,11,16; J-5,6; K-9-12; L-9-12; M-9-12; N-9-12;

P-9-12; U-10,11; Y-13,14.

Altitude: from 5,000 feet to 8,100 feet.

Movements and Dates: first seen on 6 April 1965 at 6,800 ft.; 13 April 1966 at 6,800 feet. Last seen on 15 July 1965 at 6,500 feet.

Habitat: recorded from areas of human activity in ban oak and deodar. Also in subtropical hardwoods; ban oak scrub; moru oaks.

Foraging position: terrestrial for insects; arboreal for fruits.

Food: similar to that of A. tristis except that they are not seen as frequently around garbage pits. Approximate ratio of the two species at garbage dumps is 1:10.

Behavior: often in flocks of up to 35 birds in the early spring. Smaller groups during breeding season and count on 29 April gave pairs (6); threes (1); fours(1). On 14 May flock of 11 birds in P-11 at 7,800 feet. No conflicts with common myna noted. Once common myna flew to where a jungle myna was eating berries and the latter moved without a fight.

Nesting: nests located in holes in retaining walls (29); in holes in trees (0); in holes in eaves of house (5). Nests in close proximity of humans (21); not in close proximity (13).

Density: Nests located every 90 yards in section A-16 to give density of 50 nests/100 acres.

Remarks: Previously the jungle myna has been reported to 7,000 feet (Ripley, 1961:302). It appears to have increased over the past 50 years. Now it is by far the most numerous of the two mynas in the study area and is conspicuous up to 8,000 feet. However, Briggs (1930:1076) saw only one jungle myna at 5,700 feet near Raniketh; it was not mentioned for British Garhwal by Osmaston (1923:140-160); Whistler (1928: 726-732)did not comment on it for Simla and Hudson (1930:821-827) did not report it around Naini Tal.

CORVIDAE

Garrulus glandarius (Linnaeus)

Number of observations: 60.

Status: resident.

Localities: A-11,12; B-9-15; M-4; N-1-4; R-9-12; S-9-12; T-9-12; U-9-12; V-5-12; W-5-7,9,12.

Altitude: from 6,000 feet to 8,300 feet.

Movements and Dates: a slight downward movement during winter. First seen at the 7,100 foot level (A-12) on 10 Sept. 1964; 21 Sept. 1965 at 7,200 feet. However, one record for 21 May 1966 at 7,100 feet.

Habitat: moru oak forest in summer; ban oak and deodar during the winter.

Foraging position: mostly arboreal; on the ground (3). Usually in medium-sized trees or large bushes. Often towards the center of the trees rather than on the periphery.

Behavior: single or in small flocks of up to 4 birds; six birds (2).

Seen with black-capped jays but stay higher in bushes.

Density: a transect count in May in sections S thru T gave 5 birds in 2 miles. A transect count in V thru W gave 8 birds in 2 miles.

Remarks: The Himalayan jay is a higher altitude species than the black-capped jay for it selects moru oak forest with associated maples and rhododendrons and was seen only once below 7,500 feet during the summer. In contrast, the black-capped jay prefers the ban oak forests and is infrequently seen above 7,500 feet. During the winter both birds move downwards. The white-throated laughing thrush, Garrulax albogularis, is common in both zones occupied by the jays and eats the same kinds of berries. However, the laughing thrushes forage a great deal on the ground where they spend much time scratching in the leaf debris while the jays search on top of and around the leaves without much investigation underneath.

Garrulus lanceolatus Vigors

Number of observations: 300.

Status: resident.

Localities: sections containing ban oaks; Y-11,12.

Altitude: noted from 5,500 feet to 8,500 feet.

Movements and Dates: retire to valleys for breeding; more widespread during non-breeding season.

Habitat: ban oak forest; subtropical hardwoods; deodar; edges of cultivations.

Foraging position: on the ground approx. half the time; arboreal in both top and lower parts of trees.

Food: insects, worms, acorns, berries.

Behavior: occur in flocks in the winter of up to 25 birds; single or pairs in the summer.

Density: 3 pairs suspected nesting in F-7,8,12 in 0.25 sq. mi. and 2 pairs in E-12; F-9 in 0.25 sq. mi.

Kitta erythrorhyncha (Boddaert)

Number of observations: 500.

Status: resident.

Localities: all sections of A, B, C, D, E, F, and G except for pure chir and grass slopes; I-1-8; J-5-8; K-2-8; L-1,2,5; R-5-12; T-9-11; U-11,12; W-9.

Movements and Dates: flocks are mobile and move around to new food supplies.

Habitat: ban oak; deodar; moru oak forest.

Foraging position: arboreal for berries; terrestrial for invertebrates and carrion.

Nesting: nests located in deodar at 7,100 feet; in ban oak at 6,100 feet and in Prunus at 6,000 feet.

Behavior: occur in small parties of up to 9 birds (1); single birds rare.

Nestlings in nest at 6,100 feet attacked by Himalayan treepie. Three adults attending this nest.

Density: a maximum count in mid-April gave 20 bird in 2 sq. mi.

of A-11,12; B-9-15; E-6,12; F-12,15.

Remarks: Baker (1922:42) states that the red-billed magpie moves up to 12,000 feet but he apparently was referring to the yellow-billed species which is a high altitude bird. Ripley(1961:308) also rejects Baker's statment for he lists the red-billed magpie up to only 7,000 feet. Baker also reports that the yellow-billed species was common about Simla, but this seems questionable (see Frome, 1946).

Dendrocitta formosae Swinhoe

Number of observations: 200.

Status: resident.

Localities: section A, B, C, D, E, F, G, and H except for chir pine and grass.

Altitude : from 5,000 feet to 7,300 feet.

Movements and Dates: move somewhat higher during late and post monsoon season. Restricted to valleys during breeding season.

Habitat: subtropical hardwoods; ban oak forest; deodar stands; edges of cultivations.

Foraging position: usually arboreal and most commonly in the lower half of the trees. Also noted on the ground (4).

Behavior: occur in small flocks of 2 to 4 birds with 6 max. noted. Single birds unusual.

An adult treepie watched attacking red-billed blue magpie nestlings. Adult magpies succeeded in chasing the treepie away but it remained in the vicinity of the nest.

Density: count in late April gave max. count of 8 birds in 0.25 sq. mi. in sections F-11,12; G-9,10.

Remarks: The Himalayan treepie has been recorded from "2,000 feet to 5,000 feet (7,000 feet ,rarely)" by Ripley (1961:311) but I noted it commonly in the fall up to 7,300 feet. It overlaps with the red-billed magpie and antagonism does develop as shown by the attack of the treepie on magpie nestlings. However, the treepie is largely arboreal, whereas the magpie often forages on the ground.

Nucifraga caryocatactes (Linnaeus)

Number of observations: 6.

Status: winter visitor.

Localities: A-7,11,12; B-9-11,16; C-14; X-5.

Altitude: from 6,800 feet to 8,300 feet.

Movements and Dates: first seen in study area on 1 Oct. 1965 at 8,300 feet; from 3 Nov. 1965 through 18 April 1966 around sections A and B.

Habitat: recorded flying over moru oak; in ban oak and deodar.

Foraging position: arboreal.

Food: specimen collected near study area in moru oak forest had its gizzard crammed with medium-sized iridescent beetles.

Behavior: noted as single birds (5); pair (1).

Nesting: a male shot by Paul Siefeldt on 1 March 1966 had small testes (4 mm long).

Density: 2 birds in 2 sq. mi. of section A and B.

Remarks: The nutcracker was first seen in the study area on 1 Oct. 1965; then it continued to be heard and seen through 18 April 1966. Curiously, I saw no nutcrackers in the Sirkanda fir forest where one would expect to find them.

Corvus macrorhynchos Wagler

Number of observations: 1,000.

Status: resident.

Localities: all section, predominantly near human activity.

Altitude: from 5,000 feet to 9,300 feet.

Habitat: from all habitat types except bottom of deep valleys in subtropical hardwoods.

Foraging position: terrestrial for meat and scraps; arboreal for berries and buds.

Behavior: occur in large flocks of up to 100 birds. In forests small flocks of 6 to 10 bird congregate around a food source.

Two roosting areas observed, one in study area in F-10,15 with a count of ca. 45 birds, the other outside the study area with a count of approx. 110 birds in Oct.

If fresh meat is available, birds may spend night in vicinity of food and not go to the rookery.

Birds leave for rookery 45 min. before sunset and continue until sun has set. Morning return to food areas much quicker; birds arrive just as it is beginning to get light.

Nesting: nests located in oak trees (12) in deodars (2). All in top half of trees.

Density: 9 nests in 0.25 sq. mi. of section F-1,5; E-4,8.

Notes: a rhesus monkey attempting to reach crow nest was finally driven down by dive bombing parents (Jim Jantzen report).

Remarks: The jungle crow is perhaps the most conspicuous bird around garbage dumps in the study area. With perhaps the most omnivorous diet of any bird here, it shares food sources with other species. Common mynas and rhesus monkeys, Macaca mulatta(Zimmermann), also devour vegetable and bread scraps, while dogs, cats and scavenging birds compete for meat scraps. Berries are also eaten by other corvids, turdids and timaliids. However, crows are active and bold, and judging from their numbers, are successful in holding their own against competitive species.

The crow exhibits the most obvious development of "play" behavior of any bird in this area. This "play" usually occurs at mid-day and not when the birds are busy feeding. The best example I noted took place about 2:00 PM when a crow spotted a large male rhesus monkey taking a siesta near the top of a 50 foot high chir pine. Quietly landing behind the mammal, the crow edged sideways up a branch until it reached over and gave the monkey a sharp peck near the tail. The monkey jumped, turned quickly to face its challenger, only to see the crow hop nimbly to a branch out of reach. This happened several more times and after about five

minutes the monkey slid down the tree to disappear among the oaks below.

CAMPEPHAGIDAE

Coracina melaschistos (Hodgson)

Number of observations: 8.

Status: summer visitor.

Localities: C-1,2; D-9; F-12; W-1.

Altitude: from 5,800 feet to 7,000 feet.

Movements and Dates: first heard on 3 April 1965 at 5,800 feet; 16 April 1966 at 6,100 feet. No calling records after mid-July.

Habitat: subtropical hardwoods.

Foraging position: all records of birds in top half of trees.

Behavior: occur in pairs(2) or single (3).

Density: a count in early May gave 2 pairs in C-1 and D-9 with and interval of about 1 mi. between pairs.

Remarks: The dark-grey cuckoo shrike has previously been reported up to 7,000 feet (Ripley, 1961:323) which agrees with my observations.

Pericrocotus flammeus (Forster)

Number of observations: 2.

Status: rare above 5,000 feet in summer.

Localities: G-16; H-16.

Altitude:from 5,000 feet to 5,100 feet.

Movements and Dates: 3 June at 5,000feet; 9 July at 5,100 feet.

Habitat: chir pine (1); steep grassy slopes in hot and open valley (1).

Foraging position: noted from the middle of pine tree; within 6 feet of ground on grassy slope and scattered bushes.

Remarks: The scarlet minivet has been seen up to 6,000 feet (Ripley, 1961:325) but I did not see it above 5,100 feet here.

Pericrocotus ethologus Bangs and Phillips

Number of observations: 400.

Status: resident.

Localities: in sections above 5,000 feet but rarely in chir pine forest or on entirely grassy slopes.

Altitude: from 5,000 feet to 9,100 feet.

Movements and Dates: seasonal movements for by 1 May most individuals have left 7,000 feet. During May 1966 5 birds recorded at 7,000 feet. Return in numbers to 7,000 feet in first week of September and move below 7,000 feet in Nov. to return in late Feb. Reach 9,000 feet in early April.

Habitat: chir pine; subtropical hardwoods; ban oak; moru oak; deodar; and fir. Often out on grassy slopes with few bushes in winter.

Foraging position: within one foot of ground (50) in winter; throughout tree levels in oak and fir forests.

Behavior: occur in fluctuating flock sizes with up to 60 birds in the spring; 5 to 20 birds in winter. Single

and in pairs on breeding grounds.

Usually in homogenous flocks but also form loose associations with hunting parties. Highly mobile and often flying high over observer.

Density: breeding count of 6 males in 0.12 sq. mi.in May in fir forest.

Remarks: The long-tailed minivet ranges through a wide variety of habitats and forages from a few inches above the ground to the tops of trees. These insectivorous birds appear to share insect supplies with a number of other species.

IRENIDAE

Chloropsis aurifrons (Temminck)

Number of observations: 2.

Status: rare above 5,000 feet in summer.

Localities: E-11; H-16.

Altitude: at 5,000 feet and 5,900 feet.

Movements and Dates: noted on 19 April and 26 June.

Habitat: subtropical hardwoods; ban oak forest.

Foraging position: recorded only in the top half of the trees.

Remarks: Farther east in the Himalayas the golden-fronted chloropsis is common to 6,000 feet but it was only noted twice above 5,000 feet here.

PYCNONOTIDAE

Pycnonotus leucogenys (Gray)

Number of observations: 300.

Status: resident.

Localities: A-14; B-2,3, 12; C-13-15; D-16; E-7,11; F-1,6, 11,12; G-4-16; I-10,11; K-5,6,12; L-9,10.

Altitude: from 5,000 feet to 8,300 feet.

Movements and Dates: rarely seen above 7,000 feet except in winter. Summer records above 7,000 feet (5); winter (42). Pair arrived in F-1 in last week of Feb. 1965 and first week of March in 1966 and remained for 2 weeks. After March, most records are below 7,000 ft.

Habitat: ban oak forest; ban oak scrub; open grassy slopes with some barberry bushes; around cultivations.

Foraging position: recorded on the ground (32); in small trees and bushes(frequently); in tall trees (rarely). Occasionally will act as flycatcher.

Food: one gizzard had a large berry and a large mosquito. Another gizzard crammed with barberries. Commonly pick insects out of rhododendron flowers.

Behavior: occur in loose flocks of up to 30 birds; usually between 3 and 10 birds together. Eight birds seen together on 2 sq. ft. patch of snow on 6 March 1966 at 7,200 feet. Apparently eating snow as patch examined had no embedded food.

Density: a nesting count in May gave 11 nests found or suspected in 0.25 sq. mi. in G-9-12.

Remarks: The white-cheeked bulbul differs from the other bulbuls in the study area for it ranges in open country and light forest. It prefers to forage in

bushes and is rarely seen in large trees like the black bulbul. However, during the spring white-cheeked bulbuls do frequent rhododendron trees, where they keep to the lower parts of the tree if black bulbuls are present in the upper levels.

Hypsipetes virescens (Blyth)

Number of observations: 60.

Status: resident.

Localities: A-4; F-1, 11,12,15,16; C-6.

Altitude: from 5,000 feet to 6,700 feet.

Habitat: subtropical hardwoods; ban oak forest.

Foraging position: noted only in medium-sized and small trees in thick stands. Sometimes seen flycatching.

Behavior: occur in small flocks of between 3 and 7 birds; pairs common during breeding season; single (rare).

Density: count in early May gave 14 birds in one mi. transect in F-12; G-12-16.

Remarks: The rufous-bellied bulbul differs from the other bulbuls at the same altitude for it is confined to valleys and is rarely seen away from subtropical hardwoods near running water. Entirely arboreal, it is never seen in low bushes or out in open country.

Hypsipetes madagascariensis (P.L.S. Muller)

Number of observations: 300.

Status: resident.

Localities: sections with oaks.

Altitude: from 5,500 feet to 8,000 feet.

Movements and Dates: confined to valleys below 6,200 feet during the breeding season and rarely seen up to 7,000 feet. Mobile during winter months.

Habitat: subtropical hardwoods; ban oak forest; ban oak with chir pine intrusions; moru oaks and rhododendrons; scrub oaks near cultivations.

Foraging position: bushes(rare);usually in top half of trees. During spring,birds around rhododendron trees where they pick insects from the blossoms. Sometimes seen fly-catching.

Food: insects and berries. Apparently catching insects in rhododendron flowers rather than drinking nectar; two specimens from rhododendrons had gizzards full of small black insects.

Behavior: occur in large flocks of up to 75 birds in the fall. Usually 4 to 6 birds in the winter and 1 to 4 birds in the summer. The strongest flier and most active of the bulbuls.

Remarks: The black bulbul is a higher altitude species than the rufous-bellied bulbul and it ranges over considerable territory, whereas the rufous-bellied is confined to valleys. In the spring the black bulbuls concentrate around flowering rhododendrons. The gizzards of birds collected from these trees were full of small insects. Nectar feeding is apparently a minor aspect of their diet when compared with insect feeding.

TIMALIIDAE

Pomatorhinus schisticeps Hodgson

Number of observations: 4.

Status: summer visitor.

Localities: F-16; G-13.

Altitude: from 6,000 feet to 6,400 feet.

Movements and Dates: recorded on 16 and 23 April 1966.

Habitat: noted in valley of ban oaks mixed with subtropical hardwoods.

Foraging position: recorded from small trees (8); ground (0).

Density: 3 birds calling in 0.12 sq. mi. in April.

Remarks: The slaty-headed scimitar babbler has previously been recorded up to 5,000 feet (Ripley, 1961:349) but it penetrated up to 6,400 feet here.

Pomatorhinus erythrogenys Vigors

Number of observations: 500.

Status: resident.

Localities: section to 8,000 feet except chir pine and grass.

Altitude: from 5,500 feet to 8,100 feet.

Movements and Dates: Up to 8,000 feet as late as 28 Nov.

Habitat: ban oak forest openings; thick bushes in oak scrub; moru oak forest.

Foraging position: often seen scratching on the ground; commonly in bushes for berries.

Food: grubs, insects and especially masuri and viburnum berries.

Behavior: almost always in pairs or in small flock of up to

6 birds in late summer.

Active at dusk and heard calling until nearly dark.

Nesting: one nest located on ground in F-12 in light ban oak forest.

Density: one nest found and two suspected in 0.06 sq. mi.of F-12.

Remarks: The habitat selection of the rusty-cheeked scimitar babbler is as varied as any timaliid in this area. It is a higher altitude species than the slaty-headed scimitar so that little overlap occurs between the two species.

Microura albiventer (Hodgson)

Number of observations: 35.

Status: winter visitor.

Localities: sections with dense ravines below 7,500 feet.

Altitude: noted from 5,500 feet to 7,500 feet.

Movements and Dates: first heard on 5 Oct. at 6,000 feet and last heard on 7 May at 6,000 feet.

Habitat: ravines in oaks forest; subtropical hardwoods. Often near stream edges.

Foraging position: all records are of birds on or within two feet of the ground.

Behavior: occur in pairs (1) or single (usual).

Density: count of calling birds on 16 March gave 3 birds in 0.12 sq. mi. in B-16; C-13.

Remarks: The scaly-bellied wren babbler, a winter visitor, feeds within two feet of the ground on steep northern slopes in bushy parts and along wet ravines with exposed roots

and fern cover. Fairly steep slopes seem to be an important habitat requirement. The brown-capped bush warbler, another winter visitor, prefers semi-open areas especially around cultivations, and is usually found on southern slopes. The similar wren winters down to 6,900 feet.

Stachyris pyrrhops Blyth

Number of observations: 60.

Status: resident.

Localities: D-1-4; F-11,12,15,16; G-4,7-11,13,15; H-2,5,7.

Altitude: from 5,000 feet to 7,200 feet.

Movements and Dates: slight uphill movements in late winter. Records of summer birds are from 5,500 feet to 6,500ft. But 28 Feb. at 7,000 feet and 3 March at 7,200 feet.

Habitat: mixed subtropical hardwoods; secondary bushes in ban oak forest; in bushes in ravines in ban oak - chir pine mixture.

Foraging position: up to four feet from ground in thick bushes. Not seen on ground.

Behavior: occur is small flocks of up to 8 birds during the non-breeding season. May associate with other species in loose party.

Density: a transect count in early May gave 6 suspected nesting pairs in one linear mile in sections F-7,11; G-9,10.

