The productivity estimation of female swamp buffalo population with different ages group in district Lumajang, East Java

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Abstract Proper reproductive regulation could improve the level of productivity of livestock both in terms of production and reproduction. Swamp buffalo in Indonesia, especially in East Java, faces a severe problem, related to the sharp decline in population from year to year by 3%. However, buffaloes' role is still sufficiently taken into account in the provision of employment in the fields of animal agriculture and national meat supply. This research aims to analyze the female productive age group swamp of buffalo (Bubalus bubalis) in district Lumajang. The research material was 154 buffalo farmer breeders with a total of 99 adult female buffaloes. This research method is the survey method, the data obtained, tabulated on average, deviation standard, and then analyzed descriptively. Variable observed structure different ages group, Service per Conception (S/C); Conception Rate (CR); Days Open. The results showed that the buffalo reproduction performance in district Lumajang was a total population of 99 adult females (60.74%) as many as 89 (89.9%) were of productive age average service per conception (2.68±0.89) times, NRR (9.99±0.41) %. Length of pregnancy 10.57 ± 0.07 month, days open 3.82 ± 0.35 month, calving interval 16.39 ± 0.42 month, conception rate (19.6±0.30) %. It was concluded that the reproductive performance of female productive swamp buffalo (Bubalus bubalis) in district Lumajang is potential for swamp buffalo breeding

Keywords: swamp buffalo, structure population, service per conception, days open, conception rate

1. Introduction
Swamp buffalo (Bubalus bubalis) is one of the cattle in Indonesia that has not received attention as a potential animal in producing meat, and as labor for certain areas [1]. Buffalo population in Indonesia of 1,359,390 tails, compared to the previous population of 5 there was only an increase of around 24,000 tails [2]. This shows a very slow increase in population, due to several factors, among others due to the character of buffalo reproduction, and the breeding system that is not well programmed.

Buffalo population in East Java Province in 2018 was 26,633 or 13.74% of the buffalo population in Java and 1.96% of the national buffalo population [2]. The population of buffaloes in Lumajang Regency is 4,817 or 18.09% of the buffalo population in East Java [3].

Productivity is a function of the level of reproduction and growth, but in general, the buffalo owned by the community is still traditionally maintained so that growth is slow and has an impact on the
ability of female buffalo reproduction. Productive female buffalo, which is buffalo based on a reproductive examination, is stated to have normal reproductive organs and can function optimally as an adult buffalo. The productive period of buffalo is very long up to 25 years, reproductive power produces 10 to 15 young buffalo during his life [4]. Adult buffalo that have good reproductive and growth performance need to be made into superior livestock so that the buffalo population can be increased. In connection with this, buffalo technical coefficient data from each age group is needed, therefore productive female management is very important for buffalo breeding. Besides productive females are genetic resources in breeding livestock populations. To support the implementation of breeding programs requires certainty in the structure of the buffalo population grouped by age because the management of female buffalo is very important to increase the population. Reproductive management is important in adult female management. Good reproduction management can increase livestock productivity both in terms of production and reproduction.

Reproduction is a very important factor in determining livestock productivity. The better reproductive efficiency seen from the low calving interval is expected to increase the buffalo cattle population. So that reproductive performance is very important to consider in buffaloes. To support the increased productivity of buffalo cattle in Lumajang Regency. The technical coefficient can be shown through the reproduction index, that is, the amount of insemination to produce one pregnancy, and days open [5].

2. Materials and Research Methods
The research used was a survey method, and direct observation in the field, to support the buffalo reproductive ability conducted interviews with livestock owners. The material used in this study were breeders who were raising buffaloes with 154 breeders with a total of 99 productive female buffaloes. Estimation of buffalo age is determined based on the incisors dating to swamp buffalo.

The sampling method used was snowball sampling. The observed variables are the performance of swamp buffalo reproduction, namely population structure, Service per Conception, length of pregnancy, Days Open, spacing, Conception Rate, and fertility index.

Data obtained from the study were tabulated and, then calculated on average (mean) and size (standard deviation), followed by descriptive analysis.

