

Investigation on Bird Diversity in Tianzhu Mountain

Bai Jingjing

Forestry Bureau of Anqing City, Anqing 246001, China

Abstract The bird diversity of Tianzhu Mountain in southwest Anhui Province was investigated by line transect method from 2018 to 2019. Combined with field survey and historical data analysis, it was found that there were 175 species of birds belonging to 46 families and 16 orders in Tianzhu Mountain. A total of 70 species were recorded in this survey, belonging to 31 families and 9 orders, 2 of which, *Butastur indicus* and *Yuhina castaniceps*, were newly recorded birds in the region. In terms of species number, there were 109 species and 28 families in the order Passeriformes, accounting for 62.29% and 60.87% of all species and families. In terms of the composition of bird residence type, resident birds accounted for 45.71% of the total species, followed by summer migratory birds (24.57%), winter migratory birds (17.14%) and travelling birds (12.57%). There were 123 species of breeding birds, accounting for 70.29% of the total species. The results suggest that the bird resources in Tianzhu Mountain area are relatively rich, and the monitoring and protection of birds should be strengthened to provide a more adequate research basis for biodiversity conservation in Tianzhu Mountain.

Keywords Tianzhu Mountain; Birds; Biodiversity; Protection

Tianzhu Mountain (116° 27' E, 30° 43' N) is located at the junction of Qianshan and Yuexi in the southwest of Anhui Province, with an altitude of 1 489.2 m. Tianzhu Mountain area belongs to the north subtropical monsoon climate zone, and the average annual temperature of Tianzhu Mountain is about 9.5 °C. From the perspective of biota, Tianzhu Mountain lies at the junction of Palearctic realm and Oriental realm of fauna, and at the junction of north temperate zone and north subtropical zone of flora. Special environmental conditions, superior natural environment, complex ecosystem units and transitional geographical flora provide good habitats for the growth of plants and animals^[1–2].

In the ecosystem, birds occupy a higher trophic level and are sensitive to the environment, often serving as an important indicator group for ecological environment assessment^[3–5]. So far, relevant scholars have conducted corresponding studies on bird diversity in Dabie Mountain area and Yaoluoping National Nature Reserve^[6–10], but no targeted studies have

been conducted on bird diversity in Tianzhu Mountain area. Therefore, the species and quantity of birds in Tianzhu Mountain were investigated from July 2018 to May 2019, so as to find out the status quo of bird diversity resources in Tianzhu Mountain, analyze the problems existing in the process of bird diversity protection, and put forward targeted protection measures and suggestions. The results would provide a scientific basis and lay a theoretical foundation for further management and policy formulation of protected area and ecological environment quality detection.

1 Methods

1.1 Survey methods The bird diversity of Tianzhu Mountain was investigated by line transect method from July 2018 to May 2019. The survey was conducted in Tianzhu Mountain Scenic Spot, and a total of 7 transects were set, each with a length of 3–5 km. The transects involved low-altitude hilly habitats, high-altitude habitats, and low- and middle-altitude hilly habitats (Fig.1).

Surveys were usually conducted in the early morning or evening when the weather was clear. The species and number of birds flying unidirectionally within 50 m on both sides of transects were observed and recorded by using a 10× telescope at a walking speed of 2–3 km/h. For bird species that were not easy to be directly identified, photos were taken with a telephoto camera, and then compared and identified with the help of *A Field Guide to the Birds of China*^[11]. The bird classification system referred to *A Checklist on the Classification and Distribution of the Birds of China (Third Edition)*^[12], and the protection level conformed to *Catalog of Wildlife under Key State Protection (2021 Edition)*^[13].

1.2 Data analysis The frequency, relative number, relative time component, relative spatial component, importance value, biodiversity index, evenness index and other parameters of birds were calculated according to the following methods.

Frequency = (Number of transects of a certain bird/Total number of surveyed transects) × 100%

Relative quantity component = (Number of individual birds observed/Number of individual birds with the largest num-



Fig.1 Setup diagram of survey transects for birds

ber) $\times 100\%$

Relative time component = (Number of surveys in which a particular bird has been observed/Total number of surveys) $\times 100\%$

Relative spatial component = (Number of transects with distribution of a certain bird/Total number of transects) $\times 100\%$

Importance value = (Relative quantity component + Relative time component + Relative spatial component)/3

The dominance of species was determined according to importance value: importance value > 0.8 , dominant species; $0.5 < \text{importance value} < 0.8$, subdominant species; $0.2 < \text{importance value} < 0.5$, common species; importance value < 0.2 , occasional species.

