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The Morphological and Qualitative Character the Color Bird Profileof Walik Sula (*Ptilinopus mangoliensis*)and Walik Tanah Ternate (*Chalchophaps indica*) for Conservation

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Abstract

Walik Sula (Ptilinopus mangoliensis) in Sula is called Puna Biasa or Punai because Puna bird (*Treron aromaticus*) is called Puna Giu by the local people. This bird has long been known by the people of North Maluku, it is a bird that belongs to Columbidae family, namely pigeons with small-to-medium body size.

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Walik Sula of medium size (33-36 cm) is green with a relatively long tail. There is a small maroon patch in the throat and on the head with gray color and a horizontal black line. The neck and lower body until the lower abdomen is pale green. The abdomen up to the rump is yellow for the male. These birds are endemic in Indonesia with limited distribution in P. Sula Besi, P. Mangole and P. Taliabu in Nort Maluku. The aim of this research is to analyze the morphology of Sula Walik bird, namely the morphometric profile covering the body and feather colors. The research alsp showed that Walik Sula birds were larger in size with an average weight of 146 grams, compared to that of Walik Tanah Ternate, whivh was 96 grams. Morphologically, this difference has something to do with genetic and environmental factors.

***Keywords*:** Walik Sula Bird; Walik Ternate Bird; Morphomertr.

1. Introduction

Biodiversity of North Maluku is a priority area for conservation and globally it becomes a priority area for the biodiversity of Halmahera Island. The island has a wealth of wildlife with 210 species of birds, and there are 26 species of endemic birds reported in the Maluku Islands, 24 of which are in North Maluku[22]. Walik Sula is an Indonesian endemic bird with a limited distribution area in P. Sula besi, P. Mangole and P. Taliabu, Maluku [3,4].

Walik Sula is one of the germplasm of poultry species located in North Maluku, which is found in the Regency of the Sula Islands. This regency is located in the southernmost part of North Maluku Province. Walik bird (*Ptilinopus mangoliensis*), a medium-sized bird genus, belongs to *family Columbidae* and has a kinship with pigeons. Walik is an arboreal species that lives in trees and eats fruits. This bird also entered the status of red list [8]. The list of Appendix II, Convention on International Trade in Endangered Species of Wild Fauna and Flora [2].

On a regional basis, the evaluation results showed that endangered species and other biological natural resources were still poorly integrated into conservation programs, especially outside of the nature reserves [26].The habitat of animals is strongly influenced by the environment, both in the form of biotic and non biotic factors. For biotic factors, vegetation is one of the most important factors because vegetation can be a source of food, shelter, and a living area for much needed elements in animal life [14].

States that vegetation is a collection of various types of plants that form a unity and they are interdependent. vegetation consists of all types of plants that exist in a region and is a collection of plants consisting of several types interacting with one another, both between individuals, animals and the environment which form a living and dynamic system [24]. Conservation has two main functions: first, ecological function (protection, preservation of species, germplasm) which supports natural populations through restocking of breeding results, and second, socio-economic and socio-cultural function which is to fulfill the aspects of utilization for the benefit of human welfare. The development of both functions can be as a unit of conservation or two separate things, but the principle of sustainability and purity of germplasm should be taken into consideration [5]. Efforts to conserve animals require a model or a precise concept for the preservation and development of these animals,

involving the surrounding community as a subject directly related to the habitat of these animals. In addition, the government should act as a trigger in terms of policy-making and budget assistance in handling program in saving these endangered animals from extinction. Breeding aims to increase the population to cope with extinction threats that involve research to obtain information such as determining species, sex, daily behavioral observations as well as to obtain useful information and knowledge to support the conservation efforts of Walik Sula and scientific experiments for the improvement of population and cultivation opportunity in the future [9]. The meat of Walik Sula has long been consumed by the local people. Both knowledge of morphology and morphometrics and the qualitative nature of feather colors are some aspects that need to be known by the breeders and related agencies, because they have formed the profile of Walik Sula species. In addition, it is also necessary to learn about the species profile as the genetic conservation efforts of the Indonesian wildlife and, at the same time, as a reference in selecting good and superior Walik birds that can increase production in terms of quality and quantity.

