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Bird Diversity and Distribution Patterns in The Je'neberang River Flow Region, South Sulawesi Gowa Regency

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Abstract

The Je'neberang River is a large river that flows from the eastern part of Mount Bawakaraeng and Mount Lompobattang which then goes downstream in the Makassar Strait with a river length of 78.75 km which allows the presence of many wild animals that live around the river. This study aims to determine the diversity and distribution pattern of birds in the Je'neberang watershed as an inventory of bird data. The Point Count method is used in this study where observations are divided into 5 stations from upstream to downstream, at each station, there are 6 observation spots with a distance of 300 m from each spot, with an observation radius of 50 m. The parameters of species diversity used in this research are Shanon Biodiversity, Mdified Hill's Ratio Index of Evenness, Dominance Index, and Morisita Index. based on the results of the study found 39 species from 24 families of species Diversity (H') of birds in the Je'neberang watershed with a value of H' at the five stations from 1.95 to 2.67 (1.0 < H' 3.0) meaning moderate diversity. Evenness Index (E') Bird species in the Je'neberang Watershed, Gowa Regency, were classified as unstable with an E value at the five stations, from 0.54 to 0.68. Dominance Index (D) of Bird Species in the Je'neberang River Basin at each observation station, it is known that the five stations have high dominance because the D value at each station is close to 1, which is between 0.80 - 0.89. The distribution pattern of birds in the Je'neberang Watershed is mostly clustered, namely 30 species of birds, 5 species with uniform distribution patterns, and 4 species that cannot be analyzed.

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Keyword
Je'neberang River;
Diversity;
Distribution Pettern;
Bird

Introduction

Birds are one of the animals that have had a strong relationship with human life since time immemorial. Birds live in almost all habitat types and at altitudes. Bird habitat types are highly correlated with their daily life and activities such as resting places, perching, reproduction, eating, sheltering, and nesting (Syarifuddin, 2011). Birds are scattered from the coast to the top of mountains, in natural or artificial habitats, in urban, suburban, rural areas, mountain forests, lowland forests, beaches, ponds, rivers, lakes, agricultural land, grasslands, and settlements (Baskoro, 2018).

The Je'neberang river area is located in the southern part of South Sulawesi Province. Based on Presidential Decree No. 12 of 2012 concerning the formation of river

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areas, the je'neberang river is included in the National Strategic Je'neberang River Basin. The area of the Je'neberang river is 9,389.47 km2, which includes 58 watersheds. Administratively, there are 1 (one) city and 9 (nine) regencies traversed by the Je'neberang river, namely Makassar City, Gowa Regency, Takalar, Maros, Jeneponto, Bantaeng, Bulukumba, Sinjai, Bone and Selayar Islands. (BPDAS, 2010).

Based on the data obtained, it is known that until now there is no latest data on bird diversity in the Je'neberang watershed. This study aims to determine the diversity and distribution pattern of birds. It is hoped that this research can assist in making an inventory of bird species in the Je'neberang watershed

Materials and Methods

This research was conducted from October 2020 to June 2021 in the Je'neberang River Basin from Hulu to Hilir, Gowa Regency, South Sulawesi with the tools used in the form of observation sheets/tally sheets, monocular binoculars, Canon EOS D750 camera, Canon Ultrasonic Lens 70 - 200 mm, stationery, GIS application, hygrometer, thermometer, and bird field guide book in Wallacea, Sulawesi, Maluku, and Nusa Tenggara areas. The materials used in this study were bird species at the observation site. The method of data collection in this study is using the Point Count method (Bibby et al, 2000), by determining 5 stations consisting of 6 observation spots at each station. A map of the location of bird observation points in the Je'neberang watershed, Gowa Regency, South Sulawesi is presented in Figure 1.

