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Analysis of dynamics and structure of the beef cattle population in Tolangohula Sub-District, Gorontalo District

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Abstract

The objective of this study was to analyze the factors affecting the dynamics and structure of the Bali cattle population and natural increase (NI) in Tolangohula Subdistrict by 2023.The research was conducted in three villages within Tolangohula Subdistrict: Gandasari Village, Margomulya Village, and Ombulo Tango Village. The method employed was a proportionate stratified sampling and survey with descriptive analysis. The study's variables included (1) entry rate, defined as birth rate (natality), purchase rate, and in-migration of livestock, (2) expenditure rate, defined as mortality rate, slaughter rate, sales rate, and out-migration rate of livestock, (3) natural increase value, and (4) composition and structure of Bali cattle population. The results indicated that the birth rate was 17.74%, the purchase rate was 8.37%, the in-migration rate was 0.33%, the mortality rate was 1.45%, the slaughter rate was 0.79%, the sales rate was 8.15%, and the out-migration rate was 0%. The natural increase value was 16.29%. The composition and structure of Bali cattle herds are as follows: adult males 13.73%, adult females 41.85%, young males 12.95%, young females 13.73%, calf males 6.36%, and calf females 25.5%. The composition of livestock for all ages is 33.04% male Bali cattle and 66.96% female Bali cattle. These figures indicate that the Tolangohula Sub-district is a viable location for Bali cattle development in Gorontalo Regency, contingent on the implementation of intervention programs and the enhancement of maintenance management practices by farmers.

Keywords: Natural Increase; Population Structure; Bali Cattle

1. Introduction

The government's present efforts to meet the 30% demand for meat, particularly beef, entail the importation of frozen meat and feeders from Australia (Suhana, 2016). Concurrently, Bamualim (2021) asserts that local beef cattle production has been incapable of meeting domestic beef demand, necessitating importation. This imbalance, if unaddressed, will inevitably lead to a decline in livestock population, necessitating the slaughter of even productive males and females. To address this imbalance and augment the livestock population, particularly that of Bali cattle, it is imperative to comprehend the dynamics and structure of the extant cattle population. Livestock population dynamics refer to the fluctuations or changes in the number of cattle populations within a specific area. The composition of the livestock population is also crucial for formulating policies, implementing maintenance management strategies, designing mating systems, and determining the total livestock population. The government has made efforts to address the community's demand for animal protein by leveraging the potential of livestock in the region. The development of cattle enterprises can be achieved through the optimal utilization of resources, the judicious adaptation of these resources to the natural and socioeconomic conditions of the local community, the development of livestock technology, and the support of institutions and policies (Yendraliza et al., 2018).

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The Gorontalo District has been identified as a priority area for the development of beef cattle farming in Gorontalo Province. This initiative is further bolstered by the implementation of government-backed programs and policies, which have led to the establishment of multiple regions designated as beef cattle barns.

The Tolangohula sub-district is one of the sub-districts that function as cattle barns in Gorontalo Regency. Notably, it is among four sub-districts with a relatively high beef cattle population, accounting for 7,562 heads, which constitutes 7.43% of the total beef cattle population of Gorontalo Regency. This population was recorded at 101,733 heads in 2022. A review of data concerning the fluctuations in the beef cattle population in Gorontalo Regency over the past five years reveals a somewhat erratic pattern. Specifically, there was an increase of 3,664 heads between 2018 and 2019, 3,907 heads between 2019 and 2020, a decrease of 2,496 heads between 2020 and 2021, and 2,556 heads between 2021 and 2022 (DPKH, 2023).

Bali cattle, a type of beef cattle, is extensively cultivated and developed by farmers in Gorontalo Regency, constituting approximately 75% of the total beef cattle population. However, the development of smallholder farms in this region faces several challenges, including the use of traditional maintenance patterns, limited farmers' knowledge of cultivation, and a lack of acceptance of technological applications. Furthermore, the absence of comprehensive data on livestock births, deaths, slaughter, and trade in Tolangohula Subdistrict hinders the formulation of effective initiatives to enhance Bali cattle population and productivity.

2. Methodology

This research is of a descriptive nature, employing a survey method. The study's samples comprised Balinese cattle and farmers residing in the Tolangohula Sub-district. The sample size was determined using the Slovin formula, yielding 191 respondents. The data collection process involved two stages. The initial stage entailed the collection of secondary data from the Livestock and Animal Health Service Office of Gorontalo District. The subsequent stage involved the collection of primary data. Following the collection of these data, they were meticulously tabulated and subjected to rigorous analysis.

