Bird diversity on small islands in Maluku

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Abstract. The bird species diversity is an indicator of the ecosystem stability. The high diversity index of birds is an indicator of healthy and stable ecosystem condition so that it can become a supporter of birdlife. The study aimed to determine the level of bird diversity on a small island in Maluku, namely the Saparua Island Protected Forest. The study was conducted in June - July 2019 using the Line Transect method on 100 m transect with 100 m transect distance, and 50 m band transect width left and right transect on a plot area of 50,000 m² (5 ha). Observations were carried out in the morning at 07.30 - 10.00 Eastern Indonesian Time and afternoon at 16.00 - 18.30 Eastern Indonesian Time. The parameters used are the species distribution, species diversity, species abundance, and bird species evenness. The results found that the number of bird encounters in 5 transects varied. There were 16 species in transect one, 12 bird species in transect two, 9 bird species in transect three, 7 bird species in transect four and 12 bird species in transect five. The ten bird species that have conserved value and protected value were found. There were also three endemic species - each endemic was Ambon Bueno Ceram namely Myzomela seram, and the other two species are Maluku Endemic species, namely Sikatan Kelabu and Cabai Kelabu. The three types were species of birds with very limited distribution, while seven other species were animals that were protected by the state. Richness index of bird species ranges from low - medium, which was classified as medium category, transects 1, 2 and 5, with a value of the Richness Index in the range of 2.697707 - 3.413397 (2.5 <R1> 4), while transects 3 and 4, low categories of 1.820478 - 1.987404 (R1 <2.5). The diversity index of bird species was classified as medium at 1.556579 - 2.155639 (1 <H '> 3) which shows that transects 4 and 4 are in a low category and transects 1, 2 and 5 are in the high category. The abundance class of birds with conserved value and protected value were divided into three kinds. The four types were classified as rare abundance class, namely Elang bondol, Nuri bayan, Nuri pipi-merah dan Raja-udang suci. Then, the three types were classified as uncommon abundance class, namely Pergam mata-putih, Sikatan kelabu dan Myzomela seram. Furthermore, the three types were included in the frequent abundance class, namely Cabai kelabu, madu hitam dan madu sriganti.

1. Introduction
Indonesia is the country with the greatest biodiversity in the world and its tropical rain forests are among the richest in Southeast Asia with exceptional species diversity and a high number of endemic species [1]. However, the conversion of tropical rain forests into agricultural land has resulted in the local and regional extinction of many species. Maluku, which is an archipelago, has more than 100 known bird species, but the number continues to decrease due to the large number of sampling and surveying expeditions. The natural habitat of most birds in Maluku is tropical forest, where around 77% of birds in Maluku spend their entire lives or a part of their lives in the forest. However, much of
the tropical forests in Maluku have been cleared for logging, mining and agriculture as well as for industrial and development purposes.

Birds are a key species and play a very important role in maintaining ecosystem balance by providing a variety of ecological services [2]. The diversity, abundance and distribution of birds in forest areas will be an indicator of forest health. The increasing of the complexity of vegetation structure, flower composition, and heterogeneity can increase the diversity and abundance of birds in an ecosystem. Anthropogenic damage due to human presence in the form of land clearing for settlements, agriculture, plantations has an impact on the spread of birds [3]. Natural factors such as flooding, drought, deforestation in land use, natural resources and climate change will affect vegetation because of bird habitat and bird community structure. Birds will also respond to changes that occur in their habitat, so that birds can be used as bio-indicators in assessing the health quality of a habitat or ecosystem. Birds are a key species in a food web because they spread easily and are easily seen.