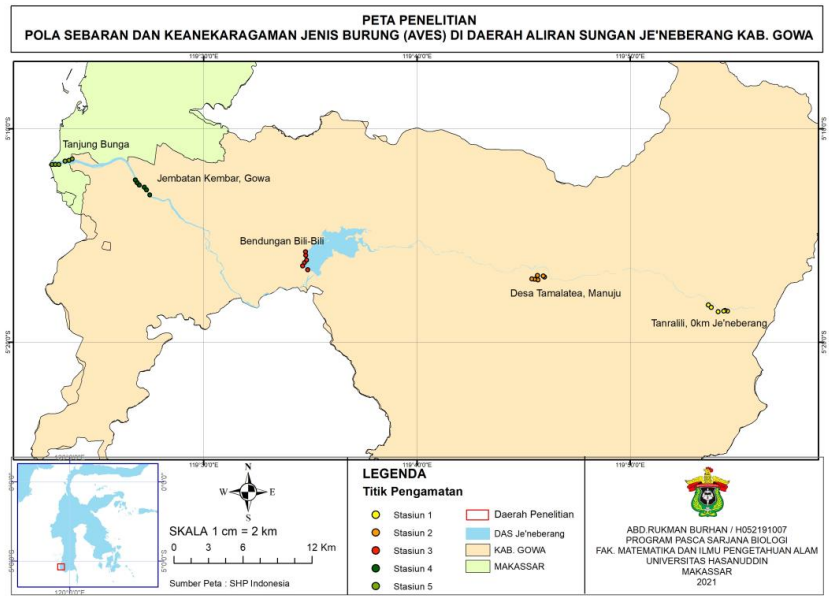


Figure1. Location map Placement of bird observation points in the Je'neberang watershed, Gowa Regency, South Sulawesi.

The workings of research observations in the Je'neberang watershed are as follows;

Preliminary Preparation

Based on the journal Rusmendro, 2009. Before data collection, preliminary observations were made, namely place observations to know the initial conditions of the research site and determine the observation points wherein each observation point the distance was 300 meters with an observation radius of 50 meters.

Data Retrieval

Observations were made in the morning at 06.00 - 09.00 WITA, continued in the afternoon at 15.00 - 18.00 WITA. Bird data was collected using the Point Count method (MacKinnon, et al 2010). Bird observation data taken is comprehensive data on bird species and the number of birds found at each observation point. Identification of the bird includes morphology, namely beak length, color, and foot color, and recording the number of birds on the tayle sheet that has been provided at each bird encounter.

Data Analysis

The data obtained were then analyzed using data analysis as follows:

a. Diversity Index (H')

$$H' = \sum_{i=1}^{n} pi \; ln \; pi$$

Information :
H' : Diversity index
Pi : ni/N
Ni : Number of Individuals of type I
N ; Total number of individuals of all types

According to Yanto, et al, 2008, the Shannon-Wienner Index has the following indicators:
H' < 1.5 ; low level of diversity
1.5 H' 3.5 : moderate level of diversity
H' > 3.5 : high level of diversity

b. Uniformity/Evenness Index (E')

$$E' = \frac{H'}{Hmaks}$$

Information :
E : Uniformity/Evenness Index
Hmax : ln S
S : Number of Species

Indicator uniformity index (Magurran, 1982);

$$E = 0 - 1$$

- The distribution of individuals between species is uneven/there are certain types of dominant (labile) when approaching 0
- The distribution of individuals between species is even if it is close to 1

c. Dominance Index (D)

The dominance index is calculated using the simpson dominance formula (Odum, 1993):

$$D = \sum (ni/N)$$

Information :
D : Simpson's Dominance Index
Ni : Number of individuals per species
N : Number of individuals of all species

The dominance index ranges from 0 to 1, if the value of the dominance index is smaller, it indicates that there is no dominant species.

d. Morisita Index

$$\text{Id} = \frac{\sum x^2 - \sum x}{\sum x^2 - \sum x}$$

$$MU = \frac{x^2_{0,975df - n - \sum x_i}}{\sum x_{i-1}}$$

$$MC = \frac{x^2_{0,025;df - n - \sum x_i}}{\sum x_{i-1}}$$

Information ;
Id : Morisita Index
Mu : Uniform Distribution Pattern Index
Mc : Index of aggregative distribution pattern
N : sample size
Xi : Number of individuals in the I-th sample unit

