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Diversity and Feeding Guilds of Birds in Way Rilau Research Station, Core Block of KPH Batutegi, Lampung Province

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ABSTRACT
Protected forests are forest areas protected by law to maintain the balance of their ecosystems. The reciprocal relationship between birds and their environment can serve as an indicator of habitat condition, as birds are highly sensitive to environmental changes. The Way Rilau Research Station, situated in Lampung Province, is a protected forest that serves as a habitat for a diverse range of bird species. Therefore, the purpose of this research is to obtain data on species diversity, species richness, species evenness, and bird species dominance. Data collection in this study was conducted using a combination of point-count and line-transect methods. Observations were conducted in the morning (6–9 am) and the afternoon (3–6 pm). The results showed that 76 bird species from 37 families were recorded, totaling 382 individuals. The diversity index (H') value is 3,836, with a high category, and the species richness index (R) value is 13,370, which is categorized as high. The bird species evenness index (E) value is 0.886, which is classified as stable, while the species dominance index (C) value is 0.034, which indicates no species dominates. Based on the bird food guild type, the insectivore group dominates with 55 species (71.05%). The frugivore group with 12 species (17.11%), the carnivore group with four species (5.26%), the next dominance is the omnivore group with four species (5.26%), and the piscivore group with one species (1.32%).

Keywords: Birds, Biodiversity, Protected Forest, Batutegi

1. Introduction

Protected forests are forest areas protected by law to maintain the balance of their ecosystems. The primary functions of protected forests include water management, erosion control, and maintaining soil fertility, all of which contribute to environmental sustainability. Beyond their primary function, protected forests also serve as natural habitats for wildlife, including birds, by providing space for daily activities. [1]. A well-maintained forest ecosystem plays a vital role in supporting the survival of birds, providing them with oxygen, habitat, and food [2]. The close relationship between vegetation structure and the forest's function, which provides abundant food, can offer direct and indirect benefits to the community and the variety of bird species within it [3]. Canopy density and heterogeneity are the dominant factors supporting the richness of bird species in a place [4].

Based on 2024 data from Burung Indonesia, Indonesia's bird diversity currently stands at 1,836 species, comprising a total of 542 endemic species, and this diversity is expected to continue evolving. Birds are highly mobile and can spread to various regions in large numbers. Birds play a crucial role in an ecosystem, supporting the lives of other organisms [5]. The presence of birds in an area is crucial to the natural regeneration process through their abilities as prey, predators, pollinators, and seed dispersers. The reciprocal relationship between birds and their environment can serve as an indicator of habitat condition, as birds are highly sensitive [6].

Furthermore, birds are also susceptible to changes in the quality of their habitat, thereby serving as indicators of environmental health [7-8].

The Batutegi Forest Management Unit (KPH Batutegi) is a protected forest area that includes the Register 39 Kota Agung Utara Forest Area, the Register 22 Way Waya Protected Forest Area, and the Register 32 Bukit Ridingan Protected Forest Area. This protected forest is situated in the Sekampung River Basin (DAS), which is home to three main rivers: the Way Sekampung, Way Sangarus, and Way Rilau Rivers, in Lampung Province. Currently, the forest, particularly the protected forest, is experiencing significant degradation due to the negative impacts of human activities, including land encroachment and illegal logging [9-10]. As in the Batutegi KPH Core Block, it continues to face similar threats and disturbances, including the diversity of bird species [11].

Signs of hunting activity are often found in the remains of equipment left behind by hunters. Therefore, area managers need to develop appropriate strategies to protect and preserve bird species and ensure their continued well-being. Implementing strategies to reduce such activity is necessary to ensure the continued existence of wild bird species [12]. However, based on routine patrol activities conducted between 2009 and 2021, it was found that the number of bird species in the Batutegi KPH had increased to 245, grouped into 61 families [11]. The bird inventory activities carried out can provide data and information on the diversity of bird species in the area, which can serve as a basis for efforts to preserve these species [13]. Therefore, this research aims to collect data on bird species in the Batutegi KPH Core Block for forest management purposes, to obtain information on species diversity, species richness, species evenness, and dominance.

2. Methods

2.1 Study Area

The research was conducted from December 2024 to January 2025 at the Way Rilau Research Station (SRWR), KPH Batutegi Core Block, Tanggamus Regency, Lampung Province, located at 5°10'54.8"S 104°45'39.4"E. The research location is at an altitude of 300-600 meters above sea level and is dominated by intact forest areas, including secondary dryland forests [11].