3. Research results and discussion

3.1. The Entry Rate of Bali Cattle Livestock

3.1.1. Birth rate (Natalities)

Table 1 Birth Rate of Bali Cattle in Tolangohula Sub-district in 2023

Indicator	Male		Female		Total	
	N	%	N	%	N	%
Gandasari Village						
Brood Population	28	14.51	52	26.94	80	41.45
Population		5.53		10.28		15.81
Margomulya Village						
Brood Population	23	20.00	38	33.04	61	53.04
Population		8.55		14.13		22.68
OmbuloTango Village						
Brood Population	6	8.95	12	17.91	18	26.86
Population		4.96		9.92		14.88
Total Brood Population	57	15.20	102	27.20	159	42.40
Total Population		6.36		11.38		17.74

Source: Processed data (2023)

The birth rate is the most significant contributing factor to Bali cattle inclusion rate in Tolangohula Subdistrict. As illustrated in Table 1, the total birth rate for the three villages was 42.40% of the mother population of 375 Bali cows, and the birth rate to the population was 17.74% of the existing population of 896 Bali cows.

Referring to the findings of previous research conducted by Arif (2015), the number of births of beef cattle in Libureng District, Bone Regency was 60.1% to the mother and 22% to the population, with a total of 466 mothers. Similarly, research conducted by Hasman (2021) revealed that the number of births of Maiwa Breeding Center partner Bali cattle in Barru Regency fluctuated over a three-year period, with the percentage of births in 2018 being 53% to the mother and 17% to the population. In 2019, there was an increase in births of 62% to the mother and 30% to the population, while in 2020, there was a decrease of 43% to the mother and 23% to the population.

This finding is further substantiated by Labatar and Aswandi's (2017) study, which revealed that the proportion of Bali cattle births in Manokwari Regency accounted for 107 heads, constituting 91.46% of the total births recorded among 165 mothers. However, the percentage of births in Tolangohula Subdistrict exceeds the results of research conducted by Putra (2017) in Payakumbuh Timur Subdistrict, Payakumbuh City. The percentage of births in one year to the parent population was 22.69%, and the birth rate of beef cattle to the population was 10.03%.

The low birth rate of Bali cattle in Tolangohula Subdistrict is attributable to several factors. Primarily, the majority of respondents, constituting 90.05%, engaged in agriculture as their primary occupation, with livestock rearing being regarded as a secondary activity. Consequently, the time allocated for livestock management is limited, resulting in suboptimal control of livestock population.

As stated by Labatar and Aswandi (2017), the maintenance patterns employed by farmers and breeders of Balinese cattle in general are still predominantly extensive. This is due to the perception that fresh forage or natural grass and land are still available in sufficient quantities. Furthermore, farmers and breeders assume that extensive maintenance patterns are more efficient than intensive ones.

The prevailing assumption is that the primary factor hindering optimal livestock productivity is the inadequate management of maintenance practices, which are predominantly characterized by an extensive (traditional) maintenance system, a part-time business model (non-agribusiness oriented), and a lack of emphasis on production inputs (Sultan, 2018).

3.2. Purchase rate

The number of livestock purchases and migration has a significant influence on the number of Bali cattle in Tolangohula sub-district. A total of 57 Bali cattle were procured by farmers, constituting 11.26% of the total livestock population in Gandasari Village, 14 cattle (5.20%) in Margomulya Village, and 4 (3.31%) in Ombulo Tango Village. The total purchase of Bali cattle in Tolangohula Subdistrict in 2023 amounted to 75 heads (8.37%) of the total population of 896 heads, as presented in Table 2. The results of this study exceed those of Putra's (2017) study, which documented the purchase of cattle in Payakumbuh Timur Subdistrict, amounting to 18 heads (5.64%) of the total population. In a similar vein, Oktafiani et al. (2021) reported that the purchase rate in Terbanggi Besar Subdistrict, Central Lampung Regency, was 20 heads of the total cattle population of 742 heads (2.7%).