The richness of bird species is influenced by the habitat environment, flora diversity, level of anthropogenic disturbance, new species invasion and predation. Birds are very sensitive to changes in habitat structure and function, so they are able to function as indicators of change and pressure in the habitat. Birds provide ecological benefits, such as seed distribution, facilitation of forest restoration, pollination of many tropical plant species, and control of insect pests and little rodents, which can destroy agricultural products [3]. Therefore, birds are the ideal study group for the assessment of ecosystem services. Environmental impacts on birds are usually assessed by recording changes in population density, abundance or distribution of species in various habitat types. The protected forest of Tuhaha Village on Saparua Island has a variety of functions and benefits for the life of living creatures, but in the last decade, a shift in function occurred. As a result, there was disruptions in daily activities, feeding and reproductive activities of birds as one of the supporting components in the forest area. The research aimed to identify birds up to the level of species, and determine the level of bird diversity, because this study shows that changes in land use and modification can change the structure of bird diversity [3].

2. Materials And Methods
2.1. Study Area
The study was conducted in June - August 2019 in the Protected Forest of Negeri in the Hata Wano Peninsula, Saparua Island, which is a type of lowland forest. The location of the research is presented in figure 1.

Figure 1. Location of Research
Bird data collected in the field includes all bird species found in the research data plot. The main concern is addressed with regard to certain types of birds that are sensitive to environmental changes. [4]. Bird data are collected using work paths in rectangular data plots. The method used for bird data collection is the Line Transect method which is placed in a data plot side by side. This method was chosen because it can explore the data plot area in a short time and allows repetition of data collection in one day according to the desired time [5]. The research data plot used is rectangular in shape. In the data plot the birds were collected using 5 transects or data collection lines with a length of 100 m each, the distance between the transects used was 100 m. This allows the width of the band transect used by 50 m left and 50 m right. With the length of the transect, the distance between the transects and the width of the left-right transect band as described above, the area of the data plot at the study site is 50,000 m² (5 ha). The research plot design is presented in figure 2.

Figure 2. Design of data plot and transect direction for bird data collection
2.2. Data Collection

Bird data were collected according to species using the "Line Transect" method in a rectangular plot of 5 transects with a length of 100 m, the distance between transects was 100 m, and the plot area was 50,000 m² (5 ha). The time of the bird collection was divided into two, namely at 07.30 - 10:00 Central Indonesian Time and 16.00 - 18.30 Central Indonesian Time. The tools and materials used in the study were GPS, Altimeter, Shunto Compass, Binoculars, digital cameras (Tele Zoom), land cover maps, topographic maps, and bird wildlife field guides [6].

2.3. Data Analysis

The parameters used are the species distribution, species diversity, species abundance, and bird species evenness. The number of types, number of contacts, and number of individual types obtained in the data collection are key variables in the analysis [7]. For consistency in the size of the number of contacts, the number of species and the number of individual species of birds encountered, the range of numbers was used as shown in the table below.

| Number Range | Categories   |
|--------------|--------------|
| 1 - 4        | Very Low     |
| 5 - 10       | Low          |
| 11 - 20      | Medium       |
| 21 - 50      | Quite High   |
| 51 - 100     | High         |
| > 101        | Very High    |

The Richness Index (R₁)

Richness index (R₁), using the Index of Margalef. Classification of Margalef Richness index values using criteria as presented in table 2.

| Index Value | Categories         |
|-------------|--------------------|
| R < 2.5     | Low type richness  |
| 2.5 > R < 4 | Medium type richness |
| R > 4       | High type richness |

The Diversity Index (H')

Diversity Index (H'), used the Shanon-Wiener equation. Classification of diversity index values used the criteria in table 3.

| Index Value | Categories        |
|-------------|-------------------|
| H < 1       | Low Diversity     |
| 1 > H' < 3  | Medium Diversity  |
| H' > 3      | High Diversity    |
The Evenness Index (E)
Evenness Index (E) used the Magurran equation. The evenness index value classification used the criteria in table 4.

Table 4. Criteria for Evenness Index values

| Index Value | Categories                                                                 |
|-------------|-----------------------------------------------------------------------------|
| E close to 0 | · Individual distribution between types is uneven / not the same             |
|             | · Distribution condition of species abundance is unstable                    |
| E close to 1 | · Distribution of individuals between types is evenly distributed            |
|             | · Distribution condition of species abundance is stable                      |

The Abundance Class
Abundance classes were based on the number of individuals found in birds divided into several classes adopted from the Abundance Sequence Scale by [3], as presented in table 5.

