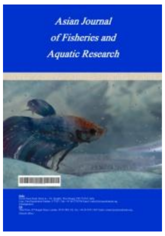

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Effect of Different Density on Survival Rate of Gourami Fingerling *(Osphronemus goramy)* Razor Size on Closed Transportation System

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

The low survival rate of gourami fingerling transportation is a problem. Setting the expected amount can lead to death. This research aims to determine the exact amount of density in the razor-sized gourami fingerling transported during the treatment period and to analyze its effect on the survival of razor-sized gourami fingerling. This research was carried out from April to June 2022. This research method used in the Factorial Randomized Group Design (FRGD) experiment consisted of two factors, namely the density factor of 4 levels (10, 20, 30, 40 fish/2L) and the three-stage transport duration factor levels (3, 5 and 7 hours). The transportation system in this study is a closed system. The parameters observed were post-transportation life, post-maintenance life for 7 days and water quality in the form of temperature, ammonia, pH and DO. Based on the results of research showed that the effective density for the transportation of razor-sized gourami fingerling was 30 fish/2L with a transportation duration of 5 hours and the survival rate post-transportation was 97.8% and post-maintenance 7 days was 90.02%.

Keywords: Gourami fingerling; density; closed transportation; survival rate.

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1. INTRODUCTION

The availability of seeds for fish becomes a much-needed consumption measure. Gourami is one of the leading commodities of the Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia with an increase in production of 8.8% per year. The demand for gourami is relatively large in meeting their needs. In the domestic market, the demand for carp is increasing along with the increasing public awareness of consuming fish as a source of animal protein. The Ministry of Maritime Affairs and Fisheries (KKP) targets carp production in 2022 to reach 389,000 tons, an increase from 2021, which is 344,000 tons [1].

Given the high consumer demand for live carp, transportation is an important thing in distributing fish to various regions. The transportation and trade of live fish is the right choice if the optimal conditions are known to maintain the survival rate of the fish. Transportation of live fish is basically forcing the fish to be placed in an environment that is different from its original environment accompanied by changes in the nature of the environment that are relatively very sudden, which threatens the life of the fish. The transportation of live fish is divided into two ways, namely the wet system and the dry system [2]. Wet system transportation demands the same medium as the previous fish habitat, namely water and oxygen. Transportation of fish with long distances and a period of more than 24 hours from the distribution area of carp production, both spawning, nursery and rearing, requires fish transportation in a closed system. Fish transportation, especially for fish fry, is usually carried out using high densities to reduce costs [3].

High density in fish transportation causes metabolic activity to increase and oxygen consumption to be high so that dissolved oxygen decreases and then causes death [4]. Increased density risks the level of survival and physical damage that arises due to friction between fish and their containers [5]. Based on this, it is necessary to do further research on the number of different densities in carp fry during the closed transportation process so as to reduce mortality.

2. MATERIALS AND METHODS

2.1 Time and Place

This research was carried out from March to May 2022. Gourami transportation activities were carried out in West Java area. Meanwhile, the maintenance of Gourami fingerlings is carried out in the Ciparanje wet laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University.

2.2 Tools and Materials

The tools used are concrete tubs measuring 200 x 100 x 60 cm^3 as many as 1 piece, aquarium size 60 x 30 x 30 cm^3 as many as 12 pieces, aerator set, drain, thermometer, pH meter, DO meter, spuit, oxygen tube, stopwatch, plastic polyethylene 60 x 40 cm^2, zipper plastic, rubber bands, measuring cup, Styrofoam box measuring 60 x 40 x 30 cm^3, 6 pieces, duct tape, stationery, pick-up car, Erlenmeyer flask, test tube, spectrophotometer, cuvette, paper filters, plastic bottles, funnels, volume pipettes, test tube racks, cameras and logbooks

The materials used were 900 fish of 3-4 cm size Gourami fingerlings, PF 1000 feed, pure oxygen, water samples before and after transportation, signette's solution and Nessler's solution.

2.3 Methods

This research method used in the Factorial Randomized Group Design (FRGD) experiment consisted of two factors, namely the density factor of 4 levels (10, 20, 30, 40 fish/2L) and the three-stage transport duration factor levels (3, 5 and 7 hours). Transportation activities are carried out at night.