Through the calculation of the above indexes, the dominance degree of various birds in Tianzhu Mountain area was demonstrated, and the importance degree of various birds in this area was analyzed, in order to master the diversity, distribution and community structure of birds.

2 Results and Analysis

2.1 Species composition

According to

the results of field survey and historical data analysis, there were 175 species of birds in Tianzhu Mountain, belonging to 46 families and 16 orders. A total of 70 species of birds belonging to 31 families and 9 orders were recorded in this survey. There were two new species of birds that had not been recorded in historical data, including *Butastur indicus* and *Yuhina castaneiceps*.

In terms of species number, there were 109 species and 28 families in the order Passeriformes, accounting for 62.29% and 60.87% of all species and families, showing a very obvious advantage. The other orders included only 1 family except Charadriiformes, which included 3 families, and Coraciiformes, which included 2 families (Tab.1).

2.2 Residence type and fauna analysis

In terms of the composition of resident birds, there were 80 species of resident birds, accounting for 45.71% of the total species, followed by summer migratory birds (43 species, 24.57%), winter migratory birds (17.14%) and travelling birds (12.57%). There were 123 species of breeding birds, accounting for 70.29% of

the total species (Fig.2).

In terms of fauna composition of breeding birds, there were 54 species in the Oriental realm, accounting for 43.90%, slightly higher than widespread species (45 species); and there were only 24 species in the Palaearctic realm, accounting for 19.51% (Fig.3).

2.3 Composition of ecological type

According to the ecological habits of different bird groups, the birds distributed in Tianzhu Mountain can be divided into six ecological types. Songbirds had the largest species number, accounting for 62.29% of the total species; followed by scansorial birds (12.00%), raptors (9.71%), wading birds (9.71%), natatorial birds (8 species, 4.57%), and terrestrial birds (3 species, 1.71%). Generally speaking, forest birds composed of songbirds, scansorial birds and raptors accounted for the vast majority, while water birds composed of natatorial birds and wading birds accounted for only 14.28% (Tab.2).

2.4 Community composition A total of 70 species of birds were recorded in the field survey. There were five dominant species, including *Parus major*, *Aegithalos*

Tab.1 Bird species composition of Tianzhu Mountain Scenic Spot

No.	Order	Number of families	Proportion of families// %	Number of species	Proportion of species// %
1	Galliformes	1	2.17	3	1.71
2	Anseriformes	1	2.17	5	2.86
3	Podicipediformes	1	2.17	1	0.57
4	Columbiformes	1	2.17	3	1.71
5	Caprimulgiformes	1	2.17	1	0.57
6	Cuculiformes	1	2.17	6	3.43
7	Gruiformes	1	2.17	3	1.71
8	Charadriiformes	3	6.52	9	5.14
9	Pelecaniformes	1	2.17	7	4.00
10	Accipitriformes	1	2.17	11	6.29
11	Strigiformes	1	2.17	4	2.29
12	Bucerotiformes	1	2.17	1	0.57
13	Coraciiformes	2	4.35	6	3.43
14	Piciformes	1	2.17	4	2.29
15	Falconiformes	1	2.17	2	1.14
16	Passeriformes	28	60.87	109	62.29
Total		46	100.00	175	100.00