The decision rules for determining the shape of the distribution pattern of the observed organisms are as follows:

1. If the value of id Mc 1, then Ip is calculated using the equation;

$$\text{Ip} = 0.5 + 0.5\left[\frac{Id - Mc}{n - Mc}\right]$$

2. If the value of Mc > Id 1, then Ip is calculated using the equation:

$$\text{Ip} = 0.5\left[\frac{Id - 1}{Mc - 1}\right]$$

3. If 1 > Id > Mu, then Ip is calculated using the equation:

$$\text{Ip} = -0.5 \left[\frac{Id - 1}{Mc - 1}\right]$$

4. If 1 > Mu > Id, then Ip is calculated using the equation:

$$\text{Ip} = -0.5 + 0.5 \left[\frac{Id - Mu}{Mu}\right]$$

95% confidence indicator IP value:
A.Ip < 0, then the distribution pattern is uniform (uniform)
B.Ip = 0, then the distribution pattern is random
C.Ip > 0, then the distribution pattern is clumped

Results and Discussion

Species of birds found in the Je'neberang watershed using the Point Count method at each station (Table 1). The number of bird species found in the Je'neberang watershed was 39 species of birds with a total of individuals and species at each station, namely station I as many as 15 species with a total of 148 individuals, station II 20 species with 169 individuals, station III 20 species with 339 individuals. , station IV has 12 types with 458 individuals, station V has 14 types with 358 individuals

Table 1. Types of Bird Composition in the Je'neberang River Basin

No	Lokal Name	Latin Name	Observation Stasiun				
			I	II	III	IV	V
1	Anis gunung	*Turdus poliocephalus*	2	0	0	0	0
2	Ayam hutan merah	*Gallus galus*	3	0	0	0	0
3	Blekok sawah	*Ardeola speciosa*	0	14	41	130	11
4	Bondol kepala pucat	*Lonchura pallida*	0	3	8	33	15
5	Bondol pecking	*Lonchura punctula*	0	0	11	6	27
6	Bondol rawa	*Lonchura malacca*	12	0	54	41	116
7	Cabai panggul kuning	*Dicaeum aureolimbatum**	5	10	9	0	0
8	Cabai sulawesi	*Dicaeum nehrrkorni**	7	0	0	0	0
9	Cekakak sungai	*Halcyon chloris*	0	2	9	0	2
10	Cerek tilil	*Charadrius alexandrius*	0	0	12	0	0
11	Cici padi	*Cisticola juncidis*	1	6	0	0	4
12	Cucak kutilang	*Pycnonotus aurigaster*	21	30	36	32	41
13	Dara biasa	*Sterna hirundo*	0	0	0	0	22
14	Decu belang	*Saxicola caprata*	2	8	0	0	0
15	Decu belang betina	*Saxicola albonata*	0	9	0	0	0
16	Elang bondol	*Haliastur indus*	0	1	0	0	0
17	Elang kelabu	*Butastur indicus*	0	2	0	0	0
18	Elang ular sulawesi	*Spilornis rufipectus**	2	0	0	0	0
19	Gagak hutan	*Corvus enca*	0	4	1	0	0