Table 2 Purchase Rate of Bali Cattle in Tolangohula Sub-district in 2023

Indicator	Male		Female		Total	
	N	%	N	%	N	%
Gandasari Village						
Calf	2	0.39	1	0.20	3	0.59
Young	29	5.73	16	3.16	45	8.89
Adult	5	0.99	4	0.79	9	1.78
Total	36	7.11	21	4.15	57	11.26
Margomulya Village						
Calf	0	0	0	0	0	0

Young	2	0.74	4	1.49	6	2.23
Adult	7	2.60	1	0.37	8	2.97
Total	9	3.34	5	1.86	14	5.20
Ombulo Tango Village						
Calf	0	0	0	0	0	0
Young	1	0.83	0	0	1	0.83
Adult	1	0.83	2	1.65	3	2.48
Total	2	1.66	2	1.65	4	3.31
Total Purchase	47	5.25	28	3.12	75	8.37

Source: Processed data (2023)

The elevated purchase rate observed in Tolangohula Subdistrict in 2023 can be attributed to the decline in market prices of cattle in Gorontalo Regency compared to previous years. As illustrated in Table 2, the analysis reveals that the majority of Bali cattle acquisitions in Tolangohula Subdistrict are comprised of young cattle, specifically 32 male Bali cattle and 20 female Bali cattle, accounting for approximately 69.33% of the total purchases made by farmers during the study period. The procurement of young Bali cattle is intended for fattening livestock and as prospective breeders.

3.3. Migration rate

In this study, the term "migration rate" is employed to denote the number of Bali cattle entering the population due to various factors, excluding birth and purchase. The inflow of Bali cattle in Tolangohula Subdistrict from the perspective of migration was 3 heads (0.33%) of the total sample population of 896 Bali cattle. Of these, 2 heads (0.39%) were recorded in Gandasari Village from 506 Bali cattle, and 1 head (0.83%) was recorded in Ombulo Tago Village from 121 Bali cattle. However, no Bali cattle migrated to Margomulya Village in 2023. The results of this study are lower than those reported by Malewa and Mu'min (2021), who documented the outcomes of cattle migration in Sigi Regency using government assistance. Their findings revealed that 10 heads (1.73%) of the total sample were included in the government-assisted migration. The Bali cattle migration that occurred in the Tolangohula sub-district during 2023 is presented in Table 3.

Table 3 Migration Rate of Bali Cattle in Tolangohula Sub-district in 2023

Indicator	**Male**		**Female**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**
Gandasari Village						
Calf	0	0	0	0	0	0
Young	0	0	2	0.39	2	0.39
Adult	0	0	0	0	0	0
Total	0	0	2	0.39	2	0.39
Margomulya Village						
Calf	0	0	0	0	0	0
Young	0	0	0	0	0	0
Adult	0	0	0	0	0	0
Total	0	0	0	0	0	0
Ombulo Tango Village						
Calf	0	0	0	0	0	0
Young	0	0	1	0.38	1	0.38

Adult	0	0	0	0	0	0
Total	0	0	1	0.38	1	0.38
Total Migration	0	0	3	0.33	3	0.33

Source: Processed data (2023)

4. The Dispenditure Rate of Bali Cattle Livestock

4.1. Mortality rate

As with the livestock entry rate, the livestock expenditure rate is influenced by several factors, including livestock mortality, slaughter, sale, and migration. The mortality rate in this study is derived from the number of Bali cattle that perished without being slaughtered in 2023. The mortality percentage in Ombulo Tango Village (2.46%) was higher than in Gandasari Village (1.38%) and Margomulya Village (1.11%). The total percentage of Bali cattle mortality in Tolangohula Sub-district was 13 out of 896 cattle population (1.45%). The high mortality rate in Ombulo Tango Village was attributed to the fact that the majority of farmers in Ombulo Tango Village (72.41%) did not use stables for their cattle.

The mortality rate observed in this study is notably lower than the 3.8% mortality rate of Bali cattle in North Lombok, as reported by Suhana (2016). A similar finding was reported by Utami (2015), who observed a mortality rate of 4.85% in cattle in Sapaya Village, Gowa Regency. However, these figures are higher than the annual mortality percentage of 1.44% observed by Susanti et al. (2015) in beef cattle.