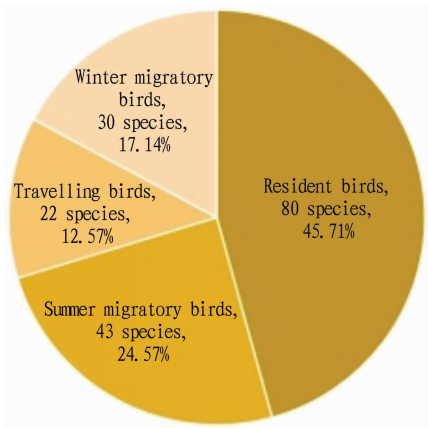


Fig.2 Residence type composition of birds in Tianzhu Mountain Scenic Spot

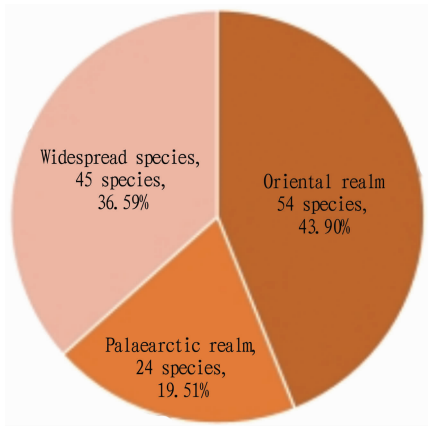


Fig.3 Fauna composition of breeding birds in Tianzhu Mountain Scenic Spot

concinus, *Garrulax canorus*, *Zosterops japonicus* and *Pycnonotus sinensis*. There were 11 subdominant species, including *Paradoxornis webbianus*, *Hypsipetes leucocephalus*, *Cettia fortipes*, *Spizixos semitorques*, *Pomatorhinus ruficollis*, *Phoenicurus aureus*, *Abroscopus albogularis*, *Streptopelia orientalis*, *Garrulus glandarius*, *Urocissa erythrorhyncha*, and *Parus venustus* (Tab.3).

2.5 Spatial distribution and change

The bird distribution of each transect in the four surveys was counted, and the species number and quantity of birds were counted. Moreover, the biodiversity index and evenness index of each transect were calculated, and the temporal and spatial distribution is shown in Tab.4.

From the perspective of bird distribution time, the species number, quantity and biodiversity index of birds in winter

Tab.2 Ecological type composition of birds in Tianzhu Mountain Scenic Spot

No.	Ecological type	Number of families	Proportion of families//%	Number of species	Proportion of species//%
1	Songbird	28	60.87	109	62.29
2	Scansorial bird	7	15.22	21	12.00
3	Terrestrial bird	1	2.17	3	1.71
4	Raptor	3	6.52	17	9.71
5	Wading bird	4	8.70	17	9.71
6	Natatorial bird	3	6.52	8	4.57
Total		46	100.00	175	100.00

Tab.3 Community composition of birds in Tianzhu Mountain National Forest Park

No.	Scientific name	Frequency %	Proportion of time//%	Proportion of transects//%	Proportion of quantity//%	Importance value
1	<i>Parus major</i>	88.89	100.00	100.00	100.00	1.00
2	<i>Aegithalos concinnus</i>	37.04	100.00	85.71	70.66	0.85
3	<i>Garrulax canorus</i>	88.89	100.00	100.00	50.47	0.83
4	<i>Zosterops japonicus</i>	44.44	100.00	85.71	61.83	0.83
5	<i>Pycnonotus sinensis</i>	51.85	100.00	85.71	60.57	0.82
6	<i>Paradoxornis webbianus</i>	48.15	75.00	85.71	75.08	0.79
7	<i>Hypsipetes leucocephalus</i>	40.74	75.00	114.29	36.59	0.75
8	<i>Cettia fortipes</i>	59.26	75.00	100.00	41.01	0.72
9	<i>Spizixos semitorques</i>	44.44	100.00	85.71	20.82	0.69
10	<i>Pomatorhinus ruficollis</i>	44.44	100.00	85.71	11.99	0.66
11	<i>Phoenicurus aureus</i>	25.93	100.00	85.71	4.42	0.63
12	<i>Abroscopus albogularis</i>	37.04	75.00	85.71	23.03	0.61
13	<i>Streptopelia orientalis</i>	48.15	100.00	71.43	10.73	0.61
14	<i>Garrulus glandarius</i>	37.04	100.00	71.43	9.78	0.60
15	<i>Urocissa erythrorhyncha</i>	29.63	100.00	57.14	7.89	0.55
16	<i>Parus venustus</i>	22.22	50.00	71.43	28.71	0.50
17	<i>Phylloscopus inornatus</i>	22.22	50.00	71.43	19.24	0.47
18	<i>Phylloscopus reguloides</i>	18.52	50.00	57.14	29.97	0.46
19	<i>Passer montanus</i>	22.22	75.00	42.86	17.98	0.45
20	<i>Motacilla alba</i>	18.52	100.00	28.57	5.05	0.45
21	<i>Hirundo daurica</i>	25.93	50.00	71.43	9.46	0.44
22	<i>Phylloscopus proregulus</i>	18.52	50.00	71.43	5.36	0.42
23	<i>Lonchura punctulata</i>	14.81	75.00	28.57	10.09	0.38
24	<i>Copsychus saularis</i>	14.81	50.00	57.14	1.58	0.36
25	<i>Alcippe morrisonia</i>	11.11	50.00	42.86	14.83	0.36
26	<i>Lanius schach</i>	18.52	75.00	28.57	2.21	0.35
27	<i>Leiothrix lutea</i>	11.11	50.00	42.86	10.09	0.34
28	<i>Passer rutilans</i>	14.81	50.00	42.86	4.42	0.32
29	<i>Tarsiger cyanurus</i>	11.11	50.00	42.86	2.52	0.32
30	<i>Latoucheornis siemsseni</i>	11.11	50.00	42.86	1.26	0.31
31	<i>Streptopelia chinensis</i>	11.11	50.00	28.57	10.09	0.30
32	<i>Lonchura striata</i>	11.11	50.00	28.57	6.62	0.28
33	<i>Aegithalos caudatus</i>	7.41	50.00	28.57	6.62	0.28
34	<i>Pericrocotus cantonensis</i>	7.41	50.00	28.57	5.36	0.28