Table 5. Lowen abundance class (1996), which was modified

| Total of Species | Abundance Class Category Based on the number of Species | Abundance Value | Character of Abundance |
|------------------|---------------------------------------------------------|-----------------|------------------------|
| < 5              | Rare                                                   | 1               | Low                    |
| 6 - 10           | Uncommon                                               | 2               |                        |
| 11 - 25          | Frequent                                               | 3               | Medium                 |
| 26 - 50          | Common                                                 | 4               |                        |
| 51 - 100         | Very Common                                            | 5               | High                   |
| >101             | Abundant                                               | 6               |                        |

Population Density
Estimated Population Density used the transect calculation formula adopted from the King Method, in the form of Line Transect where the calculation was based on "radial distance" the distance between the observer and the animal directly during detection in the field.

3. Results And Discussion

3.1. Number of Bird Types
There were 22 species of birds found, in 16 families as in table 6.

Table 6. The Distribution of Birds in the Tuhaha Protected Forest Area of Saparua Island

| No. | Family            | No. | Kind of | Kind of | Total of Contacts | Total of Individuals |
|-----|-------------------|-----|---------|---------|-------------------|----------------------|
|     | Fm.               | Sp. | Local Name | Scientific name |                  |                      |
| 1   | ACCIPITRIDAE      | 1   | Elang bondol | Haliastur indus | 1                 | 1                    |
| 2   | COLUMBIDAE        | 2   | Peragam mata-puth | Ducula perspicillata | 4                 | 7                    |
|     |                   | 3   | Walik dada- | Ptilinopus viridix | 4                 | 9                    |
The results found that the number of bird encounters in 5 transects varied. There were 16 bird species found in transect 1, 12 bird species in transect 2, 9 bird species in transect 3, 7 bird species in transect 4 and 12 species in transect 5. The ten bird species that have conserved value and protected value were found. There were also three endemic species - each endemic was Ambon Bueno Ceram namely *Myzomela seram*, and the other two species are Maluku Endemic species, namely Sikatan Kelabu and Cabai Kelabu. The three types were species of birds with very limited distribution, while
seven other species were animals that were protected by the state. The results of the study are the new meeting notes for Saparua Island, where the distribution of *Myzomela Seram* so far has only been found in Seram Buano Island in Ambon but also spread in Saparua Island [8]. The presence of the *Myzomela Seram* species on Saparua Island was assumed as a proof that the habitat on Saparua Island was able to support the life of this species. The availability of vegetation and microclimate conditions of this type were thought to be suitable for the life of this species, so that this species moved from its main habitat on Seram Island. The number of bird species in the world was estimated to reach 8,800 -10,200 species. Based on data released by the Indonesian Wild Bird Conservation Association Of the total number of species in the world, 1,672 bird species are part of the typical endemic animals owned by Indonesia [9].

![Figure 3. Distribution of Birds by Transect](image)

Based on the time of the birds meeting, it can be seen the differences in types between morning and evening. The encounter in the morning was higher than in the afternoon, presumably because in the afternoon after 16.00 Eastern Indonesian Time until the evening, the intensity of rainfall was high (85%) with low air temperatures (average 25 °C) and high air humidity (80% ) was thought to greatly affect the activity of the appearance of birds during the day. When it rains, several species of birds hide among the trees. [10]
Based on the number of contacts and the number of individual species found in each transect, it can be seen that the total number of contacts and the number of individual birds in the morning was greater than in the afternoon [7]. The number of contacts in the morning was 71 times and the number of contacts in the afternoon was 48 times, while the number of individuals in the morning was 171 tails and the number of individuals in the afternoon were 99 tails. The encounter with various species of birds in protected forest areas was influenced by the activity of humans in the area. The results of the study found that there were felling of Pala, Clove and Nira trees in the area by the local community for commercial purposes. The community took nutmeg, clove and Nira for sale, and the manufacture of brown sugar and Sopi which is a traditional drink in Maluku.
Figure 5 shows that the number of contacts in the morning occurred as many as 8-22 times and the number of contacts in the afternoon occurred as many as 5-15 times, and the number of individuals in the morning as many as 14 - 60 individuals and the number of individuals in the afternoon as many as 11 - 40 individuals.