20	Gereja erasia	*Passer montanus*	0	7	30	8	15
21	Jalak kerbau	*Acriditheres javanicus*	2	0	0	0	0
22	Kacamata biasa	*Zosterops palpebrosus*	14	15	21	32	29
23	Kacamata gunung	*Zosterops montanus*	16	0	0	0	0
24	Kapasan sulawesi	*Lalage leucopygialis**	0	3	8	0	0
25	Kapinis rumah	*Apus affinis*	0	0	0	10	0
26	Kekep babi	*Artamus leucorhynchus*	0	0	3	0	0
27	Kicuit batu	*Motacilla cinerea*	0	0	5	0	0
28	Kowak-malam merah	*Nycticorax nycticorax*	0	0	0	6	0
29	Kuntul kecil	*Egretta garzetta*	0	0	1	0	0
30	Layang-layang batu	*Hirundo tahitica*	0	3	12	18	4
31	Madu sriganti	*Nectarinia jugularis*	0	4	5	0	0
32	Merpati batu	*Columba livia*11	0	0	3	5	3
33	Raja udang erasia	*Alcedo atthis*	0	6	2	0	0
34	Sikatan bakau	*Cyornis rufigastra*	1	0	0	0	0
35	Sikatan Pulau	*Eumyias panayensis*	4	0	0	0	0
36	Terkukur biasa	*Streptopelia chinensis*	0	6	0	0	0
37	Trinil Pantai	*Actitis hypoleucos*	0	0	0	0	3
38	Trinil semak	*Tringa glareola*	0	1	0	0	0
39	Walet sapi	*Collocalia esculenta*	56	35	68	137	66
	Number of Individuals		148	169	339	458	358
	Number of Species		15	20	20	12	14

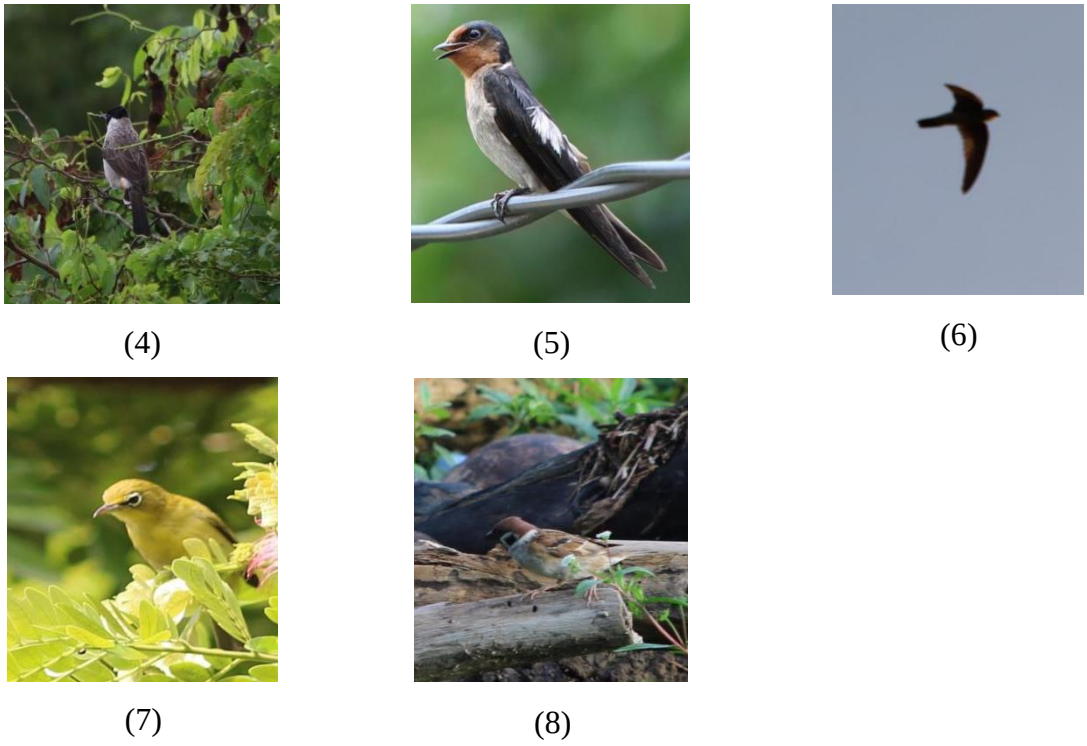
Information :
* = Endemic in the Wallacea Region

Based on table 1 above, there are 4 species of birds endemic to Sulawesi, namely the Sulawesi Snake Eagle (Splornis rufipectus), Sulawesi Kapasan (Lalage leucopygialis), Sulawesi Chili (Dicaeum nerhkoni), and Yellow Panggul Chili (Dicaeum aureolimbatum). The types of birds that most often appear at each station, namely 8 bird species can be seen in Figure 1 below, as follows.