Tab.3 Community composition of birds in Tianzhu Mountain National Forest Park

No.	Scientific name	Frequency %	Proportion of time // %	Proportion of transects // %	Proportion of quantity // %	Importance value
35	<i>Hemixos castanonotus</i>	7.41	50.00	28.57	3.47	0.27
36	<i>Enicurus leschenaulti</i>	14.81	50.00	28.57	1.89	0.27
37	<i>Pycnonotus xanthorrhous</i>	7.41	50.00	28.57	1.26	0.27
38	<i>Monticola rufiventris</i>	7.41	50.00	28.57	0.95	0.27
39	<i>Myophonus caeruleus</i>	7.41	50.00	28.57	0.95	0.27
40	<i>Delichon dasypus</i>	7.41	50.00	14.29	9.78	0.25
41	<i>Cuculus saturatus</i>	11.11	25.00	42.86	5.36	0.24
42	<i>Sturnus sericeus</i>	11.11	25.00	42.86	5.05	0.24
43	<i>Garrulax perspicillatus</i>	7.41	50.00	14.29	4.42	0.23
44	<i>Monticola solitarius</i>	7.41	25.00	28.57	2.21	0.19
45	<i>Emberiza spodocephala</i>	7.41	25.00	28.57	0.95	0.18
46	<i>Lanius cristatus</i>	7.41	25.00	28.57	0.63	0.18
47	<i>Dicrurus macrocercus</i>	7.41	25.00	14.29	6.31	0.15
48	<i>Anser fabalis</i>	3.70	25.00	14.29	4.10	0.14
49	<i>Yuhina castaneiceps</i>	3.70	25.00	14.29	4.10	0.14
50	<i>Prinia inornata</i>	3.70	25.00	14.29	1.58	0.14
51	<i>Ardeola bacchus</i>	3.70	25.00	14.29	1.26	0.14
52	<i>Emberiza cioides</i>	3.70	25.00	14.29	1.26	0.14
53	<i>Eudynamis scolopacea</i>	3.70	25.00	14.29	1.26	0.14
54	<i>Acridotheres cristatellus</i>	3.70	25.00	14.29	0.95	0.13
55	<i>Emberiza elegans</i>	3.70	25.00	14.29	0.95	0.13
56	<i>Amaurornis phoenicurus</i>	3.70	25.00	14.29	0.63	0.13
57	<i>Gracupica nigricollis</i>	3.70	25.00	14.29	0.63	0.13
58	<i>Dicrurus leucophaeus</i>	3.70	25.00	14.29	0.63	0.13
59	<i>Saxicola ferrea</i>	3.70	25.00	14.29	0.63	0.13
60	<i>Carduelis sinica</i>	3.70	25.00	14.29	0.63	0.13
61	<i>Pica pica</i>	3.70	25.00	14.29	0.63	0.13
62	<i>Cettia canturians</i>	3.70	25.00	14.29	0.63	0.13
63	<i>Syrnaticus reevesii</i>	3.70	25.00	14.29	0.32	0.13
64	<i>Cuculus canorus</i>	3.70	25.00	14.29	0.32	0.13
65	<i>Accipiter trivirgatus</i>	3.70	25.00	14.29	0.32	0.13
66	<i>Butastur indicus</i>	3.70	25.00	14.29	0.32	0.13
67	<i>Sturnus cineraceus</i>	3.70	25.00	14.29	0.32	0.13
68	<i>Picus canus</i>	3.70	25.00	14.29	0.32	0.13
69	<i>Lanius bucephalus</i>	3.70	25.00	14.29	0.32	0.13
70	<i>Cuculus sparverioides</i>	3.70	25.00	14.29	0.32	0.13