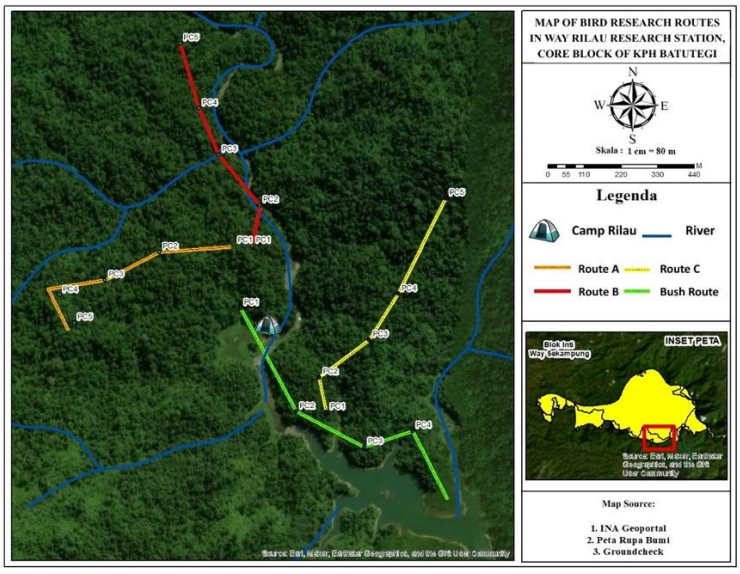

Figure 1. Research location map.

2.2 Data Collection

Data collection on the presence of birds in this study was conducted using a combination of point-count and line-transect methods, which are used to estimate bird populations at a specific location [14-15]. Observations were conducted at point count points along a 1-km route, with five points spaced 200 m apart. Observers remained at the designated points within a 20-meter radius for 20 minutes to ensure accurate object positioning

without obstruction from dense vegetation. Data collection was conducted on four routes, each with 20 points, and all bird encounters were recorded directly on site [16], then identified using a guidebook based on their characteristics. Observations were conducted in the morning (6–9 am) and afternoon (3–6 pm), with the consideration that birds are most active at these times. If it rains, no observations are made [17].

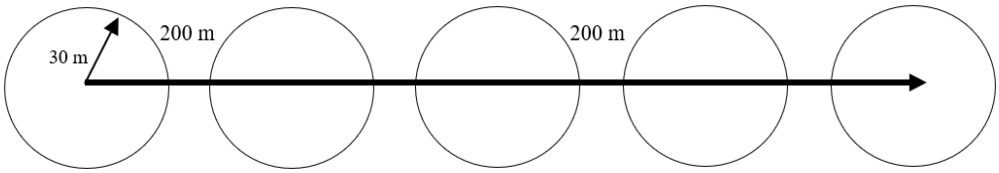

Figure 2. Illustration of observation path.

Observations were conducted along four different routes: routes A, B, and C, which covered forest cover, and route D, which covered scrubland. The collected data included bird species, the number of individuals per species, and their activity levels. Furthermore, documentation of the birds encountered was conducted using a DSLR camera to aid in detailed identification.

2.3 Data Analysis

Data on bird species found were tabulated and analyzed using the Shannon-Wiener diversity index [18], Margalef wealth index [19], equality index [20], and Simpson's dominance index [21] with the following formula:

$$H' = -\sum pi \ln pi \qquad (1)$$

pi = ni/N
H' = Number of individuals of the i-th species
ni = number of individuals of all species
N = Jumlah individu seluruh spesies
ln = Natural logarithm

$$R = \frac{(S-1)}{\ln (N)} \qquad (2)$$

R = Margalef species richness index
S = Number of species observed
Ln = Natural logarithm
N = number of individuals (all species) observed

$$E = \frac{H'}{lnS} \qquad (3)$$

E = Species evenness index
H' = Species diversity index
S = number of species

$$C = \sum (ni/N)^2 \qquad (4)$$

C = Simpson dominance index
Ni = number of individuals of each species
N = number of individuals of all species

The criteria for the diversity index value are as follows: if $H' \leq 1$, then diversity is low; if $1 < H' < 3$, then diversity is moderate; if $H' \geq 3$, then diversity is high [18]. The Margalef richness index value indicates that if $R < 2.5$, then the bird species richness is low; if $2.5 < R < 4$, then the bird species richness is moderate; and if $R > 4$, then the bird species richness is high [19]. If the value of $E < 0.20$ can be considered an unstable species distribution condition, whereas if the value is $0.21 < E < 1$, it can be said that the species distribution condition is stable [20]. If $0 < C < 0.5$, there is no dominant species; however, if $0.5 < C < 1$, a species dominates the community [21].

