

## **Dynamics and Population Structure of Bali Cattle Partnerships Maiwa Breeding Center (MBC) in Barru Regency**

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### **Abstract**

This study aims to determine the population dynamics, population structure and increase of Bali cattle population Maiwa Breeding Center partnerships in Barru Regency. This research was conducted in March to April 2020 in Barru Regency, South Sulawesi. The Reproductive Efficiency of Bali cattle was 91%. Population dynamics were only influenced by the calving, mortality and sale of livestock, with growth of 27% (2019) and 31% (2020). The population structure was dominated by cows, 31% (2018), 48% (2019) and 54% (2020). Natural Increase (NI) of livestock was 17% (2018), 28% (2019) and 20% (2020). The conclusion of this study that the growth of Bali cattle population of MBC partnerships was still low when according to calving and income because it does not reach 80% of cows based on population even shows a tendency to decrease calving.

**Keywords** : Population of dynamics, population of structure, Bali cattle, smallholder partnerships

### **INTRODUCTION**

The increase in the population always coincides with the improvement of the economy and the welfare of people's lives so as to change their patterns and lifestyles, especially in the pattern of consumption of highly nutritious foods including meat consumption (Wood *et al.*, 2019). But the availability of meat both in quantity and quality has not been able to be fulfilled so that various ways are done for the fulfillment including the productive slaughter of heifers and superior males (Drouillard, 2018)

To suffice these needs, it is necessary to increase the number of livestock populations, one of the efforts that need to be done is by knowing the structure of the livestock population (Agus and Widi, 2018). The structure of livestock populations is very important to know as the basis in policy enforcement, implementation of maintenance management, mating system, and knowing the number of livestock populations. The structure of the livestock population includes cows, males, and females, young males and females, as well as male and female cows. With the

structure of the population, it can be known how much the female and young female is productive by the ratio between the female and the young female with the male. Population structure is closely related to population dynamics (Onge *et al.*, 2011). Population dynamics are the ups and downs or changes in the number of livestock populations in a region. Factors that affect the dynamics of livestock populations include livestock calving, mortality, movements of livestock from one region to another (migration of livestock) (Ducrotoy *et al.*, 2016).

The structure of livestock populations is very important to know as the basis in policy enforcement, implementation of maintenance management, mating system, and knowing the number of livestock populations (Gill and Garg, 2013). The structure of the livestock population includes cows, males, and females, young males and females, as well as male and female cows. The structure of the population can give information how much the female and young female is productive by the ratio between the female and the young female with the male. Population structure of animals is closely related to population dynamics. Population dynamics of livestock are the ups and downs or changes in the number of livestock populations in a region (Otte *et al.*, 2019). Factors that affect the dynamics of livestock populations include livestock calving, mortality, movements of livestock from one region to another (migration of livestock).

In an effort to increase the production and productivity of beef cattle, the Faculty of Animal Science Hasanuddin University as one of the universities also contributed by forming a Maiwa Breeding Center (MBC) engaged in the cattle industry (Baco *et al.*, 2020). In the implementation of the beef cattle breeding business system, MBC collaborates with farmer groups and livestock partnerships spread across three regencies namely Enrekang, Soppeng and Barru as implementers. Through the empowerment program and cooperation between farmer groups and livestock partnerships are expected to increase the population and productivity of beef cattle, especially local cattle.

## **MATERIALS AND METHODS**

### **Research time and location**

This research was conducted from March to April 2020 in Barru Regency, South Sulawesi, Indonesia. This study used the population of Bali cattle owned by Maiwa Breeding Center (MBC) which was maintained by partnerships in Barru Regency. The equipment used is stationery.

### **Research Methods**

The research used descriptive method with survey which was a study that describes and outlines the variable conditions of calving rate, mortality rate, sales, purchasing and population structure of Maiwa Breeding Center (MBC) partnerships in Barru Regency for the last three years. The collection of population data and the structure of the population is carried out in 2 stages. The first step is to collect secondary data obtained from the MBC manager. The second step is to collect primary data, which is then tabulated and analyzed.

### **Data Analysis**

The data obtained was tabulated and analyzed descriptively.