were lower than those in other seasons. There was no significant difference in the species number and quantity of birds in May which was the breeding period. In August, there was little difference in the species number of birds in all transects, but the numbers of birds in Dongguan, Yingzhen Peak and Mystery Valley were significantly lower than those in other

transects. Since October, the species number and quantity of birds in Linjiahe and Longtoulung were significantly higher than those in other transects.

In terms of spatial characteristics of bird distribution, the species number and quantity of birds in Dongguan, Yingzhen Peak and Mystery Valley were generally lower than those in other transects, while

the species number and quantity of birds in Linjiahe and Longtoulung at low altitude were generally higher than those in other transects.

2.6 Distribution of endangered protected birds A total of 20 species of national key protected wild birds were distributed in Tianzhu Mountain area, all of which were state class-II key protected wild animals. Four species were recorded in this field survey, while the rests were recorded in previous surveys by the survey team (Tab.5).

3 Discussion

3.1 Distribution characteristics of birds in Tianzhu Mountain In general, birds in Tianzhu Mountain show the following characteristics in terms of spatial and temporal distribution.

(1) In autumn and winter, the species number of birds in low altitude areas is higher than that in high altitude areas, which may be because mountain forest birds will flock to low altitude areas for overwintering in the late breeding period.

(2) The species number and quantity of birds in Dongguan, Yingzhen Peak and Mystery Valley are lower than those in other transects. Tourist activities and other man-made interference in this area have a certain disturbance on bird distribution.

(3) Although the species number and quantity of birds in low altitude area are higher than those in high altitude area, birds in low altitude area are more common, while those in high altitude area are rare species. For example, *B. indicus*, *Pucrasia macrolopha* and *Syrnaticus reevesii* are most distributed in high altitude mountains, while common species such as *Passer montanus*, *Sturnus* spp. are distributed near villages in low altitude areas.

3.2 Distribution of protected birds in Tianzhu Mountain Among the protected birds distributed in Tianzhu Mountain, the remaining protected birds are breeding birds except *Accipiter nisus*, *Accipiter nisus*, *Buteo buteo japonicus*, which are

Tab.4 Community composition characteristics of various transects at different time

Survey time	Transect	Number of species	Quantity	Margalef	Simpson	Shannon–Wiener	Pielou
August 2018	Dongguan*	6	37	1.38	0.63	1.31	0.73
October 2018	Dongguan	12	77	2.53	0.84	2.06	0.83
May 2019	Dongguan	11	163	1.96	0.83	1.96	0.82
August 2018	Linjiahe	15	121	2.92	0.89	2.34	0.87
October 2018	Linjiahe	19	154	3.57	0.87	2.35	0.80
February 2019	Linjiahe	12	112	2.33	0.82	2.00	0.81
May 2019	Linjiahe	22	152	4.18	0.84	2.41	0.78
August 2018	Longtouling	22	272	3.75	0.83	2.23	0.72
October 2018	Longtouling	21	134	4.08	0.88	2.48	0.81
February 2019	Longtouling	11	88	2.23	0.82	1.93	0.81
May 2019	Longtouling	16	132	3.07	0.89	2.40	0.86
August 2018	Mystery Valley	9	26	2.46	0.75	1.77	0.81
October 2018	Mystery Valley	9	47	2.08	0.85	2.02	0.92
February 2019	Mystery Valley	5	26	1.23	0.62	1.23	0.76
May 2019	Mystery Valley	9	77	1.84	0.79	1.75	0.80
August 2018	Tongluozhai	19	207	3.38	0.86	2.32	0.79
October 2018	Tongluozhai	9	48	2.07	0.78	1.79	0.81
February 2019	Tongluozhai	3	17	0.71	0.55	0.92	0.84
May 2019	Tongluozhai	10	111	1.91	0.82	1.95	0.85
August 2018	Yang Clan Ancestral Hall	15	125	2.90	0.88	2.40	0.89
October 2018	Yang Clan Ancestral Hall	12	59	2.70	0.85	2.15	0.87
February 2019	Yang Clan Ancestral Hall	3	13	0.78	0.46	0.79	0.72
May 2019	Yang Clan Ancestral Hall	22	153	4.17	0.92	2.69	0.87
August 2018	Yingzhen Peak	10	52	2.28	0.76	1.73	0.75
October 2018	Yingzhen Peak	10	131	1.85	0.84	1.99	0.86
February 2019	Yingzhen Peak	2	28	0.30	0.41	0.60	0.86
May 2019	Yingzhen Peak	14	107	2.78	0.81	2.05	0.78