4.2. Slaughtering rate

The slaughter rate in this study was obtained from Bali cattle slaughtered to fulfill personal or celebratory needs. The total number of Bali cattle slaughtered in Tolangohula Subdistrict was 7 cattle (0.78%), with 5 cattle (0.99%) from Gandasari Village and 2 cattle (0.74%) from Margomulya Village. Notably, no Bali cattle were slaughtered in Ombulo Tango Village in 2023. The slaughter rate of Bali cattle in Tolangohula sub-district is presented in Table 4.

Table 4 Slaughtering Rate of Bali Cattle in Tolangohula Sub-district in 2023

Indicator	**Male**		**Female**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**
Gandasari Village						
Calf	0	0	0	0	0	0
Young	0	0	0	0	0	0
Adult	5	0.99	0	0	5	0.99
Total	5	0.99	0	0	5	0.99
Margomulya Village						
Calf	0	0	0	0	0	0
Young	0	0	0	0	0	0
Adult	1	0.37	1	0.37	2	0.74
Total	1	0.37	1	0.37	2	0.74
Ombulo Tango Village						
Calf	0	0	0	0	0	0
Young	0	0	0	0	0	0
Adult	0	0	0	0	0	0
Total	0	0	0	0	0	0
Total Slaughtering	6	0.67	1	0,11	7	0.78

Source: Processed data (2023)

The slaughter rate in this study is higher than that reported by Hasman (2021), who found that no Bali cattle were slaughtered among the partners of the Maiwa Breeding Center. In a similar vein, the findings of Oktafiani et al. (2021) indicated that the rate of cattle slaughter in four villages within Terbanggi District, Central Lampung Regency, was relatively low, with a total of 0.67% of the population being slaughtered. However, the percentage of slaughter in this study is lower than that reported by Malewa and Mu'min (2021), who stated that the total slaughter of PO cattle in Sigi District was 27 heads (4.66%). However, the results of this study are consistent with the assertion of Arif (2015), who posited that if the percentage of slaughter exceeds the tolerance limit of 12%, it will disrupt the supply of beef cattle and hinder efforts to augment the beef cattle population.

The livestock slaughter in Tolangohula subdistrict comprised six adult male Bali cattle and one cull female Bali cattle. The slaughter was conducted to meet the requirements of a specific celebration.

4.3. Sales and migration

The sales rate in this study is derived from Bali cattle that are raised and subsequently sold to the community, at the market, or slaughterhouse. The migration rate is defined as the number of Bali cattle that depart for various reasons, excluding death, slaughter, and sale. The sales and migration figures for Bali cattle in the Tolangohula subdistrict in 2023 are presented in Table 5.

Table 5 Sales and Migration of Bali Cattle in Tolangohula Sub-district in 2023

Indicator	**Male**		**Female**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**
Sales Rate						
Gandasari Village						
Calf	7	1,38	2	0,39	9	1,77
Young	11	2,17	0	0	11	2,17
Adult	34	6,72	1	0,20	35	6,92
Total	52	5,20	3	0,59	55	10,87
Margomulya Village						
Calf	0	0	2	0,74	2	0,74
Young	0	0	0	0	0	0
Adult	14	5,20	0	0	14	5,20
Total	14	5,2	2	0,74	16	5,94
Ombulo Tango Village						
Calf	2	1,65	0	0	2	1,65
Young	0	0	0	0	0	0
Adult	0	0	0	0	0	0
Total	2	1,65	0	0	2	1,65
Total Sales	68	7,59	5	0,56	73	8,15
Migration						
Gandasari Village Margomulya Village Ombulo Tango Village						

Calf	0	0	0	0	0	0
Young	0	0	0	0	0	0
Adult	0	0	0	0	0	0
Total	0	0	0	0	0	0
Total Migration	0	0	0	0	0	0

Source: Processed data (2023)

The results (Table 5) indicate that 55 Bali cattle (10.87%) were sold in Gandasari Village, 16 (5.94%) in Margomulya Village, and 2 (1.65%) in Ombulo Tango Village. Consequently, the sales of Bali cattle in Tongohula sub-district constituted 73 (8.15%) out of a population of 896. The number of Bali cattle sold in this study is notably higher than the results reported by Hasman (2021) in the Maiwa Breeding Center partners in Barru Regency, which recorded a total of 24 heads (5%) of the population. This figure stands in contrast to the findings of Utami's research (2015) in Sapaya Village, Gowa Regency, which documented a sale rate of 13.90%. Oktafiani et al. (2021) also reported on cattle sales in four villages in Terbanggi Besar Subdistrict, Central Lampung Regency, finding 98 heads (13.19%). Higher sales figures than those reported in this study were also documented by Putra (2017) in Payakumbuh Timur Subdistrict, Payakumbuh City, and Fadli et al. (2020) in Poleang Selatan Subdistrict, Bombana Regency, which obtained sales figures of 10 and 12.19% of the total population, respectively.

