Effect of using different initial temperatures and fish densities on the transportation of Siamese catfish (*Pangasianodon hypophthalmus*).

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ABSTRACT

This study aims to analyze the influence of initial temperatures and different densities that can maintain the highest survival on the closed transport system of Siamese catfish juveniles (Pangasionodon hypophthalmus). The research was carried out from May to August 2022 at the Ciparanje wet laboratory, Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran. The research method used is an experimental method using a Factorial Group Randomized Design (FGRD) which consists of two factors, namely the treatment of three initial temperature levels (16°C, 20°C, and 24°C) and a three-level density (10 fish/L, 15 fish/L, and 20 fish/L) which is repeated three times. This research using closed-system transport method. The results showed that the initial temperature treatment of 16°C during transportation with a density of 15 fish/L was the best result in an induction time of 2 minutes 45 seconds, a conscious recovery time of 4 minutes 39 seconds, the highest post-transport survival rate of 86.67%, and post-maintenance for 7 days of 71%, as well as water quality in the form of DO of 6,80 mg/l, pH of 7,34 and ammonia of ±0.0057 mg/l, at a duration of transportation of 5 hours.

Keyword: - *transportation closed system, low temperature, survival rate*

1. INTRODUCTION

Siamese catfish *(Pangasianodon hypophthalmus)* is a freshwater fishery commodity that is quite popular with the community because it has advantages, apart from its delicious taste and easy cultivation. *Pangasianodon hypophthalmus* are very adaptive to poor water conditions with high densities (low oxygen and low pH [1]. The quality of the fish fry cultivated is very dependent on the transportation of fish. In certain circumstances to be transported can be done by stunning or anesthetizing before being transported. Closed system transportation is a system in which the water in the transport container is not in direct contact with the outside air [2] .

Fish are poikilothermic animals, that is, their body temperature is affected by the temperature of their habitat, so their metabolism is highly dependent on the surrounding environment. An increase in ambient temperature can cause the concentration of dissolved oxygen in the water to decrease and oxygen consumption by fish to increase. In addition, an increase in temperature will increase in the process of respiration [3]. Live fish transportation aims to move fish in a live condition and a certain distance by providing treatment to keep the fish's survival high up to the location [4] . However are still cases of death in the implementation of transportation, caused by several factors, namely density, type of fish and water quality. The density of fish fry in the packing bag greatly affects the success of closed system transportation. One of the important factors in fish transportation activities because it relates to transportation costs. Density that is too high at a long delivery time will increase the stress level of fish due to a decrease in water quality [5].

2. MATERIALS AND METHODS

2.1 Experimental fish and rearing conditions

The experimental fish Siamese catfish (*Pangasius hypopthalmus)* were used in this study were 200 fish with a size of 5 cm. The Siamese catfish *Pangasius hypopthalmus* were used in this study were selected to obtain fish that were relatively equal size and in a healthy and unblemished condition. Before the transportation, *Pangasius hypopthalmus* were fasted in a fiber tub for 12-24 hours. *Pangasius hypopthalmus* were put into plastic bags according to each treatment. The packaged fish is then put into the styrofoam box. Styrofoam boxes arranged in a pick-up car, then transported for 5 hours at night at 07.00 PM using closed transportation methods. After the fish are transported, the post-transportation water quality and survival rate are checked. *Pangasius hypopthalmus* that have been transported are put into the maintenance aquarium according to the repetition and each treatment. Then observation while recovering conscious. Maintenance was carried out for 7 days to determine the effect of post-transportation on fish survival rate.

2.2 Methods

This study uses Factorial Randomized Block Design (RBD) with 2 treatment factors, namely temperature with 3 levels and density with 3 levels, repeated three times, as follows:

Density:
A1: 10 fish/1 liter of water
A2: 15 fish/1 liter of water
A3: 20 fish/1 liter of water
Temperature:
B1: temperature of 16^{o}C
B2: temperature of 20^{o}C
B3: temperature of 24^{o}C