Note: * indicates that Dongguan transect was not investigated during the winter survey because the road was blocked with snow.

winter migratory birds, *B. indicus* and *Falco peregrinus*, which are migratory birds. Therefore, the breeding period should be the key protection period for birds in Tianzhu Mountain. From the point of view of protected bird groups, except for *Centropus bengalensis* and *Milvus migrans lineatus* which are mainly distributed in river habitats, other birds are forest birds, indicating that the protected birds in Tianzhu Mountain mainly depend on forest ecosystem.

In this survey, one *S. reevesii* was recorded in Longtouling, adjacent to the foothill village, with an altitude of only 180 m. *S. reevesii* in Dabie Mountain area

has been only distributed in high altitude deciduous broad-leaved forests with few human activities. Combined with visits to local residents, it is suggested that the wild population of *S. reevesii* is in the recovery stage, and its habitat has expanded to the low altitude area in the southern margin of Dabie Mountain.

3.3 Suggestions on bird protection in Tianzhu Mountain

(1) Carrying out continuous bird monitoring.

At present, Tianzhu Mountain is not only a scenic spot, a national forest park, but also a global geopark. These three protected areas have overlapping phenom-

ena in the management area, and focus on different key protected objects. Scenic spots pay attention to tourism development and protect the natural landscape; national forest park lays emphasis on the protection of forest resources and vegetation; world geopark is inclined to the protection of geological relics. The conservation of birds, relative to other groups, is very deficient. Under the background that ecological civilization construction has received unprecedented attention, the integration and optimization of protected areas are progressing steadily, and the investigation of birds is in urgent need of full implementation.

This survey on birds is the first systematic survey on birds in Tianzhu Mountain. Due to the limitations of weather and seasons, a single survey can not fully reveal the distribution of birds in Tianzhu Mountain. It is suggested that the competent authorities strengthen the cooperation with professional research institutions, continue to carry out the investigation and monitoring of bird resources in Tianzhu Mountain, and point out the direction for the formulation of targeted bird protection policies while further finding out the background.

(2) Strengthening the protection of bird habitats.

According to the survey results, forest birds are the main birds in Tianzhu Mountain, and breeding birds account for the majority in terms of residence type. Therefore, the protection of birds in Tianzhu Mountain should focus on the protection of the breeding and foraging places of birds, namely the forest ecosystem. Although the field survey found that the species number and quantity of birds in low altitude areas are higher than those in high altitude areas, the distribution area of rare birds is still mainly in high altitude areas with better vegetation protection.