**Reproductive Efficiency (RE).** Reproductive efficiency was calculated by formula (Hardjosubroto,1994):

$$RE = \frac{CI \times \sum C}{I 1B - A 1M + CI - LP} \times 100\%$$

Description: RE = reproductive efficiency, CI = calving interval,  $\sum C$  = number of calf, A 1C = Age of the first calving, A 1M = Age of the first mating, LP = length of pregnancy

**Population Dynamics.**

The data analysis used for population dynamics is as follows:

$$\sum P = \frac{(\sum C + \sum I) - (\sum M + Ex)}{\sum P (end)} \times 100\%$$

Description:  $\sum P$ = number of population,  $\sum P(end)$ = number of final population (head),  $\sum M$ = number of mortality to population a year (head),  $\sum Ex$ = number of expenditure for a year (head),  $\sum C$ = number of cattle calving to the population a year (head),  $\sum I$ = number of incomes for a year (head)

**Natural increase (NI).**

The data analysis used for Natural increase was as follows (Sumadi *et al.* 2001):

Natural increase = percentage of calving per year - percentage of mortality per year

**Population Structure.** Population structure is calculated by:

$$PS = \frac{\sum Xi}{\sum X} \times 100\%$$

Description: PS = Percentage of population structure (male, female, Young male, Young female, male adult and female adult), Xi = Number of cattle 1<sup>st</sup> (male), 2<sup>nd</sup> (female), 3<sup>rd</sup> (young male), 4<sup>th</sup> (young female) and et cetera.  $\sum X$  = Number of cattle populations.

## RESULTS AND DISCUSSION

### Reproduction Efficiency (RE) of Bali Cattle

RE values can be calculated based on the data of the age of the first mating, of the first child, and the ofcalving interval. Based on the results of the RE count of Bali cattle Maiwa Breeding Center (MBC) partnerships in Barru Regency, the RE value was obtained at 91%. The average age of first mating was 24 months, the age of first calving is 34.5 months and calving interval was an average of 14.4 months. The RE value was still low because it was less than 100, this was due to the age of the first mating, the age at the first calving and calving interval is quite long. According to Kusuma *et al.* (2017) stated that the low RE value of cattle is due to the first age of calving that was still too long. The age of the first calving of more than 27 months will produce less than 100 RE but if less than 27 months it will produce RE more than 100. Susanti *et al.* (2015), the age at first mating for Bali cattle is 22.7 months, mating at a young age can shorten the generation interval so as to increase the degree of selection response to certain genetic traits. The faster the cattle are mated, the faster cattle can produce so that livestock businesses are more economical.

The low reproductive performance of Bali cattle is caused by the traditional maintenance pattern of cattle released so that the maintenance management and mating of cattle cannot be

controlled properly (Rahayu, 2014). With these conditions, the condition of livestock must not be observed properly so that the mating time of cattle can be late so that it can affect calving interval in livestock. Proper mating time is an important factor because it can produce benefits for farmers, on the contrary when the time of mating is not right tends to cause reproductive disorders because it can delay mating (Armelia *et al.*, 2018). According to Baco *et al.* (2020) stated that livestock reproductive productivity is strongly influenced by maintenance management, especially feeding at the time of mating so that it will increase pregnancy in cows, as well as after giving calving, which usually have low body condition score (BCS) status, therefore the condition of cows needs to be improved again to immediately restore the cows reproductive system after giving calving.

### Population Dynamics of Bali Cattle

Livestock populations are always experiencing changes or dynamics that are influenced by the addition or reduction of the population. The addition to the population can be due to the influx of other individuals from outside (migration) or purchase and due to calving, while the reduction in a population can be caused by mortality or the exit of individuals from that population (sales) (Saputra, 2007). The dynamics of Bali cattle population in Barru Regency for three years can be seen in Table 1.

Table 1. Bali Cattle Population Input, Expenditure and Growth

Age	2018	2019	2020			
<b>1. Livestock Input in Population</b>						
<b>Calving Rate (head)</b>						
Male	18	48	41			
Female	19	44	62			
Total Calving Rate (head)	37	92	103			
Based Cows (%)	53	62	43			
Based Population (%)	17	30	23			
<b>2. Livestock Expenditure</b>						
	<u>Mortality</u>	<u>Sell</u>	<u>Mortality</u>	<u>Sell</u>	<u>Mortality</u>	<u>Sell</u>
<b>Adult (&gt; 2 years)</b>						
Male	-	-	-	-	-	-
Female	-	-	-	-	5	9
<b>Young (1-2 years)</b>						
Male	-	-	-	-	-	8
Female	-	-	-	-	1	6
<b>Calf (&lt;1 years)</b>						
Male	-	-	1	-	4	-
Female	-	-	5	-	4	1
Total (head)	-	-	6	-	12	24
Population (%)	-	-	2	-	3	5
<b>3. Population Growth</b>						
Growth (heads)	37	86	66			
Growth (%)	17	28	15			