Remarks: The red-billed babblers feed in the lower half and interior parts of the bushes and appear on the outer edges only if disturbed.

Turdoides striatus (Dumont)

Number of observations: 4.

Status: summer visitor.

Localities: C-1; F-1; G-12,16.

Altitude: from 5,000 feet to 6,700 feet.

Movements and Dates: 3 April at 6,000 feet; 1 May at 6,700 feet; 18 Sept. at 5,500 feet.

Habitat: ban oak forest; light scrub near cultivations; around cow sheds and fields.

Foraging position: terrestrial. Birds seen in tops of trees (2) were not feeding.

Behavior: occur in small flocks of six birds(1); eight to ten birds (2); pair (1).

Density: two flocks with total of 14 birds in 0.25 sq. mi. of section G-12,16.

Remarks: The maximum elevation recorded for the Mussoorie race of the jungle babbler (T. s. striatus)is 4,000 feet (Ripley, 1961:378) but it ranged up to 6,700 feet here. The jungle babbler is similar to the streaked laughing thrush both in habitat selection and foraging behavior. In the study area the streaked laughing thrush descends to the level at which the jungle babbler begins to appear. It may be that the presence of the laughing thrush prevents the establishment of the jungle babbler - a species which is so successful elsewhere in India.

Garrulax albogularis (Gould)

Number of observations: 200.

Status: resident.

Localities: valley sections of A - H; W.

Altitude: from 5,500 feet to 8,000 feet.

Habitat: ban oak forest; moru oak forest; deodar.

Foraging position: terrestrial when birds scratch on ground; arboreal when they pick off berries.

Food: one gizzard revealed two unidentified types of seeds and one insect larva.

Behavior: occur in flocks of between 8 and 20 birds. One flock of 45 birds noted in D-11. Flocks are mobile and birds can fly up slight incline. Usually gain altitude by hopping up a tree and then flying across to another.

Density: a count in mid-March gave 104 birds in 1.50 sq. mi. in sections C-9-16; D-9-16; G-1-8.

Remarks: White-throated laughing thrushes are not confined to open areas of forests as are the streaked laughing thrushes, but forage in densely forested tracts. They are also quite arboreal and are the only laughing thrushes commonly seen flying across valleys from one clump of trees to another.

Garrulax striatus Vigors

Number of observations: 90.

Status: resident.

Localities: valleys of sections A through H; K; L; M-4; T-7; W-8,14.

Altitude: from 5,000 feet to 8,400 feet.

Movements and Dates: birds from highest elevations recorded on 8 and 14 May.

Habitat: ravines in ban oak forest, moru oak forest and subtropical hardwoods.

Foraging position: on the ground(3); in low bushes within five feet of ground (7); in medium-sized bushes or trees (30).

Behavior: occur in flocks of 2 to 6 birds with 8 birds max. Strongest fliers of the laughing thrushes and most arboreal of the genus here.

Nesting: birds calling loudly from valleys at 8,200 and 8,400 feet and apparently nesting that high in May.

Density: calling birds in mid-May gave 9 pairs in 4.0 sq. mi. of sections B, C, E, F and G.

Remarks: The striated laughing thrush has been reported up to 8,000 feet (Ripley, 1961:382) but reached 8,200 feet in this area. It is almost entirely arboreal and thus differs from the other laughing thrushes here.

Garrulax variegatum (Vigors)

Number of observations: 100.

Status: resident.

Localities: A-11,12; B-9-11,16; D-7-16; I-1-8; J-5-7; R-7,8, 11,12; S through W on northern faces; W-14,15; X and Y on both northern and southern slopes.

Altitude: noted from 6,000 feet to 9,100 feet.

Movements and Dates: move into section A and B during the

winter. First recorded in section A on 10 Nov. at 7,100 ft.; 31 Oct. 1965 at 7,100 feet. Last record for section B is 18 April in B-11. Common at 8,000 feet on 27 Nov.

Habitat: valleys and slopes of ban oak forest; moru oak; fir forest; oak scrub and rhododendron mixture.

Foraging position: terrestrial; bushes; medium-sized trees in about 1:2:1 ratio. Will secure berries from as high as 30 feet above the ground.

Behavior: occur in flocks of up to 8 birds in the winter; single or paired in the summer.

Density: a winter count in Nov. gave 18 birds in 1.0 sq. mi. in sections B-16; C-9,16; D-12.

Remarks: The variegated laughing thrush is a higher altitude species than all but the red-headed laughing thrush.

Garrulax rufogularis (Gould)

Number of observations: 100.

Status: resident.

Localities: D-14; F-6,16; G-8-11.

Altitude: from 5,900 feet to 7,300 feet.

Movements and Dates: remain to at least 6,000 feet in winter.

Habitat: valleys on northern slopes containing Rubus, Berberis, Lonicera and Rosa.

Foraging position: on the ground or in low bushes; in medium sized trees (3).

Food: grubs, insects and especially barberries and yellow raspberries.

Behavior: occur in small flocks of up to 6 birds, usually in

pairs. Secretive and remain near ground even when disturbed.

Density: a count in May gave 5 pairs in 0.12 sq. mi. in F-10,11.

Remarks: The rufous-chinned laughing thrush, perhaps the most secretive of the laughing thrushes here, differs from the others at the same altitude by inhabiting areas of thick bushes with few openings. The streaked laughing thrushes and rusty-cheeked scimitar babblers are found nearby, but at the edges of bushy tracts rather than in them. The Mussoorie race (G. r. occidentalis) has been seen up to 6,000 feet (Ripley, 1961:386) but I recorded it up to 7,300 feet.

Garrulax lineatus (Vigors)

Number of observations: 1,000.

Status: resident.

Localities: throughout study area except in grass and chir pine.

Altitude: from 5,000 feet to 9,100 feet.

Movements and Dates: birds at 9,000 feet were recorded in April, May and June and not seen there in early Oct. Common at 8,000 feet in late Nov.

Habitat: open rocky ground with scattered barberry bushes; ban oak; moru oak; fir forest; deodar stands; near cultivations in scrub oak stands.

Foraging position: on or near ground in thick bushes.

Behavior: occur in small flocks of up to 8 birds; also single and in pairs. Poor fliers and prefer to escape intruder by hopping away or by short downhill flights.

Density: Nesting density in maximum areas is about 1 per 100 yards (3 nests in F-1 averaged 90 yards apart while 2 nests in A-16 were 120 yards apart).

A calling count in late April gave 5 pairs in 0.12 sq. mi. in C-9-13.

Remarks: The streaked laughing thrush, the most terrestrial timaliid here, is mostly insectivorous and contrasts with the other laughing thrushes which are largely vegetarian. Of the timaliids, the streaked laughing thrush is the most tolerant of humans and is often seen near village houses and hedge rows.

Garrulax erythrocephalus (Vigors)

Number of observations: 3.

Status: resident (or perhaps summer visitor).

Localities: Y-7,8.

Altitude: from 8,500 feet to 9,000 feet.

Movements and Dates: noted only in the breeding season.

Habitat: understory of fir forest.

Foraging position: seen only in bushes.

Behavior: appear fairly active with much hopping and little flying. Only single bird seen.

Remarks: The red-headed laughing thrush was seen and heard only on Sirkanda. Apparently this species nests in the fir forest and then moves directly down and out of the study area. If their winter movements were primarily vertical with little lateral drift, then the species would not appear in the study area except on Sirkanda.

Pteruthius flaviscapis (Temminck)

Number of observations 30.

Status: resident.

Localities: A-11,12; B-13; D-9-14; E-3,4; F-1,2; Y-7,8,13-14.

Altitude: from 6,200 feet to 8,900 feet.

Movements and Dates: 6 April three birds singing in D; 9 April at 8,000 feet; 24 April at 6,700 feet; 30 April at 7,300 feet one with brood patch; 14 May at 7,800 feet; 19 May at 6,800 feet; 20 May at 6,700 feet; 21 May at 8,900 feet; 14 Dec. at 7,200 feet.

Habitat: ban oak forest (25); moru oak and deodar (5); fir forest (2).

Foraging position: all records were of birds in top half of the trees.

Behavior: usually single birds seen; pairs (rarely). Strong fliers. Associate occasionally with hunting party.

Remarks: The red-winged shrike babbler is an entirely arboreal species and has been seen up to 8,000 feet (exceptionally up to 10,000 feet in the Sutlej Valley, Ripley, 1961:400) but which ranged regularly up to 8,900 feet here. Insectivorous birds foraging at the tops of trees might overlap with the red-winged shrike babbler. The black bulbul, however, was only a transient along the ridges on which the shrike babbler occurs. The black-capped sibia, while sometimes near the tops of trees, is more often at a low tree level, thus avoiding

much direct conflict.

Pteruthius xanthochloris Gray

Number of observations: 6.

Status: resident.

Localities: D-14; F-10,15; W-12,15,16.

Altitude: noted from 6,300 feet to 8,200 feet.

Movements and Dates: 14 March at 6,400 feet; 16 April at 6,400 feet; 14 May at 7,200 feet; 15, 18 and 21 Nov. at between 8,000 and 8,200 feet.

Habitat: thick ban oak forest (2); open bushy ban oak forest edge (1); scattered bushes on south face with a few stunted trees(3).

Foraging position: recorded from small bushes or trees within 10 feet of the ground (6).

Behavior: usually single (3); also pairs (2) and small group of three birds (1). Not seen associating with other species.

Density: count in Nov. gave 3 birds in 0.06 sq. mi. in W-12.

Remarks: The rare green shrike babbler usually has been noted with insectivorous hunting parties, but I did not see it associating with other species. Apparently it remains at fairly high elevations during the winter for it was recorded at 8,200 feet on a cold morning in late Nov. A specimen I collected in east Nepal at 9,500 feet in January 1965 tends to support this view.

Yuhina flavicollis Hodgson

Number of observations: 40.

Status: resident.

Localities: D-7; G-9-12,16; T-9-12; U-9; X-9,13.

Altitude: from 5,300 feet to 8,100 feet.

Movements and Dates: 25 Nov. 1965 at 8,100 feet; 13 and 14 May at 7,500 feet; all year from 5,500 feet to 6,000 ft.

Habitat: valleys in ban oak and moru oak forest; subtropical hardwoods.

Foraging position: along the outer fringes of bushes and partly aerial. Birds fly off branch, catch an insect and land somewhere other than the original point. Also recorded hanging upside down while exploring twigs.

Behavior: occur in small flocks of 2 to 4 birds; max. of 7 birds. Noted with red-headed tits, stripe-throated minla, phylloscopids and flycatcher warblers.

Density: count in March gave 12 birds in 0.25 sq. mi. of G-9,11, 12. A transect count in mid-May gave 5 pairs in one linear mile in T-9-12; U-9.

Remarks: The yellow-naped yuhina, a more active bird than the green shrike babbler, was seen up to 8,100 feet which is just above the previously reported maximum (Ripley, 1961:408). Loose flocks of yuhinas associate with other insectivorous species but they are more aerial than the other birds and work around the fringes of bushes and small trees. Yuhinas rarely occur close to the ground or around the lower levels of the bushes.

Minla strigula (Hodgson)

Number of observations: 200.

Status: winter visitor.

Localities: over most forest sections.

Altitude: noted from 5,500 feet to 9,100 feet.

Movements and Dates: first seen in the fall on 14 Oct. 1964 at 6,700 feet. Remain at c6,000 feet all winter. Last spring dates 21 April 1965 at 6,000 feet; 30 April 1966 at 6,300 feet. On migration on 14 May at 7,800 feet in R-9,10; 21 May at 9,000 feet.

Habitat: bushes and small trees in ban oak forest; moru oak forest; fir forest.

Foraging position: arboreal in tall trees in oak and fir forests(c20); usually in tops of thick bushes.

Food: insects and berries. Watched one catch larva and hit it against branch in tit-like fashion.

Behavior: usually in flocks of from 3 to 10 birds; max. 14 birds (1). Often with hunting parties of phylloscopids and parids.

Density: a count of wintering birds gave 37 birds in 2.0 sq. mi. of sections F and G.

Remarks: The stripe-throated minla, a winter bird here, differs from other ecologically similar species in that it works through the centers of large bushes and small trees while the red-billed babblers remain in the small bushes and the yellow-naped yuhinas range along the outer edges.

Yuhina gularis Hodgson

Number of observations: 7.

Status: winter visitor.

Localities: B-11,12,16; D-9-16; H-1,2; F-5.

Altitude: from 6,200 feet to 7,300 feet.

Movements and Dates: 18 Feb. at 6,700 feet; 23 Feb. at 7,300 feet; heard during March in section D; 18 April in B-16.

Habitat: ban oak forest around concentrations of Rhododendron.

Foraging position: in Rhododendron (4); light oak forest (2); thick bushy area (1). Pollen ruffs around beaks.

Behavior: occur in flocks of 3 to 4 birds (4); six birds (2); pairs (1). Heavy fliers and not as agile as other yuhinas. Associate with other birds around rhododendrons.

Remarks: The westernmost limit of the stripe-throated yuhina falls in my study area (Ali, 1956:468). These birds are found in close proximity to flowering rhododendrons where they pick insects from the blossoms. Those observed on 18 April were near a late-blooming tree.

Heterophasia capistrata (Vigors)

Number of observations: 200.

Status: resident.

Localities: most sections of oak forest.

Altitude: from 6,000 feet to 8,400 feet.

Movements and Dates: above 7,500 feet in summer. First record for 7000 feet on 24 Oct. 1964; 29 Sept. 1965 at 6,700 feet. Last spring record on 21 March 1965; 17 March 1966 (one found dead by S. Rash and brought to

me from 7,000 feet on 12 April).

Habitat: moru oaks during summer; ban and moru oaks during winter.

Foraging position: primarily arboreal; also around large bushes. Some aerial activity and also search for insects on tree trunks.

Behavior: occur in winter in flocks of up to 5 birds; in pairs or single in the summer.

Density: transect count of singing birds gave 8 birds in 0.50 sq. mi. in T-5,11; W-9,10; X-10,12.

Remarks: The black-capped sibia has been recorded up to 8,000 feet (Ripley, 1961:416) but it penetrated up to 8,400 feet here. It is partial to flowering rhododendrons and is constantly seen in blossoming trees. The sibia shares the rhododendrons with several other insectivorous species, including the black bulbul, but if both species are feeding in a tree, the bulbul remains in the upper and outer parts of the tree while the sibias are in the lower strata.

MUSCICAPIDAE

Muscicapa sibirica Gmelin

Number of observations: 20.

Status: summer visitor to Sirkanda; otherwise transient.

Localities: F-1,11,16; R-9,10; T-10; W-9; Y-7,8.

Altitude: from 6,000 feet to 9,000 feet.

Movements and Dates: 19 to 22 and 28 Sept at 6,700 feet; 18 Oct. at 6,000 feet; 29,30 April at 6,500 feet;

Habitat: recorded from deodar (6), and ban oak (4) at 6,500 feet; and deodar (2), and ban oak (1) at 7,500 feet; fir (3), and birch (7) at 9,000 feet.

Foraging position: near the tops of trees (majority); low branches overhanging roads (2); telephone wires (5). In fir forest they perch on dead branches of deciduous trees.

Behavior: occur in loose parties of up to 3 birds on migration; pairs or single on breeding grounds. Hawk insects until after sundown and until nearly dark (8 ft.-c.).

Density: 3 pairs in 0.06 sq. mi. in firs on Sirkanda.

Remarks: The sooty flycatcher does not overlap with other flycatcher during the summer for it moves into the fir forests. In transit it forages from tops of deodars where it might overlap with the verditer flycatcher.

Muscicapa ruficauda Swainson

Number of observations: 2.

Status: transient.

Localities: F-1.

Altitudes: from 6,600 feet to 6,700 feet.

Movements and Dates: noted on 17 and 20 Sept. 1965.

Habitat: noted only from secondary bushes in ban oak forest.

Foraging position: recorded from the lower half of the trees and from low bushes on a relatively open slope.

Food: gizzard packed with insect parts including 2 elytra c8 mm long.

Behavior: only single birds seen associating with hunting party.

Remarks: The rufous-tailed flycatcher has been reported primarily from the crowns of trees (see Ali, 1962:108), but birds here were in the lower half of the ban oak level; a male I collected was perched three feet from the ground in a viburnum bush.

Muscicapa parva Bechstein

Number of observations: 2.

Status: transient.

Localities: F-11,15.

Altitude: from 5,900 feet and 6,200 feet.

Movements and Dates: 8 March 1965 (Pye) and 3 April 1966 (Friesen).

Habitat: open ban oak scrub.

Foraging position: in secondary bushes and lower story of trees.

Behavior: only single birds noted.

Muscicapa strophiata (Hodgson)

Number of observations: 4.

Status: transient.

Localities: D-8; F-12,13.

Altitude: from 6,000 feet to 6,300 feet.

Movements and Dates: 12 March for 6,300 feet; 16 April at 6,000 feet; 27 Feb. at 6,000 feet.

Habitat: ban oak forest; ban oak - chir pine mixture(1); (north of the study area commonly seen in kharshu oaks).

Foraging position: lower half of medium-sized trees and bushes.

Behavior: single birds seen; noted with hunting party (1).

Remarks: The orange-gorgetted flycatcher was seen only in the spring when birds foraged around small bushes and lower branches of trees. A female seen associating with a hunting party was apparently unusual as other sightings were of solitary birds.

Muscicapa superciliaris Jerdon

Number of observations: 300.

Status: summer visitor.

Localities: most sections containing oak or deodar.

Altitude: from 5,000 feet to 8,900 feet.

Movements and Dates: first observed at 7,000 feet on 1 March 1964; 10 March 1965; 2 March 1966. Last noted in late Oct. and early Nov. at 7,000 feet.

Habitat: ban oak forest; moru oak forest; deodar stands; oak intrusions into fir forest.

Foraging position: in the tops of medium-sized trees (uncommon); in the middle third of the trees (frequent). Also close to the ground. A male in S-10 pursued an insect on the ground, changing directions four times before catching and swallowing it. Often seen hovering near or clinging to trunk of large oak tree.

Behavior: usually single or in pairs; small family parties in late summer. Associate with hunting parties but usually only while party is in or near flycatcher's territory.

Nesting: nests found in hole in oak tree(2); in tangle of vines (1); in eaves of occupied house (1).

Density: one nest found and one suspected in 0.06 sq. mi of F-1. 3 pairs noted and one nest found in 0.06 sq. mi. of A-16.

Remarks: The white-browed flycatcher has a wide foraging range from the tops of large trees to ground level. It works both the interior of large trees and out into forest clearings. One bird actually pursued an insect on the ground, changing directions four times before catching it. This flycatcher nests in holes, usually in large trees and therefore is found in forests that contain old trees with the requisite holes.

Muscicapa leucomelanura (Hodgson)

Number of observations: 4.

Status: transient.

Localities: E-4,12; F-12; R-10.

Altitude: from 6,000 feet to 7,900 feet.

Movements and Dates: 17 March 1966 at 6,000 feet; 27 March 1965 at 6,000feet; 14 May 1966 at 7,900 feet; 22 Oct. at 6,700 feet.

Habitat: recorded from ban oak forest; subtropical hardwoods; mixed ban oak - moru oak forests; deodar stand.

Foraging position: noted in trees and bushes (1).

Behavior: birds in R-10 near both sooty and verditer flycatchers but not actually associating with them.

Muscicapa sundara (Hodgson)

Number of observations: 3.

Status: summer visitor.

Localities: G-9; R-10,11.

Altitudes: from 5,300 feet to 8,100 feet.

Movements and Dates: 14 March at 5,300 feet; 23 April at 8,000 feet and 28 May at 8,000 feet.

Habitat: subtropical hardwoods; understory of moru oak forest.

Foraging position: in the lower story of the trees and in larger bushes. Only recorded in areas of thick growth.

Behavior: occur as single birds and pairs (1).