All bird encounters in this study were analyzed quantitatively descriptively and information on the threat status of bird species was sourced from the International Union for Conservation of Nature (IUCN) red list,

the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and protection status was sourced from the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia P.106/MENLHK/SETJEN/KUM.1/12/2018 concerning Protected Plant and Animal Species.

3. Result and Discussion

3.1 Bird Species Composition at Way Rilau Research Station, Batutegi Forest Management Unit, Lampung Province

The results of bird encounters during observations were 76 species from 37 families with a total of 382 encounters (Table 1). Each family has a different number of species, and the species with the most significant number of individuals is *Pycnonotus brunneus* (44). Several species were only found once.

Table 1. Bird species at Way Rilau Research Station, Batutegi Forest Management Unit, Lampung. Province.

No	Family	EnglishName	Scientific Name	Conversation Status			Encounter
				IUCN	CITES	Minister of Environment and Forestry Regulation No. P.106/2018	
1	Bucerotidae	Rhinoceros Hornbill	*Buceros rhinoceros*	VU	Appendix II	Protected	34
2	Bucerotidae	Wreathed Hornbill	*Aceros undulatus*	VU	Appendix II	Protected	2
3	Bucerotidae	Bushy-crested Hornbill	*Anorrhinus galeritus*	NT	Appendix II	Protected	4
4	Pycnonotidae	Spectacled Bulbul	*Pycnonotus erythropthalmos*	LC	–	Not Protected	40
5	Pycnonotidae	Asian Red-eyed Bulbul	*Pycnonotus brunneus*	LC	–	Not Protected	44
6	Pycnonotidae	Streaked Bulbul	*Ixos malaccensis*	NT	–	Not Protected	10
7	Pycnonotidae	Ruby-throated Bulbul	*Pycnonotus dispar*	VU	–	Not Protected	9
8	Pycnonotidae	Buff-vented Bulbul	*Iole charlottae*	NT	–	Not Protected	2
9	Pycnonotidae	Black-headed Bulbul	*Microtarsus melanocephalos*	LC	–	Not Protected	2
10	Pycnonotidae	Cream-vented Bulbul	*Pycnonotus simplex*	LC	–	Not Protected	8
11	Pycnonotidae	Grey-bellied Bulbul	*Pycnonotus cyaniventris*	NT	–	Not Protected	8
12	Cuculidae	Red-billed Malkoha	*Phaenicophaeus javanicus*	LC	–	Not Protected	5
13	Cuculidae	Raffles's Malkoha	*Rhinortha chlorophaeus*	LC	–	Not Protected	6
14	Cuculidae	Green-billed Malkoha	*Phaenicophaeus tristis*	LC	–	Not Protected	2
15	Cuculidae	Chestnut-breasted Malkoha	*Phaenicophaeus curvirostris*	LC	–	Not Protected	1
16	Cuculidae	Greater Coucal	*Centropus sinensis*	LC	–	Not Protected	2
17	Cuculidae	Back's Hawk cuckoo	*Hierococcyx bocki*	LC	–	Not Protected	1
18	Chloropseidae	Lesser Green Leafbird	*Chloropsis cyanopogon*	NT	–	Protected	6
19	Chloropseidae	Greater Green Leafbird	*Chloropsis sonnerati*	EN	–	Protected	1
20	Ardedidae	Striated Heron	*Butorides striata*	LC	–	Not Protected	4
21	Motacillidae	Grey Wagtail*	*Motacilla cinerea*	LC	–	Not Protected	3
22	Vangidae	Black-winged Flycatcher-shrike	*Hemipus hirundinaceu*	LC	–	Not Protected	1
23	Aegithinidae	Green Iora	*Aegithina viridissima*	NT	–	Not Protected	7

