Natural Increase and Output of Swamp Buffalo (*Bubalus bubalis*) in Banyuwangi Regency

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Abstract. The purpose of this research was to find out the natural increase output production of Swamp Buffalo in Banyuwangi Regency. This research was conducted in 3 subdistricts area. The research material used was 122 breeders, with a total number of 384 buffaloes. The method used was surveyed. Variable observed in this study is reproduction performance, the structure of the population, mutation, percentage of births and deaths, service per conception (S/C), conception rate (CR), anestrus postpartum (APP), days open (DO). Data obtained are tabulated with Microsoft Excel and average, the standard of deviation, and then analyzed with descriptive. The results showed that the average value of the calving interval was 16.39 ± 0.42 months, Anestrus Postpartum was 4.78 ± 0.39 months, Service Per Conception was 1.3 ± 0.07, Conception Rate (CR) was 70.26 ± 8.30%, Days Open was 5.82 ± 0.35 months, output was 15.10% and the natural increase (NI) value of swamp buffalo in Banyuwangi Regency was 16.93%. Concluded that the value of the increasing natural number of buffalo in the Banyuwangi Regency is a low category, and out of balance with the number of buffalo that comes out of breeding.

1. Introduction

Buffalo (*Bubalus bubalis*) is a large ruminant livestock that has high potential in the supply of meat. Otherwise, it can be used as a source of labor. Buffalo, in some areas, is considered as a symbol of social status and is used for traditional ceremonies.

East Java Province is one of the regions in Indonesia, which has the highest buffalo population, which is 27,304 head in 2016 [1]. In the last five years, the population of buffaloes in the Banyuwangi Regency has a total of 4035 head buffaloes. In general, the factors that influence the decline in buffalo livestock population are mostly carried out extensively in livestock raising patterns, so that they rely on feed contained in grazing fields so that the mating system tends to be inbreeding. This will affect the reproductive ability of buffaloes at a productive age and will result in a lack of replacement seed in livestock breeding.

Several factors influence the ups and downs of the population that are affected by births, deaths, and mutations of livestock. High birth rates greatly affect the composition of young children and young animals, determining the presence of replacement seedlings so that it has a good effect on the composition of adult livestock. Population increase every year (natural Increase) is one of the
benchmarks to increase the buffalo population; therefore, good management and handling of mature female livestock are needed. Livestock population in a breed will remain constant if between the number of animals mutated in control with known output values. The buffalo cattle population will avoid extinction by limiting excessive outward mutations.

2. Materials and methods

2.1. Data collection and animal management

The material used in this study were 122 breeders who had adult female buffalo. The total number of female buffaloes taken was 152 head. The method used in this study is a survey method, with the determination of the location of the study using a purposive sampling method, the selection is based on certain criteria, the criteria is that of the buffalo cattle population in the Banyuwangi Regency which still has good breeding potential.

2.2. Variable and data analysis

The variables observed in this study were an animal mutation, population structure, service per conception (S/C), conception rate (CR), natural increase (NI) and output in buffalo cattle in Banyuwangi Regency. The data obtained in the tabulation are then calculated as a percentage and average, then analyzed descriptively. [2] states that using the following calculation:

\[ \text{NI} (\%) = \text{Percentage of births (\%)} - \text{Percentage of deaths (\%)} \]

\[ \text{Output} = \text{remaining replacement + male and female cattle that are rejected} \]

3. Results and discussion

3.1. Population structure

Based on the survey results at the research location, it was found that the structure of the buffalo population detailed by young cattle (male and female) and adult animals (male and female) as presented in Table 1.

| Component | Young old (PI₀, PI₁) | Adult (PI₂, PI₃, PI₄, PI₅) | Total |
|-----------|---------------------|--------------------------|-------|
|           | head (% head)       | head (% head)            | head  |
| Male      | 45  11.72            | 65  16.93                | 110   |
| Female    | 89  23.17            | 185 48.18                | 274   |
| Total     | 134 34.89            | 250 65.11                | 384   |