Muscicapa thalassina Swainson

Number of observations: 500.

Status: summer visitor.

Localities: throughout the study area except chir pine and pure grassy slopes.

Altitude: from 5,000 feet to 9,000 feet.

Movements and Dates: first seen on 29 Feb. 1964 at 7,000 feet; 4 March 1966 at 6,700 feet. Last seen on 28 Oct. at 7,000 feet.

Habitat: ban oak forest; ban oak scrub on grassy slopes; deodar; moru oak; oak intrusions in fir forest.

Foraging position: commonly perched on wires over deep valleys or on tops of trees. Also seen in steep places perched on secondary bushes near the ground. During the middle of the day in the middle story of forest; late or early in the day it is on exposed positions on trees or wires.

Behavior: occur in family flocks of up to 6 birds in late

summer; single or in pairs in the spring. Often with hunting party during the middle of the day.

Nesting: nests located among roots of tree overhanging a landslip (9); in hole in ban oak tree (1).

Density: 2 nests found and 4 suspected in 3.5 linear miles of R-9 through U-11. 5 nests found in 0.12 of F-1 and E-4. 3 nests found in 0.12 sq. mi. of A-11,16.

Remarks: The verditer flycatcher forages in more open country than does the white-browed flycatcher. A steep hillside seems to be an important habitat requirement as it nests under overhangs where landslides have occurred.

Culicicapa ceylonensis (Swainson)

Number of observations: 200.

Status: summer visitor.

Localities: forest sections of A, B through G; R-7,8; W-6 and Y-8.

Altitude: from 5,000 feet to 8,900 feet.

Movements and Dates: first seen on 3 March 1964 at 6,700 feet; arrived by 25 Feb. 1965; 2 March 1966. Leave by early Nov. from 7,000 feet.

Habitat: subtropical hardwoods; ban oak forest; moru oaks; fir forest.

Foraging position: in the lower half of the trees and in bushes. Favorite perch appeared to be on a low branch of a large tree over a clear understory.

Food: gizzard packed with small black insects.

Behavior: usually single or in pairs; one party of six birds (family?) noted. Often seen with hunting parties.

Nesting: one nest found on rhododendron tree in deep ravine.

Desnsity: one nest and five pairs suspected nesting in 0.50 sq. mi. of sections F-1,2,6,11.

Remarks: The grey-headed flycatcher has been reported up to 7,000 feet (Ripley, 1961:434), but it ranges up to 8,900 feet here. It differs from the other common flycathers in the study area for it forages in deep valleys and ravines where it often perches on a branch below the main foliage of a tree and pursues insects in open spaces beneath large trees. Nests of this bird are woven into moss hanging from large trees in dimly lit ravines.

Rhipidura hypoxantha Blyth

Number of observations: 40.

Status: transient.

Localities: D-10; F-1,2,5,9; V-10; W-9; Y-7.

Altitude: from 6,200 feet to 9,100 feet.

Movements and Dates: 11 March at 6,700 feet. In the fall first seen on 8 Oct. 1964 at 6,700 feet; last seen on 5 Nov. at 6,700 feet. Bird in F-1 stayed in one oak stand for ten days (8 to 18 Oct.) - presumed to be same bird. Several seen on northern face, moru oak forest at 8,000 feet in W-9 on 21 to 28 Nov. 1965.

Habitat: ban oak forest; moru oak forest; fir forest.

Foraging position: recorded near the trunk and in the middle parts of tree; rarely out on fringe of tree or flying out to catch insects away from tree. Usually hopping about from branch to branch and apparently causing insects to move. Not noted in bushes.

Behavior: occur in loose parties of up to 3 birds; usually single. Noted roosting under large rhododendron leaf and about 20 feet from ground in thick forest.

Remarks: The hardy yellow-bellied fantail flycatcher is seen up to 9,000 feet on Sirkanda but moves higher for the breeding season. This species rarely makes the sorties characteristic of other flycatchers. Apparently it is able to flush insects from bark crevices for on 28 November I found several at 8,000 feet on a northern slope where the temperature dropped below freezing every night at that time of year.

Terpsiphone paradisi (Linnaeus)

Number of observations: 2.

Status: summer visitor.

Localities: E-7,8.

Altitude: from 6,100 feet to 6,400 feet.

Movements and Dates: spring records.

Habitat: recorded from ban oak forest; subtropical-ban oak transition zone.

Notes: reported by students Ron Hess and Mark Kenoyer. One bird in male plumage, the other in brown plumage.

Remarks: The paradise flycatcher, which I did not see, was reported in the study area by students. This species has been reported breeding considerably higher than 5,000 feet in other areas (Ripley, 1961:438).

SYLVIIDAE

Tesia castaneocoronata (Burton)

Number of observations: 2.

Status: winter visitor.

Localities: F-11,12.

Altitude: from 6,000 feet and 6,200 feet.

Movements and Dates: specimens taken on 26 Dec. and 25 Feb. (RLF Sr.).

Habitat: dense bushes in deep valleys in subtropical hardwoods-ban oak transition zone.

Foraging position: on or within 2 feet of ground.

Cettia fortipes (Hodgson)

Number of observations: 10.

Status: transient.

Localities: F-12,15,16; G-9,15.

Altitude: from 5,700 feet to 6,300 feet.

Movements and Dates: 17 April through 3 May on upward migration; no records for fall trip.

Habitat: thick tangles of thorn bushes and overgrowth in ban oak and ban oak scrub forests.

Foraging position: in the interior of thick bushes.

Notes: all records were from unseen calling birds.

Density: a count in late April gave 3 birds calling in 0.06 sq. mi. of F-15.

Cettia flavolivaceus (Hodgson)

Number of observations: 1.

Status: winter visitor (or transient).

Localities: F-4.

Altitude: noted at 6,900 feet.

Movements and Dates: 20 Feb. 1966 at 6,900 feet.

Habitat: in thick bush (rose) on southern slope in light ban oak forest.

Behavior: came out of thicket at pigmy owl call.

Cettia brunnifrons (Hodgson)

Number of observations: 200.

Status: winter visitor.

Localities: valleys of A, B through F.

Altitude: from 5,500 feet to 7,000 feet.

Movements and Dates: no records before December. Arrive in December and last date 30 April 1966 at 6,400 feet. Single bird in transit in F-1 on 9 April 1965 at 6,700 ft. Maximum height during the winter - 6,000 feet.

Habitat: thick tangles of dead wood and bushes on southern faces in relatively level areas of ban oak scrub and near cultivations.

Foraging position: on or within three feet of ground. Rarely more than a foot away from soil surface.

Food: gizzards(4) crammed with black and brown insect parts.

Density: count in late March gave 8 birds in 0.12 sq. mi. of F-12 and G-10.

Remarks: The brown-capped bush warbler winters here and forages on or within six inches of the ground. The wintering scaly-bellied wren babbler and the chestnut-headed ground warbler select damp, overgrown slopes and not the edges of cultivations that the brown-capped bush warbler prefers. The wren forages in habitat similar to that of the bush warbler but the former does not descend to the wintering levels of the latter. During spring migration, the strong-footed bush warbler is heard in the same tangles with brown-capped bush warblers, so some overlap may exist here.

Prinia criniger Hodgson

Number of observations: 10.

Status: summer visitor.

Localities: G-14,15,16; I-10,11; N-5.

Altitude: from 5,000 feet to 7,600 feet.

Habitat: grass areas with few stunted oaks; edges of cultivations; grassy slopes with barberry bushes.

Foraging position: usually on or near ground and also to 10 feet up in small oaks.

Behavior: usually single.

Remarks: The brown hill warbler differs from the other warblers here for it ranges in grassy hillsides that are avoided by the other species.

Acrocephalus dumetorum Blyth

Number of observations: 30.

Status: transient.

Localities: F-1,5,6,10,11,13-16; G-14,15; Y-7.

Altitude: from 5,100 feet to 6,700 feet; 9,000 feet in May.

Movements and Dates: first noted on 16 April 1966. Last seen at 6,000 feet on 22 May. 21 May 1966 at 9,000.

Habitat: edges of light ban oak forest, subtropical forest and fir forest; around cultivations.

Foraging position: in low bushes and large herbaceous plants. Not recorded from trees and rarely from the ground.

Food: one gizzard packed with ladybird beetles.

Behavior: only single bird seen.

Density: 5 birds in 0.12 sq. mi. of F-15 and 16 in early May.

Remarks: The Blyth's reed warbler was first seen in the study area on 16 April 1966 at 6,300 feet. Apparently overlap with other warblers is minimized as this species occupies the edges of bushy areas and hedge-rows, whereas the others are usually in tangles.

Phylloscopus tytleri Brooks

Number of observations: 30.

Status: transient.

Localities: F-9,10,15,16; G-2,3; X-6,7; Y-7,8.

Altitude: from 6,200 feet to 9,000 feet.

Movements and Dates: noted from 5 through 25 March at 6,500 feet. Arrived by late Sept. in fir forest at 9,000feet.

Habitat: recorded from ban oak, moru oak and fir forests.

Foraging position: noted high in rhododendron trees and low in viburnum bushes.

Behavior: occasionally in hunting parties in the spring; commonly in the fall.

Specimens examined: 2. MSU 5986, male from Landour, Mussoorie at 6,300 feet, 20 March 1965; MSU 5997, from Sirkanda, 19 mi E. Mussoorie at 9,000 feet, 3 Oct. 1965.

Phylloscopus pulcher Blyth

Number of observations: 200.

Status: winter visitor.

Localities: forested sections down to 6,000 feet.

Altitude: from 6,000 feet to 8,600 feet.

Movements and Dates: at 7,000 feet by late Nov. Up through 27 March at 7,000 feet.

Habitat: ban oak forest, moru oak forest.

Foraging position: in the top half of the trees, especially in rhododendrons where they forage for insects around the flowers. Also rarely noted in the lower tree story. Usually out on exterior parts of tree.

Food: 4 gizzards examined and all contained insect parts.

Behavior: usually in hunting party of small birds.

Notes: a grey specimen with very pale wing bands collected at 6,000feet on 13 March 1965.

Specimens examined: 4. MSU 5984, male from Landour, Mussoorie at 6,000 feet on 14 March 1965; MSU 5988, male from Landour, Mussoorie at 6,700 feet on 23 March 1965; MSU 5989, a female from Landour, Mussoorie at 6,400 feet on

24 March 1965; MSU 5999, a female from Landour, Mussoorie at 6,000 feet on 13 March 1965.

Phylloscopus inornatus (Blyth)

Number of observations: 100.

Status: transient.

Localities: most forest sections.

Altitude: noted from 5,800 feet to 9,000 feet.

Movements and Dates: 15 March at 6,000 feet through 30 April at 7,000 feet. 3 Oct. in fir forest at 9,000 feet.

Habitat: recorded from ban oak, ban oak scrub, moru oak and fir forest.

Foraging position: in understory and large bushes. Also recorded in trees on Sirkanda. Favors mistletoe in tops of trees.

Behavior: noted in hunting parties especially in the fall, less frequently in the spring. Have flycather-like habits and pursue insects flushed from leaf surfaces.

Density: 7 birds in 0.06 sq. mi. of F-1 in mid-April.

Specimen examined: 9. MSU 5985, from Landour, Musoorie at 6,300 feet on 20 March 1965; MSU 5990,male? from Landour, Mussoorie at 6,600 feet on 26 March; MSU 5991, male and MSU 5992 , male from Landour, Mussoorie at 6,700 feet on 9 April 1965; MSU 5995, female? and MSU 5996, sex ? from Sirkanda, 19 mi. E Mussoorie, on 3 Oct. 1965 at 9,000 feet; MSU 6001, sex ? from Landour, Mussoorie at 6,500 feet on 30 April 1966; and MSU 6002,

a female from Landour, Mussoorie at 6,700 feet on 30 April 1966.

Phylloscopus proregulus (Pallas)

Number of observations: 200.

Status: winter visitor.

Localities: forested parts of section A through H; S through U.

Altitude: noted from 5,300 feet to 8,100 feet.

Movements and Dates: winters in the study area and seen until 18 April at 7,000 feet.

Habitat: noted from ban oak scrub, light ban oak forest, moru oak forest edge.

Foraging position: around the edges of bushes and the lower and outer parts of small trees. Not seen in high trees.

Behavior: often associated with hunting parties. Hovers a great deal around the edges of bushes.

Density: count in March gave 5 birds in 0.06 sq. mi. of F-10.

Specimens examined: 2. MSU 5983, a female from Landour, Mussoorie at 6,000 feet on 13 March 1965; MSU 5987, sex ? from Landour, Mussoorie at 6,7000 feet on 23 March 1965.

Phylloscopus nitidus Blyth

Number of observations: 6.

Status: transient.

Localities: F-1,11; B-13.

Altitude: noted from 6,300 feet to 7,300 feet.

Movements and Dates: noted from 15 April through 3 May.

Habitat: recorded in ban oak forest in medium-sized trees.

Foraging position: top half of oak trees.

Behavior: specimen flew into lighted room at night on 24 April 1966. Noted in hunting parties.

Specimens examined: 1. MSU 6000, a female from Landour, Mussoorie at 7,200 feet on 24 April 1966.

Phylloscopus occipitalis (Blyth)

Number of observations: 60.

Status: summer visitor.

Localities: Y-8,10,11.

Altitude: from 8,000 feet to 9,100 feet.

Movements and Dates: from 10 April through 6 Oct. at between 8,000 and 9,000 feet.

Habitat: recorded from moru oak forest and fir forest.

Foraging position: noted from tops of moru oaks, often out towards the tips of the branches. In the fir forests they occur in both the top and lower strata of the trees.

Density: 12 birds in 0.06 sq. mi. of Y-7 in May.

Remarks: The large-crowned leaf warbler nests on Sirkanda where it forages in both halves of the fir trees. In the moru oak it forages in the tree crown.

Several times I saw a dark leaf warbler, which I took to be the dusky leaf warbler, Phylloscopus fuscatus (Blyth), in bushes close to the ground in the subtropical-ban oak transition at 6,000 feet. In March I noted small grey-faced leaf warblers, Phylloscopus maculipennis (Blyth) associating with hunting parties in the middle and upper

tree stories.

Specimens examined: 1. MSU 5993, a male(t.s.e.) from Sirkanda, 19 mi. E Mussoorie at 9,000 feet on 17 April 1965.

Seicercus burkii (Burton)

Number of observations: 20.

Status: transient.

Localities: B-5,6; F-15; G-10,11,15,16; M-3.

Altitude: from 5,000 feet to 8,100 feet.

Movements and Dates: first noted on 27 March at 5,500 feet. Last seen on 7 May 1966 at 5,000 feet.

Habitat: recorded from thick stands of medium-sized oaks in in ban oak forest; moru oak forest; especially common in subtropical hardwoods along streams.

Foraging position: in the lower two thirds of the trees and in surrounding bushes.

Behavior: occur in loose flocks of up to 6 birds,but usually single or in pairs. Often hover, sunbird-like, up to 1 sec. Near yuhinas, warblers and grey-headed flycatcher warblers.

Density: 5 birds in 0.50 mi. transect count in early May.

Remarks: The black-browed flycatcher warbler differs from the grey-headed flycatcher warbler by frequenting stands along mountain streams and in other areas where the dense tree growth has a clear understory. It feeds in the lower half of the trees, not at the tops or near the ground.

Seicercus xanthoschistos (Gray)

Number of observations: 1,000.

Status: resident.

Localities: most sections containing oak forest up to 8,000 feet; Y-8.

Altitude: from 5,000 feet to 9,100 feet.

Movements and Dates: noted at 9,100 feet on 2 Oct. 1965.

Habitat: subtropical hardwoods; ban oak forest; moru oak forest; and fir forest edge.

Foraging position: recorded near the ground (to within an an inch of the surface) up to the crowns of trees. Usually towards the outside of the middle stratum of the trees.

Behavior: occur in small flocks of up to 8 birds, usually with hunting parties. If with hunting party, this species usually occupies the lower half of the trees, but if alone it may move into the tree canopy. Noted hovering (for 0.75 sec.) but rarely hanging upside down or clinging to tree trunk.

Nesting: 7 nests found between 6,400 and 7,200 feet. Six located under Acer oblongum trees. Young fed larvae, adult moths and other insects.

Density: 5 nests found and 2 suspected in 0.12 sq. mi. of section A-16 and F-1. Closest nests were 150 yds. apart.

Remarks: The grey-headed flycatcher warbler has previously been seen up to 6,000 feet (Ripley, 1961:486), but ranges up to 9,100 feet here. It forages at all levels

but when with a hunting party, it is usually in low trees and bushes.

Regulus regulus (Linnaeus)

Number of observations: 6.

Status: winter visitor.

Loalities: A-11,12; B-9,10,14; C-13; Y-7,8.

Altitude: from 6,900 feet to 9,100 feet.

Movements and Dates: first noted on 1 Dec. at 7,200 feet and last seen on 3 March at 6,900 feet; 2 Oct. at 9,100 ft.

Habitat: recorded from deodar trees (5) and fir(1) and all on northern slopes.

Foraging position: noted in rose bush beneath deodar,but usually in conifers. Forage both near the trunk and out toward tips of branches. Tend to remain in the top half of deodars and firs.

Behavior: occur in loose flocks of up to 4 birds; also in pairs. Seen only with hunting parties.

Remarks: the goldcrest differs from the other slyviids by foraging only in conifers. It is seen near black tits (Parus melanocephalus) and differs from them by remaining in the top half of the conifers while the tits investigated the whole tree as well as nearby oaks.

TURDIDAE

Erithacus pectoralis (Gould)

Number of observations: 2.

Status: transient.

Localities: E-4; F-10-12.

Altitude : from 5,900 feet to 6,600 feet.

Movements and Dates: 30 March at 6,600 feet (RLF Sr.), mid-March at 6,000 feet (John Jantzen).

Habitat: recorded from open areas of light ban oak forest; along stream in Sera Gad valley.

Foraging position: recorded from the ground or perched in bushes.

Behavior: single birds noted. Remained in Sera Gad for less than a week.

Erithacus cyanurus (Pallas)

Number of observations: 300.

Status: winter visitor.

Localities: throughout the study area except in chir pine and grass.

Altitude: from 5,500 feet at 9,000 feet.

Movements and Dates: first seen at 7,000 feet on 2 Nov. 1963; 11 Nov. 1964; 3 Nov. 1965. Last seen at 7,000 feet on 3 April 1964; 11 April 1965 and 17 April 1966.

Habitat: recorded from ban oak forest; deodar; moru oaks; fir. Often on edge of forest or in small clearing.

Foraging position: primarily on the ground. Often seen perched in low bushes. Birds perched on ground (4); low bush (16); small tree(7).

Behavior: Occur in pairs or as single birds. Have a definite winter territory for a male was seen throughout the winter in 0.06 sq. mi. of section F-1.

Density: a count in early March gave 10 birds in 0.25 sq. mi.

of section F-1,2,3 and 4.

Remarks: The orange-flanked bush robin appears very similar to the two phoenicurids that winter here. However, the blue-headed robin occupies the edges of oak forests and only rarely ventures into forests where the orange-flanked birds are common. The blue-fronted redstart, an open country bird, is seen in large openings in light forest.

Erithacus chrysaeus (Hodgson)

Number of observations: 10.

Status: winter visitor.

Localities: C-13; F-4,11,12,15; G-9; M-2.

Altitude: from 5,900 feet to 8,300 feet.

Movements and Dates: recorded by 3 Nov. at 7,000 feet through 30 April at 6,300 feet.

Habitat: in bushes in ban oak and moru oak forest.

Foraging position: on the ground and in the interior of bushes up to four feet from the ground.

Food: one gizzard contained insects and some unidentified seeds.

Density: a count in March gave 5 birds in 0.12 sq. mi. of section F-15 and 16.

Copsychus saularis (Linnaeus)

Number of observations: 1.

Status: summer visitor.

Localities: F-5.