No	Family	EnglishName	Scientific Name	Conversation Status			Encounter
				IUCN	CITES	Minister of Environment and Forestry Regulation No. P.106/2018	
24	Aegithinidae	Common Iora	*Aegithina tiphia*	LC	−	Not Protected	8
25	Muscicapidae	Asian Brown Flycatcher*	*Muscicapa dauurica*	LC	−	Not Protected	8
26	Muscicapidae	Pale Blue Flycatcher	*Cyornis unicolor*	LC	−	Not Protected	2
27	Muscicapidae	Indigo Flycatcher	*Eumyias indigo*	LC	−	Not Protected	2
28	Sittidae	Velvet-fronted Nuthatch	*Sitta frontalis*	LC	−	Not Protected	15
29	Eurylaimidae	Black-and-yellow Broadbill	*Eurylaimus ochromalus*	NT	−	Not Protected	8
30	Eurylaimidae	Dusky Broadbill	*Corydon sumatranus*	LC	−	Not Protected	1
31	Eurylaimidae	Banded Broadbill	*Eurylaimus javanicus*	LC	−	Not Protected	
32	Meropidae	Red-bearded Bee-eater	*Nyctyornis amictus*	LC	−	Not Protected	5
33	Alcedinidae	Banded Kingfisher	*Lacedo pulchella*	LC	−	Not Protected	1
34	Alcedinidae	Black-backed Dwarf-kingfisher	*Ceyx erithaca*	LC	−	Not Protected	1
35	Alcedinidae	Rufous-collared Kingfisher	*Actenoides concretus*	NT	−	Dilindungi	1
36	Columbidae	Asian Emerald Dove	*Chalcophaps indica*	LC	−	Not Protected	1
37	Accipitridae	Rufous-bellied Eagle	*Lophotriochis kienerii*	NT	−	Protected	2
38	Accipitridae	Oriental Honeybuzzard*	*Pernis ptilorhynchus*	LC	−	Protected	4
39	Accipitridae	Crested Serpent-eagle	*Spilornis cheela*	LC	Appendix II	Protected	1
40	Accipitridae	White-bellied Sea-Eagle	*Haliaeetus leucogaster*	LC	Appendix II	Protected	1
41	Trogonidae	Scarlet-rumped Trogon	*Harpactes duvaucelii*	NT	−	Protected	1
42	Trogonidae	Orange-breasted Trogon	*Harpactes oreskios*	LC	−	Protected	1
43	Picidae	Rufous Piculet	*Sasia abnormis*	LC	−	Not Protected	4
44	Picidae	Crimson-winged Woodpecker	*Picus puniceus*	LC	−	Not Protected	4
45	Picidae	Buff-rumped Woodpecker	*Meiglyptes grammithorax*	LC	−	Not Protected	2
46	Picidae	Rufous Woodpecker	*Micropternus brachyurus*	LC	−	Not Protected	1
47	Picidae	Buff-necked Woodpecker	*Meiglyptes tukki*	NT	−	Not Protected	3
48	Cisticolidae	Dark-necked Tailorbird	*Orthotomus atrogularis*	LC	−	Not Protected	8
49	Cisticolidae	Yellow-bellied Prinia	*Prinia flaviventris*	LC	−	Not Protected	2
50	Cisticolidae	Rufous-tailed Tailorbird	*Orthotomus sericeus*	LC	−	Not Protected	1
51	Cisticolidae	Ashy Tailorbird	*Orthotomus ruficeps*	LC	−	Not Protected	1
52	Corvidae	Malayan Black Magpie	*Platysmurus leucopterus*	LC	−	Protected	1
53	Campephagidae	Fiery Minivet	*Pericrocotus igneus*	NT	−	Not Protected	3

No	Family	EnglishName	Scientific Name	Conversation Status			Encounter
				IUCN	CITES	Minister of Environment and Forestry Regulation No. P.106/2018	
54	Campephagidae	Scarlet Minivet	*Per1icrocotus flammeus*	LC	−	Not Protected	1
55	Megalaimidae	Malayan Brown Barbet″	*Calorhamphus hayii*	NT	−	Protected	4
56	Megalaimidae	Red-throated Barbet	*Psilopogon mystacophanus*	NT	−	Protected	8
57	Hemiprocnidae	Whiskered Treeswift	*Hemiprocne comata*	LC	−	Not Protected	3
58	Timaliidae	Pin-striped Tit-babbler	*Mixornis gularis*	LC	−	Not Protected	17
59	Timaliidae	Sunda Scimitar Babbler	*Pomatorhinus bornensis*	LC	−	Not Protected	1
60	Timaliidae	Grey-headed Babbler	*Stachyris poliocephala*	LC	−	Not Protected	1
61	Pittidae	Fairy Pitta*	*Pitta nympha*	VU	Appendix II	Protected	1
62	Pittidae	Asian Hooded Pitta	*Pitta sordida*	LC	−	Protected	1
63	Cettiidae	Yellow-bellied Warbler	*Abroscopus supercilliaris*	LC	−	Not Protected	4
64	Dicaeidae	Plain Flowerpecker	*Dicaeum minullum*	LC	−	Not Protected	1
65	Oriolidae	Dark-throated Oriole	*Oriolus xanthonotus*	LC	−	Not Protected	5
66	Laniidae	Tiger Shrike*	*Lanius tigrinus*	LC	−	Not Protected	3
67	Monarchidae	Blyth's Paradise-flycatcher*	*Terpsiphone affinis*	LC	−	Not Protected	10
68	Falconidae	Black-thighed Falconet	*Microhierax fringillarius*	LC	Appendix II	Protected	1
69	Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	LC	−	Not Protected	2
70	Pandionidae	Osprey	*Pandion haliaetus*	LC	Appendix II	Protected	2
71	Phylloscopidae	Arctic Warbler*	*Phylloscopus borealis*	LC	−	Not Protected	1
72	Dicruridae	Greater Racket-tailed Drongo	*Dicrurus paradiseus*	LC	−	Not Protected	1
73	Phasianidae	Great Argus	*Argusianus argus*	VU	Appendix II	Protected	4
74	Strigidae	Collared Scops Owl	*Otus lempiji*	LC	−	Not Protected	1
75	Strigidae	Buffy Fish Owl	*Bubo ketupu*	LC	Appendix II	Not Protected	1
76	Apodidae	Edible-nest Swiftlet	*Aerodramus fuciphagus*	LC	−	Not Protected	13