3. RESULTS AND DISCUSSION

3.1 Length of Induction Time

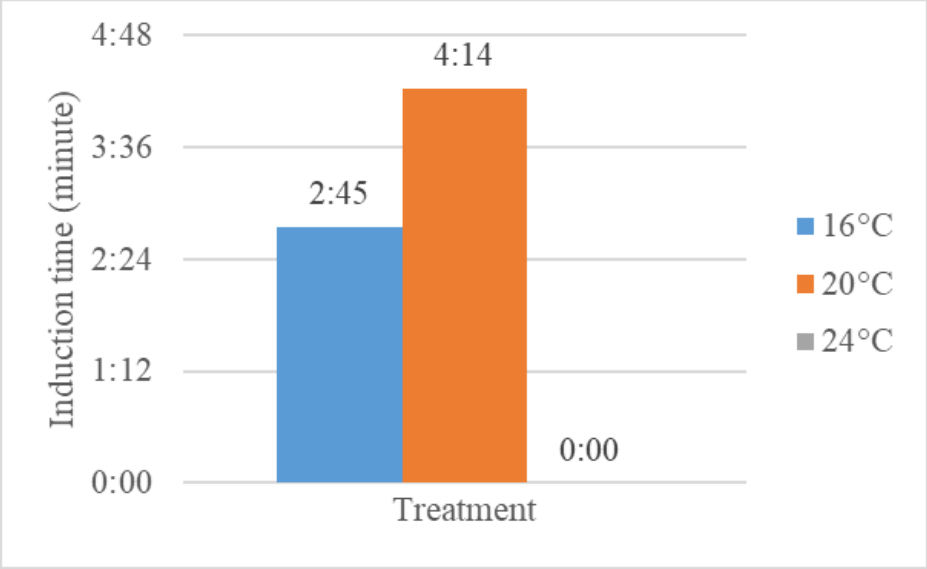

Fig -1: Induction time

Based on the results of the induction time diagram (**Figure 1**) at a temperature of 16^{o}C has a stable induction time and a temperature of 20^{o}C tends to fluctuate in each treatment. According to [6] fish that have larger gill chambers can stimulate the absorption of anesthetic substances quickly and efficiently. This is in accordance with this research using fish with densities of 10 fish/liter, 15 fish/liter and 20 fish/liter of water. Lowering the water temperature will stun or paralyze the fish, lower water temperatures can increase oxygen consumption and reduce activity. Stunning time of fish is seen from the length of time and symptoms of fainting. A good concentration for stunning fish is one that produces an induction time of under 15 minutes [7].

The temperature of 16°C for 02 minutes 45 seconds, when the temperature drops it has several signs that the fish will faint. The activity and condition of the fish has decreased considerably, this is when the fish has experienced a state of panic and swims irregularly when the water temperature has decreased, fish that have lost their balance have some of the characteristics, namely the muscles have begun to relax and react when there is a strong stimulus from outside the container [8].