The Tolangohula Subdistrict exhibits a low percentage of Bali cattle sales, predominantly comprising 68 male Bali cattle (7.59%) and 5 female Bali cattle (0.56%). This is attributed to the predominant utilization of the offspring of these animals for breeding purposes. This practice aligns with the predominant objective of farmers in Tolangohula Subdistrict, who, at 92.26%, primarily rear and develop Bali cattle for breeding purposes. A comparatively smaller proportion, 4.59%, engages in fattening, while 3.15% engage in a dual purpose of breeding and fattening. The observed low sales rate is further attributed to the tendency of farmers to sell their cattle in response to urgent needs.

Migration rate is the number of Bali cattle that left due to several reasons except death, slaughter and sale. The migration rate of Bali cattle in this study (Table 5) shows 0%. This means that there was no livestock migration that could affect the expenditure rate of Bali cattle in Tolangohula subdistrict. This figure is due to the fact that there was no movement of Bali cattle in the Tolangohula Subdistrict to other areas during 2023.

4.4. Natural Increase (NI)

Effective cattle management is a critical factor in augmenting the cattle population, particularly in the context of controlling livestock expenditures. A primary approach entails recognizing the natural increase in livestock, also termed Natural Increase. The value of natural increase is derived by calculating the difference between the birth rate percentage and the death rate percentage. This natural increment value is a critical metric for assessing the growth rate of the livestock population within a specific area over a given period.

A study of Bali cattle in Tolangohula sub-district reveals a low natural increase of 16.29%. According to Sumadi et al. (2001), the standardization of natural increase values ranging from 0 to 50% is classified as low, 50% to 80% as medium, and above 80% as high. In a similar vein, Kusuma et al. (2017) assert that if the NI value ranges from 0 to 18.05%, it is classified as low; 18.06 to 36.12% is designated as medium; and 36.13 to 54.18% is categorized as high.

The Natural Increase value in this study is lower than the research conducted by Hasman (2021). Hasman's research examined the Natural Increase (NI) of Bali cattle partners of Maiwa Breeding Center in Barru Regency over a period of three years, finding it to fluctuate. Specifically, the NI value was recorded at 17% in 2018, 28% in 2019, and 20% in 2020. In a similar vein, research by Malewa and Mu'min (2021) found that the Natural Increase value of PO cattle in Sigi Regency was 21.11%, while research from Samberi et al. (2010) found the Natural Increase value of Bali cattle in Yapen Islands, Papua Province to be 18.18%. The Natural Increase (NI) value of Bali cattle in Tolangohula sub-district is presented in Table 6.

Table 6 Natural Increase of Bali Cattle in Tolangohula Sub-district in 2023

Indicator	Against Population (%)	Against Adult Female (%)
The Entry Rate (Natalities)	17.74	42.40
The Dispenditure Rate (Mortality Rate)	1.45	3.47
Natural Increase (NI)	16.29	38.93

Source: Processed data (2023)

The value of Natural Increase in this study is higher than Utami's (2015) study, which found that the NI of Bali cattle in Sapaya Village, Gowa Regency was 0.3%. In a similar vein, research by Putra (2017) in Payakumbuh Timur Subdistrict, Payakumbuh City, reported an NI value of 5.33%, while Oktafiani et al. (2021) in Terbanggi Besar Subdistrict, Central Lampung Regency, reported an NI value of 4.59% of the population and an NI value of 11.57% for adult females.

According to Kusuma et al. (2017), the Natural Increase (NI) is closely associated with population development. A high NI indicates a substantial number of productive females in the area, potentially attributable to effective management practices. The value of Natural Increase of Bali cattle in Tolangohula Subdistrict remains comparatively low, suggesting that the maintenance management practices employed by farmers require refinement. Furthermore, the interval between calving events often exceeds 12 months, resulting in intervals between births of 2-3 years. In-depth interviews with inseminators at the field level further revealed that the low pregnancy rate of Bali cattle through artificial insemination (AI) is also influenced by the duration of the breeding period. In some cases, the breeding period has elapsed, and the mother has not conceived. This phenomenon can be attributed to the negligence of some farmers in attending to their livestock.