3.2. The Richness of Birds Types
The results of measurements of bird species richness in the Tuhaha Village Protection Forest can be seen in tables 8 and 8.

Table 7. The Richness of Birds by Transect

| No | Local Name       | Scientific Name       | Tr. 1 | Tr. 2 | Tr. 3 | Tr. 4 | Tr. 5 | Total |
|----|------------------|-----------------------|-------|-------|-------|-------|-------|-------|
| 1  | Elang bondol     | *Haliastur indus*     | 1     | 2     | 3     | 4     | 5     | 1     |
| 2  | Pergam mata-putih| *Ducula perspicillata*| 2     | 2     | 3     | 7     |       |       |
| 3  | Walik dada-lembayung| *Ptilinopus viridis*  | 2     | 7     | 9     |       |       |       |
| 4  | Nuri bayan       | *Ectlectus roratus*   |       | 1     | 1     |       |       |       |
| 5  | Nuri pipi-merah  | *Geoffroyus geoffroyi*| 2     | 1     | 3     |       |       |       |
| 6  | Wiwik rimba      | *Cacomantis variolus* | 2     | 2     |       |       |       |       |
|   | Species                          | Numbers |   |   |   |   |
|---|---------------------------------|---------|---|---|---|---|
| 7 | Walet sapi                       | Collacalia esculenta | 9 | 9 | 5 | 10|
| 8 | Raja-udang suci                  | Halcyon sancta     | 1 | 1 | 2 |   |
| 9 | Kepudang sungu-miniak            | Coracina tenuirostris |   |   |   |   |
| 10 | Kutilang emas                    | Ixos affinis      | 1 | 1 | 2 |   |
| 11 | Srigunting lencana               | Dicrurus bracteatus | 4 | 4 | 6 | 14|
| 12 | Sikatan burik                    | Muscicapa griseisticta | 1 |   |         |   |
| 13 | Sikatan kelabu                   | Myagra galeata     | 4 | 1 | 3 | 8  |
| 14 | Kehicap pulau                    | Monarcha cinerascens | 3 | 2 | 1 | 6  |
| 15 | Kehicap kaca mata                | Monarcha trivirgatus | 1 |   |   |   |
| 16 | Kipasan dada-lurik               | Rhipidura rufiventris | 2 | 1 |   | 3  |
| 17 | Perling Maluku                   | Aplonis mysolensis | 33| 17| 31| 5 | 21| 107|
| 18 | Perling ungu                     | Aplonis metalica   | 4 | 2 |   | 8 | 14|
| 19 | Myzomela seram                  | Myzomela blasii   | 2 | 1 |   |   | 3  |
| 20 | Burung-madu hitam                | Nectarinia aspasia | 5 | 2 | 1 | 4 | 12|
| 21 | Burung-madu sriganti             | Nectarinia jugularis | 3 | 5 | 3 | 1 | 9  |
| 22 | Cabai kelabu                     | Dicaeum vulneratum | 6 | 2 | 4 | 6 | 5 | 25|

**The Total of Individual Types**: 81 48 56 27 59 271

**The Total of types**: 16 12 9 7 12 56

**The Total of Contacts**: 37 24 19 13 26 119

There was only one Elang Bondol because this species prefers areas along the muddy sea such as mangrove forests, estuary and coastal areas [11]. The condition of the protected forest habitat of Saparua Island was classified as dry land and far from water sources, both seawater and fresh water so that this species was not commonly found. It was assumed that this species only crossed the protected forest area of Tuhaha Village at the time of observation. These birds usually live in wetlands such as rice fields and swamps [12].