(3) Developing targeted protection measures according to the distribution

Tab.5 List of endangered protected birds in Tianzhu Mountain

No.	Order	Family	Scientific name	Geotype	Residence type	Protection level
1	Galliformes	Phasianidae	<i>Pucrasia macrolopha</i>	Oriental realm	R	II
2			<i>Syrnaticus reevesii</i> *	Palearctic realm	R	II
3	Cuculiformes	Cuculidae	<i>Centropus bengalensis</i>	Widespread species	S	II
4	Accipitriformes	Accipitridae	<i>Aviceda leuphotes</i>	Oriental realm	R	II
5			<i>Pernis ptilorhynchus</i>	Widespread species	P	II
6			<i>Milvus migrans lineatus</i>	Widespread species	R	II
7			<i>Spilornis cheela</i>	Oriental realm	R	II
8			<i>Accipiter trivirgatus</i>	Oriental realm	R	II
9			<i>Accipiter soloensis</i>	Oriental realm	S	II
10			<i>Accipiter virgatus</i> *	Widespread species	R	II
11			<i>Accipiter nisus nisosimilis</i>	Palearctic realm	W	II
12			<i>Butastur indicus</i> *	Palearctic realm	P	II
13			<i>Buteo buteo japonicus</i>	Palearctic realm	W	II
14			<i>Hieraaetus fasciatus</i>	Widespread species	R	II
15	Strigiformes	Strigidae	<i>Otus bakkamoena</i>	Widespread species	R	II
16			<i>Bubo bubo</i>	Palearctic realm	R	II
17			<i>Glaucidium cuculoides</i>	Oriental realm	R	II
18			<i>Ninox scutulata</i> *	Oriental realm	S	II
19	Falconiformes	Falconidae	<i>Falco tinnunculus</i>	Widespread species	R	II
20			<i>Falco peregrinus</i>	Widespread species	P	II

Note: "*" indicates protected species discovered in this survey; "II" indicates state class-II key protected wild animals.

characteristics of birds.

The survey results showed that the species number and quantity of birds near the three transects of Dongguan, Yingzhen Peak and Mystery Valley were lower than those in other areas, and birds were mostly distributed in the low altitude areas in winter. It is recommended to focus on bird conservation efforts in high altitude areas during the breeding season, and pay attention to the distribution of birds in low altitude areas in winter. In the future conservation planning of Tianzhu Mountain

Nature Reserve, bird watching and sight-seeing facilities should be set up according to the distribution characteristics of birds.

References

- [1] WANG QS. Zoogeographical division of anhui province[J]. Journal of Anhui University (Natural Science Edition), 1986(1): 45–58.
- [2] ZHANG RZ. Zoogeographical division:zoogeographical division of china[J]. Bulletin of Biology, 1987(3): 1–3.
- [3] FURNESS RW, GREENWOOD J. Birds as mon-

itors of environmental change[J]. Birds As Monitors of Environmental Change, 1993, 19(1): 156.

- [4] TURNER IM. Species loss in fragments of tropical rain forest: a review of the evidence [J]. Journal of Applied Ecology, 1996, 33 (2): 200–209.
- [5] CARIGNAN V, VILLARD MA. Selecting indicator species to monitor ecological integrity: A review [J]. Environmental Monitoring and Assessment, 2002, 78(1): 45–61.
- [6] WANG QS, XING QR, HU XL, *et al.* Birds on the north slope of the Dabie Mountains in Anhui Province[J]. Chinese Journal of Wildlife, 1983 (3): 55–57.
- [7] ZHANG YY, ZHOU LZ, WANG QS, *et al.* Distribution pattern and hotspot analysis of breeding birds in Anhui Province[J]. Biodiversity Science, 2008, 16(3): 305–312.
- [8] LI L, CUI P, XU HG, *et al.* A comparative study of bird species diversity in breeding season at Anhui Yaoluoping National Nature Reserve[J]. Chinese Journal of Wildlife, 2017, 38(1): 52–62.
- [9] ZHOU L, WAN YQ, HONG X, *et al.* Using infrared camera technology to investigate large and medium-sized mammals and undergrowth birds in Yaoluoping National Nature Reserve, Anhui Province[J]. Biodiversity Science, 2018, 26(12): 1338–1342.
- [10] SUN RL, MA HH, YU L, *et al.* A preliminary report on bird diversity and distribution in Dabie Mountains [J]. Journal of Anhui University(Natural Sciences), 2021, 45(3): 18.
- [11] JOHN MA JINGNEG, KAREN PHILLIPS, HE VINCI. Wild bird handbook for China[M]. Changsha: Hunan Education Press, 2000.
- [12] ZHENG GM. The classification and distribution of birds in China [M]. Beijing: Science Press, 2017.
- [13] State Forestry and Grassland Administration, Ministry of Agriculture and Rural Affairs. List of national key protected wildlife [R]. (2021–02–05) [2021–05–04].