2. Materials and Method

This research was conducted from January to February 2017 in an experimental cage in Ternate City, Indonesian. The study used 15 Walik birds, consisting of 10 Walik Sula birds and 5 Walik Tanah Ternate birds(samples for two different species of birds due to collection problems, these birds are wild).The tools used in this study were 3 cages, a caliper, a camera, a hanging scale and a computer unit equipped with Minitab 16 program to assist data processing.The research method used was observation and measurement, and the data was processed descriptively. All external body organs were measured and the observation of the qualitative characteristic of feather colorused.The body parts of the bird measured were weight, length of digits, tail length, wings featherlength, bill length, length of tibia tarsus, tarsus metatarsus circumference, tarsus metatarsus length, length of middle toe, length of a stripe above the eyes, data filling with data retrieval form.

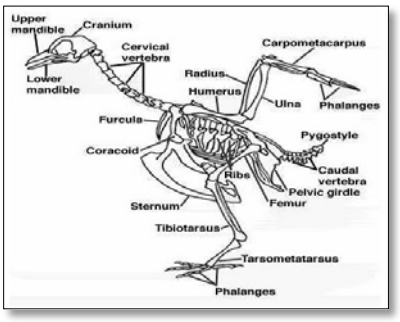

Figura 1: Bird skeleton organ

3. Data Analysis

The morphology and morphometrics were obtained by calculating the mean values, Standard Deviation (SD), and the coefficient of diversity (KK) of each variable observed by using Principal Component Analysis (PCA) or Main Component Analysis (MCA), which was used to identify morphometrics and outer organsof Walik Sula based on body conformation (size and shape).

The data analysis model used for outside organs is as

following:

$$\mathbf{Yp = a1pX1 + a2pX2 + a3pX3 + a4pX4 + ...+ anpXn}$$

Note:

Yp	=	Main component of –p
a1p, a2p, ... anp	=	Characteristic vector/Eigen vector of -1,...., n on the main component of –p
X1,X2,...,Xn	=	Observed variables: (femur length, tarsometarsus length, wing length, andmaxilla length).

The analysis used for the qualitative properties of feather color used relative frequency formula.

$Fr = \frac{X}{n} x\ 100$

Note:

Fr	=	relative frequency (%)
X	=	number of samples with a certain color (bird)
N	=	Total samples (bird)

3. Results and Discussion

3.1. Habitat of Walik Birds (Ptilinopus mangoliensis)

The regency of the Sula Islands lies between 01° 45'- 00"South Latitude and 124° 05'50" - 124° 05'- 126° 50" East Longitude. Based on its graphic position, the regency of the Sula Islands is located in North Maluku Province, in the northern borders on Maluku Sea, in the south on Banda Sea, in the west on Central Sulawesi province, and in the east on Seram Sea. Administratively, the regency is divided into 12 sub-districts and 60 villages. As an area located on the Wallacea line, the regency of the Sula Islands only recognizes two seasons, namely the dry season and the rainy season [16].

The habitats of Walik Sula birds are located in three locations: in the regency of the Sula Islands with an altitude of 20 to 291m above sea level, with an average temperature of 28°C. The research results of walik bird habitats revealed that walik birds were found in the secondary forest, in the plantation and in residential area which is adjacent to the plantation. Both species of walik have different habitats or living places. Walik Sula birds look for food arboreally and Walik Tanah Ternate look for terrestrially meal, although it is possible that Walik Sula is found foraging terrestrially eating grains and, on the contrary, Walik Tanah Ternate can be found consuming

fruit on trees.Walik Sula birds are often seen during the fruiting season, namely, when the fruit have been ripe, between banyan (*Ficcus sp*) and lem fruit (*Manilkara fasciculata*) while Walik Tanah Ternate are often seen in farming areas such as corn, tubers and rice crops. It is suspected that rice seeds are one of the favorite feeds of Walik Tanah Ternate.

3.2. Linear Sizes on Walik Sula (Ptilinopus mangoliensis)

The results of the measurements of 10 Walik Sula birds and 5 Walik Tanah Ternate birds showed differences in each external organ. The body sizes of both types can be seen in Table 1.