Perling Maluku (*Aplonis mysolensis*) was found in large numbers reaching 107 tails in the forest area. This species had a high selling value in Indonesia, and was spread across the Sula Islands, Maluku, Papua and Nusa Tenggara. This type had a long tail with a pointed middle hair. When this species was found perched on a mahogany tree (*Swietenia mahagonii*). Sometimes, it was also found above sea level at an altitude of 300 meters above sea level on Seram Island, or at the foot of hills at an altitude of 250 meters like on Halmahera, even up to 700 meters like on Buru Island.
Saparua Island Protected Forest located at an altitude of 325 m above sea level was thought to be a suitable place for this species to live.

Table 8. Diversity, Richness and Evenness of Bird Types

| Transect | The total of types (S) | The Total of Individual (N) | Index of Richness Types (R1) | Index of Diversity (H') | Index of Evenness (E) |
|----------|------------------------|----------------------------|-----------------------------|------------------------|---------------------|
| Transect 1 | 16                     | 81                         | 3.413397                    | -2.155639              | -0.777482           |
| Transect 2 | 12                     | 48                         | 2.841495                    | -2.028212              | -0.816212           |
| Transect 3 | 9                      | 56                         | 1.987404                    | -1.556579              | -0.708430           |
| Transect 4 | 7                      | 27                         | 1.820478                    | -1.624747              | -0.834954           |
| Transect 5 | 12                     | 59                         | 2.697707                    | -2.044977              | -0.822959           |

Richness index of bird species in protected forests ranges from low - medium, where transects 1, 2 and 5 were classified in the medium category, with a value of the Richness Index in the range of 2.697707 - 3.413397 (2.5 <R1> 4). The transects 3 and 4 were in the low category with a value of Richness Index ranging from 1.820478 - 1.987404 (R1 <2.5). The presence and richness of certain species of birds, are generally adjusted to their preference for certain habitats, namely on land, freshwater and sea, and can be subdivided according to plants such as dense forests, shrubs and grasses. Types of land use in the protected forest of Tuhaha Village were secondary forest and dry land mixed with bush farming. It was assumed that the type of land use with low vegetation cover resulted in some species of birds losing their nests and habitat for life. Currently bird populations in almost most forest areas in Indonesia tend to decline. The situation is a direct result of anthropogenic impacts, such as burning of forests and grasslands, shifting cultivation, hunting and bird trade.

The diversity and abundance of birds in protected forest areas was thought to be caused by abundant food resources, and low levels of predation in protected forests. Welty & Baptista (1988) said that the distribution and population of birds in a habitat are influenced by physical or environmental factors such as soil, water, temperature, sunlight and biological factors that include vegetation and other animals.

Plantation areas which are a form of new habitat after natural forests become planted forest or plantations greatly affect the presence of birds. The diversity of birds that exist in a place tends to be in line with variations in vegetation, where the more varied vegetation of a community, the diversity of bird species tends to increase as well [8].

The diversity index of bird species in forest areas was classified as medium in the five transects at numbers 1.556579 - 2.155639 (1 <H ' > 3), which shows that transects-3 and 4 are in the low category and transects 1, 2 and 5 are in the high category. The index of bird species diversity in the five transects is presented in Table 8. Bird diversity was defined as the number of bird species and their abundance in each area. Factors that influence the value of species diversity (H ’) are environmental conditions, the number of species and the distribution of individuals in each species. The species diversity index value (H ’) of birds in Saparua was included in the high category [8]. This value explains that this area had high productivity, balanced ecosystem conditions, and low ecological
pressure. In addition, the value of the species richness index (R) of birds was included in the medium category. This shows that the Saparua Island protected forest area was a suitable habitat for bird life. Ecosystems with low levels of human presence will be very good for bird life, and the availability of abundant food resources. The spread of birds in the Prevab region can be said to be stable because the value of the evenness index (E) of birds was close to 1. Evenness index value ranges from 0-1. If the value of E approaches 0, it means that the evenness between species is low, whereas if the value of E approaches 1, the distribution between species is relatively uniform. The even distribution of birds in the Prevab area was caused by the habitat compilation vegetation that supports the survival of various species of birds there. Various types of forests, such as primary forests, secondary forests and open land / shrubs are habitats for various species of birds. Some species of birds even use various types of habitat to look for food, reproduction, and maintain their survival [13].