4.5. Population Structure of Bali Cattle in Tolangohula Subdistrict

The cattle population in the study area, which includes Gandasari, Margomulya, and Ombulo Tango villages in Tolangohula sub-district, is predominantly of the Balinese cattle breed. This breed constitutes 85.88% of the total cattle population, which consists of 896 heads. The livestock population can be further delineated based on age and sex. The age of cattle is categorized into three groups: adults (Bali cattle that have been producing for more than two years), young (Bali cattle weaned from one to two years old), and children (Bali cattle under one-year-old). The population structure of Bali cattle in Tolangohula sub-district in 2023 is presented in Table 7.

Table 7 Population Structure of Bali Cattle in Tolangohula Subdistrict in 2023 by Age and Sex

No.	Composition	Village			Total
		Gandasari	Margomulya	OmbuloTango	
1	Adult (>2 years)				
	Male (amount)	73	40	10	123
	(UT)	73	40	10	123
	(%)	14,42	14,87	8,26	13,73
	Female (amount)	193	115	67	375
	(UT)	193	115	67	375
	(%)	38,14	42,75	55,37	41,85
	Total (amount)	266	155	77	498
	(UT)	266	155	77	498
	(%)	52,57	57,62	63,64	55,58
	Ownership/Respondent	2,61	2,58	2,65	2,61
	Male to female ratio	1 : 2,64	1 : 2,87	1 : 6,70	1:3,05
2	Young (1-2 years)				
	Male (amount)	88	18	10	116
	(UT)	44	9	5	58

	(%)	17,39	6,69	8,26	12,95
	Female (amount)	72	35	16	123
	(UT)	36	17,50	8	61,50
	(%)	14,23	13,01	5,95	13,73
	Total (amount)	160	53	26	239
	(UT)	80	26,50	13	119,50
	(%)	31,62	19,70	21,49	26,67
	Ownership/Respondent	1,57	0,88	0,90	1,25
	Male to female ratio	1 : 0,82	1 : 1,94	1 : 1,6	1 : 1,10
3	Calf (< 1 year)				
	Male (amount)	28	23	6	57
	(UT)	7	5,75	1,50	14,25
	(%)	5,53	8,55	4,96	6,36
	Female (amount)	52	38	12	102
	(UT)	13	9,50	3	25,5
	(%)	10,47	14,13	9,92	11,38
	Total (amount)	80	61	18	159
	(UT)	20	15,25	4,5	39,75
	(%)	15,81	22,68	14,88	17,75
	Ownership/Respondent	0,79	1,01	0,62	0,83
	Male to female ratio	1 : 1,85	1 : 1,65	1 : 0,50	1 : 1,89
4	Total (amount)	506	269	121	896
	(UT)	366	196,75	94,50	657,25
	(%)	56,48	30,02	13,50	100
	Male (amount)	189	81	26	296
	(UT)	124	54,75	16,50	195,25
	(%)	21,10	9,04	2,90	33,04
	Female (amount)	317	188	95	600
	(UT)	242	142	78	462
	(%)	35,38	20,98	10,60	66,96
	Male to female ratio	1 : 1,68	1 : 2,32	1 : 3,65	1 : 2,03
5	Total of respondents	102	60	29	191
6	Ownership/respondent	4,96	4,48	4,17	4,69

Source: Processed data (2023)

As shown in Table 7, the Bali cattle population in Tolangohula Subdistrict totals 896 heads, with a population structure comprising 296 male Bali cattle (33.04%) and 600 female Bali cattle (66.96%). The Bali cattle population is further categorized based on age into adult, young, and calf categories, with the adult category comprising 55.58% of the total population (13.73% male and 41.85% female), the young category accounting for 26.67% (12.95% male and 13.73% female), and the calf category consisting of 17.75% (6.36% male and 11.38% female).

The ratio of male to female Bali cattle in the Tolangohula subdistrict was calculated using the female Bali cattle population divided by the male Bali cattle population. The result of this calculation is presented in Table 7, showing a ratio of 1:2.03, with specific values including 1:1.05 for adult Bali cattle, 1:1.10 for young Bali cattle, and 1:1.89 for calves. The average ownership of each respondent was also calculated. The mean number of Bali cattle per respondent in Tolanguhula Subdistrict was determined to be 4.69. The demographic characteristics of the respondents' cattle ownership were as follows: adult Bali cattle 2.61, young Bali cattle 1.25, and calves 0.83.