Altitude: noted at 6,200 feet.

Movements and Dates: one collected by John Jantzen on 1 May 1966.

Habitat: in oak scrub on edge of Dhobi Ghat village.

Foraging position: terrestrial.

Remarks: The dhyal thrush has been reported to 4,600 feet (Ripley, 1961:501) but ranges up to 6,200 feet here.

Phoenicurus caeruleocephalus (Vigors)

Number of observations: 300.

Status: winter visitor.

Localities: in most sections of open oak forest.

Altitude: from 5,600 feet to 8,500 feet.

Movements and Dates: first seen on 12 Nov. 1964 at 7,000 feet; 6 Nov. 1965 at 6,000 feet. Last seen on 28 March 1965 at 6,000 feet.

Habitat: recorded from ban oak; moru oak; chir pine; edges of subtropical hardwoods; cultivations.

Foraging position: terrestrial. Not seen in thick bushes for birds usually inhabit edges of forest.

Food: one gizzard contained black insect parts.

Behavior: occur as single birds; occasionally in pairs.

Density: a count in first week of March gave 9 birds in 0.50 sq. mi. of sections F-1,6,10,11 and G-9.

Phoenicurus frontalis (Vigors)

Number of observations: 100.

Status: winter visitor.

Localities: from sections of grassy slopes and oak scrub.

Altitude: from 6,000 feet to 9,000 feet

Movements and Dates: first seen at 7,000 feet on 14 Nov. 1964; at 8,000 feet on 12 Nov. 1965. Last seen on 9 April 1964 at 7,000 feet; 31 March 1965; 5 March 1966.

Habitat: from areas near cultivations; large openings in oak forest; grassy slopes with stunted oaks.

Foraging position: terrestrial. Perching records taken in last week of Feb. were low bush (15), ground (12), and tall tree (2).

Density: a count in last week of Feb, gave 6 birds in 0.25 sq. mi. of section C-9,10,13,14.

Enicurus scouleri Vigors

Number of observations: 3.

Status: winter visitor.

Localities: stream bed with running water (D-11,12,15; F-6).

Altitude: from 5,800 feet to 6,300 feet.

Movements and Dates: 17 Oct at 6,300 feet in F; 15 Oct. to 6 Nov. in E.

Habitat: stream bed near running water.

Foraging position: terrestrial.

Behavior: occur as single birds.

Enicurus maculatus Vigors

Number of observations: 200.

Status: resident

Localities: streams of B through H; W.

Altitude: from 5,000 feet to 8,000 feet.

Movements and Dates: recorded from 8,000 feet on 27 Nov. 1965.

Habitat: stream beds and adjacent slopes in mixed subtropical

hardwoods, ban oak and moru oak forests. Birds seen twice some distance from running water, one at 7,000 feet in C-16 and some 500 feet in altitude above running water, the other at 8,000 feet on 27 Nov. near a spring in W and 300 feet above the nearest running water.

Foraging position: terrestrial. Occasionally seen in bushes but not seen feeding there.

Behavior: occur in family parties of up to 5 birds; also single and in pairs.

Density: a count along Sera Gad stream gave 4 birds in 1.75 miles; a count in F and E gave 3 birds in 1.25 linear miles in April.

Saxicola torquata (Linnaeus)

Number of observations: 100.

Status: summer visitor.

Localities: open areas from H through P.

Altitude: from 5,000 feet to 8,000 feet.

Movements and Dates: first noted on 5 March at 7,000 feet and recorded through June at 7,000 feet.

Habitat: grassy slopes with stunted oaks and rocks and cultivations.

Foraging position: terrestrial feeder although birds do perch in oaks and on bushes.

Behavior: occur in parties of up to 5 birds; usually paired.

Density a count of singing males gave 5 birds in 0.50 sq. mi. of H-3; D-16; I-9,10 in second week of May.

Remarks: The dark-grey bush chat is a summer counterpart of

the blue-headed robin for both select forest openings and edges while only rarely venturing into open country.

Saxicola ferrea Gray

Number of observations: 200.

Status: summer visitor.

Localities: open sections of A through P; V through Y.

Altitude: from 5,500 feet to 9,100 feet.

Movements and Dates: first heard at 7,000 feet on 10 March 1964; at 6,000 feet on 13 March 1965; at 7,000 feet on 29 March 1966. Last noted at 7,000 feet on 28 Sept. 1965. Recorded at 9,100 feet on 21 May 1966.

Habitat: forest edges of ban oak, moru oak, and fir. Also in open slopes with bushes and stunted oaks.

Foraging position: terrestrial but perches in small oaks and bushes.

Behavior: occur in small parties of up to 6 birds; also single or pairs.

Density: a count of singing males gave 9 birds in 0.18 sq. mi. of sections N-6,12; O-5-7 in late May.

Remarks: The stone chat is a summer counterpart of the blue-fronted redstart; both are found on grassy hillsides. The stone chat might venture near dark-grey bush chats along forest edges that abut on grassy slopes but the former are not seen above 8,000 feet and the latter not below 7,700 feet in the summer.

Chaimarrornis leucocephalus (Vigors)

Number of observations: 10.

Status: transient.

Localities: stream beds in A through G.

Altitude: from 5,000 feet to 6,200 feet.

Movements and Dates: first noted on 12 Oct. In the spring first noted on 13 March and last record on 23 April 1966.

Habitat: only in stream beds.

Foraging position: terrestrial along the streams.

Density: transect count gave 3 birds in 0.75 sq. mi. of stream in section F and G in early April.

Monticola cinclorhynchus (Vigors)

Number of observations: 100.

Status: summer visitor.

Localities: C-14,15; F-1; G-5,12; O-11,12; P-8.

Altitude: from 5,000 feet to 7,800 feet.

Habitat: recorded in chir pine forest; ban oak forest; scrub oaks.

Foraging position: in the top half of the trees. Only one record for one on the ground.

Behavior: only single birds (usually males) seen.

Density: a count of singing males gave 2 in 0.12 sq. mi. of C-14 and G-2 in mid-May.

Remarks: The blue-headed rock thrush is found in open tracts of oak scrub and overlaps in altitude with the white-cheeked bulbul. However, the bulbul is largely vegetarian, the rock thrush insectivorous.

Monticola rufiventris (Jardine and Selby)

Number of observations: 200.

Status: resident.

Localities: wooded sections of A through Y.

Altitude: from 5,800 feet to 9,000 feet.

Movements and Dates: slight downward trend in winter. Winter around 7,000 feet and leave the 7000 foot level by mid-April.

Habitat: thick ban and moru oak forest; deodar; fir.

Foraging position: arboreal, often at or near the top of trees. Recorded on the ground only on roots in steep areas. In fir forest a male was oberved to perch on birch (7), moru oak (2), and fir (0).

Behavior: usually single, but also in loose parties of up to 3 birds.

Density: a count in early March gave 4 birds in 0.50 sq. mi. of sections B-16, C-13,15 and F-3.

Remarks: The chestnut-bellied rock thrush inhabits forests and thus differs from the two open country rock thrushes. The chesnut-bellied rock thrush overlaps altitudinally with the mistle thrush, but the latter is a terrestrial feeder on open slopes while the former feeds in trees.

Monticola solitarus (Linnaeus)

Number of observations: 5.

Status: transient.

Localities: F-6; I-7; L-9; M-7.

Altitude: from 6,100 feet to 7,800 feet.

Movements and Dates: recorded on 13 and 14 May at 7,000 feet to 7,800 feet. 2 Oct at 7,300 feet and 23 Oct. at 6.100 ft.

Habitat: grassy slopes with exposed rocks and cliffs.

Foraging position: terrestrial. Also recorded perched on a tall pole (1).

Behavior: solitary.

Myiophonoeus caeruleus (Scopoli)

Number of observations: 1,000.

Status: resident.

Localities: most sections excluding chir pine and grass.

Altitude: from 5,000 feet to 8,800 feet.

Habitat: stream beds; oak forests; residential areas; fir and deodar forest. Usually associated with a small gully or ravine and located where the forest is somewhat open.

Foraging position: terrestrial and arboreal (for berries).

Behavior: usually pairs and in family groups of up to five birds. Often seen singing in the rain.

Density: 10 nests found in 0.56 sq. mi. of sections A-16; B-13; F-1,2 and 3. A transect count along Sera Gad stream gave 4 pairs in 1.75 linear miles.

Remarks: The whistling thrush overlaps with a number of wintering turdids. It feeds in clearings in forests where it finds food by hopping about rather than scratching. Other turdids find food by scratching in suitable leaf litter. The whistling thrush does share fruiting trees with the wintering thrushes and

laughing thrushes.

Zoothera citrina (Latham)

Number of observations: 1.

Status: rare summer visitor.

Localities: F-11.

Altitude: 6,100 feet.

Movements and Dates: 16 May (RLF Sr.).

Habitat: recorded from subtropical hardwoods - ban oak transition zone along the Sera Gad stream.

Foraging position: terrestrial.

Remarks: Previously the orange-headed ground thrush has been noted up to 5,000 feet (Ripley, 1961:527) but it wanders up to 6,100 feet in my area.

Zoothera mollissima (Blyth)

Number of observations: 15.

Status: winter visitor.

Localities: heavily wooded sections of A through D.

Altitude: from 6,500 feet to 7,300 feet.

Movements and Dates: first recorded at 7,000 feet on 3 Nov. 1965. Last seen at 7,000 feet on 7 March.

Habitat: in ban oak and deodar forest - all on northern slopes.

Foraging position: terrestrial. Flush into trees but not feeding there.

Behavior: only solitary birds seen.

Notes: the very similar Zoothera dixoni was not seen. Of 11 specimens examined, all were Z. mollissima.

Zoothera dauma (Latham)

Number of observations: 2.

Status: transient.

Localities: C-9; F-12.

Altitude: from 6,000 feet to 6,900 feet.

Movements and Dates: 29 March at 6,900 feet; 2 April at 6,000 ft.

Habitat: ban oak forest.

Foraging position: terrestrial.

Behavior: solitary.

Notes: collected by R. Hess and P Smyres in F-12.

Remarks: The small-billed mountain thrush, common at 9,000 feet on Nag Tiba just 7 miles north of the study area, is rarely seen here. Apparently it passes through to winter below 5,000 feet.

Zoothera monticola Vigors

Number of observations: 12.

Status: transient (possibly winter visitor).

Localities: E-11,12,15; F-5,6,9,11,12; W-9.

Altitude: from 6,000 feet to 8,000 feet.

Movements and Dates: first noted on 23 Oct. 1964 at 6,000 feet; 28 Nov. 1965 at 8,000 feet; Also on 9 Dec. 1965 at 6,300 feet and 13 Jan. (RLF Sr.). Then on 27 March at 6,400 feet and 2 April 1965 at 6,200 feet (shot by T. Bauman).

Habitat: dense nullahs with soft moist soil near running water in ban oak and moru oak forests.

Foraging position: terrestrial and probe in the soil.

Behavior: solitary.

Density: a count in early Dec. gave 3 birds in 1.5 sq. mi.of E and F.

Turdus unicolor Tickell

Number of observations: 100.

Status: summer visitor.

Localities: wooded areas of sections A through U.

Altitude: from 5,600 feet to 8,000 feet.

Movements and Dates: recorded singing in April through November; no records from late Dec. to early Feb.

Habitat: light ban and moru oak forest; edges of deodar stands.

Foraging position: both terrestrial and arboreal.

Behavior: single birds, pairs and groups to 3 birds noted. Few birds actually seen. A thrush with a soft musical song called just at dawn and again at dusk; thought to be of this species.

Nesting: one nest with 3 eggs found on 7 July at 7,600 feet.

Remarks: Tickell's thrush overlaps altitudinally with the grey-winged blackbird but the latter inhabits dense forests, whereas the former prefers light forest.

Turdus albocinctus Royle

Number of observations: 90.

Status: winter visitor.

Localities: most sections of ban oak.

Altitude: from 6,100 feet to 8,000 feet.

Movements and Dates: first seen in the fall on 5 Nov. 1965. Last seen on 18 April 1966 at 7,000 feet.

Habitat: in thick oak forest and often in rhododendrons. Also in cultivations.

Foraging position: terrestrial for insects and arboreal for fruit and rhododendron petals.

Behavior: either solitary or in pairs. Noted with black-throated thrushes and grey-winged blackbirds.

Density: a count in mid-March gave 8 birds in 0.50 sq. mi. of sections C-13,16; F-1 and 5.

Turdus boulboul (Latham)

Number of observations: 100.

Status: resident.

Localities: wooded sections of A through F; W.

Altitude: from 6,000 feet to 8,200 feet.

Movements and Dates: slight downward trend in winter. At 6,000 feet until 2 April (Hess). Male singing on 8 May at 8,200 feet.

Habitat: in thick bushes and heavy forest of subtropical hardwoods, ban oak and moru oak.

Foraging position: arboreal. Of 14 sightings, tall tree (12), small tree (2), ground (0).

Behavior: usually in small flocks of up to 6 birds.

Density: a count in March gave 10 birds in 0.75 sq. mi. of sections E-8, F-5 and 12. A count of singing males in May gave 1 pair in 0.06 sq. mi. of sections W-5,6 and 9.

Remarks: The grey-winged thrush overlaps altitudinally with other berry-eating species. Both variegated laughing thrushes and grey-winged thrushes are seen in the same fruiting trees, but apparently in small enough numbers so that I saw no aggresive behavior between them.

Turdus rubrocanus Hodgson

Number of observations: 60.

Status: winter visitor.

Localities: wooded sections of A, B, E, and F.

Altitude: from 6,200 feet to 7,500 feet.

Movements and Dates: not recorded before 15 Dec. and then up through 12 March.

Habitat: in ban oak forest.

Foraging position: both terrestrial and arboreal. Scrape in leaf litter and feed on berries in bushes or on vines in tall trees.

Behavior: usually solitary, largest flock seen was of 4 birds.

Density: count in first week of March gave 5 birds in 0.75 sq. mi. of sections B-16, E-4, F-3 and 5.

Remarks: The grey-headed thrush is strictly a forest species and differs from the white-collared blackbird which sometimes ventures into fallow fields. The similar grey-winged blackbird is also strictly a forest species but winters at a lower level than the grey-headed.

Turdus ruficollis Pallas

Number of observations: 500.

Status: winter visitor.

Localities: most sections except in grass and chir pine.

Altitude: noted from 5,000 feet to 9,000 feet.

Movements and Dates: first seen on 10 Nov 1963; 12 Nov. 1964; 25 Oct. 1965 all at 7,000 feet. Last seen on 11 April 1964; 6 April 1965; and 18 April 1966 all at 7,000 ft.

Habitat: in open areas and scrub ban oak; around cultivations; edges of fir forest; ban and moru oak forests.

Foraging position: terrestrial, especially on rich soil. Also arboreal for rhododendron petals.

Behavior: usually in flocks of from 3 to 50 birds. The large flocks noted in March.

Density: a count in early March gave 51 birds in 0.06 sq. mi.

Remakrs: The black-throated thrush, the most abundant thrush in the winter, fed in open areas near small villages or cultivations. This habitat preference differs from the other thrushes that remain in forests.

Turdus viscivorus Linnaeus

Number of observations: 200.

Status: resident.

Localities: open ridges from A through Y.

Altitude: from 7,000 feet to 9,100 feet.

Movements and Dates: slight downhill movement in winter. Not seen below 8,000 feet in the summer. Seven birds recorded at 8,000 feet on 27 Nov. 1965.

Habitat: open grassy ridges on the edges of fir, moru oak ban oak and deodar forests.

Foraging position: terrestrial on grassy slopes and abandoned fields.

Behavior: usually paired; also in small flocks of up to 7 birds noted.

Density: breeding count gave 3 pairs in 0.12 sq. mi. of Y-8 and 11.

Remarks: The mistle thrush overlaps with the black-throated thrush in the winter. Both species prefer open country but the black-throated concentrates around fields and villages while the mistle forages in unused fields or on grassy slopes.

TROGLODYTIDAE

Troglodytes troglodytes (Linnaeus)

Number of observations: 20.

Status: winter visitor.

Localities: A-11; C-13; D-10.

Altitude: from 6,900 feet to 7,400 feet.

Movements and Dates: first recorded on 2 Nov. 1965 at 7,200 feet. Last seen on 9 March 1965 at 7,000 feet and 17 March 1966 at 6,900 feet.

Habitat: on the edges of ban oak forest and in cultivations.

Foraging position: on or within two feet of ground in thick bushes or brush piles.

Behavior: solitary.

Density: winter count gave 3 birds in 1.0 sq. mi. in sections A-11 and C-13.

Remarks: The wren and the brown-capped bush warbler select

similar habitats, but the former winters at a higher elevation than does the latter.

CINCLIDAE

Cinclus pallasii Temminck

Number of observations: 6.

Status: transient.

Localities: streams of E, F and G.

Altitude: from 5,000 feet to 6,5000 feet.

Movements and Dates: on 20 April and 15 through 23 Oct.

Habitat: only along the streams.

Foraging position: terrestrial and aquatic.

Behavior: solitary (4) and in pairs(2).

Density: a count in Oct. gave 3 birds in 3.75 linear miles of stream.

PRUNELLIDAE

Prunella collaris (Scopoli)

Number of observations: 40.

Status: winter visitor.

Localities: D-14,16; W-15; X-5,6.

Altitudes: from 7,100 feet to 8,200 feet.

Movements and Dates: first seen on 15 Nov. at 8,000 feet and through 12 March at 7,200 feet.

Habitat: on grassy slopes with rocks, edges of ban oak and moru oak forest.

Foraging position: terrestrial; all but two records were of birds on the ground or rocks.

Behavior: solitary or in pairs. In comparison with the altai, the alpine accentors were less active in searching for food. Both seen together on same slope.

Density: 4 birds in 0.25 of D-14,15 in late Feb. Also 5 birds in 0.25 sq. mi. of sections W-15,16 in Dec.

Remarks: The alpine accentor forages on open grassy slopes and is not restricted to bushy areas as are the black-throated and rufous-breasted accentors.

Prunella himalayana (Blyth)

Number of observations: 100.

Status: winter visitor.

Localities: most sections in open areas.

Altitude: from 6,700 feet to 9,100 feet.

Movements and Dates: first seen in mid-Nov. at 8,000 feet. Last seen on 6 April 1965 at 7,300 feet; 5 April 1966 at 7,000 feet.

Habitat: on grassy slope and rocky outcroppings; cultivations.

Foraging position: terrestrial on the open slopes and fields.

Behavior: always in large flocks of up to 90 birds. Flock and feed together with Hodgson's mountain finch. No interspecific fighting noted but some intraspecific conflicts noted.

Density: a count in March gave 83 birds in 0.50 sq. mi.of sections A-6; B-1,14; C-13,14. A count in Nov. gave 70 birds in0.56 sq. mi. of sections V-12; W-8 and 15.

Remarks: Altai accentors forage in large flocks on grassy

hillsides and fields. When flushed they often fly up into trees and were the only accentors I saw to do so. Once a flock fed within a few feet of two alpine accentors, but no conflicts developed. The altai accentors are more active and cover more territory than the alpine. A curious relationship exists between the altai accentors and the Hodgson's mountain finch (Leucosticte nemoricola) which often feed together. I never saw interspecific fighting, although intra-specific arguments developed. If disturbed, the two species often fly together to the same tree. This relationship continues throughout the winter but the mountain finches desert their wintering grounds earlier, leaving the accentors in homogenous flocks.

Prunella strophiata (Blyth)

Number of observations: 200.

Status; winter visitor.

Localities: open areas throughout the study area.

Altitude: from 5,800 feet to 8,000 feet.

Movements and Dates: first recorded on 10 Nov. 1963 at 7,000 feet and 6 Nov. 1965 at 6,000 feet. Last seen on 29 March 1965 at 7,000 feet and 23 April 1966 at 6,000 feet.