(1)

(2)

(3)



(4) (5) (6)

(7) (8)

Figure 2. Species that often appear at each observation station (1). Blekok sawah (*Ardeola speciosa*), (2). Bird bondol kepala pucat (*Lonchura pallida*), (3). Bird bondol rawa (*Lonchura malacca*), (4). Cucak kutilang (*Pycnonotus aurigaster*), (5). Bird layang-layang batu (*Hirundo tahitica*), (6). Walet sapi (*Collocalia esculenta*), (7). Bird kacamata biasa (*Zosterops palpebrosus*) and Bird gereja erasia (*Passer montanus*) . (personal documentation, 2021)

Heterogeneity (Heterogeneity)

The heterogeneity of bird communities at the five observation stations in the Je'neberang watershed includes the Shannon-Wienner diversity index, Simpson dominance index, and evenness index. The index of bird species diversity at the two five stations ranged from 1.95 to 2.67 which was categorized as moderate diversity (1.0 < H' 3.0). The evenness index (E) obtained has a value close to 0 (0.54 - 0.68) which is considered to have an uneven distribution. The Simpson Dominance Index (D) obtained has a value close to 1 (0.80 - 0.89) indicating dominance by one or several species.

Table 2. Values of Shannon-Wienner Diversity Index (H'), Evenness Index (E), Simpson's Dominance Index (D) at the five observation stations in the Je'neberang watershed, Gowa Regency.

Observation Parameter	Observation Station				
	I	II	III	IV	V
Species Diversity (H')	2,1	2,6	2,5	1,9	2,1
Specific Evenness Index (E')	0,5	0,7	0,6	0,6	0,6
Dominance Index (D)	0,80	0,89	0,89	0,80	0,82

Distribution Pattern

Distribution patterns of birds in the Je'neberang watershed, Gowa Regency at each station (Table. 3), using the Morisita Index, namely there are 30 species whose distribution patterns are clustered, there are 5 species with uniform distribution patterns and only 4 species that cannot be analyzed. because the individual abundance of each bird species is below one individual.

Table 3. Bird distribution patterns in the Je'neberang watershed, Gowa Regency, South Sulawesi