Based on Table 1, it is known that the percentage of adult female buffalo population is 48.17% and male buffalo is 16.92% (1:3) meaning that 1 male can serve 3 females. The ratio is mostly found in cattle aged 4-5 years (PI4) as in Table 2, which means that at that age the potential is in the breeding group. The results of this study are still lower than the provisions stipulated by the Ministry of Agriculture comparison of male and female 1: (8-10) tail. One head buffalo male with good genetic quality mated with 8-10 buffaloes can improve buffalo productivity performance. Analysis of the potential for buffalo development in the Banyuwangi Regency can be further clarified by taking into account population structure based on the age group. The composition of livestock by age group can be seen in the following Table 2.
Table 2. Population structure based on age group (%)

| No | Age   | P1₀ | P1₁ | P1₂ | P1₃ | P1₄ | P1₅ | Total |
|----|-------|-----|-----|-----|-----|-----|-----|-------|
| 1  | Male head | 30  | 15  | 19  | 21  | 19  | 6   | 110   |
|    | Percentage (%) | 7.81 | 3.90 | 4.94 | 6.03 | 4.94 | 1.56 | 28.6  |
| 2  | Female head | 42  | 47  | 38  | 25  | 70  | 52  | 274   |
|    | Percentage (%) | 10.93 | 12.23 | 9.89 | 6.51 | 18.23 | 13.54 | 71.4  |

3.2. Performance reproduction

Performance reproduction of buffalo in Banyuwangi Regency as presented in Table 3 below:

Table 3. Reproductive performance of buffaloes

| Component                  | Age            | 3-4 years | 4-5 years | > 5 years | Average      |
|----------------------------|----------------|-----------|-----------|-----------|--------------|
| First of age breeding (months) | 29.89 ± 0.70   | 30.00 ± 0.53 | 30.00 ± 1.11 | 29.96 ± 0.06 |
| Weaning age (months)      | 8.22 ± 3.86    | 7.73 ± 3.18 | 8.78 ± 3.59 | 8.24 ± 0.53 |
| APP (months)              | 4.37 ± 2.11    | 4.82 ± 1.85 | 5.14 ± 2.21 | 4.78 ± 0.39 |
| S/C (time)                | 1.32 ± 0.47    | 1.36 ± 0.49 | 1.22 ± 0.44 | 1.3 ± 0.07  |
| CR (%)                    | 67.57          | 63.64      | 79.57      | 70.26 ± 8.30 |
| DO (months)               | 5.43 ± 2.02    | 5.91 ± 1.69 | 6.11 ± 2.13 | 5.82 ± 0.35 |

The reproductive performance of livestock can be measured by parameters, including Service per Conception, Days Open, spacing distance, and Conception Rate. Besides, the first age of mating, the first age of calf also influences the reproductive performance of the female buffalo. Female buffalo reproductive efficiency is said to be good according to [3] reproductive efficiency is the maximum use of reproductive capacity. Reproductive performance at each age of livestock can vary due to many factors including genetics, sex, feed, climate, weather and so on. Increasing the value of reproductive efficiency can be done by improving overall maintenance management, including a recording of breeding, detecting lust properly, improving the quality and quantity of feed provided, good sanitation and maintaining the health of livestock that is maintained. One measure of increased reproductive efficiency in a female parent is an increase in birth rates which is strongly influenced by the fertility rate of the female parent and the fertility of males in a marriage.

Breeding efforts are said to be efficient if the male is enough to marry one female until he has one pregnancy. The higher the S / C value the more inefficient the marriage is carried out. [4] states that normal S / C values range from 1.6 to 2.0. The lower the S / C value of a parent, the higher the level of fertility and vice versa the higher the value of S / C, the lower the fertility value. The S / C results from the research were supported by a CR value of 70.26 ± 8.30%. [5] states that the best CR reaches 60-70%, whereas for Indonesia, taking into account the natural conditions, management, and distribution of livestock that is spread is considered good if the CR value reaches 45-50%.

Based on Table 3, the average duration of female buffalo APP at the study site was 4.78 ± 0.39 months, this figure is high compared to the statement. Several factors can influence anestrus namely age, pregnancy, lactation period, feed, season, environment, and chronic diseases. [6] states that the failure of lust or anestrus in buffaloes is a major symptom of many other factors that affect the lust cycle. Judging from poor feed conditions, especially those that occur in grazing or extensive maintenance systems that lack feed. [7] which stated that the duration of APP on cattle generally lasts for 2 months because of female cattle after giving birth experience uterine involution which takes about 45 days. The longer the Anestrus period, the lower the fertility and reproductive efficiency of these animals. The high APP value finally had an impact on the magnitude of the Days Open value of 5.82 ± 0.35 months. that the ideal length of time is 90-120 days. The empty period is the time interval between the female parent breeds until mated again and pregnancy occurs. The longer the empty period affects the reproductive efficiency of the female parent. [8] stated that days open (DO) is the time interval between giving birth to being declared pregnant. The empty period will affect the success of breeding and breeding interval. Besides, the length of childbearing distance is also influenced by the length of pregnancy.
3.3. Mutation