Habitat: semi-open areas with numerous bushes; often near fallow fields and abandoned shacks.

Foraging position: terrestrial; rarely in bushes.

Behavior: usually in small flocks of from 3 to 6 birds.

Seen near black-throated accentors.

Density: a count in late Feb. gave 20 birds in C-13,14; E-12; F-6 and 11 in 0.31 sq. mi.

Prunella atrogularis (Brandt)

Number of observations: 30.

Status: winter visitor.

Localities: C-9,13; F-11; V-9-12; W-9.

Altitude: from 6,000 feet to 8,200 feet.

Movements and Dates: first recorded on 14 Nov. 1965 at 8,000 feet and last noted on 12 March at 7,000 feet.

Habitat: the edges of ban and moru oak forests; often near bushes in association with cultivations.

Foraging position: terrestrial around bushes.

Behavior: solitary or in small flocks of up to 5 birds. Compared with the rufous-breasted accentor, this species tends to forage closer to bushes.

Density: a count in Nov. gave 12 birds in 0.31 sq. mi of sections V-9 through 12. A count in March gave 5 birds in 0.06 sq. mi. in section C-13.

Remarks: The uncommon black-throated accentors forage on the ground around the edges of bushes and often rest in the interior or near the tops of bushes. This differs from the similar rufous-breasted accentor which often forages some distance from bushes. When disturbed the rufous-breasted accentors usually fly to some other spot on the ground rather than into a bush.

PARIDAE

Parus major Linnaeus

Number of observations: 1.

Status: rare summer visitor.

Localities: J-4.

Altitude: at 6,000 feet.

Movements and Dates: 18 Oct. 1964.

Habitat: recorded from chir pine forest.

Foraging position: arboreal.

Behavior: single bird seen in association with small flock of minivets.

Remarks: The grey tit is apparently rare here since I saw only one above 5,000 feet. The west Himalayan race, P. m. caschmirensis, occupies a level from 3,500 feet to 9,000 feet while the central Himalayan race, P. m. nipalensis, ranges from the plains up to 6,000 feet (Ripley, 1961:546). Mussoorie is apparently in the zone of intergradation between the two races (Ripley, 1961:546) but birds here occur in the altitudinal range of the central race.

Parus monticolus Vigors

Number of observations: 1,000.

Status: resident.

Localities: wooded sections from A through Y except chir pine.

Altitude: from 5,500 feet to 9,000 feet.

Habitat: primarily from ban oak forest; also in moru oak and fringes of deodar and fir stands.

Foraging position: usually in the lower half of the tree story and in bushes near the ground. Also recorded on the ground.

Behavior: solitary or in pairs in the spring; small parties of up to 7 birds. Usually in association with a hunting party.

Nesting: 13 nests located in sections A, B and F. Double brooded. Food brought to nest included black-vein butterflies (3), caterpillers (2), small insects (2), unidentified items (2).

Density: A nesting count gave 13 nests in 0.25 sq. mi of sections A-16; B-13; F-1 and 2. Closest nests were 100 yards apart. One nest located behind a rock slab on a small cliff was only 15 yards from a nest of a yellow-cheeked titmouse (found by Ron Hess).

Remarks: The green-backed tit overlaps in altitude with the yellow-cheeked tit; both species are often in the same hunting party. The former, however, forages in bushes and the lower tree level, while the latter ranges in the upper two-thirds of the trees.

Parus melanolophus Vigors

Number of observations: 300.

Status: resident.

Localities: above 7,000 feet in wooded sections.

Altitude: from 6,400 feet to 9,1000 feet.

Movements and Dates: slight downward movement in winter. Not found below 7,500 feet in the summer. First date at

7,000 feet was 31 Oct. 1963, 4 Oct. 1965. Leave 7,000 feet by mid-March.

Habitat: fir forest, moru oak, deodar and ban oak.

Foraging position: arboreal, usually in the top half of the trees. Rarely in bushes and not recorded from the ground.

Behavior: usually in flocks of from 10 to 30 birds in the fall and winter; single or pairs in the spring. Associate with hunting parties in the non-breeding season.

Density: count in Oct. gave 35 birds in 0.06 sq. mi. of section Y-8.

Remarks: The black tit differs from the other parids for it forages predominantly in conifers or in oaks on northern slopes.

Parus xanthogenys Vigors

Number of observations: 500.

Status: resident.

Localities: ban oak sections up to 7,500 feet.

Altitude: from 5,000 feet to 7,500 feet.

Habitat: subtropical hardwoods and ban oak forest.

Foraging position: recorded from the top two- thirds of the tree level; also seen in the lower third and hopping on the ground(2). Often clings to trunk of tree while looking for food.

Behavior: solitary or in pairs in the spring; in small parties of up to 7 birds in non-breeding season.

Commonly associates with hunting parties.

Nesting: nests located in holes in tree trunks, in recesses in the ground, on cliffs, but not in the eaves of houses as with the green-backed tit.

Density: 3 nests located in 0.18 sq. mi. of sections B-8,13 and 14.

Remarks: Previously the yellow-cheeked tit has been seen up to 7,000 feet (Ripley, 1961:552) but commonly ranged up to 7,500 feet here.

Parus modestus (Burton)

Number of observations: 30.

Status: winter visitor.

Localities: A-16; B-13; C-14,15; F-1; G-3; W-13.

Altitude: from 6,400 feet to 8,000 feet.

Movements and Dates: early Nov. from 6,500 feet to 7,000 feet and recorded in spring up through first week of April at 7,000 feet.

Habitat: ban oak forest and in bushes bordering ban oaks and deodars.

Foraging position: arboreal. Commonly hanging upside-down near the tips of branches and also in the interior of the tree. In mistletoe. Rare in bushes (2).

Behavior: single, pairs or in parties of up to 3 birds. Very active fliers; considerable hanging upside-down. Associations with hunting parties not common.

Density: a count in Nov. gave 10 birds in 1.0 sq. mi. of sections A-11; C-14; and F-1.

Remarks: Other observers have often found the yellow-browed titmouse in hunting parties, but I had only two such observations. Apparently it associates casually with other birds and with less regularity than previous literature seems to indicate.

Cephalopyrus flammiceps (Burton)

Number of observations: 10.

Status: transient (summer visitor at higher altitudes).

Localities: F-1,2,5; R-6; X-10; Y-7.

Altitude: noted from 6,300 feet to 8,900 feet.

Movements and Dates: recorded in March at 7,000 feet; 2 birds collected by John Jantzen on 24 March 1966 at 7,300 feet; 9 April at 8,900 feet, and 14 May at 7,600 feet.

Habitat: in ban oak, moru oak and ban oak intrusions in fir forest.

Foraging position: primarily in the top half of trees, and out towards the ends of branches.

Behavior: solitary (2) and flocks of up to 5 birds. Very active and strong fliers. Not noted to do much foraging while hanging upside down.

Density: a count in March gave 5 birds in 0.12 sq. mi. in sections F-1 and B-13. A transect count in May gave 3 birds in 7 linear miles.

Remarks: The fire-capped tit resembles the yellow-browed tit both in size and behavior. However, the former is a lower elevation bird than the latter

Aegithalos concinnus Gould

Number of observations: 1,000.

Status: resident.

Localities: oak sections up to 8,000 feet.

Altitude: from 5,500 feet to 8,300 feet.

Habitat: ban oak; ban oak scrub; moru oak; and deodar stands.

Foraging position: primarily in the lower half of trees and in bushes to within an inch of the ground. Also noted in the tree canopy. The most varied forager of the tits.

Behavior: in pairs or single in spring; parties of up to 8 birds in late summer and up to 20 birds in the fall. Usually associated with hunting party during non-breeding season, but roost together and away from other species.

Density: 2 nests found and 4 suspected in 0.12 sq. mi. of sections B-13 and F-1. Closest nests were 150 yards apart.

Remarks: The red-headed tit, the most abundant parid in the study area, forages from the tops of tall trees to within an inch off the ground. It is smaller than other tits and apparently size is a factor in minimizing competition.

SITTIDAE

Sitta castanea Lesson

Number of observations: 10.

Status: fall visitor above 5,000 feet.

Localities: F-1.

Altitude: from 6,500 feet to 6,700 feet.

Movements and Dates: 15 Oct. 1964 and 20 Nov. 1965.

Habitat: chir pine intrusions in ban oak forest.

Foraging position: top half of chir pine and large ban oak trees. Usually on the main trunk and largest branches.

Remarks: The chestnut-bellied nuthatch was seen near the white-tailed nuthatch but it worked over chir pine trees while the white-tailed ranged in large oak trees.

Sitta himalayensis Jardine and Selby

Number of observations: 500.

Status: resident.

Localities: sections of forest except chir pine.

Altitude: from 6,000 feet to 9,000 feet.

Habitat: ban oak; moru oak; deodar and fir forests - usually in large trees.

Foraging position: along the trunk and main branches of large oaks and conifers. Usually in the top half of these trees but occasionally down to within 10 feet of the ground.

Behavior: usually in pairs but also single and in small parties of up to 5 birds. Often seen in association with hunting parties which include treecreepers.

Pecks are weak compared to the piculet's.

Density: 3 nests found and 4 suspected in 0.25 sq. mi. of sections A-11,12 and 15. 2 nests suspected in fir forest of Y-8 in 0.06 sq. mi.

Remarks: The white-tailed nuthatch forages on the trunk and

major branches of large trees and overlaps in altitude with the Himalayan treecreeper. However, the latter is rarely seen in the top third of the trees, whereas the former is often seen at that height. The treecreeper flushes insects and sometimes catches them, in flycatcher fashion, as far as four feet from the tree trunk while the nuthatch probes and works crevices of the bark.

Trichodroma muraria (Linnaeus)

Number of observations: 20.

Status: transient.

Localities: on cliffs from F-4 through X-10.

Altitude: from 6,900 feet to 8,100 feet.

Movements and Dates: first seen on 5 Oct. 1963; 15 Oct. 1964; and 3 Oct. 1965. No spring records.

Habitat: cliffs and retaining walls along the Tehri road. Also recorded working up a steep landslide in light moru oak forest.

Foraging position: terrestrial. Not seen to fly out and catch insects.

Behavior: usually solitary; pairs (3).

Density: a transect count in Oct. gave 7 birds in 8 linear miles of sections B-11 through N-7.

CERTHIIDAE

Certhia himalayana Vigors

Number of observations: 300.

Status: resident.

Localities: forested sections except chir pine.

Altitude: from 6,000 feet to 9,000 feet.

Habitat: ban oak forest; moru oak; deodar and fir.

Foraging position: usually on main trunk of medium and large-sized trees. Primarily on lower two-thirds of the trunk. Of records taken in October birds on lower third (8), middle third(3), and top third (1). Rarely lower than 6 feet from the ground. Will catch insects in flycatcher-like fashion up to four feet from tree trunk.

Behavior: usually in pairs; also in parties of up to 6 birds. Often associated with hunting parties. Retire from ban oak forests to deodars for nesting.

Density: 2 nests found and 3 others suspected in 0.12 sq. mi. of sections A-11 and B-9.

MOTACILLIDAE

Anthus hodgsoni Richmond and/or A. trivialis (Linnaeus)

Number of observations: 15.

Status: transient.

Localities: D-7; F-1,15; G-2;C-1; Y-7,8.

Altitude: from 5,800 feet to 9,200 feet.

Movements and Dates: 27 March 1966 at 7,000 feet; 29 March at 6,700 feet; 2 April 1965 at 5,500 feet; 8 to 9 April flying at 9,200 feet; 16 April at5,000 feet; 23 April at 6,400 feet; 21 May at 9,000 feet; 19 Sept at 6,700 feet; 25 Oct. at 7,000 feet.

Habitat: on open grassy ridges; grassy meadows; around

cultivations; chir pine intrusions in ban oak forest; ban oaks; and flying over fir forest.

Foraging position: terrestrial. Flush into trees.

Behavior: solitary or in small flocks of up to 5 birds.

Notes: Of 3 specimens collected (one by W. Friesen) two were A. trivialis, the other A.hodgsoni yunnanensis (RLF Sr.). These two species are difficult to identify in the field so are placed together here. Another similar pipit, Anthus pelopus J.E. Gray, was collected on 18 Dec. at Khaudia, just east of the study area and must also occur as a winter visitor in the study area although not positively identified.

Anthus similis Jerdon

Number of observations: 1.

Status: summer visitor.

Localities: C-1.

Altitude: at 5,500 feet.

Movements and Dates: 2 April 1965.

Habitat: open area with considerable rock outcropping and steep grassy slopes.

Foraging position: terrestrial.

Remarks: The rock pipit and the upland pipit appear to select similar habitats, but the latter is a higher altitude species.

Anthus sylvanus (Hodgson)

Number of observations: 200.

Status: resident

Localities: grassy slopes to 9,100 feet.

Altitude: from 5,500 feet to 9,100 fet.

Movements and Dates: slight downhill movement in winter. 22 Jan 1948 (RLF Sr.)at 7,200 feet; singing on 24 Feb. 1966 at 5,800 feet; on 7 March at 7,200 feet.

Habitat: grassy slopes, often with scattered chir pines or rocky outcroppings.

Foraging position: terrestrial. Also seen but not feeding in chir pines.

Behavior: solitary or in pairs.

Density: a count of singing birds gave 7 birds in 0.56 sq. mi. of sections H-4; I-5,6,7, and 12 in last week of April.

Motacilla caspica (Gmelin)

Number of observations: 100.

Status: transient

Localities: stream beds and open tracts with some level ground in sections A through Y.

Altitude: from 5,100 feet to 8,100 feet.

Movements and Dates: first seen in spring on 4 April 1964 at 5,800 feet; 27 March 1965 at 6,100 feet; 8 April 1966 at 6,00 feet. Last seen on 24 April 1964 at 7,000 feet; 24 April 1965 at 7,300 feet; and 23 April 1966 at 7,000 feet. In the fall seen from last week of August through first two weeks of Sept. from 6,000 to 8,000 ft.

Habitat: stream beds; open areas of ban and moru oak forests;

grassy slopes. Level ground is apparently important for this species.

Foraging position: terrestrial.

Behavior: usually single or in pairs; also widely scattered flocks of up to 5 birds.

Density: transect count gave 12 birds in 2 linear miles of section G through I in first week of April.

Motacilla alba Linnaeus

Number of observations: 1.

Status: transient.

Localities: U-10.

Altitude: noted at 7,500feet.

Movements and Dates: 1 Oct. 1965 at 9:30 AM.

Habitat: recorded from a level grassy ridge and near a recently dried water hole.

Foraging position: terrestrial.

Remarks: The white wagtail, although common in the Dehra Dun Valley, apparently either passes over the study area without stopping or moves along the major rivers on its annual migrations, for I saw only one bird here.

DICAEIDAE

Dicaeum ignipectus (Blyth)

Number of observations: 7.

Status: fall visitor.

Localities: from F-1; L-3; R; S; and T.

Altitude: from 6,700 feet to 8,000 feet.

Movements and Dates: from 1 Oct. at 8,000 feet to 7 Nov. at 6,700 feet.

Habitat: from ban oaks and moru oaks in the vicinity of mistletoe.

Foraging position: in the top half of medium-sized or large oaks. Near mistletoe (4), in mistletoe (2), and not near known mistletoe (1).

Behavior: usually solitary; pair (1).

Recorded near yellow-browed tits (1); sunbirds (2).

Density: a count in Oct. gave 4 birds in 0.13 sq. mi. of sections P-8; R-9 and 10.

Remarks: Both the fire-breasted flowerpecker and Mrs. Gould's sunbird frequent mistletoe (Loranthus) but the latter ranges into bushes and other trees, whereas the former was seen only once away from mistletoe. Apparently the flowerpecker moves into the study area in the fall when the mistletoe is flowering.

NECTARINIIDAE

Nectarinia asiatica (Latham)

Number of observations: 1.

Status: summer visitor.

Localities: G-16.

Altitude: at 5,300 feet.

Movements and Dates: recorded on 7 May 1966.

Habitat: recorded from hot, dry slope with scattered trees including 3 Bombax.

Foraging position: arboreal.

Food: one gizzard contained 3 spiders and one ant.

Behavior: recorded 75 yards from an Indian yellow-backed sunbird. The specimen collected had enlarged testes and probably was nesting in the neighborhood.

Remarks: The purple sunbird overlaps in altitude with the Indian yellow-backed sunbird but the former was noted in light forest, whereas the latter ranged in heavily overgrown ravines.

Aethopyga gouldiae (Vigors)

Number of observations: 80.

Status: summer visitor.

Localities: C-13,14; F-4,5; G-10; R; S; T; V and W.

Altitude: from 5,500 feet to 8,300 feet.

Movements and Dates: noted on 6 March 1965 at 5,800 feet and another at 6,100 feet; 5 March 1966 at 7,000 feet. In the fall, a male seen at 7,000 feet on 31 Oct. 1965. All birds gone from sections R through T by early November.

Habitat: in passage in ban oak forest and barberry scrub. Not outside moru oak forest or below 7,400 feet in the summer.

Foraging position: in the top half of trees and also top half of large rose bushes. Usually out towards the edges of these trees. Especially frequent around blooming rhododendron and near mistletoe.

Behavior: usually single birds seen; pairs rarely.

Notes: Although careful note was taken, no A. nipalensis (Hodgson) were identified. Six specimens examined were A. gouldiae.

Density: a count of males gave 6 birds in 3 linear miles of sections R through T in mid-May.

Aethopyga siparaja (Raffles)

Number of observations: 2.

Status: summer visitor.

Localities: G-16; K-8.

Altitude: from 5,300 feet to 7,000 feet.

Movements and Dates: 7 May at 5,300 feet and 14 May at 7,000 feet.

Habitat: in subtropical hardwoods and in stand of Buxus on otherwise open slope.

Foraging position: in small trees; near the center.

Behavior: solitary males seen.

Remarks: Apparently the only previous records of this sunbird reaching 7,000 feet are from Nepal (Ripley, 1961:589).

Aethopyga ignicauda (Hodgson)

Number of observations: 15.

Status: transient.

Localities: C-9,14; D-13-15; F-15; U-5.

Altitude: from 6,600 feet to 7,500 feet.

Movements and Dates: recorded from 17 March to 25 March between 7,000 feet to 7,500 feet. One record at 6,600

feet on 27 Sept. 1964.

Habitat: ban oak forest and especially around flowering rhododendrons. Also flying over grassy ridge with scattered barberry bushes.

Foraging position: around tops of trees and outer edges of large bushes.

Behavior: in scattered flocks of up to 6 birds.

Notes: the males in March had tails of their breeding plumage about half grown.

Density: count in March gave 9 birds in 0.06 sq. mi.

ZOSTEROPIDAE

Zosterops palpebrosa (Temminck)

Number of observations: 30.

Status: resident.

Localities: A-14,15; E-11; F-1,2; H-2; N-5; O-6,10.

Altitude: from 6,000 feet to 8,300 feet.

Movements and Dates: recorded from sections A, F and H only during the winter, indicates an upward trend. First record for these sections on 21 Oct. 1965., and last record on 28 Feb. above 6,500 feet. In section O on 8 May at 8,300 feet.

Habitat: ban oak forest; ban oak scrub.

Foraging position: usually in the top levels of the trees or in large bushes.

Behavior: usually in small flocks of up to six birds. Associate with hunting parties.

Remarks: The white-eye previously has been seen up to 7,000

feet (Ripley, 1961:592) but it ranges up to 8,300 feet here.

PLOCEIDAE

Passer domesticus (Linnaeus)

Number of observations: 60.

Status: resident.

Localities: A-13.

Altitude: from 6,500 feet to 6,600 feet.

Habitat: recorded only from densely populated city area.

Foraging position: on the street or in grain bins. Not noted over 50 yards away from buildings.

Behavior: usually in loose flocks of up to 30 birds. Seen near a cinnamon sparrow but not associating with other species regularly.

Density: Over 30 birds in upper Mullingar Bazaar in 0.03 sq. mi.