2.4 Observation Parameters

2.4.1 Survival rate

The survival of the fish was observed and calculated when opening the transport package and after being reared for 7 days. Survival of fish is calculated from the ratio of the number of fish that live at the end of the period with those that live at the beginning of the period [6].

$$SR\ (\%) = \frac{Nt}{No} \times 100\%$$

Description:

SR = Survival of fish during the experiment
Nt = Number of fish at the end of the experiment
No = Number of fish at the beginning of the experiment

2.5 Water Quality Parameters

Observation of water quality is carried out by measuring water quality in transportation before and after transportation. Measurement of water quality in situ includes DO, pH, and temperature while ex situ includes ammonia at the Water Resources Management Laboratory of FPIK Unpad. Measurement of water quality parameters uses a thermometer to measure temperature, DO meter to measure dissolved oxygen, pH meter to measure pH and spectrophotometric methods to calculate ammonia.

Measurement of ammonia using the spectrophotometric method using the following formula

$$Ammonia\ value\ = \frac{1000}{25}\ x\ \frac{Sample\ Absorbanse}{Sample\ Absorbance}\ x\ 5\ microgram$$

Description:

Sample Absorbanse: Calculated Absorbance of sample
Standart Absorbance: Calculated absorbance from standart

3. RESULTS AND DISCUSSION

3.1 Survival Rates

Based on the research that has been done, the survival rate of fish with different densities and duration of transportation is shown in Fig. 1.

Based on Fig. 1 shows that the survival rate of gourami fingerling after transportation with different density and duration of transportation resulted in varying survival rates of test fish. Post-transportation fish survival rates ranged from 91 – 100%. The survival rate of post-transportation fish with the highest value was found in the duration of 3 and 5 hours with a density of 10 fish of 100% and the lowest value was found at a duration of 7 hours with a density of 30 fish of 91.23%. This value indicates that the higher the density and the longer the duration of transportation can reduce the survival rate of gourami fingerling.

One of the factors that can cause fish to become stressed is environmental changes such as changes in temperature, pressure, and shocks. Shocks that occur during the transportation process also cause fish to experience stress. Sumartini [7] stated that stress on fish causes respiration and metabolism to increase. Increased metabolism causes hypoxia in fish, where hypoxia is a condition where there is a lack of oxygen in body tissues which causes an increase in the opening and closing of the operculum.

The following is a diagram of the average survival rate of fish after 7 days of rearing Observations of the maintenance of post-transport test fish began when the test fish were transferred to the aquarium for the next 7 days. The survival rate of gourami fingerling after maintenance with different densities resulted in the survival rate of test fish that varied but tended to decrease. The survival rate of fish after rearing ranged from 73 – 90%. The survival rate of post-transportation fish with the highest value was found for a duration of 5 hours with a density of 30 fish of 90.2% and the lowest value was found for a duration of 7 hours with a density of 40 fish of 73.23%. This value indicates that the higher the density can reduce the survival rate of Gourami Fingerling.

At the beginning of the maintenance of fish adapt to the new environment of the transportation container causing a high mortality rate of fish. This is in accordance with the research of Maryani et al [8], fish deaths in rearing aquariums mostly occur at the beginning of rearing due to adaptation to a new environment which causes high mortality rates.

The next day, the test fish continued to die but the number was less than the initial rearing. The test fish have been able to adapt to the new environment so that many fish can survive. The siphoning process which is carried out every day is an effort to maintain water quality so that it does not decrease with the aim of reducing the mortality rate. There are still deaths suspected to be due to significant temperature fluctuations. During the day at the maintenance site the temperature is 28-30^oC while the temperature at night is around 22-24^oC.

3.2 Water Quality

Measurement of water quality in this research was carried out before and after transportation. The temperature before transportation is in the range of 26 - 27^oC and at the time after transportation the temperature is in the range of 24 - 28^oC. The optimal temperature for rearing gourami fry is 25-30°C (SNI, 2000b). The temperature of the transportation media has decreased due to the time of transportation carried out at night. The decrease in temperature will not harm the fish during transportation because the temperature does not decrease too drastically. Temperature indirectly affects the metabolism of fish, at high temperatures or above 30°C can cause oxygen consumption to increase because the metabolic rate of fish will increase so that it can cause death. Meanwhile, at low temperatures or below 25°C the metabolism of fish becomes slow and oxygen consumption also decreases [9].