Table 1 can be seen that the population dynamics of Bali cattle Maiwa Breeding Center (MBC) partnerships in Barru Regency every year experienced an increase in population numbers by fluctuations, where in 2018 there were 37 heads, in 2019 increased by 86 heads and in 2020 again reduced to 66 heads. The percentage growth of Bali cattle to the population is 17%, 28% and 15% respectively. The increase in livestock population growth is due to the amount of livestock input more than the expenditure where the number of livestock calving more than the number of mortality cattle and livestock sold annually. The increase and decrease in the number of livestock populations is largely determined by the calving, mortality and sale of livestock. High calving will affect the composition of calf and young cattle that will be a potential surrogate for the cows so that the composition of adult livestock increases (Putra, 2017).

### **Livestock Input in Population**

The income of Maiwa Breeding Center (MBC) partnerships in Barru regency only comes from the calving of livestock raised by members of livestock groups without any purchase or importation of livestock from outside (livestock migration). The number of calving of Bali cattle MBC partnerships in Barru Regency can be seen in Table 1, shows that the number of calving of Bali cattle MBC partnerships in Barru Regency for three years occurred in a volatile manner, whereas the percentage of calving in 2018 as much as 53% of the cows and 17% of the population, while in 2019 there was a 62% increase in calving to the based cows and 30% to the population and in 2020 there was a decrease to 43% to the cows and 23% to the population. This indicates that the number of calving of Bali cattle is still likely to be low.

The low calving rate of Bali cattle Maiwa Breeding Center (MBC) partnerships in Barru Regency was caused by several factors including, most members of MBC partnerships have the main job as farming while breeding only as part-time work. Thus most of the time spent to rise only briefly so that to control livestock is not maximal. So that the maintenance management system was done that cattle are grazed during the day then farmed at night (semi-intensive) or even fully grazed throughout the day (extensive) especially during the harvest season. According to the Sultan (2018) that the inhibitory factor that is suspected as the cause of low productivity of livestock is the management of maintenance that has not been optimal, which is characterized by an extensive (traditional) maintenance system, non agribusiness oriented and does not pay attention to production inputs. According to Baco, *et al.* (2020) in general, the maintenance management of Bali cattle in the community is still traditional and, consequently low livestock productivity. With such a maintenance system, it is not able to exploit the potential of breeding even if genetically these animals have a high productivity potential. Poor or improper management can lead to poor cows and calf conditions, making livestock susceptible to certain diseases that can lead to calving. According to Bonewati (2020) stated that there are still many farmers who maintain an extensive maintenance system on the grounds that it saves time making it possible to do other work, does not need to provide feed and drinking water, and does not require labor. So with an extensive maintenance system that causes beef cattle not to be pregnant.

## Livestock Expenditure

Livestock expenditure of Maiwa Breeding Center (MBC) partnerships in Barru Regency can be seen in Table 1. It was known that the production of livestock MBC partnerships in Barru Regency was affected by the mortality and sale of livestock, and there are no slaughter and mutation of livestock. Livestock mortality occurred in 2019 as much as 6 heads or 2% of the population and in 2020 as many as 12 heads or 3% of the population while in 2018 there were no mortality. Thus, it can give an idea that the percentage of mortality of Bali Cattle MBC partnerships was quite low. Most of the mortality Bali cattle of MBC partnerships in Barru Regency are dominated by calf and adult heifers (cows), this is due to the traditional breeding pattern so that health management and feeding as the needs of calf and cows that have just given calving is not fulfilled. This is in accordance with Labatar and Aswandi (2017) who said that the highest livestock mortality was in the physiological state of the calves, it was because the most dominant breeding model by farmers was the extensive system, so that cows and calves are not well controlled which diseases attack calf and cows, feed that does not meet the basic needs of life and production, on the other hand, there was a lack of technical knowledge for farmers on proper maintenance of Bali cattle. This is also consistent with Baco *et al.* (2019) that the Bali cattle calf mortality rate which is maintained extensively is very high at 49.5% compared to calf which are intensively reared which is only 9%. Improving livestock rearing management can decreasing of mortality and increase calf productivity so that the population can be increased.