Table 1: Linear sizes of the outer organs of Walik Sula dan Walik Tanah Ternate

Variable	Walik Sula (n = 10 birds)		Walik Tanah Ternate (n = 5 birds)	
	X± SD (mm)	KK (%)	X±SD (mm)	KK (%)
Digits length (X1)	42.17 ± 5.78	13.7	48.73 ± 4.39	9.02
Tail length (X2)	79.41 ±10.95	13.79	88.79 ± 4.77	5.37
Bill length (X3)	17.83 ± 2.27	12.77	17.90± 1.65	9.22
Wings feather length (X4)	132.81 ± 5.41	4.07	175.96 ± 3.63	2.06
Tibia tarsus length (X5)	36.26 ± 5.21	14.39	38.86 ±19.81	50.97
Tarsumetarasus circumference (X6)	18.30 ± 3.82	14.99	15.53 ± 2.42	15.59
Tarsumetarsus length (X7)	18.04 ± 2.35	13.04	22.72 ± 4.28	18.86
Middle toe length(X8)	20.50 ± 4.93	24.06	25.91 ± 0.79	3.05
Length of stripe above eyes(X9)	2.67 ± 1.12	41.95	2.37 ± 0.67	28.48

Description: X = Average, SD = Standard Deviation, KK = Coefficient of Diversity, n = Number of sample

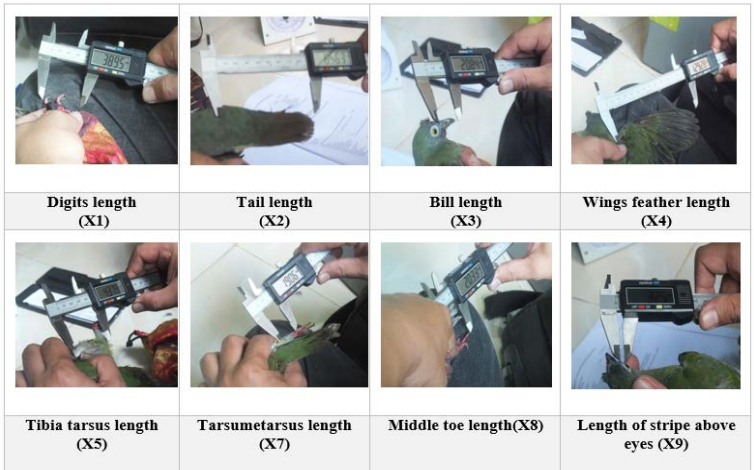

Figure 2: Measurement of the size of the body a walik sula bird (Ptilinopus mangoliensis).

Source: Own colection

Based on the results in Table 1, it can be seen that there are differences in linear body sizes of Walik Sula and Walik Tanah Ternate. The outer organs of Walik Tanah Ternate have a smaller body size compared to Walik Sula organs. The lowest diversity coefficient of the organs of Walik Tanah Ternate was on the lengths of wing

feathers (2.06%) and the highest diversity coefficient of the organs of Walik Tanah Ternatewas on the lengths of tibia tarsus (50.97%).

The lowest diversity coefficient of Walik Sula was the lengths of wing feathers (4.07%) and the highest diversity coefficient was in the stripelength above the eyes(41.95%). Body size in birds has size and shape that vary due to developmental differences and adapted to habitat [7].

Body Weights of Walik Sula and Walik Tanah TernateThe results of the body weight measurement of Walik Sula and Walik Ternate can be seen in Table 2:

Table 2: Body weights of Walik Sula and Walik Tanah Ternate

Sample	Walik Sula *(Ptilinopus mangoliensis)/g*	Walik Tanah Ternate *(Chalchophaps indica)/g*
X1	160	100
X2	160	90
X3	170	100
X4	100	90
X5	90	100
X6	200	
X7	200	
X8	160	
X9	100	
X10	120	
Average	146	96
SD	40.87	5.47
KK	27,9 (%)	5,70 (%)

Standard Deviation of Walik Sula body weight was 27.9%, indicating high diversity among birds which could be caused by the small number of the birds, while Walik Tanah Ternate had a standard deviation of the body weight of 5.70% The above data show that there is a difference in body weight between Walik Sula and Walik Sula Tanah Ternate.

Walik sula had a larger body compared to Walik Tanah Ternate.

This is in line with the finding of family Columbidae tend to be small, medium to large in size [1]. State that the diversity of livestock body size is influenced by genetic and environmental factors [12].

Genetically, Walik Sula and Walik Tanah Ternate are different species. In addition, Walik Sula and Walik Tanah Ternate have different habitats so that the apportunity to obtain food is also different.

3.3. Digest Length of Walik Sula and Walik Tanah Ternate

Digest Lengths of Walik Sula and Walik Tanah Ternate can be seen in Table 3.