Remarks: The house sparrow frequents the densely populated Mullingar Bazaar and is not seen around the small villages where the cinnamon sparrow is common. In the residential Landour area the cinnamon sparrow is well established and the house sparrow has not been recorded.

Passer rutilans Temminck

Number of observations: 100.

Status: resident.

Localities: A11-13,15; B-9; E-4; K-2,5,6; L-5,9; N-5; P-9-12; U-10,11; V-11,12.

Altitude: from 5,700 feet to 8,200 feet.

Movements and Dates: up to 7,300 feet throughout the winter. At 8,000 feet on 28 Nov.

Habitat: residential areas of deodar and ban oak forest; open grassy areas edging cultivations and scrub oaks; edges of moru oaks forest near cultivations.

Foraging position: both terrestrial and in bushes (for berries).

Behavior: usually in flocks of up to 10 birds; rarely single or in pairs. Seen near house sparrows at Mullingar and also near green finches along the Tehri road.

Density: a count in May gave 48 birds in "pockets" around cultivations in about 0.62 sq. mi. of sections A-11,12; K-5,6; L-5; M-5; P-10,11; U-10,11.

Petronia xanthocollis (Burton)

Number of observations: 2.

Status: summer visitor.

Localities: C-1; K-4.

Altitude: from 5,300 feet to 5,500 feet.

Movements and Dates: 3 April and 4 May.

Habitat: near the edge of cultivations and small villages

Foraging position: recorded from large bushes near houses; in scattered fruit trees among the fields.

Behavior: in small flocks of 3 and 5 birds. Seen near cinnamon sparrows and tree pipits.

Density: a count on 3 April gave 8 birds in 0.12 sq. mi. of section C-1.

Remarks: The yellow-throated sparrow occurs around villages in hedge-rows and along the edges of fields which

is similar to the cinnamon sparrow except that the former remains at a lower altitude than does the latter. Previously the yellow-throated has been recorded to 3,000 feet (Ripley, 1961: 597) but it penetrated up to 5,500 feet here.

Lonchura punctulata (Linnaeus)

Number of observations: 6.

Status: summer visitor.

Localities: A-14; C-1,14; F-12; G-11.

Altitude: from 5,500 feet to 7,300 feet.

Movements and Dates: noted on 25 June at 6,800 feet; 18 Sept. at 5,500 feet through 31 Oct. at 7,000 feet in C-14.

Habitat: near cultivations at 5,500 feet; also over ban oak scrub and perched in ban oak forest.

Foraging position: terrestrial.

Behavior: occurs in small flocks of up to 10 birds; also in pairs.

Remarks: The nutmeg mannikins travel in small flocks and regularly move over the 7,000 foot mark during the fall (see Ripley, 1961:605).

FRINGILLIDAE

Myzerobas icterioides (Vigors)

Number of observations: 60.

Status: resident.

Localities: A-11; R-9-10; S-11,12; V-9; Y-7,8.

Altitude: from 7,300 feet to 9,100 feet.

Movements and Dates: slight downward trend noted in winter. Recorded at 9,000 feet on 3 Oct. and from 8,000 feet in November. Also at 7,800 feet on 14 May.

Habitat: fir forest; deodar stands and moru oak forest in summer. Ban oak forest in winter.

Foraging position: top half of the trees. sually forage out towards the tips of branches.

Behavior: usually in loose flocks of up to 8 birds in the non-breeding season; pairs and singles in the breeding season.

Density: a count in May gave 8 males in 0.12 sq. mi of sections Y-7and 8.

Remarks: The black and yellow grosbeak is the only resident grosbeak in the study area and overlaps with the white-winged grosbeaks in the winter. Grosbeak flocks are highly noblile and it is difficult to tell how the requirements of the two species differ. Both were seen eating Cornus berries. The allied grosbeak rarely wanders this low and was seen only in maples and oaks.

Mycerobas affinis (Blyth)

Number of observations 3.

Status: winter visitor.

Localities: F-1,2.

Altitude: from 6,500 feet to 6,800 feet.

Movements and Dates: from 10 through 21 Feb.

Habitat: in ban oak forest, apparently preferring the Acer

Foraging position: in the top half of the maples and oaks.

Behavior: in a loose flock of 10 birds.

Mycerobas melanozanthos (Hodgson)

Number of observations: 3.

Status: winter visitor.

Localities: A-10,14; B-13; F-2,3; V-11,12.

Altitude: from 6,500 feet to 7,200 feet.

Movements and Dates: from 3 December (1964) until 1 March (1966) at 7,000 feet.

Habitat: ban oak forest in fruiting dogwood (2) and black cherry (1).

Foraging position: noted eating fruit both toward the interior and exterior of the trees and at all levels.

Behavior: in flocks of 20 to 30 birds.

Carduelis carduelis (Linnaeus)

Number of observations: 7.

Status: winter visitor.

Localities: B-12; F-2,3; V-11,12.

Altitude: from 6,500 feet to 8,000 feet.

Movements and Dates: recorded on 16 to 21 Nov. at 8,000 feet; 2 Jan., 20 Feb., 4 and 24 March at or near 7,000 feet.

Habitat: ban oak forest; edges of deodar stands; openings near moru oak forest; fallow fields with thistles.

Foraging position: high in maple trees and to within 3 feet of the ground on thistles.

Behavior: in loose flocks of from 6 to c50 birds. Near prunellids and mountain finches at 8,000 feet.

Carduelis spinoides Vigors

Number of observations: 100.

Status: resident.

Localities: C-13,14; N-5-7; L-9; P-9-12; S-5,6,12; T-12; U-5,9-11; V-10-12; Y-11,12.

Altitude: from 6,800 feet to 9,100 feet.

Habitats: open scrub oak; grasslands; near cultivations and villages; openings in moru oak forest; edge of fir forest.

Foraging position: terrestrial.

Behavior: usually in small flocks of up to 8 birds in non-breeding season; single or pairs in breeding season. Often seen near cinnamon sparrows.

Density: a transect count gave 16 birds in 6 linear miles of sections K-9 through P-11.

Remarks: During the winter the green finch overlaps with the goldfinch but the former inhabits open slopes, whereas the latter forage in light forest and on thistle plants in abandoned fields.

Callacanthis burtoni (Gould)

Number of observations: 6.

Status: winter visitor.

Localities: A-11,12; F-1; W-9.

Altitude: from 6,500 feet to 8,000 feet.

Movements and Dates: first recorded on 20 Nov. at 8,000 feet (S.VanRooy) through 3 March (collected) to 26 March (sight record) at 7,200 feet.

Habitat: ban oak, deodar and moru oak forest.

Foraging position: on the ground and in bushes.

Behavior: occur in pairs or small flocks of up to 4 birds. Seen near pink-browed rose finches.

Density: a winter count gave 6 birds in 0.25 sq. mi. of sections A-6,7,11,12. A flock of 4 birds in 0.06 sq. mi of F-1.

Serinus pusillus (Pallas)

Number of observations: 20.

Status: winter visitor.

Localities: C-13,14; F-5; G-13; H-8.

Altitude: from 5,300 feet to 7,100 feet.

Movements and Dates: first noted on 16 Feb. at 5,300 feet and then through 3 April 1965; and 2 April 1966 both at 7,000 feet.

Habitat: edges of ban oak forest; ban oak scrub; cultivations.

Foraging position: primarily terrestrial feeders; also in stinging nettle bushes as high as 6 feet from ground.

Behavior: occur in flocks of up to 50 birds. In March the flocks break up so that by last of March the birds have separated into pairs. Seen near rufous-breasted accentors, black-throated accentors and mountain finches.

Density: a count in March gave 31 birds in 3.0 sq. mi of sections C, F and H (not all prime habitat).

Remarks: The gold-fronted finch overlaps with the red-headed bullfinch for both eat stinging nettle seeds. However, the former also feeds on the ground, while the latter ranges into fruiting trees.

Leucosticte nemoricola (Hodgson)

Number of observations: 200.

Status: winter visitor.

Localities: grassy slopes above 6,500 feet.

Altitude: from 6,500 feet to 9,100 feet.

Movements and Dates: first recorded on 4 Nov. 1965 at 7,000 feet and last seen on 9 March 1966 at 7,100 feet.

Habitat: in open areas of grassy slopes and stone outcroppings; deserted fields and orchards.

Foraging position: terrestrial feeders.

Behavior: occur in flocks of up to over 100 birds. Rarely under 10 birds in flock. Constantly with the altai accentors. Usually more finches than accentors and lowest ratio seen was about 30 finches to 10 accentors.

Density: a count of over 100 birds in 0.06 sq. mi.

Remarks: Hodgson's mountain finches associate regularly with altai accentors. Both species forage on grassy slopes or abandoned fields that are largely avoided by other prunellids and finches.

Carpodacus erythrinus (Pallas)

Number of observations: 12.

Status: transients.

Localities: C-1,5,13; F-15,16; G-11,12; L-5; N-7; P-9; U-9.

Altitude: from 5,500 feet to 8,100 feet.

Movements and Dates: first recorded on 1 April 1966 and up through 14 May at 8,100 feet. Also from 18 through 23 Sept. at around 7,000 feet.

Habitat: ban oak scrub; open hillsides with barberry bushes; bushes on edges of fallow fields.

Foraging position: usually in bushes but also noted searching leaf litter beneath oak trees.

Behavior: usually in small flocks up of to 15 birds; also single and in pairs. Seen near cinnamon sparrows.

Density: count in early May gave 9 birds in 0.12 sq. mi. in sections F-16 and G-13.

Remarks: The habitat selections and foraging position of the common rose finch is somewhat similar to that of the pink-browed rose finch, but the latter leaves the study area before the former arrives.

Carpodacus nipalensis (Hodgson)

Number of observations: 3.

Status: winter visitor.

Localities: F-4,5.

Altitude: from 6,100 feet to 6,800 feet.

Movements and Dates: recorded on 9 Jan (RLF Sr.) at 6,900 feet; 19 Jan. (RLF Sr.) at 6,800 feet; 4 March at 6,100 feet.

Habitat: ban oak forest, especially around rhododendrons; ban oak scrub.

Foraging position: in middle of rhododendron tree but primarily terrestrial feeders.

Behavior: noted in small flocks of up to 4 birds; pair (1).

Carpodacus rhodochrous (Vigors)

Number of observations: 300.

Status: winter visitor.

Localities: wooded sections of study area.

Altitude: from 6,000 feet to 9,100 feet.

Movements and Dates: first seen on 10 Nov. 1963 at 7,000 feet; 12 Oct. 1965 at 7,000 feet. Last seen on 8 April 1964; 13 April 1965; and 10 April 1966 all at c7,000 feet.

Habitat: wintering in ban oak forest; ban oak scrub; deodar stands; bushes around cultivations. On migration in fir forest.

Foraging position: terrestrial and in cyathula and barberry bushes.

Behavior: noted in small flocks of up to 14 birds; usually 4 to 8 birds. Seen near prunellids and buntings in bushy areas. Perched on top of the fir trees on Sirkanda.

Density: a count in late Feb. gave 11 birds in 0.12 sq. mi of section F-1 and 2. Also 7 birds in 0.06 sq. mi of section C-13.

Remarks: The pink-browed rose finch overlaps in altitude with the rare red-browed finch, but the latter occurs on slopes of herbaceous plants and not often in thick bushes, whereas the former are most often in or near bushes.

Loxia curvirostra Linnaeus

Number of observations: 1.

Status: winter visitor.

Localities: A-10,15,16.

Altitude: from 6,500 feet to 7,200 feet.

Movements and Dates: occurred in the winter of 1961.

Habitat: in light ban oak forest and at the edge of deodar stands.

Foraging position: on the seeds of marijuana plants, primarily from the top half of the standing plants.

Behavior: birds tame and several specimens were collected by S. and G. VanRooy.

Remakrs: Previously the Himalayan crossbill (L. c. himalayensis has not been recorded below 10,000 feet (Ripley, 1961: 625) but a flock wandered down to 6,500 feet here.

Haematospiza sipahi (Hodgson)

Number of observations: 1.

Status: rare winter visitor.

Localities: C-11.

Altitude: at 5,700 feet.

Movements and Dates: 5 March.

Habitat: recorded from ban oak scrub near subtropical hardwoods.

Foraging position: noted in top half of an oak tree near a spring and may have been coming for water.

Behavior: occurred in a party of 3 birds. Shy but one collected.

Remarks: The scarlet finch I collected is the westernmost record of this species (see Ripley, 1961:626).

Pyrrhula nipalensis Hodgson

Number of observations: 90.

Status: winter visitor.

Localities: A-15,16; B-14,15; F-1,2,5,6.

Altitude: from 6,000 feet to 7,100 feet.

Movements and Dates: arrive in late December and last seen on 23 April 1965 and 1 April 1966.

Habitat: ban oak forests, often near rhododendrons.

Foraging position: arboreal, in the lower two-thirds of the trees to low bushes within a inch of the ground.

Food: differs from red-headed bullfinch by eating tender leaf buds, shoots and flower petals.

Behavior: always in flocks of between 6 and 12 birds.

Density: a count in the first week of March gave 23 birds in 0.18 sq. mi. of sections B-14; F-1 and 5.

Pyrrhula erythrocephala Vigors

Number of observations: 100.

Status: winter visitor.

Localities: A-6; B-16; C-13; D-11,12; F-5,6,11,12; G-4; H-1-3; T-11,12; W-12,15,16.

Altitude: from 5,900 feet to 8,200 feet.

Movements and Dates: arrived by late December at 7,000 feet. Last seen on 24 March 1964; 13 March 1965 and 17 March 1966. Also noted on 15 Nov. 1965 at 8,200 feet.

Habitat: ban oak scrub; ban oak; moru oak; deodars.

Foraging position: arboreal and in bushes. Also to within 3 feet of ground on stinging nettle plants.

Behavior: in small flocks of up to 10 birds. Seen near pink-browed rose finches and streaked laughing thrushes.

Density: a count in last week of Feb. gave 12 birds in 0.75 sq. mi. of sections of C and F.

Remarks: The red-headed bullfinch overlaps in altitude with the brown bullfinch but the former has a wide habitat range and eats seeds and berries, whereas the latter eats buds and flower petals.

EMBERIZIDAE

Emberiza cia Linnaeus

Number of observations: 200.

Status: winter visitor.

Localities: open areas from A through Y.

Altitude: from 5,800 feet to 8,300 feet.

Movements and Dates: first noted on 14 Nov. 1965 at 8,000 feet. Last noted on 6 April 1964 at 7,000 feet; 2 April 1965 at 7,300 feet; and 9 April 1966 at 7,300 feet.

Habitat: grassy slopes; ban oak scrub; especially common in both fallow fields and winter wheat fields.

Foraging position: terrestrial, in fields or on grassy slopes.

Behavior: usually in loose flocks of up to 12 birds; also in pairs. Noted with blue-headed robins and blue-fronted redstarts and near prunellids and pink-browed rose finches.

Density: a count in first week of March gave 10 birds in 0.12 sq. mi. of sections H. Also 12 birds in 0.06 sq. mi. of section C-13. A transect count gave 15 birds in 1.25 linear miles in H-3 through I-9.

Remarks: The rock bunting overlaps in altitude with prunellids

and several finches. However, these other species, unlike the buntings, always forage near bushes. Moreover, the buntings are the only birds commonly seen in winter wheat fields; the others occur in fallow fields.

DISCUSSION

HABITAT CONSIDERATIONS

Habitat preference

The habitat preference for each species of bird is listed in table 6. Some species, particularly migratory ones, might occur briefly in habitats other than the ones for which they are listed. For example, migrating brown bullfinches (*Pyrrhula nipalensis*) might stop in the fir forest on Sirkanda but are not listed for the firs since they were not recorded there. Several species, including the brown bullfinches, were not seen in habitats at a level higher than their wintering grounds and it appears feasible that they might fly directly to their summer territories - in some cases less than 40 miles away - without stopping on intervening ridges to rest or forage.

The total number of species noted in each habitat is given in table 7, which shows that the highest number of species was found in ban oak and ban oak scrub forests. The center of the moru oak forest is only approximately 1,500 feet higher than the center of the ban oak forest (8,000 vs. 6,500 feet), yet the difference in number of avian species counted was dramatic. The paucity of the bird life in the chir pine forest (12 species) and the reduced number of birds on grassy slopes (48 species) show clearly in these data - even though the grasslands extend throughout the entire altitudinal range of the study area.

Table 6. Habitat preference of the avian population.

Species	Ban	Ban Scb.	Moru	Moru Scb.	Fir	Grass	Deod.	Chir	St. Bed	Subt. Hard.	Cult.	Cliff	Unr.
Milvus migrans	r	r									r		
Haliastur indus		wa											
Accipiter gentilis	w		w										
Accipiter nisus/virgatus	s					s							
Buteo buteo		m		m							m		
Buteo rufinus	w												
Spizaetus nipalensis	r												
Aquila nipalensis													m
Ictinaetus malayensis	r	r	s			r							
Torgos calvus			r	r									r
Gyps himalayensis												r	r
Pseudogyps bengalensis		s				s							
Neophron percnopterus	s	s				s							s
Gypaetus barbatus												r	r
Spilornis cheela	r	r											
Falco tinnunculus	r	r				r							r
Alectoris graeca		r				r					r		
Francolinus francolinus		s									s		
Arborophila torqueola	r		r		r								
Tragopan melanocephalus			r										
Lophophorus impejanus				w	s	r							
Lophura leucomelana	r	r	r	r							r		
Gallus gallus	s	s									s		
Pucrasia macrolopha	r		r		r		r	r					
Catreus wallichii						r		r					
Porzana pusilla													m
Scolopax rusticola	m		m		m					m			
Treron sphenura	s									s			
Columba leuconota						w					w	w	
Columba livia						m							m
Columba hodgsonii	w	w		w									

Key: r = resident, s = summer, w = winter, m = on migration, wa = wanderer, Unr.= unrestricted, Cult. = both fields and villages.

Table 6. continued.

Species	Ban	Ban Scb.	Moru	Moru Scb.	Fir	Grass	Deod.	Chir	St. Bed	Subt. Hard.	Cult.	Cliff	Unr
Streptopelia orientalis	s	s	s	s	s	s	s			s	s		
Streptopelia decaocte		s											
Psittacula himalayana	w	w									s		
Cuculus sparverioides	m		s	s	s					r			
Cuculus micropterus	s	s											
Cuculus canorus										s			
Cuculus saturatus	s					s							
Otus spilocephalus	r	r	r				s			s			
Otus bakkamoena	r		r	r	s		r						
Glaucidium brodiei	r	r	r	r			r	r					
Glaucidium cuculoides	r	r									r		
Strix aluco	r	r	r			s		r		r			
Asio otus						m							
Caprimulgus indicus		s		s	s	s							
Caprimulgus macrurus		s									s		
Collocalia brevirostris													m
Apus melba													m
Apus pacificus												s	s
Apus affinis											s		s
Alcedo atthis									s				
Upupa epops		m		m	m	m							
Megalaima virens										r			
Megalaima asiatica	w	w		w						r			
Jynx torquilla		m											
Picumnus innominatus	r	r								r			
Picus squamatus	r		r		r		r	r					
Picus canus	r	r		r		r				r			
Picus chlorolophus	s	s											
Hypopicus hyperythrus	w		m		s								
Dendrocopos himalayensis	w		s	s									
Dendrocopos auriceps	r	r					r	r					
Psarisomus dalhousiae	m												

Table 6. continued.