Description: *(Migrant Bird); ″(Endemic); EN: Endangered; VU: Vulnerable; NT: Near Threatened; LC: Least Concern

Several bird species have been newly identified in the KPH Batutegi area or are not included in the list of findings in the book "Wild Birds of the KPH Batutegi Forest Area." According to [11], such as the rufous-bellied eagle(*Lophotriochis kienerii*), scarlet-rumped trogon(*Harpactes duvaucelii*), and fairy pitta (*Pitta nympha*). The observations also identified migratory bird species originating from the northern hemisphere, including grey wagtail(*Motacilla cinerea*), Asian brown flycatcher (*Muscicapa dauurica*), tiger shrike(*Lanius tigrinus*), oriental-honey buzzard(*Pernis ptilorhynchus*), arctic warbler(*Phylloscopus borealis*), oriental paradise-flycatcher(*Terpsiphone affinis*), and fairy pitta(*Pitta nympha*). The SRWR area is one of the protected areas chosen by migratory birds as a route and stopover location to gather maximum energy [17]. The presence of migratory birds at a location can influence the diversity of bird species at that location [28], indicating that the location visited provides sufficient food sources.

Several bird species have varying conservation statuses (Table 1). Based on the IUCN threat status, the greater green Leafbird (*Chloropsis sonnerati*) is classified as endangered (EN), the Rhinoceros hornbill (*Buceros rhinoceros*), fairy pitta (*Pitta nympha*), ruby-throated bulbul (*Pycnonotus dispar*), wreathed hornbill (*Aceros undulatus*), and great argus (*Argusianus argus*) are classified as vulnerable (VU), 14 other species are categorized as near threatened (NT), including the Grey-rumped Shama (*Pycnonotus cyaniventris*) (Figure 3a). In comparison, 55 different species are classified as low risk (LC). Species included in CITES with Appendix II status or a list of species that are not threatened with extinction, but potentially threatened with extinction if traded without regulation, include 10 species, namely *Buceros rhinoceros*, *Pitta nympha*, *Microhierax fringillarius* (Figure 3c), *Pandion haliaetus*, *Aceros undulatus*, *Spilornis cheela*, *Anorrhinus galeritus*, *Argusianus argus*, *Haliaeetus leucogaster*, and *Bubo ketupu*. Based on the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia P.106 / MENLHK / SETJEN / KUM.1 / 12/2018, there are 20 species included in the protected category, one of which is the Rhinoceros Hornbill (*Buceros rhinoceros*) (Figure 3b). This explains that any form of illegal hunting, trade, or possession of these 15 species is subject to legal sanctions. These birds often have specific habitat requirements and are sensitive to environmental changes. The presence of birds indicates that the protected forest ecosystem still provides sufficient resources, such as food, water, and a safe resting place, protecting birds from predators and adverse weather conditions. [28].

(a) (b) (c)

Figure 3. (a) Grey-bellied Bulbul (*Pycnonotus cyaniventris*); (b) Rhinoceros hornbill (*Buceros rhinoceros*); (c) Black-thighed Falconet(*Microhierax fringillarius*).