The five transects had a high evenness index value (E), with the Evenness Index value being 0.708430 - 0.834954. The types of birds found were then examined with the Abundance Class to show their nature more clearly. The results of the Abundance Class measurements are presented in table 9.

Table 9. Class Abundance of bird species found in Protected Forests, Tuhaha Village, Saparua Island

| No | Kind of Local Name | Scientific Name | The Total of individual per transect | The Class of Abundance |
|----|--------------------|-----------------|-------------------------------------|-----------------------|
|    |                    |                 | Tr.1  | Tr.2  | Tr.3  | Tr.4  | Tr.5 | Total | Individua l |
| 1  | Elang bondol       | Haliastur indus | 1     |       |       |       |    | 1     | Rare            |
| 2  | Pergam mata-putih  | Ducula perspicillata | 2  | 2     | 3     |       | 7   | Uncommon        |
| 3  | Walik dada-lembayung | Ptilinopus viridis  | 2     | 7     |       |       | 9   | Uncommon        |
| 4  | Nuri banyan        | Eclectus roratus | 1     |       | 1     |       | 1   | Rare            |
| 5  | Nuri pipi-merah    | Geoffroyus geoffroyi | 2  | 1     |       |       | 3   | Rare            |
| 6  | Wiwik rimba        | Cacomantis variolus | 2   |       |       |       | 2   | Rare            |
| 7  | Walet sapi         | Collacalia esculenta | 9  | 9     | 5     | 10    | 4   | 37   | Common         |
| 8  | Raja-udang sucian  | Halcyon sancta  | 1     | 1     |       |       | 2   | Rare            |
| 9  | Kepudang sungu-miniak | Coracina tenuirostris | 3  |       |       |       | 3   | Rare            |
| 10 | Kutilang emas      | Ixos affinis    | 1     | 1     |       |       | 2   | Rare            |
| 11 | Srigunting lencana | Dicrurus bracteatus | 4   | 4     | 6     |       | 14  | Frequent        |
| 12 | Sikatan burik      | Muscicapa griseisticta | 4  | 1     | 3     |       | 8   | Uncommon        |
| 13 | Sikatan kelabu     | Myagra galeata  | 3     | 2     | 1     |       | 6   | Uncommon        |
| 14 | Kehicap pulau      | Monarcha cinerascens | 3   | 2     | 1     |       | 6   | Uncommon        |
15  Kehicap kaca mata  
16  Kipasan dada-lurik  
17  Perling maluku  
18  Perling ungu  
19  Myzomela seram  
20  Burung-madu hitam  
21  Burung-madu sriganti  
22  Cabai kelabu  

| Class          | Abundance |
|----------------|-----------|
| Monarcha trivirgatus | Rare     |
| Rhipidura rufigenitalis | Rare     |
| Aplonis mysolensis | 107  Abundant |
| Aplonis metalica | Frequent |
| Myzomela blasi | Frequent |
| Nectarina aspasia | Frequent |
| Nectarina jugularis | Frequent |
| Dicaeum vulneratum | Frequent |

The four types were classified as rare abundance class, namely Elang bondol, Nuri bayan, Nuri pipi-merah dan Raja-udang suci. Then, the three types were classified as uncommon abundance class, namely Pergam mata-putih, Sikatan kelabu dan Myzomela seram. Furthermore, the three types were included in the frequent abundance class, namely Cabai kelabu, madu hitam dan madu sriganti. Cinenen Kelabu bird species (Orthotomus ruficeps) favored forest areas and were usually active in groups on tree trunks and tree canopies. In addition, the presence of insects such as crickets, kroto and pelet abound in these ecosystems. These insects were feeds for the Kehicap kaca mata birds, while the purple Perling birds were insectivorous birds that had habitat on agricultural land, and open lowlands [3].