NO	SPESIES	AMOUNT	IP	INFORMATION
1	Anis gunung (*Turdus poliocephalus*)	2	1	Clumped
2	Ayam hutan merah (*Gallus galus*)	3	0,12	Clumped
3	Blekok sawah (*Ardeola speciosa*)	196	0,1	Clumped
4	Bondol kepala pucat (*Lonchura pallida*)	59	0,12	Clumped
5	Bondol pecking (*Lonchura punctula*)	44	0,08	Clumped
6	Bondol rawa (*Lonchura malacca*)	223	0,07	Clumped
7	Cabai panggul kuning (*Dicaeum aureolimbatum*)	24	0,08	Clumped
8	Cabai sulawesi (*Dicaeum nehrrkorni*)	7	0,23	Clumped
9	Cekakak sungai (*Halcyon chloris*)	13	-0,01	Uniform
10	Cerek tilil (*Charadrius alexandrius*)	12	1	Clumped
11	Cici padi (*Cisticola juncidis*)	11	0,01	Clumped
12	Cucak kutilang (*Pycnonotus aurigaster*)	160	0,009	Clumped
13	Dara biasa (*Sterna hirundo*)	22	1	Clumped
14	Decu belang (*Saxicola caprata*)	10	0,09	Clumped
15	Decu belang betina (*Saxicola albonata*)	9	0,19	Clumped
16	Elang bondol (*Haliastur indus*)	1	-	-
17	Elang kelabu (*Butastur indicus*)	2	1	Clumped
18	Elang ular sulawesi (*Spilornis rufipectus*)	2	1	Clumped
19	Gagak hutan (*Corvus enca*)	5	-0,06	Uiniform
20	Gereja (*Passer montanus*)	60	0,08	Clumped
21	Jalak kerbau (*Acriditheres javanicus*)	2	1	Clumped
22	Kacamata biasa (*Zosterops palpebrosus*)	111	0,042	Clumped
23	Kacamata gunung (*Zosterops montanus*)	16	0,63	Clumped
24	Kapasan sulawesi (*Lalage leucopygialis*)	11	0,19	Clumped
25	Kapinis rumah (*Apus affinis*)	10	1	Clumped
26	Kekep babi (*Artamus leucorhynchus*)	3	1	Clumped
27	Kicuit batu (*Motacilla cinerea*)	5	1	Clumped
28	Kowak-malam merah (*Nycticorax nycticorax*)	6	0,6	Clumped
29	Kuntul kecil (*Egretta garzetta*)	1	-	-
30	Layang-layang batu (*Hirundo tahitica*)	37	0,04	Clumped
31	Madu sriganti (*Nectarinia jugularis*)	9	0,37	Clumped
32	Merpati batu (*Columba livia*)	11	0,21	Clumped
33	Raja udang erasia (*Alcedo atthis*)	8	-0,0043	Uniform
34	Sikatan bakau (*Cyornis rufigastra*)	1	-	-
35	Sikatan Pulau (*Eumyias panayensis*)	4	0,35	Clumped
36	Terkukur biasa (*Streptopelia chinensis*)	6	-0,007	Uniform
37	Trinil Pantai (*Actitis hypoleucos*)	3	-0,02	Uniform

38	Trinil semak (*Tringa glareola*)	1	-	-
39	Walet sapi (*Collocalia esculenta*)	362	0,07	Clumped

Discussion

Composition Type

Birds are members of a group of vertebrate animals (vertebrates) that have feathers and wings (Kuswanda, 2010). Birds are also wild animals that have survived in all habitats, and have high mobility, and are easy to adapt to a wide variety of environmental types (Welty, 1982 in Rohiyan et al, 2013).

This research was conducted in the Je'neberang River Basin, Gowa Regency, from October 2020 to May 2021 by collecting data at five observation stations with six observation points at each station which were divided into six points per station. The data obtained is based on table 1. there are 39 species of birds from 24 families, with a total number of individuals at each station, namely at station 1 there are 148 individuals with a total of 15 species, at station 2 there are 169 individuals with 20 species, at station 3 there are 339 individuals with 20 species, station 4 there are 458 with 12 species, and station 5 there are 356 individuals with 14 species. Species found at all observation stations in the Je'neberang watershed tend to experience an increase in the number of individuals and a decrease in the number of species, which is fluctuating, it can be seen in Table 1. found at station 2 and station 3, this is because at stations 2 and 3 are areas that have many adequate sources of feed because they are close to forest areas, agricultural land, fish ponds, and according to Lack, 1971 that the presence of birds in an area depends on the characteristics habitat, the number of species is also influenced by the level of adequate resources.

Heterogeneity

1. Diversity of Bird Species in the Je'neberang River Basin

Based on observations and data analysis, it is known that the diversity of bird species in the Je'neberang watershed shows that the five stations have an average value of species diversity that is almost the same, which is between 1.9 to 2.6 (Table 2) and overall has a moderate level of diversity, with a moderate level of productivity, fairly balanced ecosystem conditions and moderate ecological pressure (1 < H 3) (Figure 3).