A total of 382 bird species were encountered at the research site, belonging to 37 different families. At the research site, the dominant bird families were Pycnonotidae (8 species, 10.53%), Cuculidae (6 species, 7.89%), and Picidae (5 species, 6.58%). Pycnonotidae was the most frequently encountered family along the observation route, with eight species being spectacled bulbul (*Pycnonotus erythropthalmos*), red-eyed bulbul (*Pycnonotus brunneus*), streaked bulbul (*Ixos malaccensis*), buff-vented bulbul (*Iole charlottae*), ruby-throated bulbul (*Pycnonotus dispar*), black-headed bulbul (*Microtarsus melanocephalos*), cream-vented bulbul (*Pycnonotus simplex*), and grey-bellied bulbul (*Pycnonotus cyaniventris*) (Figure 3). The Pycnonotidae family is an adaptable group of birds that can utilize various strata, or vertical layers, within the forest as their habitat. In general, these species can be found from the top canopy to the understory [22], depending on species and resource availability. Some species prefer the canopy layer for foraging on fruit and insects [23]. While other species are more often seen in the middle or lower layers, searching for insects among leaves or building nests in bushes. Additionally, the availability of suitable nesting sites is a crucial factor for some species to build nests in the high tree canopy, while others construct nests in bushes or undergrowth. Another factor that influences habitat selection is the presence of predators. These birds tend to avoid strata with a high risk of predation and choose strata that offer better protection [24]. The ability to utilize various strata allows Pycnonotidae to coexist with other bird species and reduce competition [25].

The Cuculidae family (7.89%) (Figure 4) ranks second among the most commonly found families, including the red-billed malkoha (*Phaenicophaeus javanicus*), raffles's malkoha (*Rhinortha chlorophaeus*), green-billed malkoha (*Phaenicophaeus tristis*), chestnut-breasted malkoha (*Phaenicophaeus curvirostris*), greater coucal (*Centropus sinensis*), and dark hawk-cuckoo (*Hierococcyx bocki*). Birds in this family have long tails and are often found in bush habitats or on tree branches. The Great White-rumped Shama prefers bush habitats and open, grassy areas, including reeds, and basks in the sun in the morning or after rain [26]. The third-highest number of encounters was the Picidae family (6.58%), which includes the rufous piculet (*Sasia abnormis*), crimson-winged woodpecker (*Picus puniceus*), buff-rumped woodpecker (*Meiglyptes grammithorax*), rufous woodpecker (*Micropternus brachyurus*), and buff-necked woodpecker (*Meiglyptes tukki*). Members of this family are often seen pecking at trees with their strong beaks to search for insects in

tree trunks and to build nests in dead trees. The presence of the woodpecker family indicates that their food source (boring insects) is abundant in this habitat [27] and shows that environmental conditions are stable with abundant food availability.