3. Results and Discussion
Population structure is a parameter that shows the breakdown of the number of animals divided by sex and biological classification of livestock. This population structure is very useful to know the development of livestock in an area, making it easier to regulate and evaluate the maintenance patterns. The structure of the buffalo population at the study site can be seen in Table 1.

| Table 1. The population structure |
|----------------------------------|
| **Structure** | **Adult** | **Young** | **Total** |
|                | head | %   | head | %   | head | %   |
| Male           | 29   | 17,79 | 12   | 7,36 | 41   | 25,15 |
| Female         | 99   | 60,74 | 23   | 14,11| 122  | 74,85 |
| Total          | 163  | 100  |      |      |      |      |

Note: adult > 3rd years; Young < 3rd years

Based on Table 1, that the structure of the population in buffalo is only distinguished based on two biological classifications of adults and young, this is adjusted by the change of incisive teeth into permanent teeth in buffalo starting at less than 3 years old, Rukmana and Yudirahman (2017) stated that incisive teeth begin to change teeth permanent at the age of 2.5 years, and at that age, the female buffalo shows its reproductive character that is the adult age of the body and can be mated (inseminated) for the first time [6]. The results of this study were 122 buffaloes which consisted of 99
adult females and 23 young buffaloes. This shows that at the study site only 60.74% of adult females had the opportunity to produce offspring, while 14.11% were still not showing adult bodies and could be made as a group of female candidates to substitute adult females. However, the population structure based only on this biological classification cannot answer the question of whether with a large number of adult females, it is guaranteed to be able to increase its population. Likewise, with a large number of young buffalos, it can be used as a guideline that the continuity of the population can be maintained, and whether the young female is sufficient as replacement stock. Based on the reproductive character of buffalo in general, the three problems concerning the population structure of this serving result, cannot yet be used as a guideline because it is not yet differentiated by age in each buffalo group. So it is not yet known how many adult female buffalo are included in the productive female group and how many buffaloes have entered the adult body age. Table 2 follows the population structure of the survey results grouped by age.

Table 2. Structure of the female buffalo population by age group

| Female adult (years) | Age 3-4 | Age 4-5 | Age 5-6 | Age 6-7 | Age 7-8 | Age 8-9 | Total |
|----------------------|---------|---------|---------|---------|---------|---------|-------|
| total (head)         | 11      | 24      | 31      | 23      | 8       | 2       | 99    |
| Percentage (%)       | 11,1    | 24.24   | 31.31   | 23.23   | 8.08    | 2.02    | 100   |

Table 2 shows that the percentage of female buffaloes holds an important role because it can know the number of females that are in the productive category (3-9 years old) or this study there are 6 age groups. The grouping of female livestock is adjusted to their reproductive capacity, which is generally that the older the cattle, the ability of livestock to produce offspring decreases, so that to maintain the stability of the population in producing offspring, more young females should be prepared or the birth rate in the population should be high. According to Budiarto et al. (2018) that for stock replacement of large ruminants at least 70 percent higher than the cattle that will be replaced [7]. Knowledge of population structure is very important to classify the status of livestock populations, and one of the ways in animal conservation programs is to determine the status of livestock populations. Furthermore, the status of livestock populations can be determined by counting the number of adult animals depicted from the number of adult females [8]. The structure of the livestock population can be known as the number of productive adult livestock and can produce replacement seeds for cattle that are old or no longer in production. The more number of adult female cattle in an area will increase the number of births followed by an increase in population. Besides, knowing the structure of the livestock population in an area can be used to facilitate the determination of appropriate management in livestock management. The decline in livestock population is caused by several factors, including low birth rates, increased number of slaughter, and livestock deaths are the main causes of the decline.

The percentage of female buffalo population as in table 2 can be said to have begun to be critical, because the high percentage of productive females in the 4-7 year age group ranges from 23-31 percent, while the number of productive females in the 3-4 year age group is only 11.1 percent. This shows a decrease in the number of productive females by 50 percent. This composition can be predicted in the following years the lower the percentage of productive females if there is no immediate improvement in the buffalo's reproductive power. Because the percentage of productive females aged 4-7 years is still quite large, the birth rate must be increased, so that the buffalo population remains constant and it is expected that in the future the composition will range from 16-17 percent in each age group, and the percentage of young females ready for marriage is greater. 70 percent of the ideal percentage (27-28 percent). Budiarto, et al. (2018) stated that the buffalo population structure obtained, illustrates that East Java has a low number of productive adult-aged females, and there is still a shortage of stock of young buffaloes as a potential parent replacement, although the buffalo population in East Java is quite high if grouped based on productive females are still in the low category, and as an illustration, there are in Lumajang district [7].
Buffalo Reproduction Performance

Data on buffalo reproduction performance in Lumajang Regency can be seen in Table 3.