The measurement of dissolved oxygen in the transportation medium was carried out using a DO meter on water samples and was carried out before and after transportation. The measurement of dissolved oxygen before transportation is done by measuring directly from the sample in the tub, while the measurement of dissolved oxygen after transportation is done by directly measuring the water sample from each

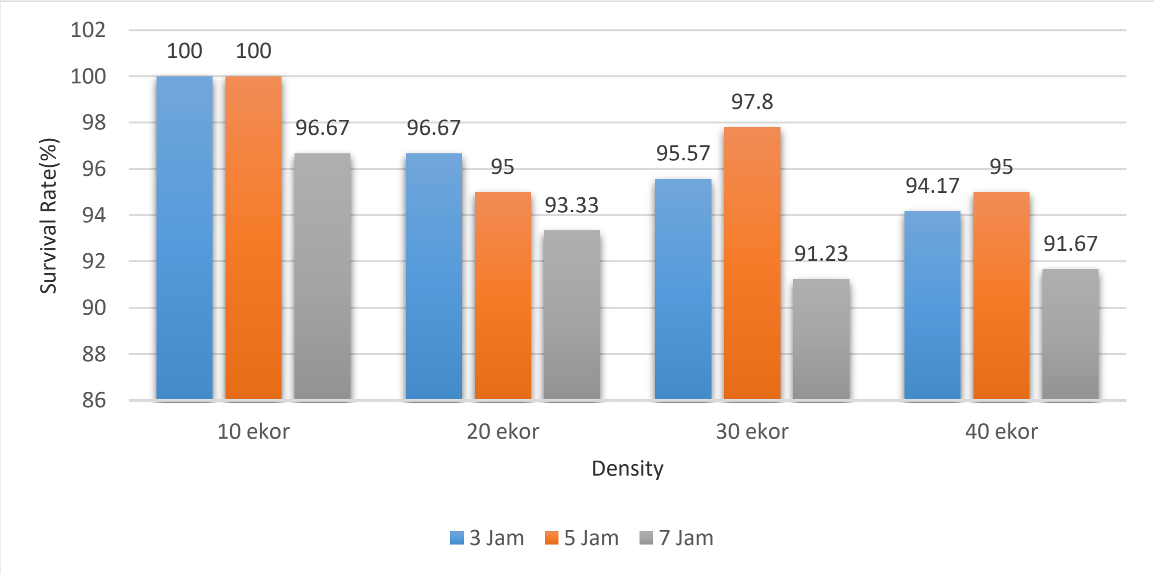

Fig. 1. Diagram of the effect of density on survival of fish seeds post-transportation test at different durations

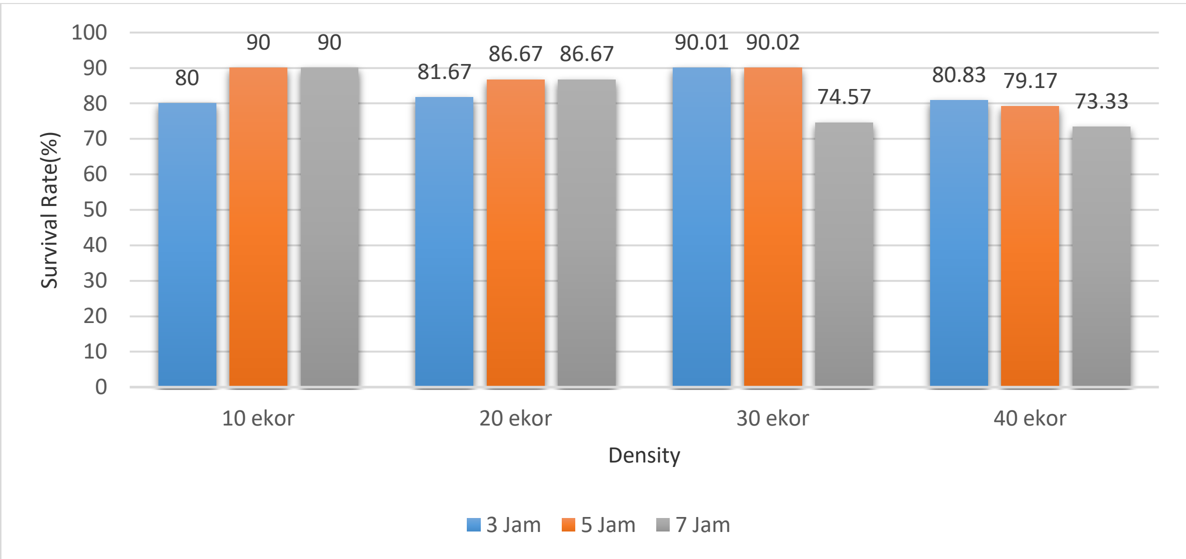

Fig. 2. Diagram of the effect of density on survival of fish seeds tested after 7 days of maintenance at different transportation durations