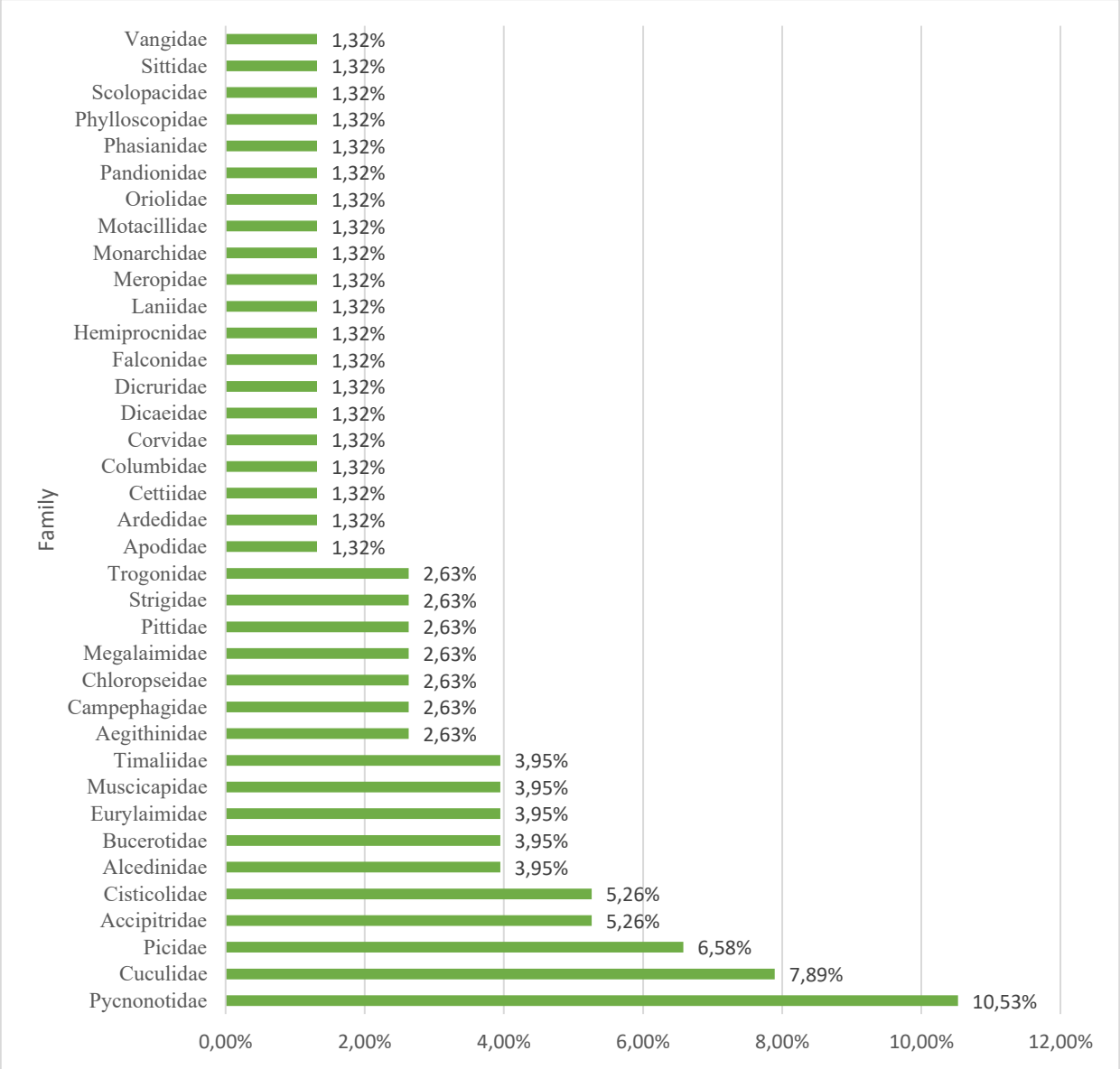

Figure 4. Percentage of bird family composition at Way Rilau Research Station, Lampung Province.

3.2 *Bird Species Diversity at Way Rilau Research Station, Batutegi Forest Management Unit, Lampung Province*

The results of data collection in the field were used to calculate species diversity (H'), species richness (R), species evenness (E), and species dominance (C), which are presented in Table 2.

Table 2. Index values of bird species diversity, richness, evenness, and dominance.

No	Observation Trail	(H')	(R)	(E)	(C)
1.	A	3.47	8.35	0.95	0.03
2.	B	2.85	5.48	0.92	0.07
3.	C	2.98	6.60	0.86	0.07
4.	Scrub	2.87	5.90	0.87	0.08

The diversity index (H') results for the four research paths used, namely paths A, B, C, and Semak, were 3,836 (Table 2), where if H' ≥ 3, then diversity is classified as high. High bird diversity results from complex interactions among environmental factors that tend to maintain better conditions than in other forest areas that are degraded or converted for other purposes [29]. These optimal habitat conditions are a significant draw for

a variety of bird species, from those with specialized habitats to more generalists. The diversity of vegetation structure, the availability of food sources, and minimal human disturbance create an ideal environment for birds to breed, forage, and seek refuge from predators [25]. The diversity of tree and other plant species also contributes to the availability of a variety of food and nesting sites that suit the needs of each bird species.

The species richness index (R) is 13,370 (Table 2), indicating high species richness (R> 2.5). The bird species richness is supported by high plant diversity, including fruit-bearing trees and flowers, which serve as the primary food source for many bird species. For example, red-throated barbet(*Psilopogon mystacophanus*) (Figure 5a) utilizes the fruiting bay tree (*Syzygium polyanthum*) on route A as a food source. Furthermore, the yellow-bellied warbler (Abroscopus superciliaris), a member of the Cettiidae family, uses insects found in its habitat as its primary food source (Figure 5b). Other factors, such as topography and climate, also influence the richness of bird species in protected forests [30]. Extensive protected forests with diverse topography tend to have higher bird species richness than small protected forests with relatively flat topography.

The evenness (E) of bird species was 0.886, indicating a stable population at the research location. This suggests that bird encounters along each pioneering route were evenly distributed due to the availability of still-maintained habitat. Meanwhile, the species dominance index (C) value fell into the no-dominant species category (C < 0.5), specifically 0.034. Differences can influence this in foraging locations, such as the bird species that use vertical layers of the forest (canopy, middle, and bottom), which are more suitable for their food [31]. Additionally, some bird species are active during the day (diurnal), while others are active at night (nocturnal). This difference in activity times enables them to avoid competition and capitalize on resources available at different times. [8].