Table 3: Digest Lengths ofWalik Sula and Walik Tanah Ternate

Sample	Walik Sula *(Ptilinopus mangoliensis)/mm*	Walik Tanah Ternate *(Chalchophaps indica)/mm*
X1	*34.95*	*46.75*
X2	*36.92*	*56.52*
X3	*32.56*	*47.26*
X4	*45.89*	*45.8*
X5	*43.77*	*47.32*
X6	*46.55*	
X7	*38.95*	
X8	*47.8*	
X9	*46.5*	
X10	*47.86*	
Average	42.175	48.73
SD	5.7813	4.39
KK	13.7 %	9.02 %

Digit Length ofwalik sula from X1-X10 ranged from 32.56 to 47.86 mm with an average digitlength of 42.75 mm, whereas digit length ofWalik Ternate ranged from 45.8-56.52 mm with an average digit length of 48.73 mm. The result of the research showed that the digit of Walik Tanah Ternate waslonger than that of Walik Sula, which is probably caused by genetic factor, stated the different shapes of the bill and feet of birdsare due to their feeding habits and locomotive capabilities [17].

3.4. Tail lengths of Walik Sula and Walik Tanah Ternate

The measurement results of tail lengths of Walik Sula and Walik Tanah Ternate can be seen in Table 4.

Table 4: Tail lengths of Walik Sula and Walik Tanah Ternate

Sample	Walik Sula *(Ptilinopus mangoliensis)/mm*	Walik Tanah Ternate *(Chalchophaps indica)/mm*
X1	*70.55*	*89.55*
X2	*87.94*	*90.9*
X3	*77.47*	*91.8*
X4	*85.69*	*80.38*
X5	*88.95*	*91.32*
X6	*60.36*	
X7	*62.97*	
X8	*87.68*	
X9	*85.95*	
X10	*86.55*	
Average	79.41	88.79
SD	10.95	4.77
KK	13.79 %	5.37 %

The lengths of Walik Sula tail feathers from X1-X10 were between 60.36 - 88.95 mm, with an average length of the tail feather being 79.41 mm. Meanwhile, the lengths of tail feathers of Walik Tanah Ternate were between

80.38 - 91.8 mm, with an average tail length being 88.79 mm. The differences in the length of bird tail feathers was caused by different genetic factors [11].

3.5. Bill lengths of Walik Sula and Walik Tanah Ternate

Bill lengths of Walik Sula and Walik Tanah Ternate can be seen in Table 6.Bill is one of the morphological features to identify bird species based on feed and the way they take feed[17]. Birs bills have almost the same function as the hands,and the mouth, and at the same time, they indicate the eating habits of birds [21]. The size of the bill shown in length, width and depth could contribute information on size scores based on the Main Component Analysis, but more ecological information may provide variations in the size and shape of the bill as a result of the types of feed consumed [23].

Table 5: Bill lengths of Walik Sula and Walik Tanah Ternate

Sample	Walik Sula *(Ptilinopus mangoliensis)/mm*	Walik Tanah Ternate *(Chalchophaps indica)/mm*
X1	17.2	16.9
X2	18.33	15.88
X3	16.72	19.52
X4	16.55	17.56
X5	16.14	19.66
X6	22.71	
X7	20.84	
X8	17.65	
X9	15.25	
X10	16.95	
Average	17.83	17.90
SD	2.27	1.65
KK	12.77 (%)	9.22 (%)

The bill length of Walik Sula from R1 - R10 ranged from 15.25 to 22.71 mm, with an average bill length of 17.33 mm and Walik Tanah Ternate rangedfrom 15.88 to 19.66 mm, with the average bill of 17.90 mm.

The average length of the bills of these bird species based on the results of the measurements showed that Walik Tanah Ternate had a longer bill, and this was thought to be influenced by genetic and environmental factors

The difference in the bills of Walik Sula and Walik Tanah Ternate may be caused by different genetic factors. The bill is the body structure found on the bird's mouth, and each bird species has a different bill shape.

3.6. Length of Wing Feathers of Walik Sula and Walik Tanah Ternate

Wing Feather Lengths of Walik Sula and Walik Tanah Ternate can be seen in Table 6.