| Performance of Reproduction | Average ± St.dev |
|-----------------------------|------------------|
| Service per Conception (S/C) | 2.68 ± 0.89      |
| Length pregnant (month)     | 10.57 ± 0.07     |
| Days Open (month)           | 3.82 ± 0.35      |
| Calving interval (month)    | 16.39 ± 0.42     |
| Conception Rate (%)         | 19.30            |
| Index fertility             | 11.14            |

In table 3 the reproductive appearance of productive buffalo is very low (low reproductive efficiency, this is possible due to many factors such as the percentage of buffalo grouping at the age of 4-7 years which reaches 23-31 percent. Komariah, et al. (2015) stated that the main problem of productivity in buffalo is low reproductive efficiency marked by silent heat, irregular cycles, long anoestrous seasonal mating, low pregnancy rate, and long calving intervals [9]. Therefore, efforts are needed to improve buffalo reproduction. Sianturi, et al. (2010) stated that buffalo has a lower reproductive rate compared to cows, among others, is the difficulty in detecting estrus animals due to silent heat, relatively longer pregnancy period (11 months) compared to cattle (9 months) and longer birth intervals as a result of long postpartum [10].

In connection with the appearance of reproduction in the Lumajang Regency, along with the appearance of buffalo reproduction in East Java in 2017 which is still below the ideal, due to the buffalo maintenance patterns of the community is still very simple [11]. Further explained the impact on buffalo birth rates in East Java is low 18.63%. When connected with the mortality rate in one year 5.3%, the natural population increase in East Java per year is only 13.33%.

Service per Conception value of cattle with a natural mating system is ideally 1 time (meaning that with one insemination can produce one pregnancy); with the same mating system, the female buffalo S/C value obtained at 2.7 means to produce a pregnancy requires 2-3 times of insemination. This is made possible by many factors including the age and ability of male buffalo (male fertility), the ratio of adult male females, time of marriage, also possibly influenced by the pattern of maintenance and skills of farmers. Soeharsono, Saptati, and Dwiyanto (2010) stated that the factors that influence the value of S/C are the knowledge and skills of farmers in the detection of heat [12].

The appearance of prolonged pregnancy reproduction is not much different from some of the results of previous studies, this shows that the ability to reduce the old nature of buffalo pregnant did not experience differences. Female buffalo generally experience a pregnancy period of 10.5 months [13]. The results of this study are in line with the study of Lendhanie (2005) which states that the age of buffalo pregnancy which was monitored since mating and the beginning of pregnancy in 2005 until giving birth in 2006 was recorded with an average of 311 days (10 months 11 days) [4].

The distance between postpartum to the emergence of the first estrus and S/C is the main key in determining the number of days open, then it will affect the calving interval between two births. Izquierdo (2008) states that the ideal free time ranges from 85-115 days [14]. According to Susilawati and Affandy (2004), the ideal of whether or not the empty period is caused by several factors such as the length of weaning, the period of mating after parturition (anoestrus postpartum), the number of S/C and the age of first mating [15]. The results of this study obtained a productive buffalo free period of 3.82 months (ranging from 114-115 days), these results are still in the upper limit of previous studies. The longer the distance between parturition to the first heat after parturition (anoestrus postpartum) and the higher the value of S/C, the empty period will be longer and the calving interval will be long (15.97-17.1 months). This empty period has an important role in achieving the target calving interval. Long Days Open causes long calving intervals [16].
Based on the S/C value, the percentage of pregnancy from the results of the first mating (C/R), as well as the empty period (DO), can be used to calculate buffalo fertility index (evaluating buffalo females of productive age and evaluating maintenance patterns). According to Ciptadi et al. (2018), ideally, the buffalo index value (buffalo) in general (without age grouping) the best minimum fertility index result is 65 [17]. The fertility index obtained in Lumajang Regency is 11.14; this shows that the maintenance patterns, especially the management of productive female buffalo, have not met the minimum standard value of fertility index. However, if the management of productive females aged 3-7 years (89.89 percent) is improved by an effective estrus detection approach, rational feeding of buffalo both male and female, then the appearance of buffalo reproduction and calving rate will increase.

4. Conclusion
The productivity of productive buffalo in terms of reproductive appearance is still low, while the factor of low reproductive performance can be controlled through livestock composition by age group. Based on the buffalo composition of the productive age group (89.89%), Lumajang Regency still has the potential to increase its population. Suggestion from this research is, the productivity of buffalo is slow due to factors related to the appearance of reproduction (APP, DO, the distance of breeding length), can be approached to be ideal by improving the management of female buffaloes that have been grouped by age.

Acknowledgments
This field action research was supported by the grant of doctoral Program from Brawijaya University, Contract no. DIPA:023.17.2.677512/2020.

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