3.2 Recovery Time After Transportation

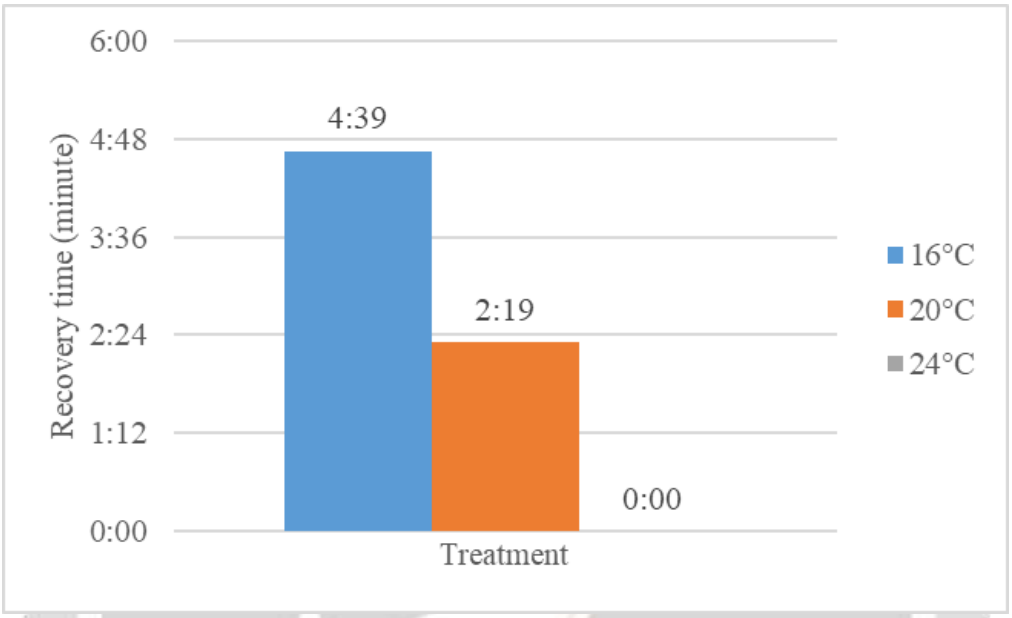

Fig -2: Recovery Time

The results of the recovery time (**Figure 2**) show that the lower the water temperature (16°C, 20°C and 24°C) and the density (10 fish/l, 15 fish/l and 20 fish/l), the longer the process of decaying fish fry will be. Siamese catfish. The lower the temperature given, the longer the process of conscious fish will recover. The lower the temperature given, the recovery process will take longer to realize because the fish are in a weak condition during transportation. The faster the recovery process because fish need time to adjust to the conditions of their habitat when rehabilitated [9].

The longest time in the recovery process was in transportation with a temperature of 16°C where the average time to recover to consciousness was 04 minutes 39 seconds. In addition, at a temperature of 20°C it has the fastest time in the process of rejuvenation of Siamese catfish fry where the average is 02 minutes 19 seconds. The length of time for the conscious fish to recover is calculated when the test fish is in clean water, where the calculated time ends until the fish has regained consciousness from fainting and returns to normal swimming which can be seen by the characteristics of starting to become active again and receiving a stimulus response from outside with the state of the body which is not weak [10].

3.3 Survival Rate Post-Transportation

Based on the data in **Table 1**, the post-transportation survival rate of Siamese catfish fry using low temperature treatment with different transportation durations resulted in varying survival rates. Based on the results of the ANOVA test, post-transportation survival rates of Siamese catfish fry using low temperatures and different densities resulted in varying levels of survival of the tested fish. The results of the F test analysis with a 5% increase in confidence between the density treatment and the transport temperature treatment showed that the results were not significantly different. The average value of the survival rate of Siamese catfish fry ranges from 70-86.67%. The low temperature treatment of 16°C with a transport density of 15 fish/l was able to maintain the highest life cessation value of 86.67%. This is in accordance with previous research that the density of fish in the transportation process does not have a significantly different effect on the survival rate of fish [11].

Table 1. Post-Transportation Survival Rate of Siamese Catfish Fry with Different Temperature and Density Treatments

Treatments		Average
Density (fish/L)	**Temperature (°C)**	
10 fish/L	16	73,33 ± 10,41
	20	80,00 ± 5,00
	24	70,00 ± 5,00
15 fish/L	16	86,67 ± 3,33
	20	75,56 ± 5,09
	24	82,22 ± 3,85
20 fish/L	16	78,33 ± 1,44
	20	80,00 ± 0,00
	24	73,33 ± 2,89