3.3. Population Density

The results of calculating the estimated Population Density are presented in table 10.
Table 10. Estimated bird population density in Protection Forests Negeri Tuhaha Saparua Island

| Local Name         | Scientific Name            | Tr. 1 | Tr. 2 | Tr. 3 | Tr. 4 | Tr. 5 | The Total of Density |
|--------------------|-----------------------------|-------|-------|-------|-------|-------|---------------------|
|                    |                             | (1 ha)| (1 ha)| (1 ha)| (1 ha)| (1 ha)| (5 ha)              |
| Elang bondol       | Haliastur indus             | 1     | 1     | 1     | 1     | 1     | 1                   |
| Pergam mataputih   | Ducula perspicillata       | 2     | 2     | 2     | 3     | 2     | 7                   |
| Walik dalemabayung | Ptilinopus viridis          | 2     | 2     | 2     | 9     | 2     | 11                  |
| Nuri bayan         | Eclectus roratus           | 1     | 1     | 1     | 1     | 1     | 1                   |
| Nuri pipi-merah    | Geoffroyus geoffroyi       | 2     | 2     | 2     | 1     | 2     | 3                   |
| Wiwik rimba        | Cacomantis variolus         | 2     | 2     | 2     | 2     | 2     | 2                   |
| Walet sapi         | Collacalia esculenta       | 37    | 18    | 13    | 23    | 8     | 99                  |
| Raja-udang suci    | Halcyon sancta              | 1     | 1     | 1     | 2     | 1     | 2                   |
| Kepudang sunguminai| Coracina tenuirostris      | 1     | 1     | 1     | 4     | 1     | 4                   |
| Kutilang emas      | Ixos affinis               | 1     | 1     | 1     | 2     | 1     | 2                   |
| Srigunting lencana | Dicrurus bracteatus        | 7     | 7     | 6     | 7     | 6     | 20                  |
| Sikatan burik      | Muscicapapa griseisticta   | 1     | 1     | 1     | 1     | 1     | 1                   |
| Sikatan kelabu     | Myagra galeata             | 7     | 2     | 6     | 7     | 2     | 6                   |
| Kehicap pulau      | Monarcha cinerascens       | 10    | 5     | 3     | 10    | 5     | 18                  |
| Kehicap kaca mata  | Monarcha trivirgatus       | 1     | 1     | 1     | 1     | 1     | 1                   |
| Kipasan dadelurik  | Rhipidura rufiventris      | 7     | 2     | 6     | 7     | 2     | 9                   |
| Perling maluku     | Aplonis mysolensis         | 86    | 47    | 69    | 5     | 23    | 230                 |
| Perling ungu       | Aplonis metalica           | 13    | 5     | 18    | 13    | 5     | 36                  |
| Myzomela seram     | Myzomela blasti            | 6     | 3     | 9     | 6     | 3     | 9                   |
The relative abundance of birds in protected forest was strongly influenced by the number of individuals of each bird species encountered during the observation. The availability of feed in a habitat type is one of the main factors for the presence of bird populations. [14]. This also relates to the ability of birds to choose habitats that are in accordance with the availability of resources for their needs. The availability of feed in mangrove forests is different from the availability of feed in lowland forests. Most of the birds in the Saparua protected forest are carnivores (eaters of insects, fish and vertebrates). The madu hitam bird was very fond of ants. At the time of observation, this bird was found eating ant carcasses on the branches of Rambutan Tree (*Nephelium lapaceum*). This was in accordance with the opinion that this species likes ants and beetles and likes to be alone and makes nests on hollow dead trees [15].

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