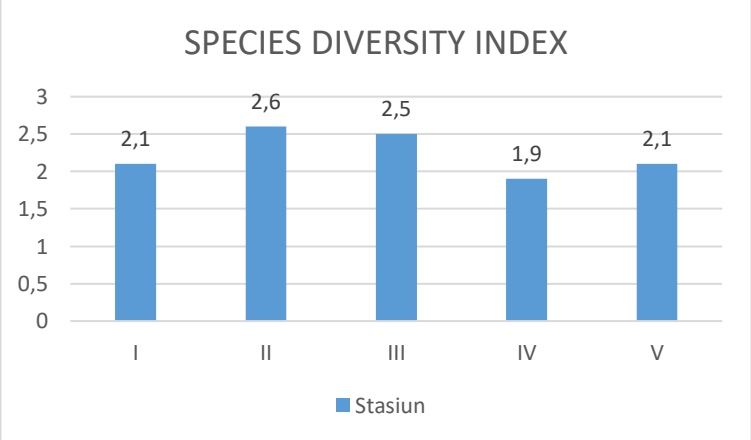


Figure 3. Histogram of the bird diversity index (H') at five stations in the Je'neberang River Basin, Gowa Regency 2021

Based on the analysis of the diversity index at all stations, the data obtained at station one has a diversity of 2.1, station two has a diversity value of 2.6, station three has a diversity of 2.5. station four has a diversity value of 1.9 and station five has a diversity of species that is 2.1, it can be seen in table 2. The results of the study indicate that station two has the highest level of diversity, while station four has a low level of diversity. This is because station four is located with densely populated conditions and human activities are too dense, which causes the availability of food sources for birds to not be fulfilled, and also human interaction in residential areas makes the natural ecosystem for birds to experience competition against the environment and the natural environment of birds is disturbed. Habitat conditions greatly affect the high and low diversity of bird species (Simanjuntak, et. Al, 2013). According to (Yoga, 2018), in his journal, the higher the Shannon Wiener Index, the better the carrying capacity of the ecosystem in that location.

2. Species Evenness Index in the Je'neberang Watershed

The Species Evenness Index (E) can be seen in Figure 4. where the highest value is 0.68 at station two. Then at station three, the evenness value is 0.61, Station four, and Station five have the same type of evenness, namely 0.58. And the lowest is at station one, which is 0.54, this is because at station one it was caused by extreme weather at the time the research was conducted and the air temperature was too low. In the Je'neberang watershed at each observation station, the evenness index obtained has a value close to 0 (0.54 - 0.68) which means it has an uneven distribution (labile). Evenness in a habitat will reach its maximum point and is classified as homogeneous if all species have a balanced number of individuals in all observed habitats (Fikriyanti et al., 2018).

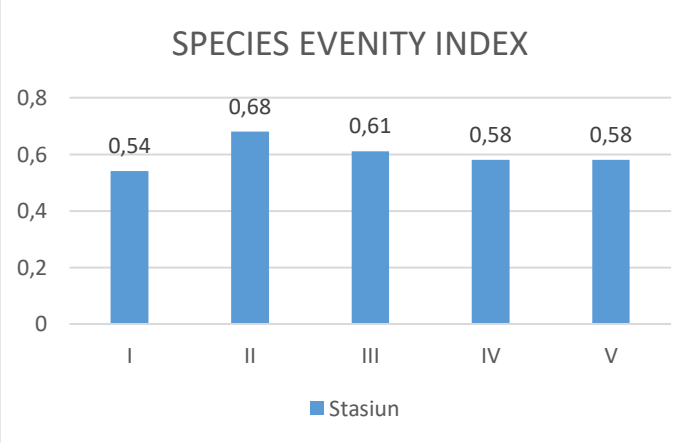


Figure 4. Histogram of evenness index (E') of birds at five stations in the Je'neberang River Basin, Gowa Regency 2021.

3. Simpson's Dominance Index (D)

Based on observations made at each station, it was found that at station 1 the dominance value was 0.80, at station 2 and station 3 had the same dominance value of 0.89, at station 4 had a dominance value of 0.80, and station 5 had dominance value of 0.82. The dominance index shows that at each observation station in the Je'neberang watershed, it is close to 1 (0.80 - 0.89) indicating dominance by one or several species.