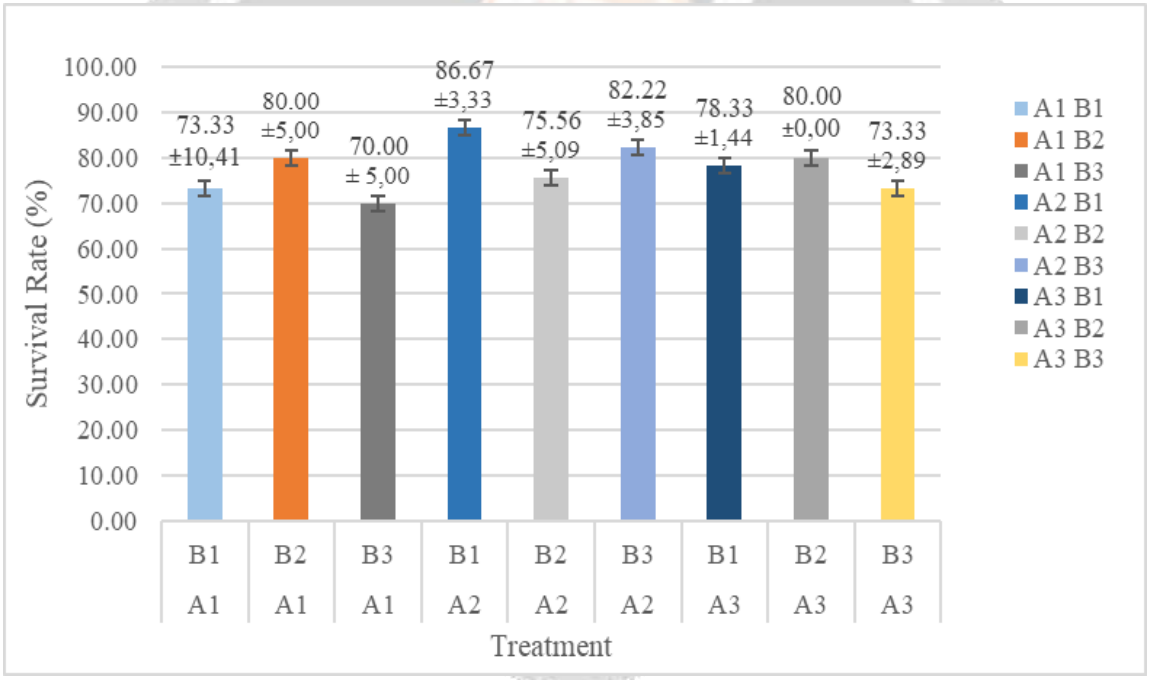

Fig -3: Survival Rate Post-transportation

Fish placed in a container using an initial temperature of 16°C will have very slow metabolic activity or be in a stupor. According to [12] fish can stay alive at temperatures of 10°C-12°C and 14°C-16°C for 4 hours. Fish mortality began to be found at 6 hours and died totally at 8 hours. However, a drastic decrease in temperature will not make the fish faint, but the fish will become stressed and eventually die. According to [13], low survival is due to high space competition, dense space will affect the movement of the operculum. Active movement of the operculum accompanied by a movement to take in air. So it can cause high friction and impact with narrow and dense space conditions.

3.4 Post Maintenance Siamese Catfish Fry Survival

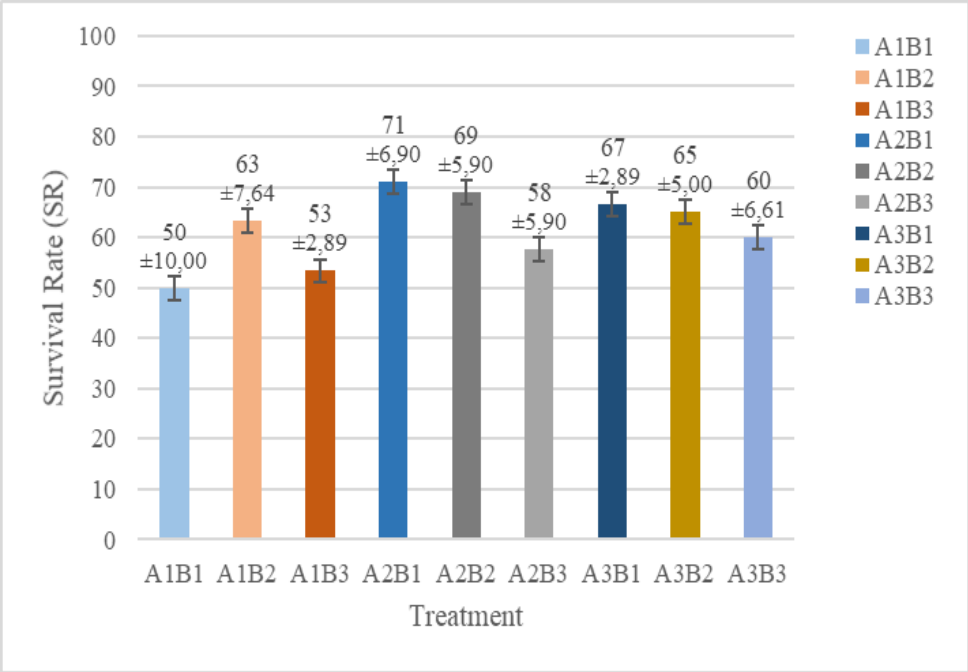

Fig -4: Survival Rate (SR) After Maintenance

Based on the ANOVA test, the average survival rate after maintenance showed no significant difference for replicates, density, transportation temperature or factorial for the interaction of density and temperature. The research results show that the SR is quite diverse. SR maintenance with a transport treatment at a density of 15 fish/L and a temperature of 16^{o}C had the highest SR value of 71%, followed by a transport treatment at a density of 20 individuals/l and a temperature of 20^{o}C of 69%, which was not far from the treatment with a density of 20 individuals/l at a temperature of 16oC by 67%. The lowest value was found in the treatment with a density of 10 fish/l at 16^{o}C of 50%.