Species	Ban	Ban Scb.	Moru	Moru Scb.	Fir	Grass	Deod.	Chir	St. Bed	Subt. Hard.	Cult.	Cliff	Unr.
Hirundo rupestris						m						m	m
Hirundo daurica						s					s		s
Delichon urbica													m
Oriolus oriolus										s			
Oriolus traillii	s			s						s			
Dicrurus leucophaeus	s	s		s			s	s		s	s		
Acridotheres tristis	s	s					s				s		
Acridotheres fuscus	s	s		s		s	s			s	s	s	
Garrulus glandarius	w		s	s			w						
Garrulus lanceolatus	r	r	s	s						r			
Kitta erythrorhyncha	r	r	r	r			r			r			
Dendrocitta formosae	s	s								r			
Nucifraga caryocatactes	w			w			w						
Corvus macrorhynchos	r	r	r	r	r	r	r	r			r		
Coracina melaschistos		s								s			
Pericrocotus flammeus										s			
Pericrocotus ethologus	w	w	m	m	s	m	w	w		w			
Chloropsis aurifrons										s			
Pycnonotus leucogenys	w	r				r				r	r		
Hypsipetes virescens		r								r			
Hypsipetes madagascariensis	r	r	s	s						r			
Pomatorhinus schisticeps	s	s											
Pomatorhinus erythrogenys	r	r		r									
Microura albiventer	w												
Stachyris pyrrhops	r	r								r			
Turdoides striatus	s	s									s		
Garrulax albogularis	r	r	r	r									
Garrulax striatus	r			s						r			
Garrulax variegatum	w	w	r	r	s								
Garrulax rufogularis		r											
Garrulax lineatus		r		r	r	r					r		
Garrulax erythrocephalus					s								

Table 6. continued.

Species	Ban	Ban Scb.	Moru	Moru Scb.	Fir	Grass	Deod.	Chir	St. Bed	Subt. Hard.	Cult.	Cliff
Pteruthius flaviscapis	s		s	s	s							
Pteruthius xanthochloris	m			s								
Minla strigula	w	w	m	m	m					w		
Yuhina flavicollis		s		s						r		
Yuhina gularis	w	w										
Heterophasia capistrata	w	w	s	s								
Muscicapa sibirica	m	m	m		s		m					
Muscicapa ruficauda	m											
Muscicapa parva		m										
Muscicapa strophiata	m	m										
Muscicapa superciliaris	s	s	s	s								
Muscicapa leucomelanura		m					m					
Muscicapa sundara	m		s	s						m		
Muscicapa thalassina	s	s	s	s	s	s	s					
Culicicapa ceylonensis	s	s	s	s	s		s			s		
Rhipidura hypoxantha	m	m	m	m								
Terpsiphone paradisi	m	m								m		
Tesia castaneocoronata										w		
Cettia fortipes		m										
Cettia flavolivaceus		m										
Cettia brunnifrons		w										
Prinia criniger		s				s					w	
Acrocephalus dumetorum	m	m			m							
Phylloscopus tytleri	m		m		m							
Phylloscopus pulcher	w		m									
Phylloscopus inornatus	m	m	m		m							
Phylloscopus proregulus	w	w		m								
Phylloscopus nitidus	m											
Phylloscopus occipitalis			m		s							

Table 6. continued.

Species	Ban	Ban Scb.	Moru	Moru Scb.	Fir	Grass	Deod.	Chir	St. Bed	Subt. Hard.	Cult.	Cliff
Seicercus burkii	m									m		
Seicercus xanthoschistos	r	r	r	r	s							
Regulus regulus					w		w					
Erithacus pectoralis		m								m		
Erithacus cyanurus	w	w	m	m	m							
Erithacus chrysaeus		w		w						w		
Copsychus saularis		s										
Phoenicurus caeruleocephalus	w	w		m		w		w				
Phoenicurus frontalis	w	w		w		w					w	
Enicurus scouleri									m			
Enicurus maculatus		wa	wa						r			
Saxicola torquata		s				s						
Saxicola ferrea		s				s						
Chaimarrornis leucocephalus									m			
Monticola cinclorhynchus	s	s				s						
Monticola rufiventris	w	w	s	s	s							
Monticola solitarius						m						
Myiophoneus caeruleus	r	r		r	s	r	r		r		r	
Zoothera citrina		s								s		
Zoothera mollissima	w						w					
Zoothera dauma	m	m										
Zoothera monticola		w	m						w	w		
Turdus unicolor	s	s	s	s								
Turdus albocinctus	w	w	w	w			w				w	
Turdus boulboul	w	w	s	s						w		
Turdus rubrocanus	w	w										
Turdus ruficollis		w		w		w					w	
Turdus viscivorus	w	w		r	s	r	w					
Troglodytes troglodytes	w	w										
Cinclus pallasii									m			

Table 6. continued.

Species	Ban	Ban Scb.	Moru	Moru Scb.	Fir	Grass	Deod.	Chir	St. Bed	Subt. Hard.	Cult.	Cliff
Prunella collaris		w		w		w						
Prunella himalayana						w					w	
Prunella strophiata		w		w							w	
Prunella atrogularis		w		w							w	
Parus major								s				
Parus monticolus	r	r	r	r	s		r					
Parus melanolophus	w		r	r	r		w					
Parus xanthogenys	r	r								r		
Parus modestus	w	w										
Cephalopyrus flammiceps	w		s		s							
Aegithalos concinnus	r	r	r	r								
Sitta castanea	wa											
Sitta himalayensis	r		r		r							
Trichodroma muraria						m						m
Certhia himalayana	r		r		r		r					
Anthus hodgsoni/trivialis		m			m	m						
Anthus similis						s						
Anthus sylvanus						r		r				
Motacilla caspica		m		m		m			m			
Motacilla alba						m						
Dicaeum ignipectus	m		s									
Nectarinia asiatica										s		
Aethopyga gouldiae	m	m	s									
Aethopyga siparaja										s		
Aethopyga ignicauda		m		m								
Zosterops palpebrosa	w	w								r		
Passer domesticus											r	
Passer rutilans	r					r					r	
Petronia xanthocollis						r					r	
Lonchura punctulata	w	w									r	

Table 6. concluded.

Species	Ban	Ban Scb.	Moru	Moru Scb.	Fir	Grass	Deod.	Chir	St. Bed	Subt. Hard.	Cult.	Cliff
Mycerobas icterioides	w		s	s	s							
Mycerobas affinis	w											
Mycerobas melanozanthos	w	w										
Carduelis carduelis	w	w		w							w	
Carduelis spinoides		r		r	r	r						
Callacanthis burtoni	w		w				w					
Serinus pusillus		w									w	
Leucosticte nemoricola		w				w					w	
Carpodacus erythrinus	m	m									m	
Carpodacus nipalensis		w										
Carpodacus rhodochrous	w	w					w				w	
Loxia curvirostra		w										
Haematospiza sipahi		w										
Pyrrhula nipalensis	w	w										
Pyrrhula erythrocephala	w	w		w								
Emberiza cia		w		w		w						

Further examination reveals other significant trends. The composition of the population according to season and habitat is given in table 8. The slight difference between the ban oak and the ban oak scrub community totals seems to be due to the number of summer residents, whereas the difference between the moru oak and moru oak scrub groups results from a difference in the number of wintering birds. Other noticeable trends are the increases in the summer populations of both the fir forest and the subtropical hardwood forest.

There is a surprising difference in the population composition between closely related ban oak and ban oak scrub habitats. Of 158 species found in either the ban oak forest or in the ban oak scrub, only 75 are common to both. The proportion of shared species in each habitat is nearly equal. Using the proportion equation (see Wallis and Roberts, 1965:429) it can be shown that these proportions are equal at the 95% confidence limits:

given: $X_1=.65$; $1-X_1=.35$; $X_2=.62$; $1-X_2=.38$; $N_1=115$; $N_2=119$

so that $-0.0876 < p-p < +0.1476$

The range covers zero, consequently one would not reject the hypothesis at the 95% confidence level.

An indication of the affinity between various habitat populations can be attained by using the resemblance equation (see Preston, 1962:419) to calculate the dissimilarity (z). The z values for various habitats compared to ban oak forest are shown in table 9. The dissimilarity of ban oak and

Table 7. Birds correlated with habitat

Habitat	Number of species
ban oak	115
ban oak scrub	119
moru oak	56
moru oak scrub	65
fir	39
deodar	29
grassland	48
chir	12
stream bed	8
subtropical hardwoods	43
cultivations	36
cliffs	8
unrestricted	18

Table 8. Habitat and seasonal correlation of the birds.

Habitat	W	R	S	M	WA
ban oak	41*	33	21	19	1
ban oak scrub	39	30	28	20	2
moru oak	3	20	20	12	1
moru oak scrub	13	18	23	11	
fir	1	9	21	8	
deodar	10	10	7	2	
chir	2	8	2	0	
grass	8	15	15	10	
stream bed	1	2	1	4	
subtropical hardwoods	6	17	15	5	
cultivation	11	12	11	2	
cliffs	1	3	3	1	

* numbers represent species

deodar populations (0.45) is lower than the fir and ban oak correlation (0.59) but this seems to be due to the proximity of the deodar stands within the ban oak forests. However, the chir pine forest birds compared with those from ban oaks have a z value of 0.77 even though the pine forest is spatially close to the ban oaks and covers the same altitudinal zone. The grassland habitat has a z value comparable to the chir pine.

The z values for coniferous forests are also shown in table 9 and demonstrate that there is not much affinity between birds in these habitats. As expected, however, a much greater similarity exists between the fir and deodar than between the fir and chir assemblages. Nevertheless, there seeems to be more affinity between ban oak and deodar than between the deodar and fir, probably due largely to differences in altitude.

Foraging level

Each of the habitats considered is composed of various sub-levels in which the birds range and are classified as terrestrial, bush, low tree, high tree, and aerial levels (also see Yapp, 1955:113). Most birds will forage through several heights. For example, the white-throated laughing thrush was found on the ground, in bushes and even in fruit-

Table 9. Population affinities of different habitats.

Habitats compared	Species in common	z values
ban oak scrub-ban oak	75	0.42
moru oak-ban oak	47	0.45
subtropical hardwoods-ban oak	29	0.62
chir pine-ban oak	09	0.77
fir-ban oak	28	0.59
deodar-ban oak	27	0.45
grassland-ban oak	19	0.79
fir-deodar	13	0.69
deodar-chir	06	0.73
chir-fir	04	0.84

bearing trees. Yet, after considerable observation, I noted that in most cases a species will exhibit a preference for a particular level. For example, the white-throated laughing thrush was seen foraging on the ground more often than in the other levels. Accordingly, the birds were separated into five categories. The foraging level correlated with habitat preference is given in table 10. This chart tabulates the foraging position of the more permanent species in the habitat and includes the transient birds only in the general population totals.

The most common foraging position for the population as a whole is on the ground, followed in order by high tree, bush, low tree, and aerial. One would expect the ground to be a major food-finding level for birds that eat carrion, seeds, terrestrial insects, plant roots and grass blades. Only fruit and aerial insect eaters would be largely excluded. In the grassland habitat the vast majority of the birds are ground feeders. However, all foraging heights are utilized in the ban oak forest. In the firs, the population is largely split between the high tree level (13 species) and the ground ground (10) with little activity in the bush (2) or low tree (2) levels.

Food preference

-- Each species also exhibits food preferences, which, for purposes of analysis, the following broad categories were recognized: carnivorous, non-flying and larval insects,

Table 10. Foraging level correlated with habitat preference.

Habitat	Terr.	Bush	Low tree	High tree	Aerial	Aquatic	Unlisted
grass	29*	4	1	1	3		
fir	10	2	2	13	4		
ban oak	33	15	21	22	4		
general population totals							
	80	31	25	39	21	2	2

* numbers represent species

berries and plant parts, berries-insects, seeds and omnivorous. In some species these separations are not distinct and since considerable overlapping does occur these species are classified according to their apparent major food preference. In the case of the insect-berry category, I found that a large number of birds utilize both foods about equally and so considered them under a separate heading. The population analysis according to food preference in grassland, fir and ban oak habitats is given in table 11. Here, again, the transients are not included in the habitat totals but are added to the general population totals. Table 11 also illustrates the feeding range of the birds in these habitats. The greatest number of birds in the ban oak, grassland and fir forest eat insects with the berries-insects group next in importance.

Seasonal changes in food preference correlated with habitat are shown in table 12. These data demonstrate that there is not a complete change from summer to winter in insect-eating to seed-eating birds. Insect eaters vacate the higher areas - no aerial foragers remain in the study area during the winter - but at the ban oak level there were 26 species that survived on insects throughout the winter. Other birds that eat insects during the summer often switched to berries in the colder weather and then resumed a predominantly insect diet in March and April.

The seasonal availability of fruits on shrubs, vines and trees in ban oak forest is given in table 5. The availability

Table 11. Food preferences correlated with habitat.

Habitat	Carn.	Insects	Aerial Ins.	Berries	Ber.-Ins.	Seeds	Omniv.
grass	5*	11	3	3	5	9	1
fir	1	12	3	4	5	5	1
ban oak	12	32	4	11	24	9	3
general population totals							
	20	84	18	19	27	29	3

* numbers represent species

Table 12. Seasonal food preferences correlated with habitat.

Season	Carn.	Insects	Aerial Ins.	Berries	Ber.-Ins.	Seeds	Omniv.
Habitat: fir forest							
winter	0*	1	0	0	0	0	0
summer	1	9	3	4	4	3	0
resident	0	4	0	2	1	3	1
Habitat grass:							
winter	0	2	0	0	1	5	0
summer	4	6	3	0	1	1	1
resident	1	3	0	4	4	6	0
Habitat: ban oak							
winter	2	15	0	9	11	9	0
summer	2	6	4	2	5	2	1
resident	8	11	0	7	8	4	2

* numbers represent species

of a given fruit depends not only on the time at which it ripens, but also on its preservation index. For example, Rubus lasiocarpus fruit starts to ripen about the middle of June and berries continue to mature through mid-July. This fruit is short-lived, for within one or two weeks after maturity the drupes drop off. Viburnum cotinifolium, by contrast, starts to ripen about mid-July and continues through early September. Fruiting of this species was recorded in July and August by Gupta (1928); however, the fruit remains on the plant much later and is available to birds through December. Fruit maturity is not the only consideration of seasonal availability for several birds feed on berries before they have ripened. For example, the grosbeaks consumed Cornus fruits in December and January although they would not have ripened until early March.

ZOOGEOGRAPHY

From a zoogeographical point of view, the position of the study area is of interest not only because it lies along the Jumna-Ganges watershed ridge, but also because it falls in a transitional zone between the large Palearctic region to the north and the Oriental region on the south (see Ripley, 1961:xvii). In the Himalayas the dividing line between these two great areas has not been - or can not be - closely defined. Altitude complicates the picture. Wallace (1876:329) noted that the Palearctic generally falls above the 9,000 foot level in the Himalayas, while Vaurie (1959:xi)

pointed out the interdigitating nature of the fauna. Fisher and Peterson (1964:62) mentioned that the blend zone between the Palearctic and the Ethiopian or Oriental regions is broad. This is the case with the Ethiopian-Palearctic blend zone and part of the Oriental-Palearctic, but in the mountains one would expect the telescoping effect of altitude to sharpen the zoogeographical divisions.

Data in table 13 indicate that of the bird species recorded during this study the largest number (42 per cent) range into the Oriental region, followed by the Palearctic element (27 per cent) and the Ethiopian (5 per cent). Only 6 species range as far as the Australian region.

Remembering the cool temperatures of the study area, it is somewhat surprising to find such a high proportion of Oriental birds here. The Oriental region is divided into three subregions: the Indian, Indochinese and the Malaysian. The study area lies only 15 miles from the edge of the Indian subregion (the Indo-Gangetic plains), some 1,000 miles from the border of the Indochinese subregion, and approximately 1,500 miles by land from the Malaysian. By geographical position, one would expect the Indian subregion to be of paramount importance to the Oriental element found here.

Data in table 14 reveal that the Indian subregion contributes only one species (1.2 per cent of the Oriental element) to the area. The Indochinese subregion, on the other hand, contributes 50 per cent of the Oriental element with 42 species present. Moreover, 19 per cent of the Oriental

Table 13. Breeding distribution of the birds near Mussoorie.

Range	Number of Species
Oriental	84
Oriental and Palearctic	23
Oriental to Australian	3
Palearctic	55
Holarctic	3
Palearctic, Oriental, Australian	2
Palearctic, Oriental to Australian trans. zone	1
Ethiopian, Palearctic, Oriental, Australian	1
Ethiopian, Palearctic, Australian	1
Ethiopian, Palearctic, Oriental	6
Ethiopian, Oriental	1
Ethiopian trans. zone, Palearctic and Oriental	1
Ethiopian trans. zone to Palearctic	1
Ethiopian, Palearctic	1
Himalayan only	16

Table 14. Subdivisions of the Oriental element.

Range	Number of species
Indochinese	42
Indochinese and Malaysian	14
Indochinese, Malaysian and Indian	16
Indochinese and Indian	2
Indian	1
Ethiopian trans. zone down through:	
Indian, Indochinese and Malaysian	1
Indian, Indochinese	1
Indian	2
Australian trans. zone up through:	
Malaysian, Indochinese and Indian	4
Malaysian and Indochinese	1

species range into both the Indochinese and Malaysian but only 2.4 per cent extend into both the Indochinese and Indian subregions.

If one examines the smaller group of 23 species that overlap into both the Palearctic and Oriental regions, the predominance of the Indochinese proportion is further accentuated. Here, as shown in table 15, the Indochinese proportion is 73 per cent, the Malaysian 13 per cent, and the Indian 0.0 per cent. The Indochinese and the Indian together comprise 9.0 per cent of this sampling. Also note from tables 14 and 15 that there are no species with discontinuous ranges in the Malaysian and Indian subregions, for all include the Indochinese subregion in their distribution.

The reason for this seemingly unusual penetration of Indochinese elements far into the western Himalayas is due primarily to the amount of rainfall and type of vegetation in these mountains. The annual rainfall diminishes gradually westward in the Himalayas. Likewise, the proportion of Indochinese forms also decreases in a westernly direction concomitant with an increase in Palearctic types.

Since the study area lies within an avian transition zone the question arises as to whether the whole study area lies in this zone, or whether a part of it is in either the Palearctic or Oriental region. Furthermore, the degree of penetration by either region upon the other needs clarification. The species composition of the avifauna,

Table 15. The Oriental ranges of Palearctic-Oriental overlaps.

Oriental range	Number of species
Indochinese	17
Indochinese, Malaysian	3
Indochinese, Malaysian, Indian	1
Indochinese, Indian	2
Indian	0

in relation to altitude and season but without direct regard for habitat, provides some data for analysis with respect to these questions.

The population fluctuation correlated with altitude and season is given in table 16. The species are listed for the altitude and season at which they were actually noted; not for the hypothetical height and season at which they might occur A number of species are either Palearctic-Oriental overlaps, or are restricted to the Himalayan chain and they are assigned to the totals according to their predominant affinities. For example, the monal pheasant is placed in the Palearctic element since it nests above the tree line, winters in the snow zone, and rarely descends even to the median temperate zone.

Data given in table 16 show that at 9,000 feet the avian components of the two biogeographical regions are nearly equal during June; then the population composition shifts to overwhelmingly Palearctic in December. If two proportions are equal, one expects a p value of 0.5. In June at 9,000 feet, the p value is 0.496.

The equality of the two regions at 9,000 feet in June points to this height as a mid-line within the transition zone and that this portion of the study area is neither in the Palearctic nor the Oriental divisions. Nevertheless, at 9,000 feet in winter the composition of the population is definitely Palearctic for less than 25 per cent of the avifauna is classed as Oriental.

Table 16. Population fluctuation correlated with season and altitude.