Based on the measurement results, the wing feather length of Walik Sula from X1-X10 ranged from 142.6 to 124 mm, with an averageof 132.8 mm. Walik Ternate has a wing feather length of X1-X5 ranged from 169.68 -

179.12 mm, with an average of 175.96 mm. These results indicated that the wing feathers of Walik Tanah Ternate were longer than Walik Sula. This difference was caused by different feeding habits. Walik Tanah Ternate search for food in a terestorial way and take a rest on the tree so that the roaming area from the ground to the tree requires more flying power than walik sula, which search for food in an arboreal way from branch to branch. The difference in wing feathers between Walik Sula and Walik Tanah Ternate is also thought to be caused by the active Walik Tanah Ternate using its wing feathers to save itself. In addition, the difference in wing feather is thought to be influenced by different genetic factors. Suggest that the wings in birds vary in size and shape due to the different development which is adapted to habitat [20,7].

Table 6: Wing Feather Lengths of Walik Sula and Walik Tanah Ternate

Sampel	Walik Sula *(Ptilinopus mangoliensis)/mm*	Walik Tanah Ternate *(Chalchophaps indica)/mm*
X1	*142.6*	*179.12*
X2	*135.31*	*169.68*
X3	*137.19*	*177.16*
X4	*127*	*177.15*
X5	*124*	*176.69*
X6	*133.7*	
X7	*129.28*	
X8	*135.21*	
X9	*129.65*	
X10	*134.25*	
Rataan	132.819	175.96
SD	5.4132	3.6336
KK	4.0756	2.0650

3.7. Length of the Tibia Tarsus of Walik Sula and Walik Tanah Ternate

The length of the Tibia Tarsus of Walik Sula and Walik Ternate can be seen in table 7.

Table 7: The Length of the Tibia Tarsus of Walik Sula and Walik Tanah Ternate

Sample	**Walik Sula *(Ptilinopus mangoliensis)/mm***	**Walik Tanah Ternate *(Chalchophaps indica)/mm***
X1	33.84	52.29
X2	39.06	48.22
X3	25.52	49.62
X4	35.98	39.75
X5	32.65	4.43
X6	43,79	
X7	42.63	
X8	38.20	
X9	34.90	
X10	35.98	
Average	**36.26**	**38.86**
SD	**5.21**	**19.81**
KK	**14.39 (%)**	**50.97 (%)**

The length of the tibid tarsus of Walik Sula from X1-X10 ranged from 25.52 - 43.79 mm, with Tibia Tarsus length average of 36.2mm, while the length of the tibid tarsus of Walik Tanah Ternate from X1-X5 ranged between 39.75-52.29 mm, with Tibia Tarsus length average of 38.86 mm. Based on the research results, Walik Sula had a tibia tarsus average shorter than Walik Tanah Ternate. This could be influenced by genetic and environmental factors.

3.8. Tarsumetatarsus Diameter of Walik Sula and Walik Tanah Ternate

Tarsumetatarsus Diameter ofWalik Sula and Walik Tanah Ternate can be seen in Table 8.

Table 8: Tarsumetatarsus Diameter of Walik Sula and Walik Tanah Ternate

Sample	*Walik Sula (Ptilinopus mangoliensis)/mm*	*Walik Tanah Ternate (Chalchophaps indica)/mm*
X1	17.33	13.25
X2	17.26	12.58
X3	23.71	17.33
X4	19.89	16.86
X5	13.33	17.67
X6	22.01	
X7	18.72	
X8	20.35	
X9	18.65	
X10	20.7	
Average	18.30	15.53
SD	3.82	2.42
KK	20.89 (%)	15.59 (%)

The Tarsumetatarsus diameter of Walik Sula from R1-R10 ranged from 13.33 - 23.71 mm, with an average lower bill width of 18.30 mm, while Walik Tanah Ternate from R1-R5 ranged from 12.58 - 17.67 mm, with an average diameter of 15.59 mm.

Based on observation, the tarasumetarsus diameter of Walik Sula had a narrower size compared to Walik Tanah Ternate. This was influenced by the genetic factor.

3.9. The Tarsometatarsus length of Walik Sula and Walik Tanah Ternate

The Tarsometatarsus length of Walik Sula and Walik Tanah Ternate can be seenIn Table9.