(a) (b)

Figure 5. (a) Red-throated barbet (*Psilopogon mystacophanus*); (b) Yellow-bellied warbler (*Abroscopus supercilliaris*).

3.3 Bird Feed Guild at Way Rilau Research Station, KPH Batutegi

Feeding guilds are a classification system for grouping animal species based on the types of food they consume. This grouping is used to understand the feeding patterns and interactions between species in the ecosystem. All species encountered along the research path are divided into feeding guilds: insectivores, omnivores, frugivores, piscivores, and carnivores. Based on the type of feeding guild, the insectivorous bird community dominated the research location with 55 species (71.05%), followed by the frugivore group with 12 species (17.11%), the carnivore group with four species (5.26%), the next dominant group is the omnivore group with four species (5.26%), and the piscivore group with one species (1.32%).

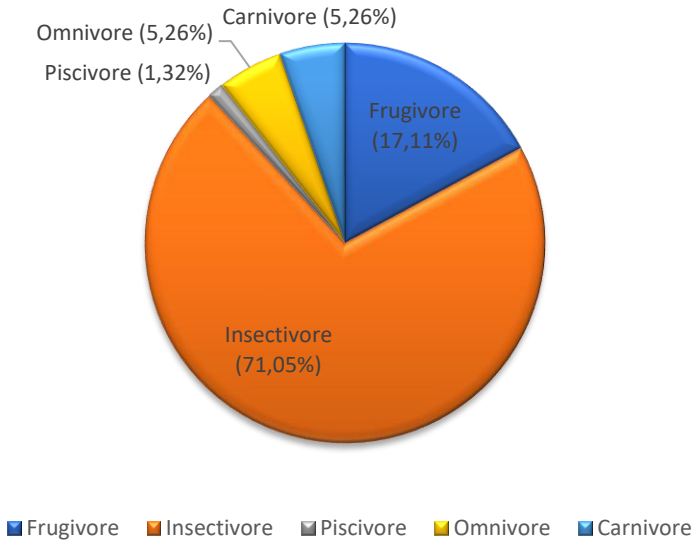

Figure 6. Bird feeding guild.

The insectivore guild is the most abundant, accounting for 71.05% of the total species. Species from the families Cuculidae, Pycnonotidae, and Picidae dominate this group. The availability and abundance of insects in this area support the existence of the insectivore guild. The breadth of their niches also allows for overlap, allowing them to be found in high numbers within a given habitat [32]. Birds such as the Yellow-bellied Warbler(*Abroscopus supercilliaris*) (Figure 5), rufous piculet(*Sasia abnormis*), and Black-and-yellow Broadbill(*Eurylaimus ochromalus*) are birds from the insectivore guild, whose presence can help control insect populations, mainly herbivorous insects that can damage the plants that are their food source [33]. By eating insects, they prevent pest population explosions and maintain healthy vegetation.

Frugivorous birds are fruit-eating birds that play a significant role in the process of spreading seeds that other animals cannot spread [34]. Some plants rely solely on frugivorous birds to disperse their seeds [35]. Furthermore, frugivores are also a type of bird that eats large amounts of fruit, and their ability to swallow and regurgitate seeds is crucial for regeneration and ensuring the sustainability of forest ecosystems. Seeds dispersed far from the parent tree have a greater chance of germination because they reduce competition with the parent tree and other seedlings for light, water, and nutrients. The colorful species of hawk-eaten birds (*Psilopogon mystacophanus*) (Figure 5) is one of the birds with an omnivorous food group that is often found on bay trees on Route A.

4. Conclusion

The study recorded 76 species from 37 families, with 382 encounters, including newly identified species in the Batutegi FMU area, such as rufous-bellied eagle (Lophotriochis kienerii), scarlet-rumped trogon (Harpactes duvaucelii), and fairy pitta (*Pitta nympha*). The diversity index value (H') was 3,836, categorized as high. The species richness index (R) was 13,370, which is classified as high. The species evenness index (E) was 0.886, categorized as stable, while the species dominance index (C) was 0.034, indicating that no single species dominates. Based on the type of bird food guild, the insectivore group dominates with 55 species (71.05%), followed by the frugivore group with 12 species (17.11%), the carnivore group with four species (5.26%), the next dominant group is the omnivore group with four species (5.26%), and the piscivore group with one species (1.32%). The conservation status of birds comprises one species with Endangered (EN) status, five with Vulnerable (VU) status, 14 with Near Threatened (NT) status, and the remaining 55 with Least Concern (LC) status, according to the IUCN. There are 20 protected species and 10 species listed in Appendix II of CITES.

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