The population structure based on the age of adult cattle obtained in this study is lower than the research of Tanari et al. (2011) in Pamona Utara District, Poso Regency, which obtained the percentage of adult cattle 70%, young cattle 15%, and calves 15%. (2021) reported that the population structure based on the age of beef cattle in Terbanggi Besar Subdistrict, Central Lampung Regency was 64.51% adults (24.79% males, 39.6 22.63% of the population was classified as young (9.43% of whom were males and 13.20% of whom were females), while 12.79% of the population was classified as calves (5.92% of whom were males and 6.87% of whom were females).

The population structure based on adult age in this study exhibits a higher percentage than that observed in the study conducted by Putra et al. (2015) in Pesisir Selatan Regency, West Sumatra Province, which recorded 48.77% adult cattle, 24.56% young cattle, and 26.67% calves. A similar finding was reported by Kusuma et al. (2015) in their study of the PO cattle population in Kebumen Regency, Central Java Province, where the composition and structure were 50.39% adult, 15.49% young, and 34.13% calves.

As illustrated in Table 7, the numerical difference between male and female Bali cattle in each age group is less than the number of female Bali cattle. This disparity can be attributed to the predominant purpose of Bali cattle husbandry in Tolangohula Subdistrict, which is to produce seedlings or calves. The survey results indicated that 87.96% of respondents raised Bali cattle for breeding purposes, 3.14% for fattening purposes, and 8.90% for both fattening and breeding purposes. This finding is further corroborated by the data on sales, which indicates a preponderance of male Bali cattle sold, with a total of 68 males sold, in contrast to the sale of only 5 female Bali cattle. Furthermore, the data indicates that the total number of Bali cattle slaughtered in 2023 was 6, with 1 female Bali cattle being culled.

The population composition and structure of the Tolangohula sub-district, which exhibits a lower population of male Bali cattle of all ages compared to female Bali cattle, has the potential to be developed by improving the management of Bali cattle rearing.

5. Conclusion

A comprehensive analysis of the research findings on the dynamics and composition of the Balinese cattle population structure in Tolangohula District, Gorontalo Regency, has yielded the following conclusions.

- The dynamics of the Bali cattle population in Tolangohula Subdistrict in 2023 are influenced by three factors: the entry rate, the dispenditure rate, and the value of natural increase.
    - The entry rate is comprised of the following components: a natality rate of 17.74% of the population and 42.40% of the broodstock, a purchase rate of 8.37% (75 heads), and a migration rate of 0.33% (3 heads).
    - The dispenditure rate includes a mortality rate of 1.45% (13 head), a slaughter rate of 0.78% (7 head), a sale rate of 8.15% (73 head), and an out-migration rate of 0%.
    - The value of natural increase was determined to be 16.29% for the population and 38.93% for adult females.
- The Bali cattle population in Tolangohula Subdistrict is characterized by the following age demographics: adult males comprise 13.73% of the population (123 heads), adult females constitute 41.85% (375 heads), young males represent 12.95% (116 heads), young females make up 13.73% (123 heads), male offspring account for 6. The Bali cattle population in Tolangohula Subdistrict is further characterized by the composition of all ages, which is 33.04% males (296 heads) and 66.96% females (600 heads). This indicates a ratio of males to females of 1:2.03 and an average Bali cattle ownership of 4.69 per respondent.
- The Tolangohula sub-district has been identified as a viable location for the development of Bali cattle in Gorontalo Regency. This potential is attributed to the implementation of targeted livestock programs and the enhancement of husbandry practices by local farmers.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Arif, A. N. A. 2015. Study of Population Structure and Efforts to Improve Beef Cattle Production in Libureng District, Bone Regency. Thesis. Faculty of Animal Husbandry. Hasanuddin University, Makassar

[2] Gorontalo Central Bureau of Statistics (BPS). 2022. Gorontalo in Figures Year 2022. Jakarta Bessant, Wijayanti, B.T. 2005. Analysis of Beef Cattle Farming Business in Relation to Farmer Welfare in Bogor District and City. Management and Business Approval Program. IPB.