The length of Tarsometatarsus of the Walik Sula from X1-X10 ranged from 15-15 mm, with an average length of 18.04 mm, while Walik Tanah Ternate from R1-R5 ranged from 16.86 - 26.72 mm, with an average length of 22.72 mm. The results of this study indicated that the tarsumetatarsus of Walik Tanah Ternate was longer than Walik Sula,

Table 9: The Tarsometatarsus length of Walik Sula and Walik Tanah Ternate

Sample	Walik Sula (*Ptilinopus mangoliensis*)/mm	Walik Tanah Ternate (*Chalchophaps indica*)/mm
X1	15.91	23.76
X2	19.85	19.85
X3	19.06	26.72
X4	20.27	16.86
X5	15.15	26.45
X6	24.33	
X7	16.74	
X8	22.26	
X9	20.12	
X10	21.27	
Average	18.04	22.72
SD	2.35	4.28
KK	13.04 (%)	18.86 (%)

3.10. The length of the middle toe of Walik Sula and Walik TanahTernate

The length of the middle toe of Walik Sula and Walik TanahTernate can be seen in Table 10

Table 10: The length of the middle toe of Walik Sula and Walik TanahTernate

Sample	Walik Sula *(Ptilinopus mangoliensis)/mm*	Walik Tanah Ternate *(Chalchophaps indica)/mm*
X1	*21.17*	*25.48*
X2	*13.31*	*26.80*
X3	*18.17*	*26.24*
X4	*24.41*	*24.78*
X5	*25.45*	*26.29*
X6	*19.34*	
X7	*20.33*	
X8	*26.81*	
X9	*22.61*	
X10	*24.41*	
Average	20.50	25.91
SD	4.93	0.79
KK	24.06 (%)	3.05 (%)

3.11. Length of Stripe above the Eyes of Walula Sula andWalik Ternate

Length of Stripe above the Eyes of Walula Sula andWalik Ternate can be seen in Table 11.

The length of the middle toe of Walik Sula from X1-X10 ranged from 13.31-26.21 mm, with an average of 20.50 mm, while Walik Tanah Ternate from X1-X5 ranged from 24.78 to 26.80 mm, with an average of 25.91 mm. The results of this study indicated that the middle toe of Walik Tanah ternate was longer that that of Walik sula. The position of toes can be used for the interest of taxonomy associated with the position of birds when

perching or not perching.

Table 11: The Length of Stripes above the Eyes of Walula Sula andWalik Ternate

Sample	Walik Sula *(Ptilinopus mangoliensis)/mm*	Walik Tanah Ternate *(Chalchophaps indica)/mm*
X1	*1.07*	*2.94*
X2	*3.39*	*1.58*
X3	*4.03*	*2.82*
X4	*2.42*	*1.69*
X5	*2.46*	*2.83*
X6	*3.26*	
X7	*3.25*	
X8	*3.25*	
X9	*2.92*	
X10	*2.2*	
Average	2.67	2.37
SD	1.12	0.67
KK	41.95 (%)	28.48 (%)

The white stripe length above the eyes of Walik Sula from X1-X10 ranged from 1.07-4.03 mm with an average of 2.67 mm, while white stripe length above the eyes of Walik Sula from X1-X5 ranged from 1.58-2.94 mm with an average of 2.67 mm.

Walik Sula and Walik Tanah Ternate are two different types of birds. While Walik Sula has wider eyebrows, Walik Tanah Ternate has long white stripeabove its thinner eyes

Size and Body Shape of Walik Sula (*Ptilinopus mangoliensis*) and Walik Tanah Ternate (*Chalchophaps indica*) of Domestication based on Major Component Analysis.

The results of data processing based on the Main Component Analysis showed the morphological and morphometric differences of Walik Sula and Walik Tanah Ternate. These differences can be expressed in terms of size and shape. This equation is based on the score of the matrix coefficient component based on the results of the data processing using the Main Component Analysis.

The use of the Main Component Analysis method in morphometric analysis explained that the first major component indicated size as the size vector and the second main component indicated the shape as the shape vector of the studied animal [10].The main component was used to form the distribution diagram. It was further explained that the crowd diagram was made based on the size and shape scores determined by the shape and size equations after being analyzed using the Main Component Analysis method.

Equation of Body Size with Total Diversity and Eigen Values on Sula Walik

The result of the main component analysis in Table 1 shows that the highest characteristic vector value in the equation of the main component of walik Sula body size was the tail length (X2), with the characteristic vector

value of -0.929. This means that the tail length is a characteristic variable to measure the body size of Walik Sula in the SulaIslands. Meanwhile, the characteristic variable of Walik Tanah Ternate body size is the length of tibia tarus (X5) with a characteristic vector value of -0.992.