Table 1. Water quality during transportation

Duration	Density (fish/2L)	Temperature (^{O}C)		DO (mg/L)		pH		Ammonia (mg/L)	
		pre	post	pre	post	pre	post	pre	post
3 hours	10	27.7	25.8	7.4	9.0	6.9	6.5	0.00	0.0087
	20		24.9		8.6		6.3		0.0133
	30		28.6		8.4		6.3		0.0227
	40		26.0		8.3		6.3		0.0267
5 hours	10	27.7	25.5	7.3	9.0	7.1	6.3	0.00	0.0107
	20		26.4		9.4		5.1		0.0203
	30		26.0		9.1		6.3		0.0210
	40		26.4		9.1		5.4		0.0330
7 hours	10	26.4	25.6	6.5	10.0	6.9	6.6	0.00	0.0143
	20		25.6		9.8		6.5		0.0180
	30		25.7		10.0		6.5		0.0217
	40		25.7		9.6		6.4		0.0233

plastic bag according to the treatment. The value of oxygen solubility (DO) before being transported was 6.5-7.4 mg/L. The DO value obtained before transportation is still in the recommended range. According to Irmawan [10], the optimal dissolved range for carp is 3-8 mg/L. This indicates that the dissolved oxygen content is quite good for the environmental conditions of the carp.

The measurement of the value of the degree of acidity (pH) in this research was carried out using a pH meter on the media and carried out before and after transportation. The average value of the degree of acidity before transportation ranged from 6.9 to 7.1 and after transportation ranged from 5.1 to 6.5. The degree of acidity tends to decrease after transportation compared to before transportation. The feasibility of the optimal acidity (pH) value for the survival of carp fry according to (SNI, 2000b) is 6.5 - 8.5. Based on this statement, the pH values obtained during the study before transportation and after transportation were still at an optimal level to support the survival of fish.

The Ammonia value was obtained by taking water samples after transportation and then tested in the MSP FPIK Unpad laboratory using the spectrophotometric method. The average value of ammonia after transportation is 0.008 – 0.03. Based on Table 1, it can be seen that the ammonia value increases with the increase in fish stocking density. The increase in ammonia was due to the increase in metabolic waste material as the stocking density increased. The waste material tends to be acidic so that it affects the increasing ammonia content. According to Effendi [11] the feasibility level of ammonia for the survival of carp in rearing media should be less than 0.2 mg.L. The value of ammonia obtained in this research is still categorized as safe because the value obtained is still far from the value of the feasibility level of ammonia according to Effendi [11].

3.3 Fish Performance Post Transportation

Density and bending treatments affect the condition of carp seeds after the transportation process. Cracking for 1 day resulted in a weak condition for the fish. A higher level of fish density causes stress to the fish so that their condition is weaker. Fish transported with a density of 40 individuals showed a weaker condition when compared to those transported with a density of 10 individuals. This is indicated by the tilted body position of the fish due to loss of balance.

In addition, the bending and density also affect the physical condition of the fish. This can be seen after observing the condition of the fish before and after being transported. Judging from the morphology after transportation which shows the physical condition of the fish after being transported, the damage suffered was damage to the fish fins. The higher density treatment causes more friction so that the possibility of damage is also higher [12,13].

4. CONCLUSION

Based on the research that has been done, it can be concluded that the best treatment for the transportation of carp fry is with a density of 30 fish/2L with a transportation duration of 5 hours because the survival rate in post-transportation is 97.8% and at post-maintenance 7 days is 90. 0.02% with water quality that is still suitable for the survival of gurami fingerling.

DISCLAIMER

Suggestions that can be given in this study are carp seed transportation, it is recommended to use a density of 30 fish/2L and a transportation duration of 5 hours because it can produce high survival.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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