[3] Dania, I.B., Poerwoto, H, R. A. Suhardiani, R.A, and Hidjaz, T. 2013. Teaching Materials for Management of Beef and Working Livestock. Faculty of Animal Husbandry, University of Mataram. Mataram

[4] Gorontalo District Livestock and Animal Health Services (DPKH). 2023. Gorontalo District Livestock Statistics Data

[5] Fadli, Nafiu. L. O, Aku. A. S. 2020. Structure and Population Dynamics of Bali Cattle in South Poleang District, Bombana Regency. Journal. Faculty of Animal Husbandry. Halu Oleo University. Kendari. Scientific Journal of Halu Oleo Animal Husbandry: Vol 2, No 1

[6] Hasman. 2021. Dynamics and population structure of Bali cattle of Maiwa Breeding Center (MBC) partners. Thesis. Master Program in Animal Science and Technology. Hasanuddin University. Makassar.

[7] Kusuma S.B., Ngadiyono N., and Sumadi. 2017. Estimation of Population Dynamics and Reproductive Performance of Ongole Peranakan Cattle in Kebumen District, Central Java Province. Faculty of Animal Husbandry. Gadjah Mada University, Yogyakarta. Buletin Peternakan Vol. 41 (3):

[8] Labatar. S.C. and Aswandi. 2017. Maintenance System, Population Structure of Bali Cattle in People's Farms of Manokwari Regency. Journal 66 Triton. West Papua Province. Department of Animal Husbandry Extension. College of Animal Husbandry Extension (STPP) Manokwari. Manokwari. Vol. VII, No. 1

[9] Labatar. S.C. and Aswandi. 2017. Maintenance System, Population Structure of Bali Cattle in People's Farms of Manokwari Regency. Journal 66 Triton. West Papua Province. Department of Animal Husbandry Extension. College of Animal Husbandry Extension (STPP) Manokwari. Manokwari. Vol. VII, No. 1

[10] Lestari, S. K. 2000. Investment analysis of beef cattle farming incorporated in group pens. Bachelor Thesis of Animal Husbandry, Gadjah Mada University, Yogyakarta.

[11] Malewa, A.G., Mu'min, N.A. 2021. Population Dynamics of PO Cattle in Sigi Regency. Scientific Journal of Agrisains. Faculty of Animal Husbandry, Tadulako University. Palu

[12] Putra, D. E., Sumadi, and Hartatik, T. 2015. Estimation of Beef Cattle Output in South Pesisir District, West Sumatra Province. Indonesian Journal of Animal Husbandry 17(2):105- 115.

[13] Putra, E. Y. 2017. Structure and Population Dynamics of Beef Cattle in Payakumbuh Timur Subdistrict, Payakumbuh City. Thesis. Faculty of Animal Husbandry, Andalas University. Payakumbuh.

[14] Suhana, N. 2016. Population Structure and Natural Increase in North Lombok District. Faculty of Animal Husbandry. Thesis. University of Mataram. Mataram

[15] Sultan. R. 2018. Study of the Implementation of Artificial Insimination Program in Supporting the Achievement of One Million Cattle Program of the Government of South Sulawesi. Animal Husbandry Study Program. Faculty of Agricultural Sciences. Al Assariah Mandar University. West Sulawesi.

[16] Sumadi, W. Hardjosubroto, Ngadiyono, N. and Prihadi, S. 2001. Potential of PO Cattle in Sleman Regency. Analysis of Breeding and Meat Production. Yogyakarta.

[17] Susanti A. E, Ngadiyono. N. and Sumadi. 2015. Estimation of Beef Cattle Output in Banyuasin District, South Sumatra Province. Journal. Faculty of Animal Husbandry, Gadjah Mada University. Sriwijaya Livestock Vol. 4, No. 2. Yogyakarta.

[18] Tanari, M., Y. Duma, Y. Rusiyantono, and Mangun, M. 2011. Dynamics of Beef Cattle Population in Pamona Utara District, Poso Regency. Journal of Agrisains. Vol. 12 No. 1 pp. 24-29. Animal Husbandry Study Program. Faculty of Agriculture. Tadulako University, Poso.

[19] Yendraliza, Magfirah, Y. and Rodiallah, M. 2018. Population Structure and Potential of Benai Sub-district in Kuantan Singingi District for Beef Cattle Development. Scientific Journal of Animal Sciences, 21 (2):70- 77