Livestock mutations (movements of animals included in the breeding group or from other breeding sites) included in the mutation component are due to sales, slaughtering, death, other deductions, purchases, births, other additions. In the following Table 4.

| Table 4. Mutation (%) |
|-----------------------|
| Component             | Male (young) | Male (adult) | Female (Young) | Female (adult) |
|                       | head | %     | head | %     | head | %     |
| Mutation (in)         | 2    | 2.94  | 1    | 1.47  | 5    | 7.35  |
| Mutation (out)        | 11   | 16.17 | 24   | 35.29 | 11   | 16.17 |
| Total                 | 13   | 19.11 | 25   | 36.76 | 16   | 23.52 |

Data Table 4 shows that young male cattle enter the breeding area by 2.94%, and those that breed out by 16.17%, in this case, it has the understanding that the area shows a breeding area because the percentage of outflows is greater than the cattle that enter breeding. So are for young females, but for the percentage of buffaloes the young females coming out are more resilient than incoming females, if there is no control there will be negative impacts for the breeding of the area surveyed because the stock of young livestock as replacements is a small percentage. [9] that if the percentage of livestock that comes out is higher than the percentage of cattle that enter, it means that the region is a producer of buffalo cattle.

3.4. Natural increase

The following Table 5 is presented components to calculate the natural increase and output in the Banyuwangi Regency.

| Table 5. Natural increase |
|---------------------------|
| Description               | total (head) | Percentage (%) |
| Adults female to Population| 185          | 48.17          |
| Number of births          | 73           | 19.01          |
| Number of deaths          | 8            | 3.09           |
| Natural Increase          | 65           | 15.92          |

Based on the data in Table 5 above shows that the NI value of mud buffalo in Banyuwangi Regency is 15.92%, the NI value obtained from the study site can be concluded that the high number is caused by the composition of the population dominated by productive adult females, especially in the age group 4-5 years at 48.17%. The value of NI increases if it can maintain productive females with good management so that it can increase the birth rate and reduce the mortality rate in buffalo. NI value of 16.92% is categorized as moderate because in the range of NI values between 15.01-30.00%. This is in accordance with [8] which states that the range of NI values is between 0.00-45.90% with a range of NI values for each class that is low with a range of values of 0.00-15.00%, moderate with a range of values of 15.01-30.00%, and high with a range of values of 30.01-45.90%. [2] states that the amount of output
is influenced by NI, therefore the output is calculated based on the difference between NI and the need for livestock substitutes for one year.

3.5. Output

The output is the potential of the region in removing livestock leftover substitutes and rejected animals. In detail, the composition of buffalo cattle output can be seen in the following Table 6.

| No | Description          | Percentage |
|----|----------------------|------------|
| 1  | Natural increase     |            |
|    | a. Male              | 7.11       |
|    | b. Female            | 8.81       |
| 2  | Replacement          |            |
|    | a. Male              | 4.94       |
|    | b. Female            | 9.89       |
| 3  | Output Production    |            |
|    | male dan female      | 15.10      |

Table 6. Natural increase and production output

Data from Table 6 shows that several adult females that are classified as productive can give an idea that each year the natural population increase is 15.92%. Furthermore, to maintain and increase the buffalo population in the breeding group, efforts must be taken into account is the number of livestock as a prospective substitute (replacement), excessive outward mutation of livestock, therefore it needs to be limited by the large value of livestock output. From this research, it is obtained that the maximum value of adult male and female livestock output is 15.10% if within this breeding area can be controlled the population will remain constant. [9] that the output can consist of male and female rejecting (adult) livestock, remaining young male and female substitutes.

4. Conclusion and suggestion

4.1. Conclusion

Based on reproductive performance data, the percentage of productive adult females and buffalo mortality obtained a Natural Increase value of 15.92%, including that which will be used as substitute livestock by 14.83%. While from the composition of livestock based on age groups, the value of the output of male and female cattle due to age is no longer productive at 15.10%, the buffalo population inbreeding remains stable.

4.2. Suggestion

From the value of NI and output obtained, it is recommended that the data can be used to estimate the dynamics of the livestock population in the following years, as long as the reproductive performance is still constant.

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