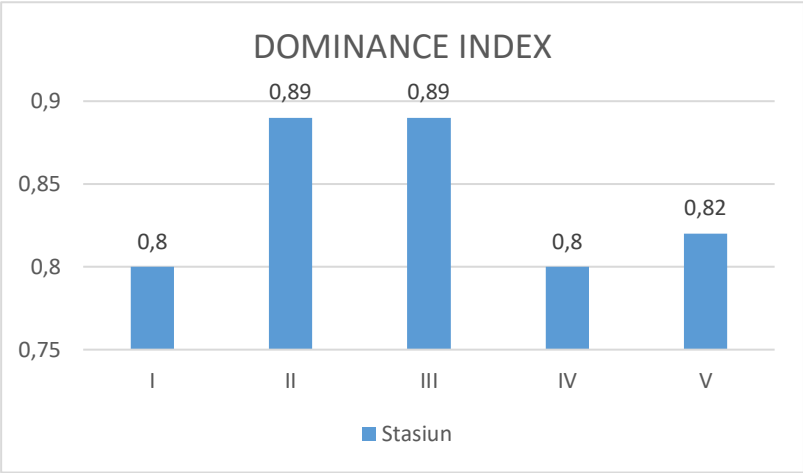


Figure 5. Histogram of bird dominance index (D') at five stations in the Je'neberang Watershed, Gowa Regency 2021.

From the observations obtained, it is known that there are several types of birds in the Je'neberang watershed that dominate, namely Blekok rice fields (Ardeola speciosa), Pale head Bondol (Lonchura pallida), Swamp Bondol (Lonchura malacca), Cucak finches (Pycnonotus aurigaster), Ordinary glasses (Zosterops palpebrosus), stone kite (Hirundo tahitica), church (Passer montanus) and cow swallow (Collocalia esculenta). From each observation station, it is known that the five stations have high dominance because the D value is close to 1. According to (Odum,1971), states that this category can be caused by lack of food and hunting for certain bird species so that it can cause pressure or obstacles to bird species in the five stations. observation.

Distribution Pattern

The spread of bird species is strongly influenced by the suitability of birdlife which includes bird adaptation to the environment, ecosystem level, competition, food availability, and natural selection (Wisnubudi, 2009).

Based on the results of research conducted in the Je'neberang watershed, it can be seen in Table 3. that most of the bird species in the Je'neberang watershed are more widely distributed in groups than a uniform distribution pattern. factor. According to (Alan, 2012) being influenced by the presence of resources, especially food in a habitat, is a very urgent limiting factor for the distribution and becomes very important in the survival of organisms in that habitat. Grouping indicates that organisms gather in several productive habitats, this event is caused by group behavior, diverse environments, reproductive structures that have special characteristics, physical and chemical factors, weather, food availability, social level. And due to the nature to defend themselves from predators and other unfavorable factors (Junaidi et al. 2009). The distribution pattern of an organism in nature rarely forms a uniform, but generally forms a clustered pattern (Gate, et al, 2007 in the journal Putri, et al 2015). This can be seen from the existence of the ecosystem around the Je'neberang river which is homogeneous and scattered in each observation, namely the same type of ecosystem at each station.

Conclusions

Based on the results of research and bird observations in the Je'neberang River Basin, it can be concluded that;

1. Species Diversity (H') of birds in the Je'neberang Watershed with a value of H' at the five stations from 1.95 to 2.67 (1.0 < H' 3.0) means moderate diversity.
2. Evenness Index (E') Bird species in the Je'neberang River Basin, Gowa Regency, are in the unstable category with an E value at the five stations, namely 0.54 to 0.68.
3. Dominance Index (D) Bird Species in the Je'neberang Watershed at each observation station, it is known that the five stations have high dominance because the D value at each station is close to 1, which is between 0.80 - 0.89.
4. The pattern of bird distribution in the Je'neberang Watershed is 30 species of birds with a group distribution pattern, only 5 species with uniform distribution patterns, and 4 species that cannot be analyzed.

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