Both these walik birds have similar characteristic vector score of body size. However, the total diversity (KT) value of Walik Ternate (83.80%) was higher than Walik Sula (54.10%).

This means that the total diversity of Walik Ternate body size can be explained by the length of tibia tarsus (X5) of 83.80%. Meanwhile, the total diversity of Walik Sula body size can be explained by the tail length (X2) of 54.10%.

The equation of the main component of Walula Sula (*Ptilinopus mangoliensis*) size and body shape with total diversity (KT) and eigen value (λ) can be seen in table 12 below:

Table 12: The equation of the major components of Walula Sula (*Ptilinopus mangoliensis*) size and body shape with total diversity (KT) and eigen values (λ).

Location	Main Component	Equation	KT (%)	eigen (λ)
Sula Islands	Body Size	$-0{,}208X_1 - 0{,}929X_2 + 0{,}189X_3 + 0{,}152X_4 - 0{,}057X_5 + 0{,}086X_6 + 0{,}004X_7 - 0{,}156X_8 + 0{,}005X_9$	54,10	134,60
	Body Shape	$-0{,}653X_1 + 0{,}220X_2 + 0{,}355X_3 - 0{,}094X_4 + 0{,}529X_5 + 0{,}016X_6 - 0{,}163X_7 - 0{,}288X_8 + 0{,}019X_9$	23,10	57,58
Ternate	Body Size	$-0{,}053X_1 + 0{,}023X_2 + 0{,}022X_3 + 0{,}050X_4 - 0{,}992X_5 + 0{,}072X_6 + 0{,}071X_7 + 0{,}005X_8 + 0{,}008X_9$	83,80	398,72
	Body Shape	$0{,}542X_1 + 0{,}659X_2 - 0{,}384X_3 - 0{,}035X_4 - 0{,}015X_5 - 00{,}164X_6 + 0{,}284X_7 + 0{,}122X_8 + 0{,}007X_9$	8,40	39,82

Note: X_1 = length of digits, X_2 = length of tail, X_3 = length of wing feathers, X_4 = length of bill, X_5 = length of tibia tarsus, X_6 = circumference of tarsus metatarsus, X_7 = length of tarsus metatarsus, X_8 = length of middle toe, X_9 = length of stripe above the eye.

The research results presented in Table 12 show the difference between Walik Sula and Walik Tanah Ternate, including the variables of body shape. Digit length (X1) was a characteristic of Walula Sula's body shape. The characteristic of vector value in the equation of the main component of body shapewas -0.653 with the total diversity of 23.10%. Meanwhile, the characteristic variable of Walik Ternate body shape was the tail length (X2) with the characteristic vector value of 0.659, with the total diversity was only 8.40%.

Comparison between size and shape diagrams of Walik Sula and Walik Ternate can be seen in Figure 1.

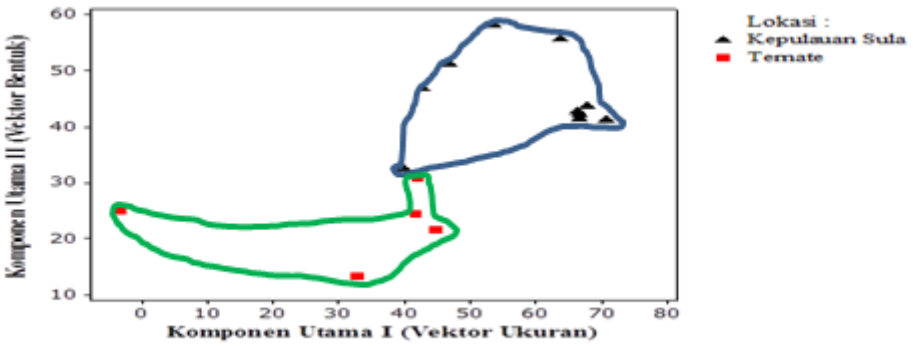

Figure 3: Diagram of the size and body shape of Walula Sula and Walik Tanah Ternate

These results show that both bird species, in terms of morphometrics, just have a number of similar components. The diagram above shows that in terms of shape vector and size vector, walik sula (*Ptilinopus mangoliensis*) is larger than walik tanah ternate (*C. indica*), which is thought to be influenced by not only genetic factors but also feeding habits, where walik terrestrial food was constantly disturbed by humans and land predators.