## Population Structure

The structure of the population is important to know in order to know the development of livestock populations so as to improve the next management system (Lawal-Adebowale, 2012). The structure of Bali cattle can be distinguished by gender and age. Bali cattle can be distinguished based on age from three types of age, namely calf (calf that still suckles in their cows with an age range of 0 months to 1 year), heifers (Calf that has been released and has not reproduced with the age of 1 to 2 years), and adult cows (cows that are ready to produce with the age of over 2 years). The population structure of Bali cattle MBC partnerships in Barru Regency can be seen in Table 2.

**Table 2.** Bali Cattle Population Structure Maiwa Breeding Center (MBC) Partnerships in Barru Regency

Populasi Struktur	2018		2019		2020	
	Number (head)	(%)	Number (head)	(%)	Number (head)	(%)
<b>Adult (&gt;2 years)</b>						
Male	-	-	-	-	-	-
Female	70	31	148	48	240	54
<b>Young (1-2 years)</b>						
Male	-	-	5	2	41	9
Female	117	52	63	20	61	14
<b>Calf (0-1 years)</b>						
Male	18	8	48	16	41	9
Female	19	8	44	14	62	14
<b>Total</b>	<b>224</b>	<b>100</b>	<b>308</b>	<b>100</b>	<b>445</b>	<b>100</b>

Table 2 presents it can be seen that the Bali cattle population of Maiwa Breeding Center (MBC) partnerships has increased quite high every year. Population structure dominated by mature cattle and heifers, the number of cows each year increased by a population of 70 in 2018 to reach 240 in 2020 with a percentage of the population of 31% and 54% respectively.

Bali Cattle population is different from other cattle populations, MBC adult bulls did not exist throughout 2018 until 2020. This was because the initial procurement and selection of cattle seedlings consist only of heifer cattle and cows productive that meets the criteria and standards that have been determined MBC in the hope that it will next produce superior Bali cattle seedlings because the success factor of the breeding business is determined by seedlings or good candidates. Selection can be done at the time calf age (205 days), young age (365 days), and or adult age (2 years), depending on the selection criteria (Boligon *et al.*, 2010). Dewantari (2016) stated that one of the success factors of breeding is the selection of seedlings by adjusting the purpose of maintenance, if the purpose of maintenance wants to get livestock then the selection of livestock seedlings takes precedence over the selection of female livestock.

### Natural Increase (NI)

The natural increase value was obtained by reducing the calving rate by the mortality rate in a given region and a certain time that is usually measured within one year (Sumadi *et al.*, 2001). To know the NI of Bali cattle Maiwa Breeding Center partnerships in Barru Regency can be seen in Table 3.

Table 3. Natural Increase (NI) of Bali Cattle Maiwa Breeding Center (MBC) Partnerships in Barru Regency

Description	2018	2019	2020
Calving Rate (%)			
- Based on Cows	53	62	43
- Based on Population	17	30	23
Mortality Rate (%)	-	2	3
<b>Natural Increase(%)</b>	<b>17</b>	<b>28</b>	<b>20</b>

Data on Table 3 can be known that NI of Bali cattle Maiwa Breeding Center partnerships in Barru Regency for three years experienced NI fluctuating, wherein 2018 the population increased by 17% and increased by 28% in 2019, but again there was a decrease to 20% in 2020. Thus the NI of Bali cattle MBC partnerships in Barru Regency is still very low. The low value of NI of Bali cattle MBC partnerships in the Barru Regency is caused by the low calving rate of cows when compared to the number of livestock populations. This is in accordance with Marsudi *et al.* (2017), that the low value of NI of buffalo cattle in Poso Regency is because the existing cows have not yet calved and the new young cattle are included in the breeding.

### CONCLUSION

Based on the results and discussion of research, it is concluded that:

1. Reproductive Efficiency (RE) of Bali cattle Maiwa Breeding Center (MBC) partnerships in Barru Regency was 91%.

2. The income of Bali cattle Maiwa Breeding Center (MBC) partnerships in Barru Regency is only influenced by calving and is relatively low with a percentage of the based on cows 53% (2018), 62% (2019) and 43% (2020).
3. The expenditure of Bali Cattle Maiwa Breeding Center (MBC) partnerships in Barru Regency was affected by deaths and sales which include low with the number of deaths 2% (2019) and 3% (2020) while sales amounted to 5% of the total population (2020).
4. The population structure of Bali cattle Maiwa Breeding Center (MBC) partnerships in Barru Regency annually undergoes changes dominated by heifers
5. Natural Increase(NI) of Bali cattle Maiwa Breeding Center (MBC) partnerships in Barru Regency every year has increased fluctuating with NI values of 17% (2018), 28% (2019) and 20% (2020).

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