Species range	9,000 ft.		7,000 ft.		5,000 ft.	
	June	Dec.	June	Dec.	June	Dec.
Palearctic	14	12	14	27	5	5
overlaps	4	3	7	15	2	3
Himalayan	1	1	4	9	1	2
total	19	16	25	51	8	10
percentage	46	76	36	56	18	32
Oriental	20	4	39	38	35	19
overlaps	1	0	5	1	2	1
Himalayan	1	1	0	1	0	1
total	22	5	44	40	37	21
percentage	54	24	64	44	82	68

The situation at 7,000 feet in June shows that the Palearctic is represented by 36 per cent while the Oriental has 64 per cent. One would expect an increase in the Oriental forms as one drops away from the transition mid-line and this is shown to be the case in my area. During the winter, however, there is a marked increase in Palearctic types so that at 7,000 feet in December the Palearctic proportion is 56 per cent while the Oriental is 44 per cent. The p value for this winter proportion equality is p=0.49 which is less than that measured at 9,000 feet in June. Consequently, the mid-line between the Palearctic and the Oriental in the study area during the winter falls slightly below the 7,000 foot level.

At 5,000 feet the Oriental birds are very conspicuous, for in June the following percentages were noted: 82 for Oriental, 18 for Palearctic. This indicates that the Oriental region, with respect to birds, apparently extends up to nearly 5,000 feet in summer. The winter situation also shows this proximity to the Oriental for in December the Palearctic is represented by 32 per cent, whereas the Oriental maintains 68 per cent. Note that in the winter at 9,000 feet almost the reverse is the case: the Palearctic with 76 per cent and the Oriental with 24 per cent.

These figures also point out the penetration into either zone by birds of the other. The plants of the study area, except in the subtropical stream valleys, are definitely temperate and are consequently associated with the Palearctic

region. Oriental plants are subtropical and tropical. If birds of either region were capable of equal "penetrating power", then the center of the avifauna transition should be along the subtropical-temperate break. However, as has been shown, the bird population is largely Oriental at this subtropical-temperate division and the mid-line between the two avian assemblages falls in a cold boreal fir forest in June, moving to a point just under 7,000 feet during the winter. The presence of Oriental forms in the Palearctic zone has been noted before (especially in regard to China) and this is definitely upheld in this study area where the telescoping effect of altitude clarifies the situation.

CLIMATIC INFLUENCES

Monsoons

In considering the effects of the monsoon rains on birds, the fact that it does not rain uniformly or continuously for 85 days (see table 2) is important. In fact, most of the daylight hours are free of rain.

The behavior of birds during the monsoons can be divided into three categories: activity during hours of no rain, activity during light rain, and activity during heavy rain. Light rain was interpreted as ranging from a drizzle to about 20 mm per hour; heavy rain as a fall of about 20 mm or over per hour.

When it was not raining, the activity of birds differed only slightly from other times of the year. In the

monsoon period plant growth is luxurious and insect life increases, reducing hunting time and foraging distances of birds so that they are noticeably less active.

Light rain has a definite effect on birds, for although foraging does not stop, they are forced close to the ground and reduce their flights across open spaces. Arboreal species such as the yellow-cheeked tit are found in low bushes and a hunting party of several species may occupy thick tangles of shrubs and annuals on or with five feet from the ground. Consequently there is a direct relationship between the intensity of the rain and the position of the birds.

Little avian activity occurs during periods of heavy rain. This may be due in part to the observational difficulties under these curcumstances. However, it was noted that birds in a heavy rain move towards the interior of the thickest bushes available. They also select small, thickly foliaged trees and remain near the trunk. For example, a party of three parids, flycatcher warblers, and white-browed blue flycatchers was spread through the lower parts of a large tree and around in the secondary growth during moderate rain. The rain increased in intensity during the period of observation and the hunting party moved quickly into a small leafy tree, particularly near the trunk, and into two adjoining bushes. The birds shifted occasionally and continued to call, but were hard to hear even at twenty feet away.

Certain species do not seem to mind getting wet in light or moderate rain for they sit on exposed perches with the water running off their feathers. Several species that were observed perched in open positions in rain are listed in table 17. Moreover a few species also vocalized from exposed perches. The jungle crows have a specific rain call (a deep "kaaa" or "kula") that they give from perches in rain. Whistling thrushes often whistle for long periods from exposed branches during a light rain.

Rain is not the only factor affecting bird behavior. The cloud cover (see table 3) probably reduces the ability of carnivorous birds to locate food. The wide-ranging vultures, such as the Himalayan griffon and the black vulture, that do not utilize garbage dumps are greatly affected by clouds. Griffons are occasionally seen sailing within twenty feet of the ground during heavy mists. In the monsoons these large scavengers concentrate in interior valleys that are usually free of ground-level clouds.

Except for the wide-ranging species the mist does not seriously inhibit avian activities. Flycatchers continue to hawk insects under misty conditions and even forage in light rain. For example, white-browed flycatchers were seen catching insects during a light rain as far as twenty feet out from their perches.

During the monsoons there are fewer bird species present than in other seasons (see table 3) yet food availability in terms of insects and berries is at the

Table 17. Birds seen on exposed perches in rain.

Species	Freq. on exposed perches
Common kite	occasional
Ashy drongo	frequent
Jungle crow	frequent
White-cheeked bulbul	occasional
Common myna	frequent
Jungle myna	frequent
Stone chat	occasional
Whistling thrush	frequent
Mistle thrush	occasional
Upland pipit	occasional

highest level (see table 5). This relationship may help the birds in two ways. First, the young of the year become established when food is plentiful and predation somewhat reduced. Secondly, this is a period of molt for many species and their reduced mobility would be compensated for by increased food availability.

The monsoon period is also a time of post-breeding dispersion. Several species are seen in places where they were otherwise not regularly noted. For example, the Himalayan treepie is common in the oak forests at 7,000 feet during the late summer but not at other times. Other species with this dispersal tendency are the common hill partridge, green pigeon, rusty-cheeked scimitar babbler, and the white-throated laughing thrush.

Many plants appear during the monsoons, including the sporophytes of more than 80 species of ferns. However, most birds made little or no use of ferns. A tragopan, Tragopan satyra (Linnaeus), collected by my father in Nepal had its crops full of curled fern fronds, but I noted no birds feeding on ferns. In one case Polystichum squarrosum was utilized as a covering over a grey-headed flycatcher warbler nest, and various rhizomes are used in nest construction by several species.

Another conspicuous phenomenon associated with the rains is the appearance of leeches; however, no instances of bird predation on these animals were recorded.

Winter

During the winter most birds either move downhill or remain as residents. Blue grouse in the western USA move uphill in winter (Marshall, 1946). During my study red-billed babblers, white-cheeked bulbuls, white-eyes, Himalayan barbets, and slaty-headed parakeets tended to move uphill during the winter due either to water or food availability.

Red-billed babblers inhabit valleys up to about 6,000 feet during the summer, but in late winter they are common between 7,000 feet and 7,500 feet in ban oak forest and suitably bushy country.

In the summer white-cheeked bulbuls are common in bushes lining ravines at or below 6,500 feet. Then during the winter they move in flocks of up to 30 birds into ban oak forests between 7,000 and 7,500 feet. At one place at 7,300 feet eight birds were noted on a patch of snow about 12 inches square. The birds were pecking at the snow which when examined showed no evidence of embedded food, so they were probably after moisture. White-cheeked tits and grey-headed flycatcher warblers also peck at snow and may secure water in this way. The presence of snow may allow some birds to occupy otherwise dry forests.

On 8 May a flock of white-eyes was seen at 8,300 feet in open barberry country, but this is unusual because most summer records are of birds below 6,500 feet. In November this species appears commonly between 7,000 and 7,500 feet where it remains until March and then apparently

moves downhill.

In summer the slaty-headed parakeets and Himalayan barbets are usually found in heavily-foliaged valleys below 7,000 feet. However, food sources attract them upwards in winter and they were most numerous at 7,500 feet during the late winter.

Spring

The heavy snowfall on 1 and 2 April 1965 did not noticeably affect the birds because the snow melted quickly. Summer visitors that had already arrived at 7,000 feet remained through the storm. Several ashy drongos (a tropical species) were recorded perched on snow-covered trees, surveying the quiet white landscape. These summer nesters had not begun to build and the species that were nesting by early April were largely those with protected nests. Had the snow remained much longer than two days, it might have had a profound effect on insectivorous species.

Another climatic condition affecting nesting birds is the spring hailstorm. These storms occur at any time between April and June and I estimate that the majority of exposed nests are destroyed during the most severe hailstorms that hit this area each year. A severe hailstorm in late May 1965 passed quickly over the area, and four of seven exposed nests under observation were destroyed. Many species in the study area nest in holes or under protective overhangs and consequently would not

be greatly affected. Few of the thunder showers recorded each year (see page 24) would be severe enough to damage nests.

Daily wind fluctuations (see page 25) with diurnal updrafts affect the movements of gliding species such as the lammergeier. Violent winds during spring storms also affect nesting success and were responsible for the loss of one ashy drongo nest under observation.

INTERSPECIFIC ASSOCIATIONS

Birds often forage or pass close to other species, but most of them do not form constant or continuous associations. However, other species are often found together and move about as a unit. I termed such interspecific aggregations "hunting parties" and have seen them in tropical Asia, Japan, Mexico, and the U.S.A. Hunting parties are also reported by others (see Willis, 1966).

During this study the associations were usually composed of smaller passeriforms, some with woodpeckers attached. The species seen in hunting parties are listed in table 18.

Three factors may account for this behavior in birds: (1) if a species were gregarious in nature, its members might group together on a purely social basis; (2) the passage of many birds through a tree might aid in foraging since insects disturbed by one bird might be picked off by

Table 18. Composition of hunting parties at Mussoorie.

Species	Frequency
Speckled piculet	occasional
Himalayan pied woodpecker	regular
Brown-fronted pied woodpecker	regular
Ashy drongo	occasional
Long-tailed minivet	occasional
Red-winged shrike babbler	occasional
Stripe-throated minla	occasional
Sooty flycatcher	occasional
White-browed blue flycatcher	regular
Verditer flycatcher	regular
Grey-headed flycatcher	regular
Rufous-tailed flycatcher	occasional
Orange-barred leaf warbler	regular
Yellow-rumped leaf warbler	regular
Grey-faced leaf warbler	regular
Yellowish leaf warbler	regular
Plain leaf warbler	occasional
Tytler's leaf warbler	occasional
Large-crowned leaf warbler	regular
Grey-headed flycatcher warbler	regular
Goldcrest	occasional
Yellow-browed tit	occasional
Green-backed tit	regular
Crested black tit	regular
Yellow-cheeked tit	regular
Red-headed tit	regular
White-tailed nuthatch	regular
Himalayan treecreeper	regular
White-eye	occasional

another; and (3) an increase in individuals might reduce the danger of surprise attack.

The first possibility mentioned was not tested but is not assumed to be a major factor. The second idea seems more probable for these aggregations are composed almost entirely of insectivorous birds. However, if obtaining food were a main objective of a hunting party, the birds would naturally stay around a rich food source until forced to more on by diminishing supplies. Such an explanation does not seem adequate. For example, the flowering Hedra helix attracted many small insects. When a hunting party approached an ivy vine, a few birds discovered and caught a number of insects. However, in less than two minutes the warblers left to continue along with the main hunting party, although there were many insects still left at the vine. Examples like this are commonplace and do not point to food gathering as a motivating principle in hunting party formation. Only rarely was an insect disturbed by one bird seen captured by another bird.

Protection from predators seems to be the major reason for the existance of hunting parties. Many times while I was watching the birds, an alarm call would be given by one of them. If the call is sharp and "urgent", the birds immediately dive into the cover of a nearby bush or move in towards the center of the tree canopy. The alarm call is given for danger approaching either from the ground or from the sky. Predatory mammals, including man, evoke sharp

warning notes. A hawk flying anywhere in the vicinity causes alarm. A slowly circling crow does not release the reaction but a diving crow or even a whistling thrush does. The sight of a snake or of perched owls also stirs up considerable agitation. However, this warning system is not completely foolproof as the attack of a kestrel showed. In the latter case, one tit uttered a weak alarm note as the falcon flew away with its kill, but not one bird gave a definite, sharp, alarm call even though the victim was taken from the middle of the aggregation.

The hunting party is not a static phenomenon for its composition changes throughout the day. The nucleus of a hunting party forms within the first five minutes of early morning activity (see table 19).

Some species join a hunting party as long as it is within a certain geographical area. For example, white-browed blue flycatchers are often seen with a hunting party, but they do not remain with it for the whole day; as an assemblage passes from one place to another it is joined and later left by several of these flycatchers. On the other hand, the grey-headed flycatcher tends to stay with the hunting party throughout the day. Verditer flycatchers often join a group during the middle of the day, but they usually feed alone during the early morning and late afternoon hours.

The composition of a hunting party also varies with the season. From October through February, the party is

Table 19. Formation of a hunting party on 30 Sept., ban oak forest, between 6,200 and 6,900 ft. alt.

Time	Activity	Distance of first appearance from area of formation, yds.	Light, ft.-c.
5:25	first whistling thrush calling		Jupiter visible
5:30	pigmy owl calling; whistling thrush singing; rooster crowing		
5:37	first jungle crow arriving from roost		
5:40	first red-billed magpie calling		
5:45	crepuscular cicada calling		1
5:47	scimitar babbler calling		3
5:49	white-browed blue flycatcher calling	30 NW	5
5:52	two whistling thrushes chasing each other		
5:59	treepie uttering alarm call; grey-headed flyc. warbler calling (2)	10 E 50 N	18
6:00	first white-cheeked tits calling	20 E	
6:01	first white-tailed nuthatches calling	10 N	
6:02	yellow-cheeked tits calling red-headed tits calling	30 SE 15 N	26
6:04	leaf warbler calling	30 S	31
6:07	party formed		40
6:09	parakeets calling from valley		47
6:10	brown-fronted pied woodpecker calling	100 E	
6:11	brown-fronted pied joins party		63

fairly stable and is composed of resident yellow-cheeked tits; green-backed tits, red-headed tits, grey-headed flycatcher warbler, white-tailed nuthatches, treecreepers and brown-fronted pied woodpeckers with wintering treecreepers, black tits, goldcrests and an occasional yellow-browed tit.

A hunting party has a routine schedule. For example, one party observed over a three year period covered an area of about 10 acres and arrived at certain points in its schedule at regular times. This timing fluctuated with the season and composition of the party. Within the assemblage each species maintained a more or less distinct foraging level and position within the party.

Altitude apparently changes the composition of hunting parties. Close associations between yellow-naped yuhinas, black-browed flycatcher warblers, grey-headed flycatchers and phylloscopids are noted at 5,000 feet but they lack the cohesiveness of a well-defined hunting party. At 6,000 feet the composition of the groups is about the same as at 7,000 feet. At the 8,000 foot moru oak level, the black tit and phylloscopid participation increases, but the yellow-cheeked tits are eliminated and the red-headed tits reduced At the 9,000 foot fir forest level, fewer species are seen, but with over 30 black tits involved in some parties, the total number of individuals in a foraging party may actually increase.

The composition of groups also varies according to habitat. No hunting parties were observed in grasslands

Table 20. The composition of selected hunting parties.

Species	Numbers
20 February, ban oak forest, 8:00 AM	
green-backed tits	4
yellow-cheeked tits	2
red-headed tits	6
phylloscopids (2 species)	7
brown-fronted pied woodpeckers	2
white-tailed nuthatches	3
stripe-throated minlas	6
treecreepers	2
grey-headed flycatcher warblers	7
totals: 39 birds of 10 species	
5 March, ban oak forest, 4:00 PM	
green-backed tits	2
red-headed tits	6
phylloscopids (2 species)	6
kinglets	2
grey-headed flycatcher warblers	4
totals 20 birds of 6 species	
5 March, cultivation edge, 4:30 PM	
blue-headed robins	3
blue-fronted redstarts	2
meadow buntings	8
totals: 13 birds of 3 species	
18 April, ban oak and ringal bamboo, 4:30 PM	
yellow-cheeked tits	2
green-backed tits	2
red-headed tits	4
phylloscopids (3 species)	15
total: 23 birds of 6 species	

Table 20. continued.

Species	Number of birds
28 Sept. ban oak forest, 7:00 AM	
yellow-cheeked tits	6
green-backed tits	8
nuthatches	2
grey-headed flycatcher warblers	4
phylloscopids	2
brown-fronted pied woodpecker	1
treecreepers	2
totals: 25 birds of 7 species	
2 October, fir forest, 9:00 AM	
black tits	31
phylloscopids (2 species)	9
nuthatches	3
treecreepers	2
totals: 45 birds of 5 species	
3 December, ban oak forest, 7:00 AM	
red-headed tits	8
flycatcher warblers	5
phylloscopids (3 species)	7
green-backed tits	4
nuthatches	2
yellow-cheeked tits	5
totals: 31 birds of 8 species	

or in chir pine forests. The composition of an assemblage in a deodar stand resembles that in ban oak forests as birds pass from one habitat into the other during their tours.

Another type of interspecific association was observed between Hodgson's mountain finches and altai accentors which were seen together regularly in winter. The adaptive advantage for either species can only be conjectured. Both species forage in open country and larger aggregations of individuals would increase the possibility of recognizing danger.

SUMMARY

The habitat selections, foraging positions, interspecific associations, altitudinal distributions, seasonal movements, behavior patterns and zoogeographical affinities of the birds near Mussoorie, U.P., India were studied during a period from 6 July 1963 to 21 July 1966.

The study area, at 30 degrees N latitude and 78 degrees E longitude, was located in the western Himalayas some 200 miles northwest of the border of Nepal and 200 miles southeast of the border of Kashmir. The area was selected on the basis of topographical and vegetational features in the altitudinal zone between 5,000 feet and 9,000 feet. The vegetation was composed of temperate species with subtropical elements below 6,000 feet. Approximately 100 inches of rain fell during the summer monsoons. The habitats studied were: ban oak, ban oak scrub, moru oak, moru oak scrub, chir pine, deodar, fir, cliffs, grasslands, subtropical hardwoods, stream beds and cultivations.

Over 2,000 hours were spent observing birds in the study area. Additional data were obtained from more than 1,000 birds collected here prior to 1953; these are now in the collections of the Field Museum of Natural History, Chicago, and at Albion College, Albion, Michigan. Other specimens are in the research collections of the Michigan State University Museum.

The habitat selection of each species was recorded. Ban oak scrub had the greatest species diversity (119) with the ban oak (115 species) a close second. Chir pine (12), cliffs (8),

and stream beds (8) had the lowest numbers of birds.

Populations in the ban oak scrub and the ban oak habitats, with a z value of 0.42, were the most similar of the associations studied. Of the birds found here, 104 species were predominantly insectivorous, 38 selected seeds, and 20 were carnivorous. The feeding level of each species was examined; the greatest number were terrestrial foragers (80), followed by high tree (39), bush (31) and low tree (25). Birds in ban oak forests were more or less evenly spaced at the different foraging levels, whereas in the fir forest, most fed either on the ground or in the highest parts of the trees.

Birds in the study area were predominantly Oriental (42 per cent) and Palearctic (27 per cent). The Indochinese subregion of the Oriental had a major influence on this avifauna. Analyses of the populations at 9,000 feet, 7,000 feet and 5,000 feet showed that the center of the Palearctic-Oriental transition zone apparently falls at about 9,000 feet in the summer and just below 7,000 feet in the winter.

No two avian species occupied the same ecological niche. Although the niches of most species overlapped with one or more other birds, only Leucosticte nemoricola and Prunella himalayana apparently held nearly the same position for as long as three months. Ecologically similar species, Turdoides striatus and Garrulax lineatus for example, often occupied different altitudinal levels.

The monsoon season modified avian activity. Birds

continued to forage in light rain but sought shelter under leaves and in tangles during periods of heavy rain. Clouds restricted movements of scavengers and accipiter-type predators.

Seasonal movements of birds demonstrated that many species passed through the study area to winter further south and that some Palearctic forms remained over winter. Conversely, a number of birds moved up to the study area to nest during the summer. A late monsoon dispersal was noted in seven species. Five species moved uphill in winter.

Interspecific associations changed in size and composition through a day or over a period of a year. I felt that the formation of these groups was based on protection from predators rather than added food-gathering potential.

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