Genetically, this difference is related to environmental conditions that are relatively significant. Walik Sula also had a larger body shape score than Walik Ternate, each ranging from 39.4931 to 70.4402 and 3.3178 to 44.7506. Body shape was included in qualitative properties.

This property was more influenced by genetic factors, whereas the influence of environmental factors wasvery little or even none [13].

Qualitative Properties of Feather Color in Walik Sula (*Ptilinopus mangoliensis*) and Walik Tanah Ternate (Chalchophaps indica)

Based on the samples of Walik sula and Walik Tanah Ternate observed, the difference of feather color variation on both speciescan be clearly seen as shown in the following picture.

Figure 4: Walik Sula (*Ptilinopus mangoliensis*), male (on the left), female (on the right)

Figure 5: Walik Tanah Ternate (*Chalchophaps indica*), male (on the left), female (on the right)

Based on the qualitative nature of the feather colors observed, obviously there are differences in the feather colorsof each bird. Characteristics of qualitative properties of feather color can be seen in Table 13 below:

Table 13: Characteristics of qualitative properties of feather colorsin Walik Sula and Walik Tanah Ternate

Qualitative Properties	Walik Sula		Walik Tanah Ternate		Relative Frequency (%)
	Male	Female	Male	Female	
Head:					
- white with black straight lines above it	10	-	-	-	100
- grayish white	-	-	5	-	33
- brown	-	-	-	5	33
-green	-	10	-	-	100
Bill:					
- gray	-	10	-	5	100
- red	-	-	5	-	33
- white	10	-	-	-	66
Neck:					
- white with yellow lines below it	10	-	-	-	66
- white	-	-	5	-	33
- grayish brown	-	-	-	5	33
- green	-	10	-	-	66
Breast:					
-green	10	10	-	-	100
- brown	-	-	5	5	66
Back:					
- greenish brown	-	-	5	5	66
- green	10	10	-	-	100
Abdomen :					
-green	10	10	-	-	100
- brown	-	-	5	5	66
Wings:					
- greenish brown	-	-	5	5	66
- green	10	10	-	-	133
Tail:					
- greenish brown	-	-	5	5	66
- green	10	10	-	-	100
Legs:					
- red	10	-	-	-	66
- gray	-	10	5	5	100
Under Tail Covert:					
- yellow	10	-	-	-	66
- grayish	-	-	5	5	66
- green	-	10	-	-	66

Note: (N = Number of samples for Walik Sula and Walik Tanah Ternate as many as 15 birds)

The data in Table 13 show the qualitative properties of feather colors on Walik Sula and Walik Tanah Ternate, wherethe males and females generally show a uniform color on the parts of their bodies. The percentage of the relative frequency of the feather color indicated a more similar percentage of 80.77%.

There is a color difference in the neck, bill, and legs. The male Walik Sula has a yellow neck, white bill and red legs, while the female has green feathers, red legs, and grayish bill. The male Walik Tanah Ternate has a red bill and gray legs while the female has a black bill and legs. This color variation is also influenced by genetic and environmental factors.

The color variation of the feathers is a genetic characteristic whose expression is controlled by several genes in the body [18].In addition, environmental factors also have an effect on the inheritance of feather color in quails. The genetic and environmental factors are the two main factors in the inheritance of livestock traits [15,11].Differences in environment or geographical location such as the intensity of solar radiation, as reported [19]. would affect the intensity of feather colors, but not in their basic color [25,6].

4. Conclusion

The main characteristic of the outer organs of Walik Sula (*Ptilinopus mangoliensis*) are the third toe length, the wing length, and the lengths of the bill and neck. For Walik Tanah Ternate, the main characteristic is the length of femur and tibia. For the outer organ, it is the maxilla length, and for the shape, it is the neck length. The qualitative nature of feathers on Walik Sula is different from that of Walik Tanah Ternate. However, on the neck to the head, the two males are somewhat similar in that they have a white color. In general, Walik Sula and Walik Tanah Ternate have different feather colors. Walik Sula has a green color and Walik Tanah Ternate has a greenish brown color. Only on their wings, do they have resemblance in green.

Conflict of Interests

The authors have no conflict of interest directy relevant to the content of this article.

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