High levels of stress due to poor water quality and high densities result in weak fish response to disturbances and low fish appetite after transportation [14]. This is thought to be caused by unstable water quality during maintenance because it does not use stored water but water directly from Ciparanje water sources which come from nature and sometimes fluctuate. Fish experience excessive stress which results in changes in blood glucose which can interfere with fish life and in the worst conditions will cause fish death [15].

3.5 Water Quality

Table 2. Post-Transportation of Siamese Catfish Fry Water Quality

Treatment		Temperatures (^{o}C)		DO (mg/L)		pH		Amonia (mg/L)	
Density (fish/l)	**Initial Temperatures (^{o}C)**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
10 fish/l	16	16	19	7,07	6,93	7,22	7,30	0,00	0,0027
	20	20	21	7,00	6,83	7,19	7,32	0,00	0,0060
	24	24	23	7,33	7,23	7,20	7,28	0,00	0,0080
15 fish/l	16	16	19	6,97	6,80	7,36	7,34	0,00	0,0057
	20	20	21	7,20	7,47	7,29	7,29	0,00	0,0080

	24	24	23	7,03	7,13	7,25	7,23	0,00	0,0130
	16	16	19	7,00	7,13	7,36	7,30	0,00	0,0077
20 fish/l	20	20	22	7,07	6,70	7,39	7,28	0,00	0,0117
	24	24	22	7,20	6,53	7,33	7,25	0,00	0,0173

The initial temperature conditions of transportation used low temperatures (16^{o}C, 20^{o}C and 24^{o}C), then temperature observations were carried out after transportation there were temperature changes where the average obtained was around 19^{o}C - 26^{o}C. Temperature affects wet transportation with a closed system, because temperature can increase the metabolic rate of fish. This is in line with Putra's opinion that the energy for respiration is in metabolic value so it can be concluded that if the temperature rises it will cause an increase in the metabolic rate (16). The use of low temperatures during the transportation of fish which aims to inhibit the process of fish metabolism so that when the transportation takes place the mortality rate of fish due to lack of oxygen will be reduced (17).

The results in this study showed that the dissolved oxygen content before transportation averaged 6.97 mg/l - 7.33 mg/l. Then, pure oxygen is added to the aqueous medium before transportation. After being added, transportation was carried out. After observing dissolved oxygen after transportation, there was a change after transportation where the values ranged from an average of 6.5 mg/l – 7.5 mg/l. The decrease in dissolved oxygen that occurs due to the use of fish during transportation takes place (18).

The average value of the degree of acidity before transportation ranged from 7.19 to 7.39 and after transportation the pH value ranged from 7.25 to 7.34. The decrease in pH is caused by an activity of the fish during transportation and the addition of an anesthetic substance to the transportation medium. If the pH is low, it is caused by the large amount of carbon dioxide compounds produced by an aquatic organism [19] . According to [20] the range of degrees of acidity (pH) for the survival of Siamese catfish fry is 6.5 – 8.5.

The average value of ammonia after transportation is 0.0060 mg/l – 0.0173 mg/l found in (**table 2**). The range of ammonia for fish survival is 0.1 mg/l [21] . Based on this statement, it proves that the level of ammonia content in each fish treatment is still within the normal threshold, namely not exceeding 0.1 mg/l, thus supporting a high survival rate. According to Djariah (2001); [22] the limit for ammonia levels for catfish is 0.1 – 0.3 mg/l, so that the ammonia content in the transport of each treatment meets the requirements.

4. CONCLUSION

The initial transportation temperature of 16oC with a density of 15 fish/l was the best to produce an induction time of 2 minutes 45 seconds, a conscious recovery time of 4 minutes 39 seconds, the highest post-transportation survival rate was 86.67%, and post-maintenance for 7 days was 71 %, and water quality in the form of DO of 6.80 mg/l, pH of 7.34 and ammonia of 0.0057 mg/l, for a duration of 5 hours of transportation.

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